Database Toolbox™

User's Guide

MATLAB®

R2018b

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Database Toolbox™ User's Guide

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Contents

1 Before You Begin

2 Getting Started with Database Toolbox

3 Working with Data Sources

4 Using Database Explorer

5 Using Database Toolbox Functions

6 Database Toolbox Interface for Apache Cassandra Database Topics

7 Neo4j Topics

8 Database Toolbox Interface For MongoDB Topics

9 Functions — Alphabetical List

Before You Begin

Database Toolbox Product Description

Exchange data with relational and nonrelational databases

Database Toolbox provides functions and an app for exchanging data with relational and nonrelational databases. It enables this exchange by automatically converting between database and MATLAB® data types.

Database Toolbox supports any ODBC-compliant or JDBC-compliant relational database, as well as NoSQL databases including Cassandra®, MongoDB®, and Neo4j®.

With the Database Explorer app, you can explore relational data without writing code and then generate MATLAB code for automating or operationalizing database workflows.

For large data workflows, you can split SQL queries and parallelize access to data (with Parallel Computing Toolbox™ and MATLAB Distributed Computing Server™).

Key Features

- Support for JDBC-compliant and ODBC-compliant relational databases
- Support for NoSQL databases, including MongoDB, Cassandra, and Neo4j
- Database Explorer app for working with relational databases without writing code
- Native ODBC interface for fast read/write
- MATLAB interface to SQLite
- Custom import options for relational databases

Data Type Support

You can import these data types into the MATLAB workspace and export them back to your database.

Database	Supported Data Type
All databases	• `BOOLEAN` • `CHAR` • `DATE` • `DECIMAL` • `DOUBLE` • `FLOAT` • `INTEGER` • `NUMERIC` • `REAL` • `SMALLINT` • `TIME` • `TIMESTAMP` **Note** When importing `TIMESTAMP` data into MATLAB, you can get an incorrect value at the daylight savings time change. To avoid an incorrect value, convert `TIMESTAMP` data to strings in your SQL query. Then, convert the strings back to the MATLAB data type you want. Or, connect to your database using a different driver.

Database	Supported Data Type
Microsoft® SQL Server®	• `NTEXT` • `TEXT` • `VARCHAR(MAX)` • `CHAR(8000)` • `NCHAR(4000)` • `NVARCHAR(MAX)` • `TINYINT`
MySQL®	• `MEDIUMTEXT` • `LONGTEXT` • `TINYINT`
Oracle®	• `LONG` • `VARCHAR2(4000)` • `NCHAR(2000)` • `NVARCHAR2(4000)`

To import data of another data type, manipulate the data before importing it into the MATLAB workspace. For details, see your database documentation.

See Also

`fetch` | `sqlwrite` | `update`

More About

- "Import Data from Database Table Using sqlread Function" on page 5-52
- "Insert Data into Database Table" on page 5-55

Data Retrieval Restrictions

In this section...

Spaces in Table Names or Column Names

Microsoft Access™ supports the use of spaces in table and column names, but most other databases do not. Queries that retrieve data from tables and fields whose names contain spaces require delimiters around table names and field names. In Access, enclose the table names or field names in quotation marks, for example, `"order id"`. Other databases use different delimiters, such as brackets, [ ].

Quotation Marks in Table Names or Column Names

Do not include quotation marks in table names or column names. The Database Toolbox software does not support data retrieval from table and column names that contain quotation marks.

Reserved Words in Column Names

You cannot use the Database Toolbox software to import or export data in columns whose names contain database reserved words, such as `DATE` or `TABLE`.

See Also

More About

- “Data Import Using Database Explorer App or Command Line” on page 2-145

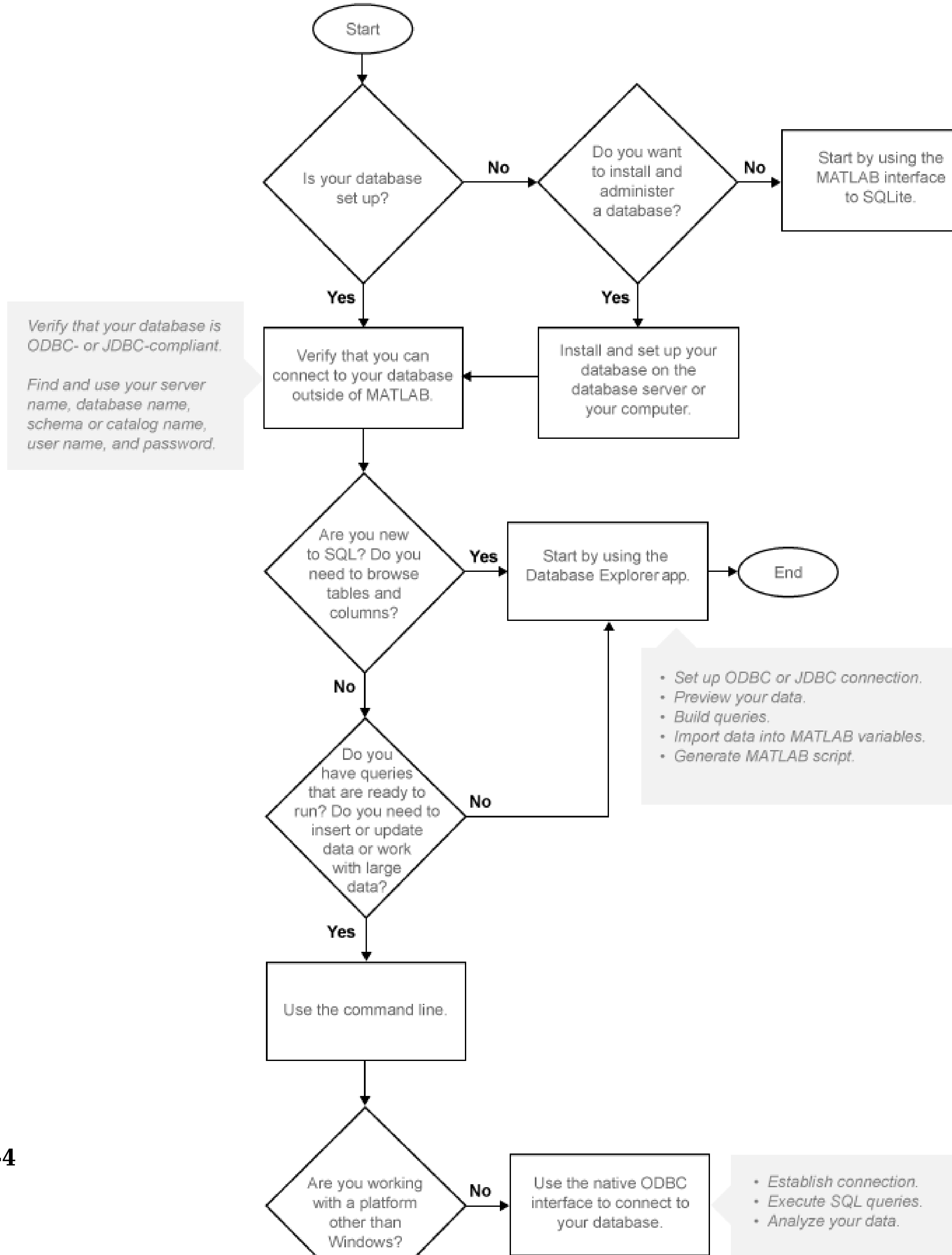
Getting Started with Database Toolbox

Access Relational Database Data in MATLAB

This tutorial shows how to use Database Toolbox with relational databases. To gain the maximum benefit from this toolbox and understand its capabilities, use the following steps and decision flow chart.

1. If you do not have an installed database and want to store relational data quickly, use the MATLAB interface to SQLite. For details, see “Working with MATLAB Interface to SQLite” on page 2-6.
2. Install your database. For details, refer to your database administrator or your database documentation.
3. Choose between using the **Database Explorer** app or the command line.
4. Choose between using an ODBC driver or a JDBC driver. For details, see “Choosing Between ODBC and JDBC Drivers” on page 2-13.
5. For ODBC drivers, the driver is typically preinstalled on your computer. For JDBC drivers, install the driver. For details about ODBC and JDBC drivers, see Driver Installation. If you have questions about which driver you need, refer to your database administrator or your database documentation.
6. Create a data source for ODBC-compliant drivers. For JDBC-compliant drivers, add the full path of the driver to the static Java® class path. Then, create a data source for JDBC-compliant drivers. For details, see “Configuring Driver and Data Source” on page 2-15.
7. Test the connection to your database using the Database Explorer app or the command line.
8. Connect to your database using the Database Explorer app or the command line. For details, see “Connecting to Database” on page 2-142.
9. Select data from your database and import the data into a MATLAB variable by using the Database Explorer app or the command line. For details, see “Data Import Using Database Explorer App or Command Line” on page 2-145.
10. Insert data into your database by exporting data from a MATLAB variable. For details, see the `sqlwrite` function.
11. When you use the Database Explorer app to import data, generate a MATLAB script to automate your tasks. For details, see “Generate MATLAB Script” on page 4-19.

This flow chart illustrates the steps to take and the decisions to make when you use Database Toolbox with relational databases.


Start
Is your database set up?
No
Do you want to install and administer a database?
No
Start by using the MATLAB interface to SQLite.
Yes
Yes
Verify that your database is ODBC- or JDBC-compliant.
Find and use your server name, database name, schema or catalog name, user name, and password.
Verify that you can connect to your database outside of MATLAB.
Install and set up your database on the database server or your computer.
Are you new to SQL? Do you need to browse tables and columns?
Yes
Start by using the Database Explorer app.
End
Set up ODBC or JDBC connection.
Preview your data.
Build queries.
Import data into MATLAB variables.
Generate MATLAB script.
No
Do you have queries that are ready to run? Do you need to insert or update data or work with large data?
No
Yes
Use the command line.
Are you working with a platform other than Windows?
No
Use the native ODBC interface to connect to your database.
Establish connection.
Execute SQL queries.
Analyze your data.

See Also

More About

- “Setup Requirements for Database Connection” on page 2-12
- “Choosing Between ODBC and JDBC Drivers” on page 2-13
- “Configuring Driver and Data Source” on page 2-15
- “Connecting to Database” on page 2-142
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Working with MATLAB Interface to SQLite” on page 2-6

Working with MATLAB Interface to SQLite

In this section...

To analyze your data using SQL in MATLAB without access to a database or driver, use the MATLAB interface to SQLite. After installing Database Toolbox, you can use the MATLAB interface to SQLite to move data between MATLAB and a SQLite database file. The SQLite connection is different from a database connection created using a JDBC driver. For background information about SQLite databases, see SQLite Home Page. To use all the Database Toolbox functionality, install the SQLite JDBC driver and connect to your SQLite database file using a URL string. For details, see "Configuring Driver and Data Source" on page 2-15.

MATLAB Interface to SQLite Advantages

The advantages of using the MATLAB interface to SQLite are:

- Start working with data immediately after installing the Database Toolbox by creating a SQLite database file.
- No installation or administration of software or drivers required.
- Share data using SQLite database files.
- Support for Windows®, Linux®, and Mac.

SQLite JDBC Connection Differences

The following table describes the differences between the MATLAB interface to SQLite and connecting to a SQLite database using the JDBC driver.

	SQLite Connection Using the MATLAB Interface to SQLite	SQLite Database Connection Using a JDBC Driver
Driver installation	Not required	Required

	SQLite Connection Using the MATLAB Interface to SQLite	SQLite Database Connection Using a JDBC Driver
Database installation	Not required	Required
Database administration	Not required	Required
Database connection function	`sqlite`	`database`
Import data	Yes	Yes
Export data	Yes	Yes
Database Explorer	No	Yes
Run stored procedures	No	Yes
Database metadata	No	Yes
Other complex database operations and functionality	No	Yes

MATLAB Interface to SQLite Workflow

To connect to a database quickly and import data, use the MATLAB interface to SQLite. These steps provide a high-level workflow for using the MATLAB interface to SQLite.

1. Create a SQLite database file using `sqlite`. The SQLite database file has a `.db` extension.
2. Create tables in the SQLite database file using `exec`.
3. Export your data into the SQLite database file using `insert`.
4. Import data into MATLAB using `fetch`.
5. Perform data analysis in MATLAB.
6. Export results into the SQLite database file using `insert`.
7. Close the SQLite connection using `close`.
8. Share the SQLite database file with others.

MATLAB Interface to SQLite Limitations

The limitations of using the MATLAB interface to SQLite are:

- Only `DOUBLE`, `INT64`, and `CHAR` data types are supported.
- `NULL` values in columns are not supported.
- Database Explorer is not supported. Use the command line.

See Also

`close` | `exec` | `fetch` | `insert` | `sqlite`

Related Examples

- “Import Data Using MATLAB® Interface to SQLite” on page 5-35

More About

- “Access Relational Database Data in MATLAB” on page 2-3
- “Configuring Driver and Data Source” on page 2-15

External Websites

- SQLite Home Page

Connection Options

You can connect to a database in various ways using Database Toolbox. If you have access to a database, create a data source. Then, you can connect to the database either by using the **Database Explorer** app or the command line. If you do not have an installed database and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see “Working with MATLAB Interface to SQLite” on page 2-6.

Creating or Connecting to Data Source

If you already have a database driver installed, you can create a data source. For an ODBC driver, use the Microsoft ODBC Data Source Administrator. For a JDBC driver, add the path of the driver to the Java class path in MATLAB. For examples, see “Configuring Driver and Data Source” on page 2-15. Otherwise, see Driver Installation for information about installing your driver. If your data sources are defined, then you are ready to connect to your database. For details, see “Connecting to Database” on page 2-142. After establishing a connection, you can explore the database and view data using the **Database Explorer** app or the command line. For details, see “Data Import Using Database Explorer App or Command Line” on page 2-145.

Defining Operating System Authentication

Operating system authentication enables you to connect to a database using your operating system user account. The operating system performs user validation, and the database does not require a different user name and password. Operating system authentication facilitates the maintenance of database access credentials. For example, Windows provides operating system authentication that can be configured to work with a Microsoft SQL Server database. For details about Microsoft SQL Server Windows authentication, see Set up the operating system authentication. on page 2-35

Connection Options

Use this table to choose your best connection option.

Connection Option	Why Use This Option?
Database Explorer app	Use the Database Explorer app to: • Visually inspect the structure, or schema, of a database. • Assess the general size of a database by viewing the database structure. • Select the data in a table and import it into a MATLAB variable. • Generate a MATLAB script. • Generate an SQL query.
Command line	Use the command line to: • Import data from a database into MATLAB. • Export data from MATLAB into a database. • Work with large amounts of data. • Run SQL queries stored in text files. • Run stored procedures and functions.

There are multiple options to connect to your database using the command line. Use this table to choose your best connection option.

Command-Line Connection Option	Why Use This Option?
ODBC connection	Connect to your database with maximum performance.
JDBC connection	Achieve maximum platform independence.
SQLite connection	Import data without installing a database or a driver. For details, see "Working with MATLAB Interface to SQLite" on page 2-6.

You can create multiple connections at a time to the same database or a different database. For creating multiple connections using the Database Explorer app, see "Create SQL Queries Using Database Explorer App" on page 4-2. Or, you can use the `database` function to create multiple connections at the command line.

See Also

`database`

More About

- “Choosing Between ODBC and JDBC Drivers” on page 2-13
- “Connecting to Database” on page 2-142
- “Data Import Using Database Explorer App or Command Line” on page 2-145
- “Working with MATLAB Interface to SQLite” on page 2-6

Setup Requirements for Database Connection

Refer to these setup requirements to establish the first connection to a database.

- If you do not have an installed database and want to store relational data quickly, use the MATLAB interface to SQLite. For details, see "Working with MATLAB Interface to SQLite" on page 2-6.
- Ensure that you know the name of your database server or machine, the name of your database, the port number, and your user name and password. For ODBC drivers, once you create a data source, remember the data source name. For JDBC drivers, ensure that you know the file path where the JDBC driver is installed. For some JDBC drivers, you also need the URL string and the driver Java class object. For some databases, more credentials are required. Contact your database administrator for all required database credentials to establish a connection to the database.
- Ensure that you have access to your database and driver documentation.
- Determine if your database uses operating system authentication. If you can connect to your database from outside of MATLAB without providing a user name and password, then your database uses operating system authentication. Exceptions to this rule are databases set up without any operating system or database authentication requirements, such as Microsoft Access and SQLite database files. Connecting to a database using operating system authentication from MATLAB can require additional steps.
- Ensure that you have write access to the path MATLAB displays after you execute `prefdir` at the command line.
- For ODBC data sources, ensure that you have administrator rights to the database for creating and modifying data sources.

See Also

`database`

More About

- "Access Relational Database Data in MATLAB" on page 2-3
- "Connecting to Database" on page 2-142

Choosing Between ODBC and JDBC Drivers

In this section...

Defining Database Drivers

Database vendors, such as Microsoft and Oracle, implement their database systems using technologies that vary depending on customer needs, market demands, and other factors. Software applications written in popular programming languages, such as C, C++, and Java, need a way to communicate with these databases. Open Database Connectivity (ODBC) and Java Database Connectivity (JDBC) are standards for drivers that enable programmers to write database-agnostic software applications. ODBC and JDBC provide a set of rules recommended for efficient communication with a database. The database vendor is responsible for implementing and providing drivers that follow these rules.

Deciding Between ODBC and JDBC Drivers

ODBC is a standard Microsoft Windows interface that enables communication between database management systems and applications typically written in C or C++.

JDBC is a standard interface that enables communication between database management systems and applications written in Oracle Java.

Database Toolbox has a C++ library that connects natively to an ODBC driver. Database Toolbox has a Java library that connects directly to a pure JDBC driver.

Depending on your environment and what you want to accomplish, decide whether using an ODBC driver or a JDBC driver meets your needs.

Use native ODBC for:

- Fastest performance for data imports and exports
- Memory-intensive data imports and exports
- All functionality except the `runstoredprocedure` function

Use JDBC for:

- Platform independence, allowing you to work with any operating system (including Mac and Linux), driver version, or bitness
- Access to all Database Toolbox functions

The only limitation for these drivers is memory performance. MATLAB memory restricts the native ODBC driver. However, both MATLAB and JVM™ heap memory restrict the JDBC driver.

See Also

`close` | `database`

More About

- "Access Relational Database Data in MATLAB" on page 2-3
- "Connection Options" on page 2-9
- "Configuring Driver and Data Source" on page 2-15
- "Connecting to Database" on page 2-142
- "Working with Large Data Sets" on page 2-148

Configuring Driver and Data Source

Database Toolbox enables you to create a connection to a database installed on a machine or located in the cloud. To connect to an installed database, first install the driver. For all databases, define a data source for ODBC or add the full path of the driver to the static Java class path for JDBC. If you do not have an installed database and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see “Working with MATLAB Interface to SQLite” on page 2-6.

ODBC uses a Data Source Name (DSN) that is the logical name to refer to the drive and other required information for accessing data. This name is used to connect to an ODBC data source, such as a Microsoft SQL Server database.

Find your database environment in the following table by choosing your platform across the top and your database on the left. The link brings you to a page that has all the required steps for connecting to your database.

Database	**Platform**		
	Windows	**macOS 64-bit**	**Linux 64-bit**
Microsoft Access	“Microsoft Access ODBC for Windows” on page 2-18		
Microsoft SQL Server	“Microsoft SQL Server ODBC for Windows” on page 2-24 “Microsoft SQL Server JDBC for Windows” on page 2-32	“Microsoft SQL Server JDBC for macOS” on page 2-83	“Microsoft SQL Server JDBC for Linux” on page 2-88
Oracle	“Oracle ODBC for Windows” on page 2-42 “Oracle JDBC for Windows” on page 2-48	“Oracle JDBC for macOS” on page 2-94	“Oracle JDBC for Linux” on page 2-100

Database	Platform		
	Windows	macOS 64-bit	Linux 64-bit
MySQL	"MySQL ODBC for Windows" on page 2-55 "MySQL JDBC for Windows" on page 2-61	"MySQL JDBC for macOS" on page 2-106	"MySQL JDBC for Linux" on page 2-111
PostgreSQL	"PostgreSQL ODBC for Windows" on page 2-66 "PostgreSQL JDBC for Windows" on page 2-72	"PostgreSQL JDBC for macOS" on page 2-116	"PostgreSQL JDBC for Linux" on page 2-122
SQLite	"SQLite JDBC for Windows" on page 2-77	"SQLite JDBC for macOS" on page 2-127	"SQLite JDBC for Linux" on page 2-133

Microsoft Access is not supported for Mac 64-bit and Linux 64-bit platforms.

For ODBC-compliant or JDBC-compliant databases that are not listed in the table, see "Other ODBC-Compliant or JDBC-Compliant Databases" on page 2-139.

See Also

`close` | `database`

More About

- "Access Relational Database Data in MATLAB" on page 2-3
- "Setup Requirements for Database Connection" on page 2-12
- "Choosing Between ODBC and JDBC Drivers" on page 2-13
- "Connecting to Database" on page 2-142
- "Modify and Delete Data Sources" on page 4-15

- “Working with MATLAB Interface to SQLite” on page 2-6

Microsoft Access ODBC for Windows

This tutorial shows how to set up a data source and connect to a Microsoft Access database using the Database Explorer app or the command line. This tutorial uses the Microsoft Access Driver (*.mdb, *accdb) to connect to a sample Microsoft Access 2016 database.

Step 1. Setup the sample Access database.

You can access the sample database file, `tutorial.accdb`, in the folder returned by entering this code at the command line.

```
fullfile(matlabroot,'toolbox','database','dbdemos')
```

Copy this database file into a folder where you have permission to write. Ensure that the database file is writable by verifying its properties:

1. Right-click the database file and select **Properties**.
2. On the **General** tab, if the **Read-only** option is selected, clear it.

Note To write data to the sample database, ensure that you run MATLAB as an administrator.

Note Depending on the Access version you are running, you might need to convert the database to that version. For example, beginning in Access 2007, the software includes the option to save as `*.accdb`. For details, consult your database administrator.

Step 2. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

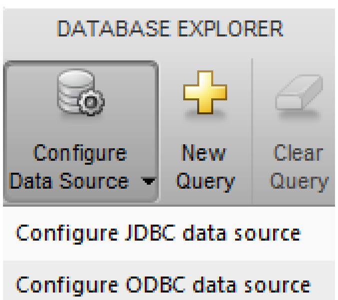
Note Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of Access. Or, to connect to the 32-bit version of Access, see https://www.mathworks.com/matlabcentral/answers/235949-how-to-connect-to-32-bit-microsoft-access-database-from-64-bit-matlab. For details about working with the 64-bit version of Windows, see https://www.mathworks.com/products/matlab/preparing-for-64-bit-windows.html.

Step 3. Set up the data source using the Database Explorer app.

Set up the sample Access database as the data source by using the Database Explorer app. You can locate the target database on a PC running the Windows operating system or on another system to which the PC is networked. These instructions use the Microsoft ODBC Data Source Administrator Version 10.0.16299.15 for the US English version of Microsoft Access 2016 for Windows systems.

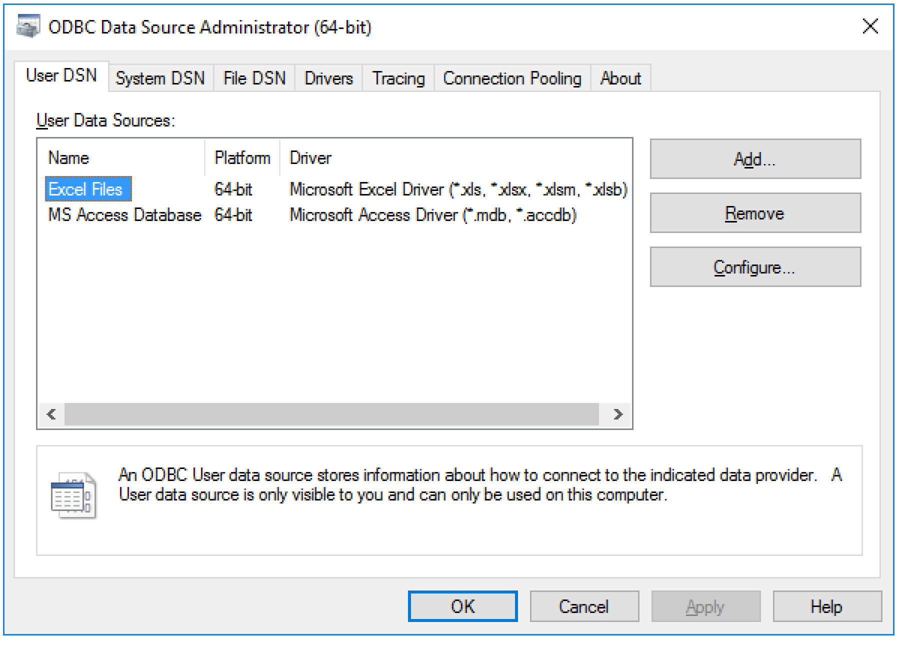
The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1. Close any open Access databases.
2. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
3. Select **Configure Data Source** > **Configure ODBC data source**.

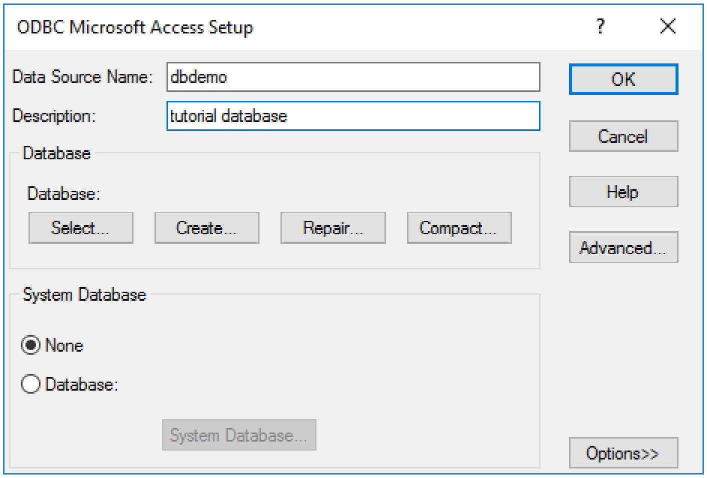


In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.



4. On the **User DSN** tab, click **Add**. The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.
5. Select `Microsoft Access Driver (*.mdb, *.accdb)` and click **Finish**.
6. In the ODBC Microsoft Access Setup dialog box for your driver, enter `dbdemo` as the data source name. Enter `tutorial database` as the description.



7 Click **Select** to open the Select Database dialog box, where you specify the database you want to use. For the `dbdemo` data source, select `tutorial.accdb`. If the database is on a system to which your PC is connected:

   a Click **Network**.

   b In the Map Network Drive dialog box, specify the folder containing the database you want to use. Ensure that you map to the *folder* and not the database file.

   c Click **Finish**.

8 Click **OK** to close the Select Database dialog box. In the ODBC Microsoft Access Setup dialog box, click **OK**. The ODBC Data Source Administrator dialog box displays the `dbdemo` data source and any additional data sources that you added on the **User DSN** tab. Click **OK** to close the dialog box.

After you complete the data source setup, connect to the Access database using the Database Explorer app or the command line with the native ODBC connection.

Step 4. Connect using the Database Explorer app or the command line.

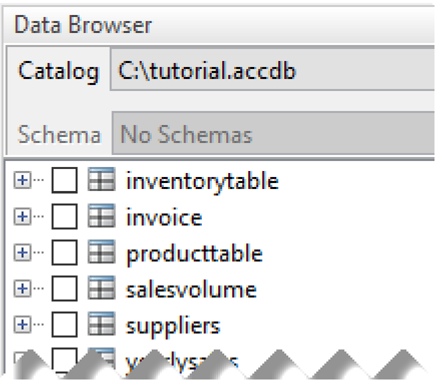
Connect to Access Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, select the data source `dbdemo` from the **Data Source** list.

3 Leave the **Username** and **Password** boxes blank, and click **Connect**.

The Database Explorer app connects to the database and displays a list of its objects, such as tables, in the **Data Browser** pane. The data source tab named **dbdemo** appears to the right of the pane. The data source tab contains empty **SQL Query** and **Data Preview** panes.



4 Select tables in the **Data Browser** pane to query the database.

5 Close the **dbdemo** data source tab to close the SQL query and the database connection.

Tip If multiple database connections to different databases are open, then close the Database Explorer app to close all database connections.

Connect to Access Using ODBC Driver and Command Line

1 Connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Microsoft SQL Server ODBC for Windows

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the Database Explorer app or the command line. This tutorial uses the Microsoft ODBC Driver 13.1 for SQL Server to connect to a Microsoft SQL Server 2016 Express database.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

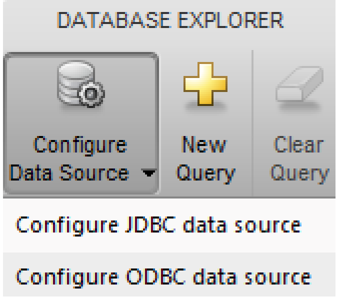
Note Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of SQL Server. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see "Microsoft SQL Server JDBC for Windows" on page 2-32. For details about working with the 64-bit version of Windows, see https://www.mathworks.com/products/matlab/preparing-for-64-bit-windows.html.

Step 2. Set up the data source using the Database Explorer app.

The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

2 Select **Configure Data Source > Configure ODBC data source**.



In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.

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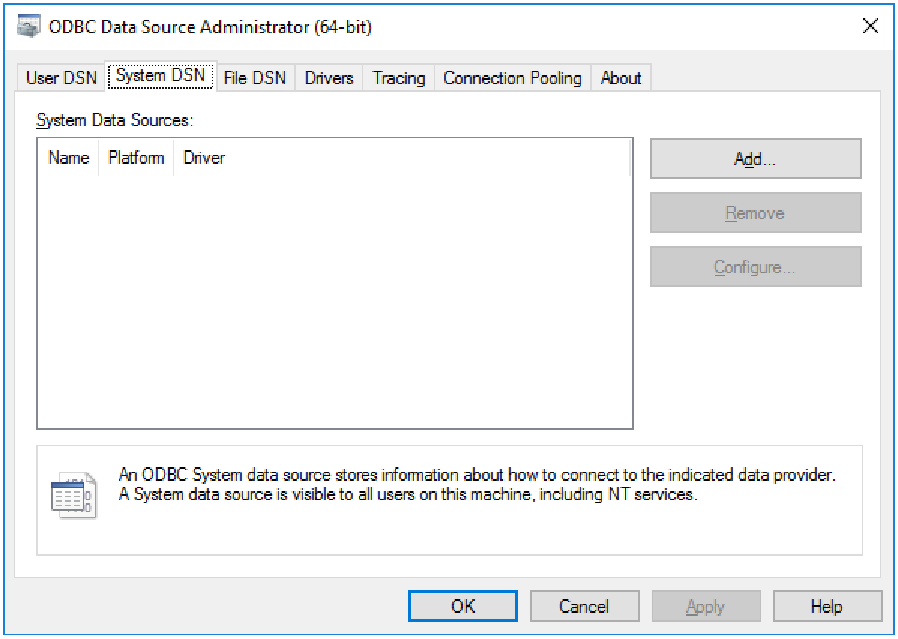
3 Click the **System DSN** tab, and then click **Add**.



The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

4 Select `SQL Server Native Client 11.0`.

Note The name of the ODBC driver can vary.

Click **Finish**.

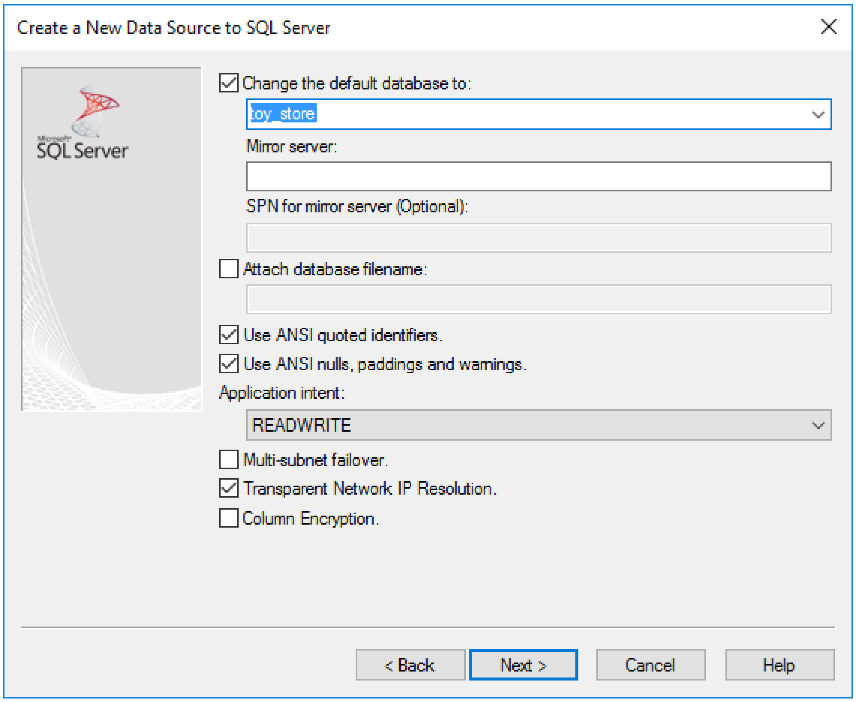
5 In the Create a New Data Source to SQL Server dialog box, enter an appropriate name for the data source. You use this name to establish a connection to your database. Here, in the **Name** box, enter `MS SQL Server` as the data source name. In the **Description** box, enter `Microsoft SQL Server` as the description. From the **Server** list, select the database server for this data source to use. Consult your database administrator for the name of your database server. Click **Next**.

6 You can set up an ODBC data source with or without Windows authentication.

If you want to connect to SQL Server using Windows authentication, select **With Integrated Windows Authentication**. Then click **Next**.

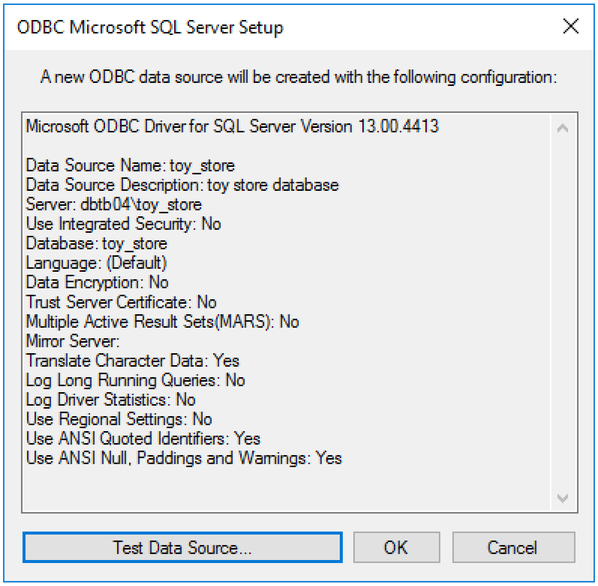
Or, if you want to connect to SQL Server without Windows authentication, select **With SQL Server authentication using a login ID and password entered by the user**. Enter your user name in the **Login ID** box and your password in the **Password** box. Then click **Next**.

7 In the Create a New Data Source to SQL Server dialog box, select **Change the default database to** and enter the name of the default database on the database server for connection. Here, use the database `toy_store`. Then click **Next**.

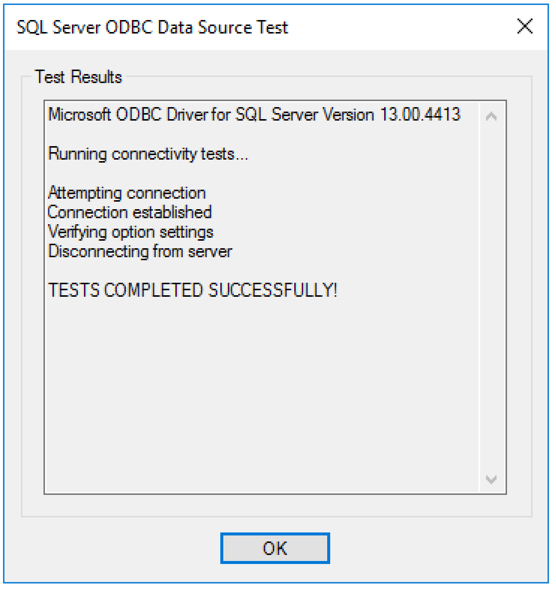


8 Click **Finish** to accept the default settings.

9 In the ODBC Microsoft SQL Server Setup dialog box, test your connection by clicking **Test Data Source**.



10 If the connection succeeds, the SQL Server ODBC Data Source Test dialog box opens and displays a message indicating the tests completed successfully. Click **OK** to close this dialog box. Click **OK** to close the ODBC Microsoft SQL Server Setup dialog box.



11 The ODBC Data Source Administrator dialog box shows the new data source under System Data Sources on the **System DSN** tab. Click **OK** to close the ODBC Data Source Administrator dialog box.

   After you complete the data source setup, connect to the SQL Server database using the Database Explorer app or the command line with the native ODBC connection.

Step 3. Connect using the Database Explorer app or the command line.

Connect to SQL Server Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, connect with Windows authentication by selecting the data source you defined from the **Data Source** list. Leave the **Username** and **Password** boxes blank. Click **Connect**.

   Or, connect without Windows authentication by selecting the data source you defined. Enter a user name and password. Click **Connect**.

   The Catalog and Schema dialog box opens.

3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `MS SQL Server`, and two tabs named `MS SQL Server` and `MS SQL Server1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to SQL Server Using ODBC Driver and Command Line

1. To connect with Windows authentication, connect to the database with the authenticated ODBC data source name and a blank user name and password. For example, this code assumes that you are connecting to a data source named `MS SQL Server Auth`.

   ```
   conn = database('MS SQL Server Auth','','');
   ```

   Or, to connect without Windows authentication, connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `MS SQL Server` with the user name `username` and the password `pwd`.

   ```
   conn = database('MS SQL Server','username','pwd');
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`close` | `database`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Microsoft SQL Server JDBC for Windows

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the Database Explorer app or the command line. This tutorial uses the Microsoft JDBC Driver 4.0 for Microsoft SQL Server to connect to a Microsoft SQL Server 2016 Express database.

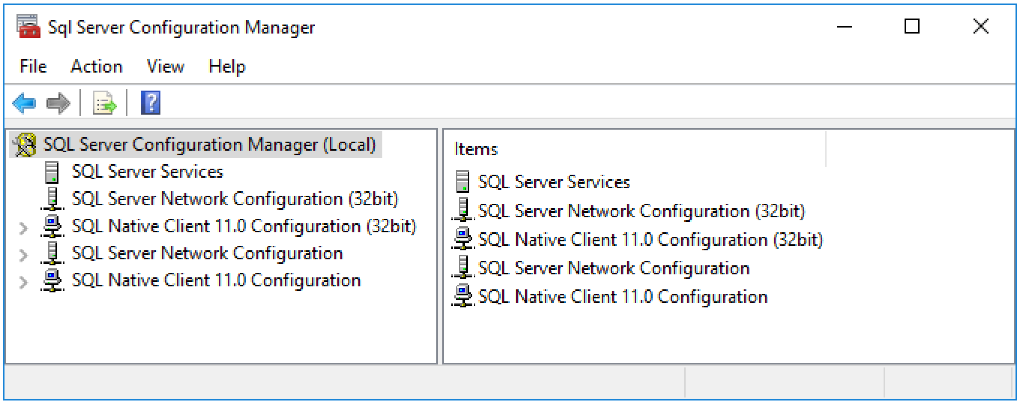
Step 1. Verify the driver installation.

If the JDBC driver for Microsoft SQL Server is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Verify the port number.

Complete the following steps on the machine where SQL Server is installed to find your port number for database connection. If you experience connection issues with the port number that you find, contact your database administrator.

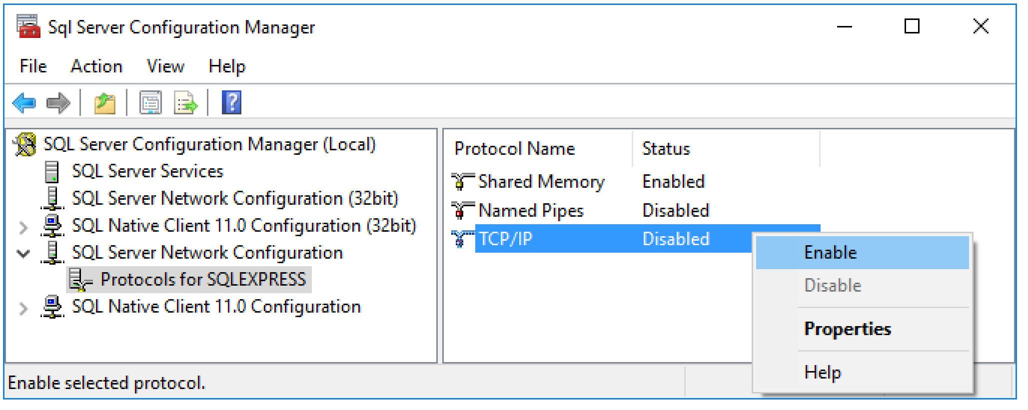
1 On the machine where your SQL Server database is installed, click **Start**. Select your Microsoft SQL Server version folder and click **SQL Server Configuration Manager**.



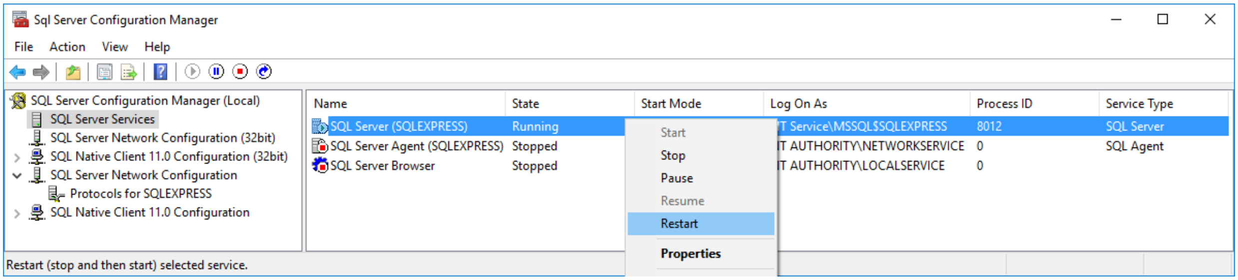
2 On the left of the Sql Server Configuration Manager window, click **SQL Server Network Configuration**. Double-click **Protocols for SQLEXPRESS**.

3 See if TCP/IP is enabled. If so, skip steps 4 and 5.

4 If TCP/IP is disabled, right-click **TCP/IP** and select **Enable**.

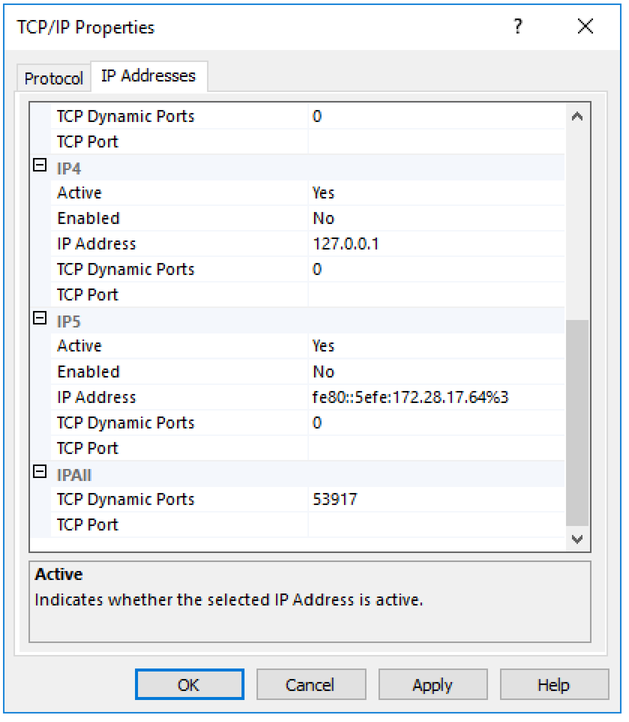


5 To finish the process of enabling the TCP/IP protocol, restart the server. On the left side of the window, click **SQL Server Services**. Right-click **SQL Server (SQLEXPRESS)** and click **Restart**. The server restarts, enabling TCP/IP.



6 Click **Protocols for SQLEXPRESS** and right-click **TCP/IP**. Select **Properties**.

7 In the TCP/IP Properties dialog box, scroll to the bottom on the **IP Addresses** tab until you see the **IPAll** group. The number next to **TCP Dynamic Ports** is the port number. Use this port number in the JDBC Data Source Configuration dialog box when configuring a data source using the Database Explorer app. Or, enter this port number as an input argument of the `database` function at the command line. Here, the port number is `53917`. If this number is `0` or if you want to configure your SQL Server database server to listen to a specific port, delete the entry in the **TCP Dynamic Ports** box. Then, enter another port number in the **TCP Port** box.



8 Click **Apply** and click **OK** to close the TCP/IP Properties dialog box. Then, close the Sql Server Configuration Manager dialog box.

Step 3. Set up the operating system authentication.

Windows authentication enables you to connect to a database using your Windows user account. In this case, Windows performs user validation, and the database does not require a different user name and password. Windows authentication facilitates the maintenance of database access credentials. After you add the required libraries to the system path, the Microsoft SQL Server JDBC driver enables connectivity using Windows authentication. The following steps show how to add these libraries to the Java library path in MATLAB. For details about Java libraries, see “Java Class Path” (MATLAB).

1 Ensure that you have the latest Java driver library installed on your computer. To install the latest library, see Driver Installation.

2. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
3. Close MATLAB.
4. Navigate to the folder from step 2, and create a file named `javalibrarypath.txt` in the folder.
5. Open `javalibrarypath.txt` and insert the path to the Java library file `sqljdbc_auth.dll`. This file is installed in the following location:

   ```
   <installation>\sqljdbc_<version>\<language>\auth\<arch>
   ```

   `<installation>` is the installation folder of the Microsoft SQL Server JDBC driver, `<version>` is the JDBC driver version, `<language>` is the JDBC driver language, and `<arch>` is the architecture.

   Use the x64 folder. In the entry, include the full path to the library file. Do not include the library file name. The following is an example of the path: `C:\DB_Drivers\sqljdbc_4.0\enu\auth\x64`. Save and close `javalibrarypath.txt`.
6. Restart MATLAB.

Step 4. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `C:\DB_Drivers\sqljdbc_4.0\enu\sqljdbc4.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

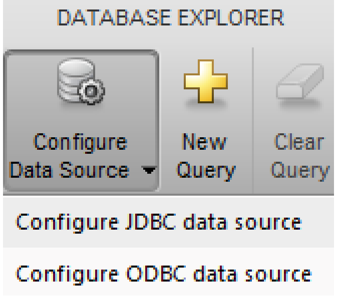
Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

Step 5. Set up the data source using the Database Explorer app.

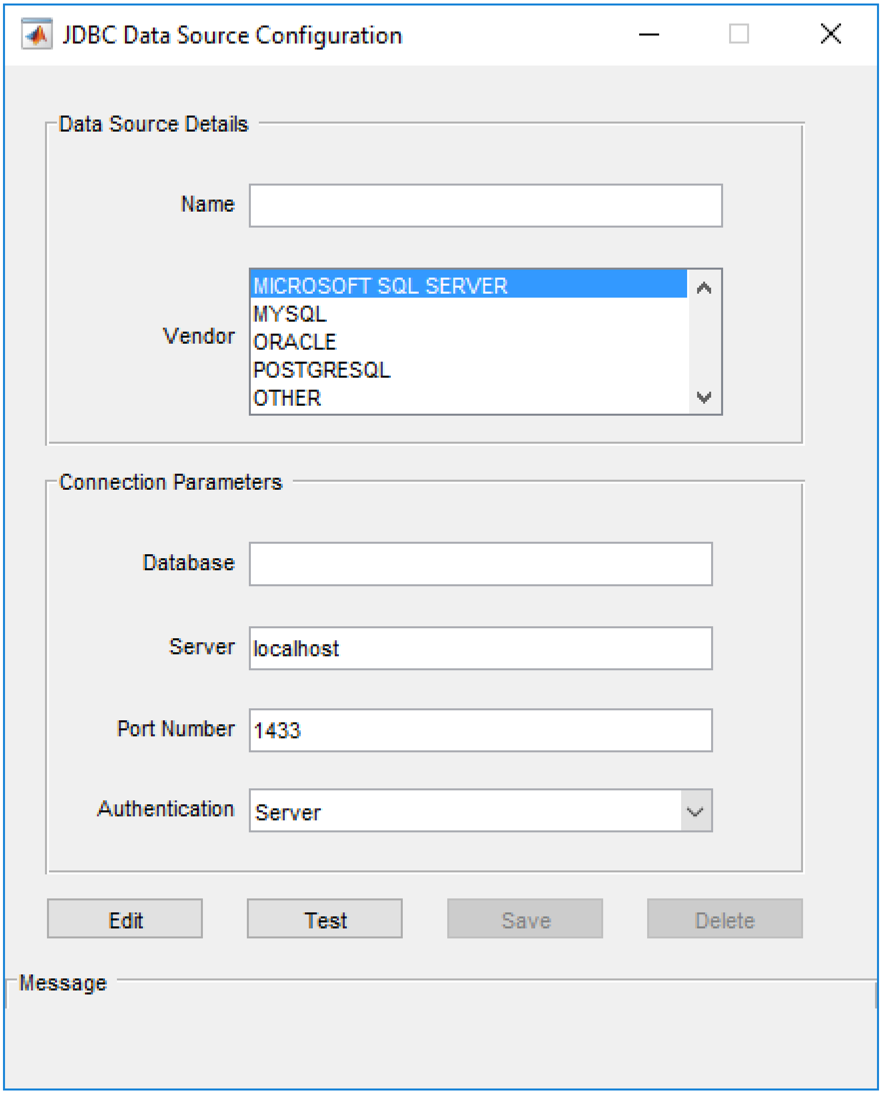
This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see "Connect to SQL Server Using JDBC Driver and Command Line" on page 2-40.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.



3 In the **Name** box, enter a data source name. If you enter a name that duplicates an existing ODBC data source name, the Database Explorer app appends `_JDBC` to the name after you save it.

4 From the **Vendor** list, select `MICROSOFT SQL SERVER`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the

bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 4 on page 2-36.

5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6 To establish the data source with Windows authentication, set **Authentication** to `Windows`.

   Or, to establish the data source without Windows authentication, set **Authentication** to `Server`.

7 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database. If you are connecting with Windows authentication, then leave these boxes blank. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

8 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the SQL Server database using the Database Explorer app or the command line with the JDBC connection.

Step 6. Connect using the Database Explorer app or the command line.

Connect to SQL Server Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, connect with Windows authentication by selecting the data source you defined from the **Data Source** list. Leave the **Username** and **Password** boxes blank. Click **Connect**.

   Or, connect to your database without Windows authentication by selecting the data source you defined. Enter a user name and password. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `MS SQL Server`, and two tabs named `MS SQL Server` and `MS SQL Server1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to SQL Server Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1. To connect with Windows authentication, use the `Vendor` name-value pair argument of the `database` function to specify a connection to a SQL Server database. Use the `AuthType` name-value pair argument to connect with Windows authentication. Specify a blank user name and password. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the port number `123456`.

```
conn = database('dbname','','','Vendor','Microsoft SQL Server', ...
    'Server','sname','AuthType','Windows', ...
    'PortNumber',123456);
```

   Or, to connect without Windows authentication, use the `AuthType` name-value pair argument of the `database` function to specify a connection to the database server. For example, this code assumes that you are connecting to a database named `dbname` with the user name `username` and the password `pwd`.

```
conn = database('dbname','username','pwd', ...
    'Vendor','Microsoft SQL Server','Server','sname', ...
    'AuthType','Server','PortNumber',123456);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Oracle ODBC for Windows

This tutorial shows how to set up a data source and connect to an Oracle database using the Database Explorer app or the command line. This tutorial uses the OraClient11g_home1 ODBC driver to connect to an Oracle 11g Enterprise Edition database.

In this section...

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

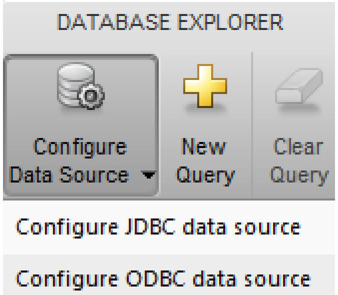
Note: Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of Oracle. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see "Oracle JDBC for Windows" on page 2-48. For details about working with the 64-bit version of Windows, see https://www.mathworks.com/products/matlab/preparing-for-64-bit-windows.html.

Step 2. Set up the data source using the Database Explorer app.

The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

2 Select **Configure Data Source > Configure ODBC data source**.



In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.

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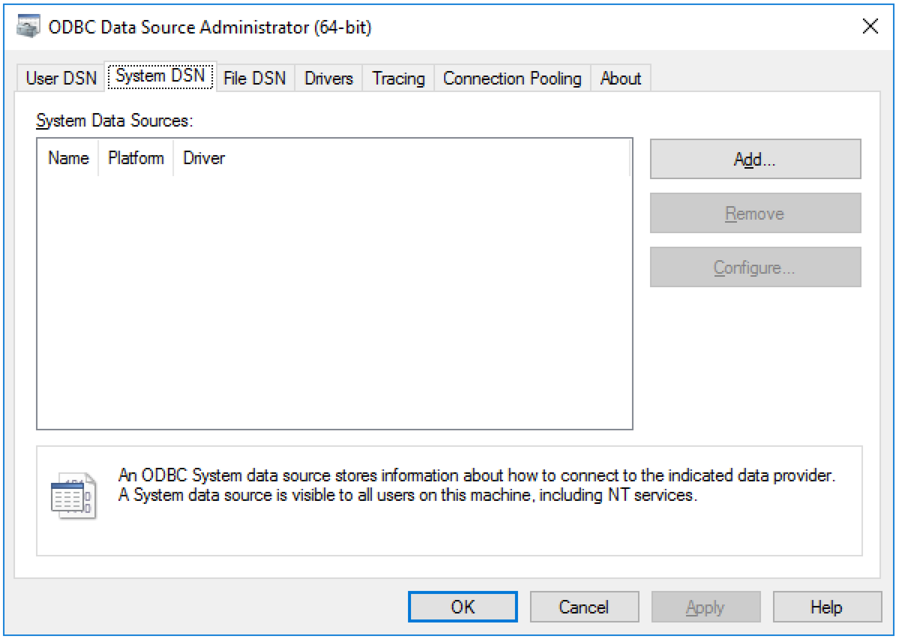
3 Click the **System DSN** tab, and then click **Add**.

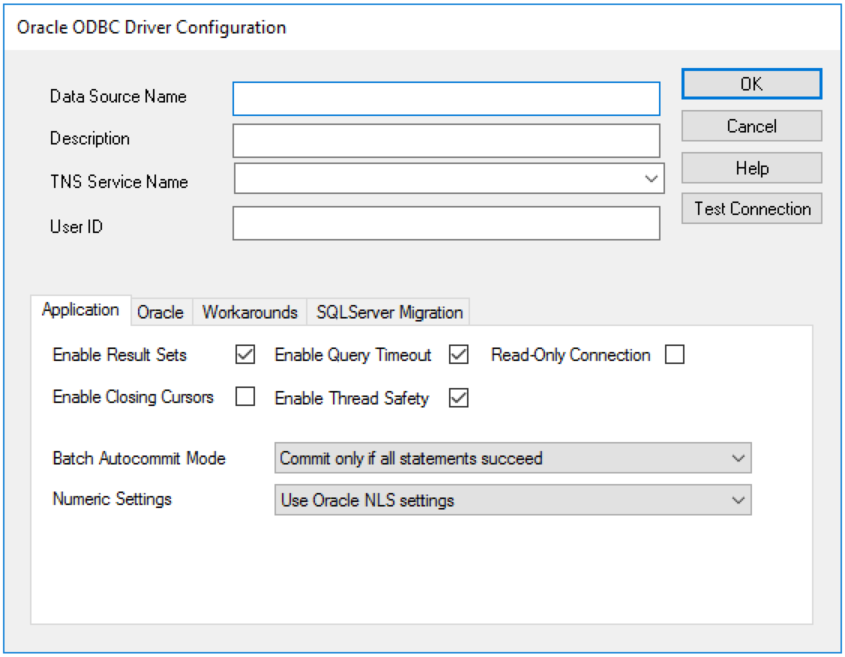


The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

4 Select the ODBC driver `Oracle in OraClient11g_home1`.

Note The name of the ODBC driver can vary.

Click **Finish**.



5 In the Oracle ODBC Driver Configuration dialog box, enter an appropriate name for the data source. You use this name to establish a connection to your database. Here, in the **Data Source Name** box, enter `ORA` as the data source name. In the **Description** box, enter a description for this data source, such as `Oracle database`. In the **TNS Service Name** box, enter the name of your database.

6 You can set up an ODBC data source with or without Windows authentication.

To establish the data source without Windows authentication, enter your user name in the **User ID** box. Or, to establish the data source with Windows authentication, leave this box blank. Leave the **Application**, **Oracle**, **Workarounds**, and **SQLServer Migration** tabs with the default settings.

7 Click **Test Connection** to test the connection to your database. The Oracle ODBC Driver Connect dialog box opens. If you are establishing the data source with Windows authentication, the Testing Connection dialog box opens.

8 Enter your password in the **Password** box. Your database name and user name are automatically entered in the **Service Name** and **User Name** boxes. Click **OK**. If your computer successfully connects to the database, the Testing Connection dialog box displays a message indicating the connection is successful. Click **OK**.

9 Click **OK** in the Oracle ODBC Driver Configuration dialog box. The ODBC Data Source Administrator dialog box shows the ODBC data source `ORA`.

After you complete the data source setup, connect to the Oracle database using the Database Explorer app or the command line with the native ODBC connection.

Step 3. Connect using the Database Explorer app or the command line.

Connect to Oracle Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, connect with Windows authentication by selecting the data source you defined from the **Data Source** list. Leave the **Username** and **Password** boxes blank. Click **Connect**.

Or, connect without Windows authentication by selecting the data source you defined. Enter a user name and password. Click **Connect**.

The Catalog and Schema dialog box opens.

3 In the **Schema** list, select the schema. Click **OK**.

The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `ORA`, and two tabs named `ORA` and `ORA1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to Oracle Using ODBC Driver and Command Line

1 To connect with Windows authentication, connect to the database with the authenticated ODBC data source name and a blank user name and password. For

example, this code assumes that you are connecting to a data source named Oracle_Auth.

```
conn = database('Oracle_Auth','','');
```

Or, to connect without Windows authentication, connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named Oracle with the user name username and the password pwd.

```
conn = database('Oracle','username','pwd');
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
close | database

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Oracle JDBC for Windows

This tutorial shows how to set up a data source and connect to an Oracle database using the Database Explorer app or the command line. This tutorial uses the Oracle Database 11g Release 2 (11.2.0.3) JDBC driver for use with JDK™ 1.6 to connect to an Oracle 11g Enterprise Edition Release 11.2.0.1.0 database.

Step 1. Verify the driver installation.

If the JDBC driver for Oracle is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the operating system authentication.

Windows authentication enables you to connect to a database using your system or network user name and password. In this case, the database does not require a different user name and password. Windows authentication facilitates connecting to the database and maintaining database access credentials. After you add the required libraries to the system path, the Oracle JDBC driver enables connectivity using Windows authentication. The following steps show how to add these libraries to the Java library path in MATLAB. For details about Java libraries, see “Java Class Path” (MATLAB).

1. Ensure that you have the latest Oracle OCI libraries installed on your computer. To install the latest library, see Driver Installation.
2. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
3. Close MATLAB.

4. Navigate to the folder from step 2, and create a file named `javalibrarypath.txt` in the folder.
5. Open `javalibrarypath.txt` and insert the path to the Oracle OCI libraries. The entry must include the full path to the library files. The entry must not contain the library file names. The following is an example of the path: `C:\DB_Libraries\instantclient_11_2`. Save and close `javalibrarypath.txt`.
6. In the environment variables of the advanced system settings, add the Oracle OCI library full path to the Windows Path environment variable.
7. Restart MATLAB.

Step 3. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `C:\DB_Drivers\ojdbc6.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

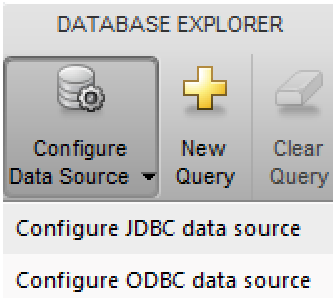
Step 4. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to Oracle Using JDBC Driver and Command Line” on page 2-53.

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps

gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

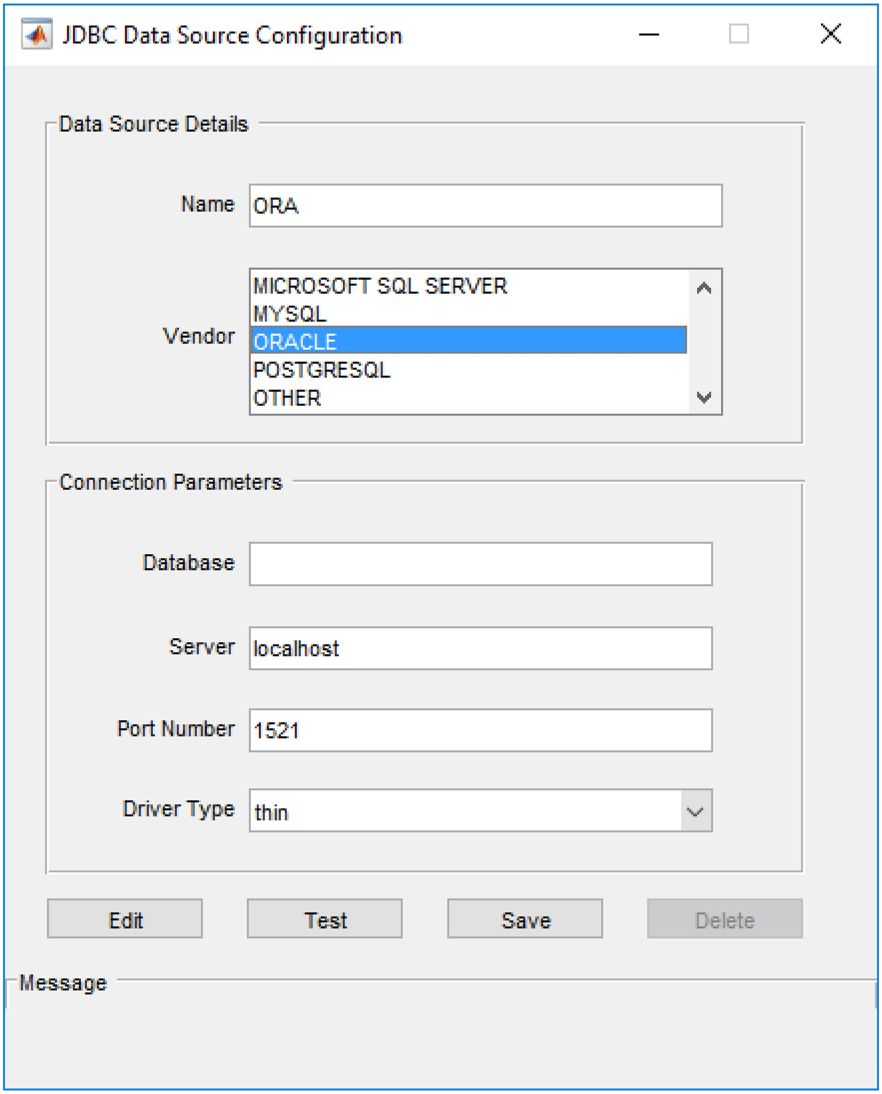
2 Select **Configure Data Source > Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.

3 In the **Name** box, enter the name of your data source. (This example uses a data source named `ORA`.) You use this name to establish a connection to your database. If you enter a name that duplicates an existing ODBC data source name, the Database Explorer app appends `_JDBC` to the name after you save it.

4 From the **Vendor** list, select `ORACLE`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 3 on page 2-49.



5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6 To establish the data source with Windows authentication, set **Driver Type** to `oci`.

Or, to establish the data source without Windows authentication, set **Driver Type** to `thin`.

7. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database. If you are connecting with Windows authentication, then leave these boxes blank. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
8. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the Oracle database using the Database Explorer app or the command line with the JDBC connection.

Step 5. Connect using the Database Explorer app or the command line.

Connect to Oracle Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, connect to your database with Windows authentication by selecting the data source you defined from the **Data Source** list. Leave the **Username** and **Password** boxes blank. Click **Connect**.

   Or, connect to your database without Windows authentication by selecting the data source you defined. Enter a user name and password. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Schema** list, select the schema. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is ORA, and two tabs named ORA and ORA1 are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to Oracle Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1 To connect with Windows authentication, use the `Vendor` name-value pair argument of the `database` function to specify a connection to an Oracle database. Use the `DriverType` name-value pair argument to connect with Windows authentication by specifying the `oci` value. Specify a blank user name and password. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the port number `123456`.

```
conn = database('dbname','','', ...
    'Vendor','Oracle','DriverType','oci', ...
    'Server','sname','PortNumber',123456);
```

`dbname` can be the service name or the Oracle system identifier (SID), depending on your specific Oracle database setup. For details, see your `tnsnames.ora` file, which is often in `<ORACLE_HOME>\NETWORK\ADMIN` where `<ORACLE_HOME>` is the folder containing the installed database or Oracle client.

Or, to connect without Windows authentication, use the `DriverType` name-value pair argument of the `database` function with the value `thin` to specify a connection to the database server. For example, this code assumes that you are connecting to a database named `dbname` with the user name `username` and the password `pwd`.

```
conn = database('dbname','username','pwd', ...
    'Vendor','Oracle','DriverType','thin', ...
    'Server','sname','PortNumber',123456);
```

If you have trouble using the `database` function, use the full entry from your `tnsnames.ora` file in the URL string as one consecutive line. Leave the first argument blank. For example, this code assumes that the value of the `URL` name-value pair argument is set to the specified `tnsnames.ora` file entry for an Oracle database.

```
conn = database('','username','pwd', ...
    'Vendor','Oracle', ...
    'URL',['jdbc:oracle:thin:@(DESCRIPTION = ' ...
    '(ADDRESS = (PROTOCOL = TCP)(HOST = sname)' ...
    '(PORT = 123456)) (CONNECT_DATA = ' ...
    '(SERVER = DEDICATED) (SERVICE_NAME = dbname) ) )']);
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-6
- "Data Preview Using Database Explorer App" on page 4-11
- "Java Class Path" (MATLAB)
- "Modify and Delete Data Sources" on page 4-15
- "Database Explorer App Error Messages" on page 3-17
- "Database Connection Error Messages" on page 3-10

MySQL ODBC for Windows

This tutorial shows how to set up a data source and connect to a MySQL database using the Database Explorer app or the command line. This tutorial uses a MySQL ODBC 5.3 Driver to connect to the MySQL database.

In this section...

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

Note: Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of MySQL. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see “MySQL JDBC for Windows” on page 2-61. For details about working with the 64-bit version of Windows, see https://www.mathworks.com/products/matlab/preparing-for-64-bit-windows.html.

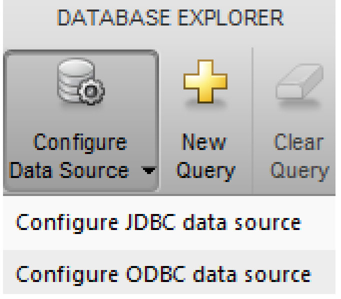
Caution If you use a MySQL ODBC driver version 8 or later, MATLAB has unexpected behavior. To avoid this behavior, install a previous version of the ODBC driver or use the JDBC driver instead. For details about the JDBC driver, see “MySQL JDBC for Windows” on page 2-61.

Step 2. Set up the data source using the Database Explorer app.

The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

2 Select **Configure Data Source** > **Configure ODBC data source**.



In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.

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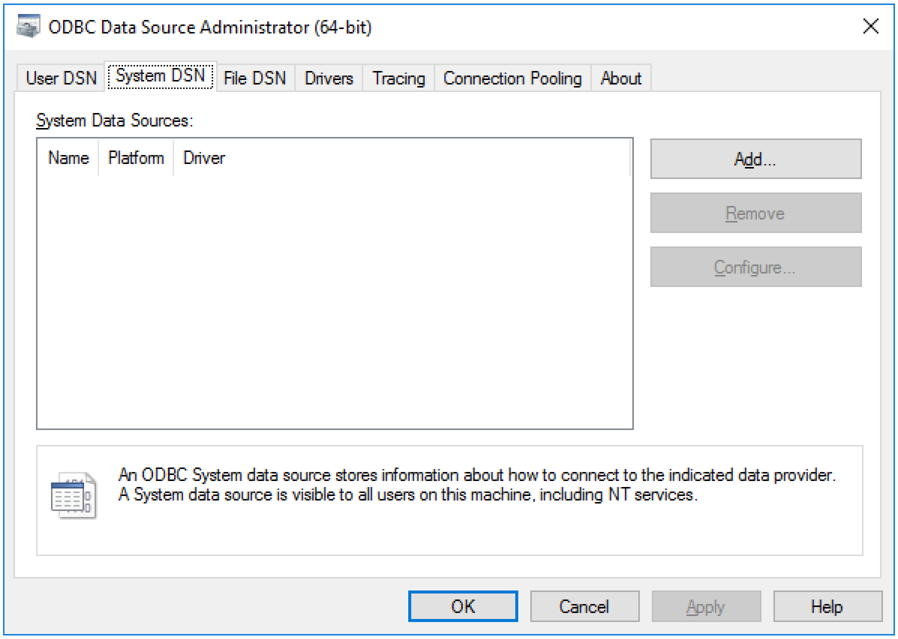
3 Click the **System DSN** tab, and then click **Add**.



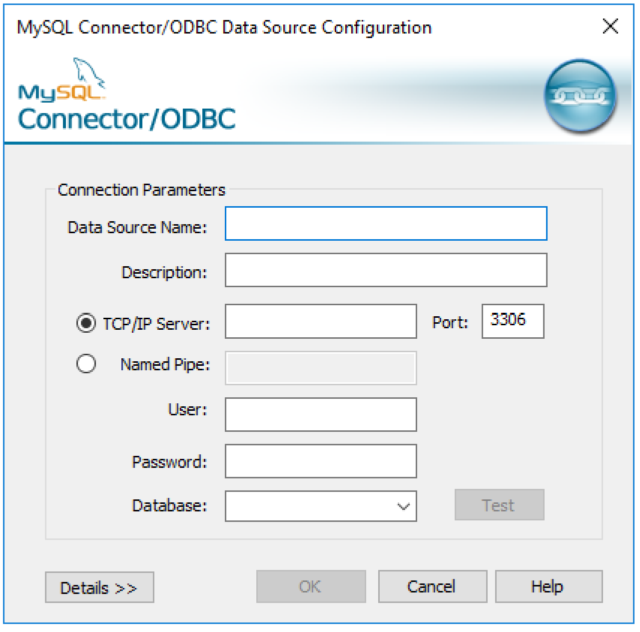
The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

4 Select the ODBC driver `MySQL ODBC 5.2a Driver`.

Note The name of the ODBC driver can vary.

Click **Finish**.

5 In the MySQL Connector/ODBC Data Source Configuration dialog box, fill out the boxes.



- In the **Data Source Name** box, enter an appropriate name for the data source, such as `MySQL`. You use this name to establish a connection to your database.
- In the **Description** box, enter a description for this data source, such as `MySQL database`.
- In the **TCP/IP Server** box, enter the name of your database server. Consult your database administrator for the name of your database server.
- In the **Port** box, enter the port number. The default port number is `3306`.
- In the **User** box, enter your user name.
- In the **Password** box, enter your password.
- In the **Database** box, enter the name of your database.

6 Click **Test** to test the connection to your database. If your computer successfully connects to the database, the Test Result dialog box opens and displays a message indicating the connection is successful.

7 Click **OK** in the MySQL Connector/ODBC Data Source Configuration dialog box. The ODBC Data Source Administrator dialog box shows the ODBC data source `MySQL`.

After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the command line with the native ODBC connection.

Step 3. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Catalog** list, select the catalog. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `MySQL`, and two tabs named `MySQL` and `MySQL1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to MySQL Using ODBC Driver and Command Line

1. Connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `MySQL` with the user name `username` and the password `pwd`.

   ```
   conn = database('MySQL','username','pwd');
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`close` | `database`

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-6
- "Data Preview Using Database Explorer App" on page 4-11
- "Modify and Delete Data Sources" on page 4-15
- "Database Explorer App Error Messages" on page 3-17
- "Database Connection Error Messages" on page 3-10

MySQL JDBC for Windows

This tutorial shows how to set up a data source and connect to a MySQL database using the Database Explorer app or the command line. This tutorial uses the MySQL Connector/J 5.1.46 driver to connect to a MySQL Version 5.5.16 database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for MySQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `C:\DB_Drivers\mysql-connector-java-5.1.46-bin.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

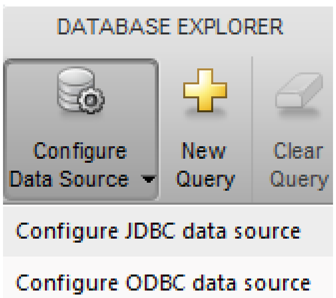
Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to MySQL Using JDBC Driver and Command Line” on page 2-65.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

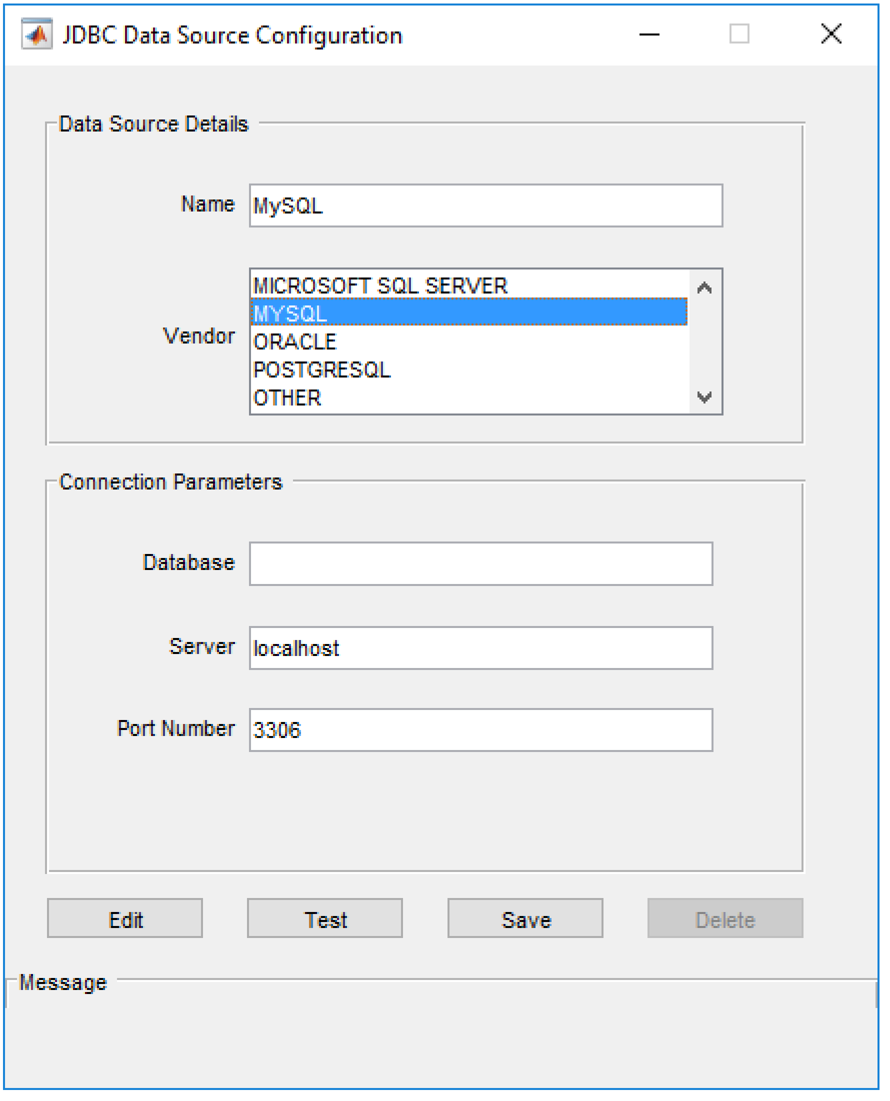
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.

3 In the **Name** box, enter the name of your data source. (This example uses a data source named `MySQL`.) You use this name to establish a connection to your database. If you enter a name that duplicates an existing ODBC data source name, the Database Explorer app appends `_JDBC` to the name after you save it.

4 From the **Vendor** list, select `MYSQL`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-61.



5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Catalog** list, select the catalog. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `MySQL`, and two tabs named `MySQL` and `MySQL1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to MySQL Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1. Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a MySQL database. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the user name `username` and the password `pwd`.

   ```
   conn = database('dbname','username','pwd', ...
       'Vendor','MySQL', ...
       'Server','sname');
   ```

2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

PostgreSQL ODBC for Windows

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the Database Explorer app or the command line. This tutorial uses the PostgreSQL ANSI(x64) driver to connect to a PostgreSQL 9.2 database.

In this section...

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

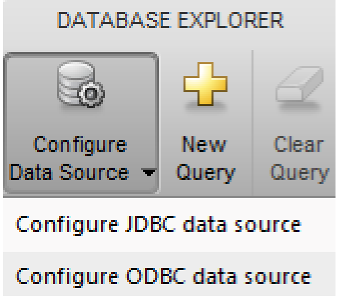
Note: Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of PostgreSQL. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see “PostgreSQL JDBC for Windows” on page 2-72. For details about working with the 64-bit version of Windows, see https://www.mathworks.com/products/matlab/preparing-for-64-bit-windows.html.

Step 2. Set up the data source using the Database Explorer app.

The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

2 Select **Configure Data Source > Configure ODBC data source**.

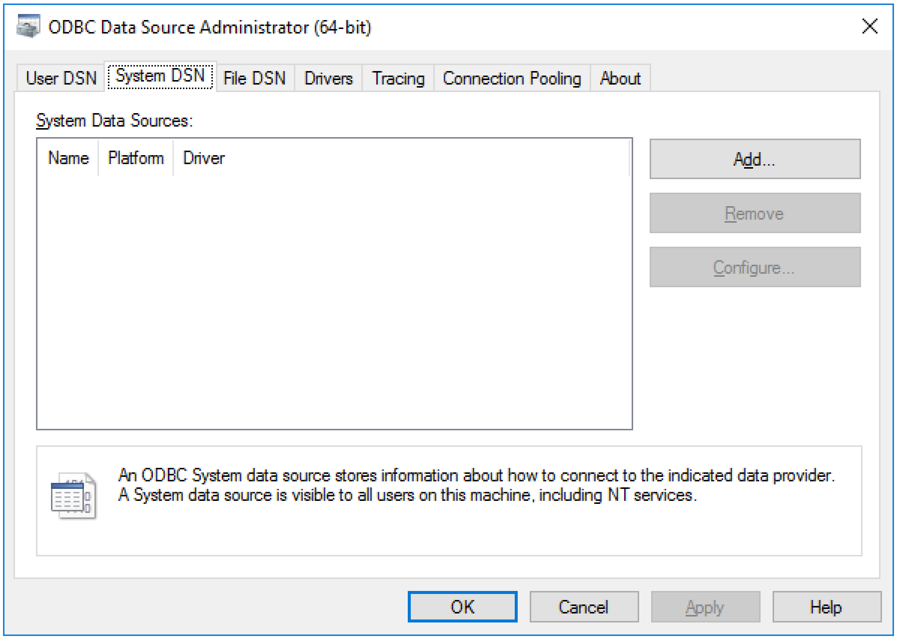


In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.

---

3 Click the **System DSN** tab, and then click **Add**.



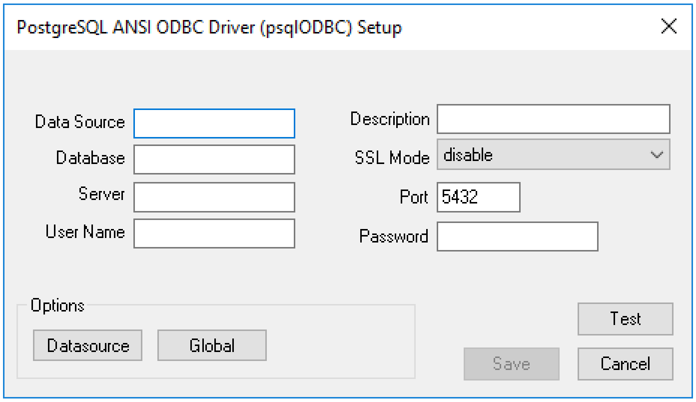
The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

4 Select the ODBC driver `PostgreSQL ANSI(x64)`.

Note The name of the ODBC driver can vary.

Click **Finish**.

5 In the PostgreSQL ANSI ODBC Driver (psqlODBC) Setup dialog box, fill out the boxes.



- In the **Data Source** box, enter an appropriate name for the data source, such as `PostgreSQL`. You use this name to establish a connection to your database.
- In the **Description** box, enter a description for this data source, such as `PostgreSQL database`.
- In the **Database** box, enter the name of your database.
- In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server.
- In the **Port** box, enter the port number. The default port number is `5432`.
- In the **User Name** box, enter your user name.
- In the **Password** box, enter your password.

6. Click **Test** to test the connection to your database. If your computer successfully connects to the database, the Connection Test dialog box opens and displays a message indicating the connection is successful.
7. Click **Save** in the PostgreSQL ANSI ODBC Driver (psqlODBC) Setup dialog box. The ODBC Data Source Administrator dialog box shows the ODBC data source `PostgreSQL30`.

After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the command line with the native ODBC connection.

Step 3. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `Postgresql`, and two tabs named `Postgresql` and `Postgresql1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to PostgreSQL Using ODBC Driver and Command Line

1. Connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `PostgreSQL` with the user name `username` and the password `pwd`.

   ```
   conn = database('PostgreSQL','username','pwd');
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`close` | `database`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

PostgreSQL JDBC for Windows

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the Database Explorer app or the command line. This tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for PostgreSQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `C:\DB_Drivers\postgresql-8.4-702.jdbc4.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

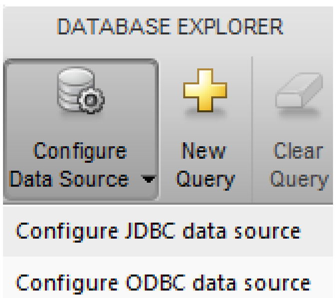
Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see "Java Class Path" (MATLAB).

Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see "Connect to PostgreSQL Using JDBC Driver and Command Line" on page 2-76.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

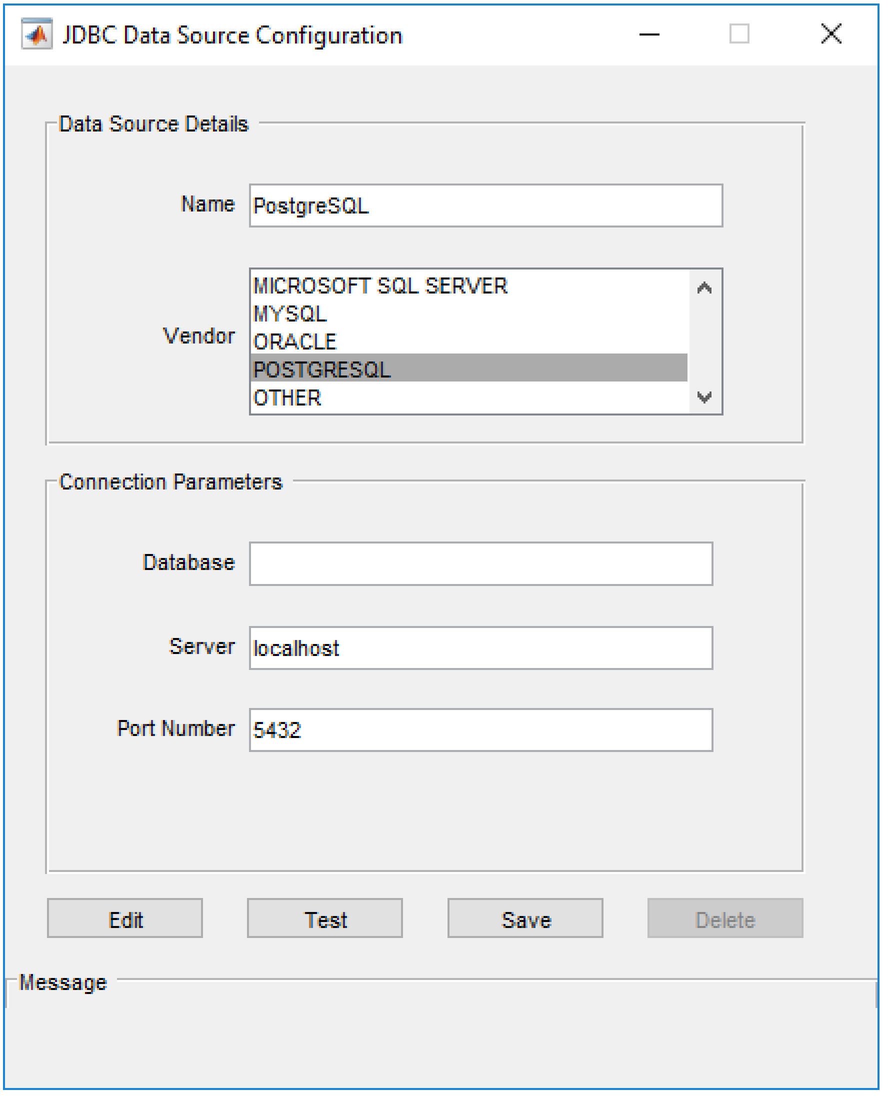
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.

3 In the **Name** box, enter a data source name. (This example uses a data source named `PostgreSQL`.) You use this name to establish a connection to your database. If you enter a name that duplicates an existing ODBC data source name, the Database Explorer app appends `_JDBC` to the name after you save it.

4 From the **Vendor** list, select `POSTGRESQL`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-72.



5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, select the data source name you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `Postgresql`, and two tabs named `Postgresql` and `Postgresql1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to PostgreSQL Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1 Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a PostgreSQL database. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the user name `username` and the password `pwd`.

```
conn = database('dbname','username','pwd', ...
    'Vendor','PostgreSQL', ...
    'Server','sname');
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

SQLite JDBC for Windows

This tutorial shows how to set up a data source and connect to a SQLite database using the Database Explorer app or the command line. This tutorial uses the SQLite JDBC 3.7.2 Driver to connect to a SQLite Version 3.7.17 database.

Step 1. Verify the driver installation.

If the JDBC driver for SQLite is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

If you do not want to install a driver and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see "Working with MATLAB Interface to SQLite" on page 2-6.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `C:\DB_Drivers\sqlite-jdbc-3.7.2.jar`. Save and close `javaclasspath.txt`.

5 Restart MATLAB.

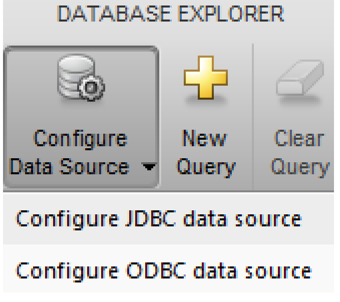
Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to SQLite Using JDBC Driver and Command Line” on page 2-81.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

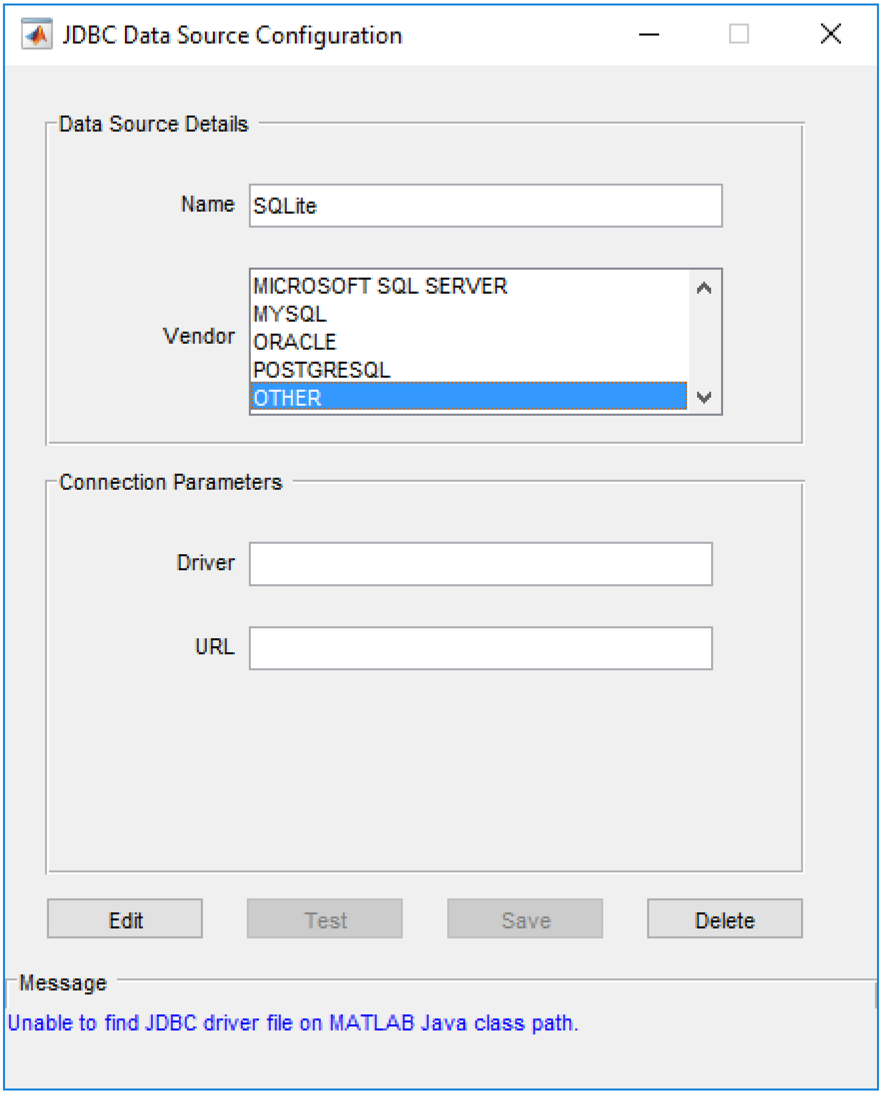
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.

3 In the **Name** box, enter a data source name. (This example uses a data source named `SQLite`.) If you enter a name that duplicates an existing ODBC data source name, the Database Explorer app appends `_JDBC` to the name after you save it.

4 From the **Vendor** list, select `OTHER`.



Your entries for **Driver** and **URL** can vary depending on the type and version of the JDBC driver and your database. For details, see the JDBC driver documentation for your database.

5. In the **Driver** box, enter the SQLite driver Java class object. Here, use `org.sqlite.JDBC`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-77.
6. Connect to the SQLite database by creating a URL string using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string stays constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. The last part of the URL string is `subname`. For SQLite, `subname` contains the location of the database. For example, your string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer. Enter your string in the **URL** box and press **Enter**.
7. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
8. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the SQLite database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to SQLite Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

3 Select tables in the **Data Browser** pane to query the database.

4 Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `SQLite`, and two tabs named `SQLite` and `SQLite1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to SQLite Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1 Connect to the SQLite database by using the `database` function.

   - Enter the data source name that you defined for the first argument.
   - Enter your user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.
   - The fourth argument is the driver Java class object. This code assumes that the class object is `org.sqlite.JDBC`.
   - The last argument is the URL string `URL` that you create using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string stays constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. The last part of the URL string is `subname`. For SQLite, `subname` contains the location of the database. For example, your string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer.

   For example, this code assumes that you are connecting to a data source named `SQLite`.

```
conn = database('SQLite','username','pwd','org.sqlite.JDBC','URL');
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Microsoft SQL Server JDBC for macOS

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the Database Explorer app or the command line. This tutorial uses the Microsoft JDBC Driver 4.0 for Microsoft SQL Server to connect to a Microsoft SQL Server 2016 Express database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for SQL Server is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

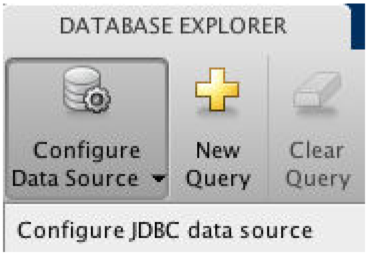
1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/sqljdbc4.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

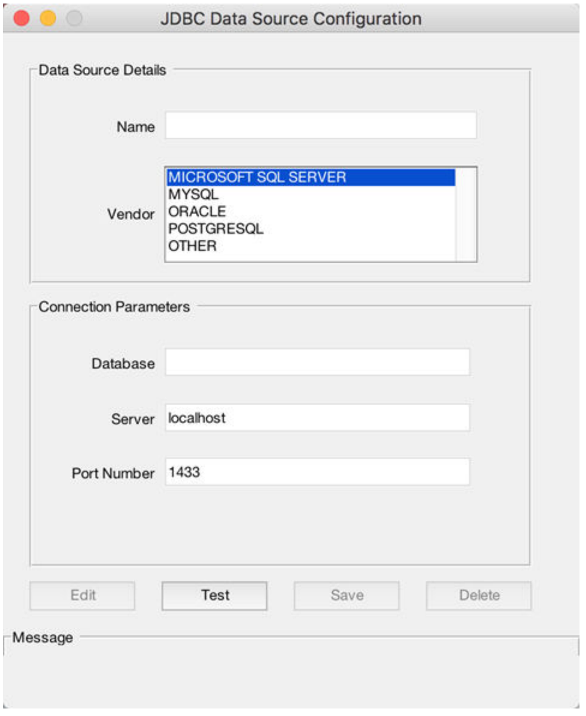
Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to SQL Server Using JDBC Driver and Command Line” on page 2-86.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.



3 In the **Name** box, enter a data source name.

4 From the **Vendor** list, select `MICROSOFT SQL SERVER`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-83.

5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the SQL Server database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to SQL Server Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `MS SQL Server`, and two tabs named `MS SQL Server` and `MS SQL Server1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to SQL Server Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1. Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a SQL Server database. Set the `AuthType` name-value pair argument to `Server`. For example, this code assumes that you are connecting to a database

named dbname, on a database server named sname, with the user name username, the password pwd, and the port number 123456.

```
conn = database('dbname','username','pwd', ...
    'Vendor','Microsoft SQL Server','Server','sname', ...
    'AuthType','Server','PortNumber',123456);
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
close | database | javaaddpath

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Microsoft SQL Server JDBC for Linux

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the Database Explorer app or the command line. This tutorial uses the Microsoft JDBC Driver 4.0 for Microsoft SQL Server to connect to a Microsoft SQL Server 2016 Express database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for Microsoft SQL Server is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

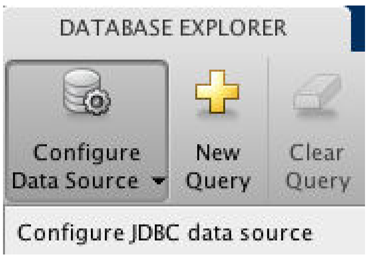
1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/sqljdbc4.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

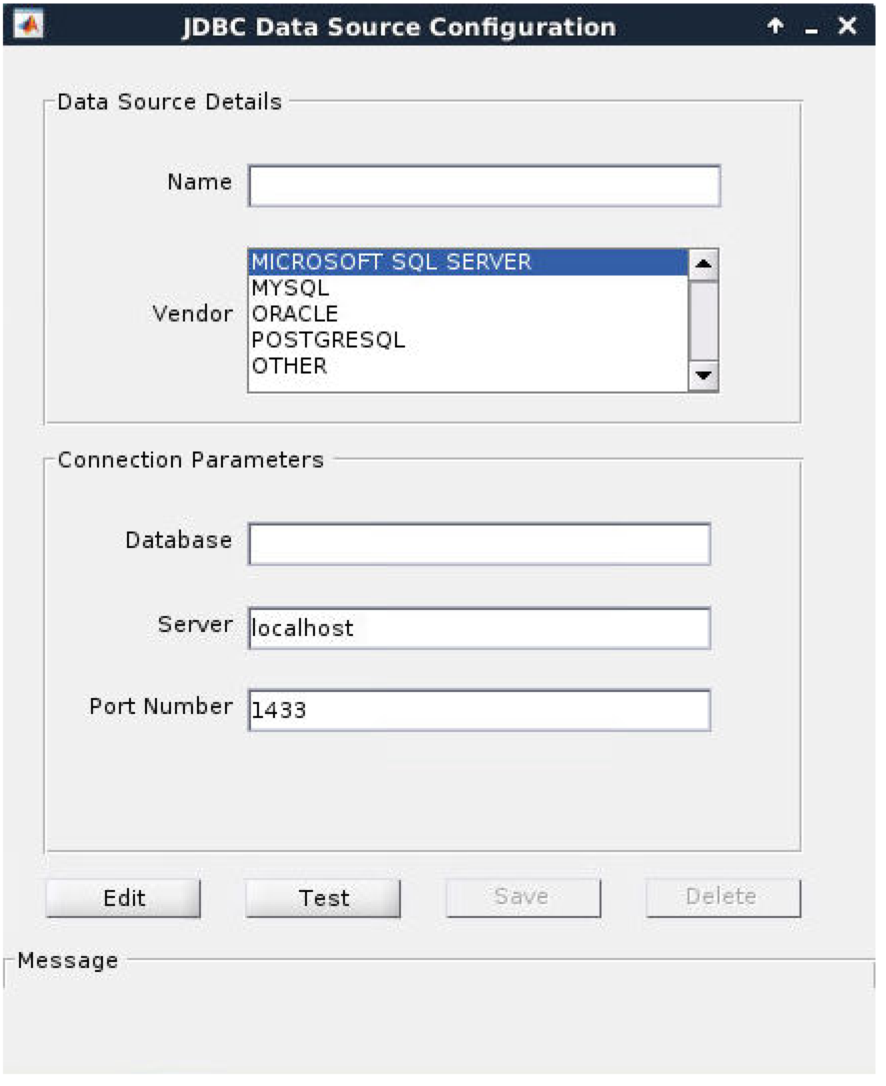
Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to SQL Server Using JDBC Driver and Command Line” on page 2-92.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.



3 In the **Name** box, enter a data source name.

4 From the **Vendor** list, select `MICROSOFT SQL SERVER`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-88.

5. In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number. From the **Authentication** list, select `Server`.
6. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
7. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the SQL Server database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to SQL Server Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is

MS SQL Server, and two tabs named MS SQL Server and MS SQL Server1 are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to SQL Server Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1 Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a SQL Server database. Set the `AuthType` name-value pair argument to `Server`. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the user name `username`, the password `pwd`, and the port number `123456`.

```
conn = database('dbname','username','pwd', ...
    'Vendor','Microsoft SQL Server','Server','sname', ...
    'AuthType','Server','PortNumber',123456);
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-6
- "Data Preview Using Database Explorer App" on page 4-11
- "Java Class Path" (MATLAB)
- "Modify and Delete Data Sources" on page 4-15

- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Oracle JDBC for macOS

This tutorial shows how to set up a data source and connect to an Oracle database using the Database Explorer app or the command line. This tutorial uses the Oracle Database 11g Release 2 (11.2.0.3) JDBC driver for use with JDK 1.6 to connect to an Oracle 11g Enterprise Edition Release 11.2.0.1.0 database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for Oracle is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

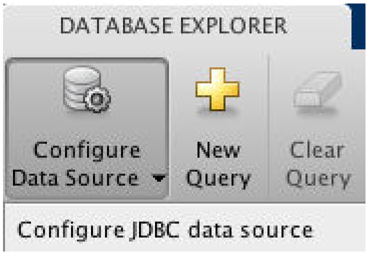
1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/ojdbc6.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

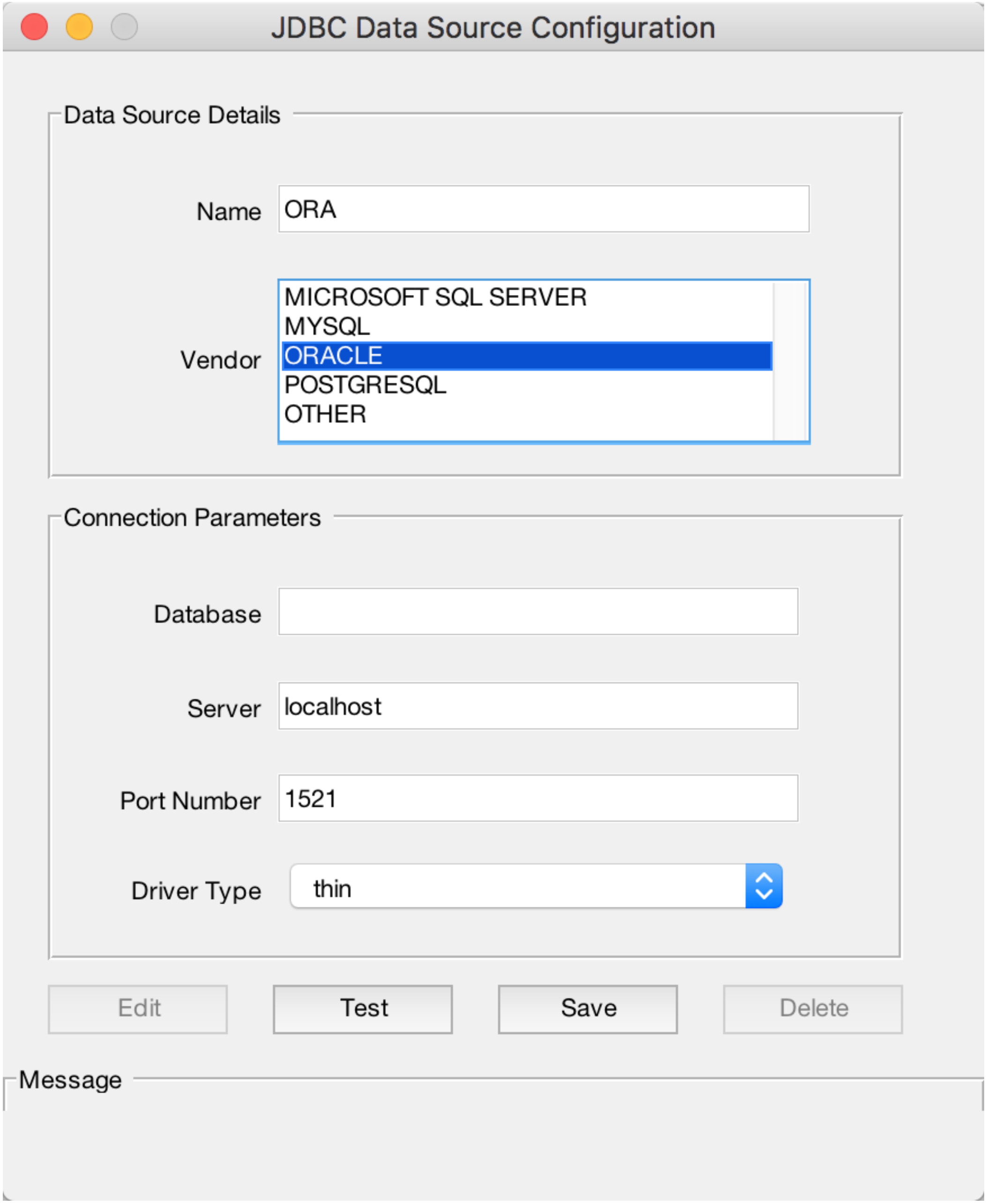
Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to Oracle Using JDBC Driver and Command Line” on page 2-98.

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. Select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a data source name. (This example uses a data source named `ORA`.)
4. From the **Vendor** list, select `ORACLE`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-94.


JDBC Data Source Configuration
Data Source Details
Name
ORA
Vendor
MICROSOFT SQL SERVER
MYSQL
ORACLE
POSTGRESQL
OTHER
Connection Parameters
Database
Server
localhost
Port Number
1521
Driver Type
thin
Edit
Test
Save
Delete
Message

5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number. From the **Driver Type** list, select `thin` or `oci`. (Use `thin` as the default driver. Use `oci` if you installed an OCI driver.)

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the Oracle database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to Oracle Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 In the **Schema** list, select the schema. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is ORA, and two tabs named ORA and ORA1 are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to Oracle Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1. Use the `Vendor` name-value pair argument of the `database` function to specify a connection to an Oracle database. Set the `DriverType` name-value pair argument to `thin`. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the user name `username`, the password `pwd`, and the port number `123456`.

   ```
   conn = database('dbname','username','pwd', ...
       'Vendor','Oracle','DriverType','thin', ...
       'Server','sname','PortNumber',123456);
   ```

   `dbname` can be the service name or the Oracle system identifier (SID), depending on your specific Oracle database setup. For details, see your `tnsnames.ora` file, which is often in <ORACLE_HOME>/NETWORK/ADMIN where <ORACLE_HOME> is the folder containing the installed database or the Oracle client.

   If you have trouble using the `database` function, use the full entry from your `tnsnames.ora` file in the URL string as one consecutive line. Leave the first argument blank. For example, this code assumes that the value of the `URL` name-value pair argument is set to the specified `tnsnames.ora` file entry for an Oracle database.

   ```
   conn = database('','username','pwd', ...
       'Vendor','Oracle', ...
       'URL',['jdbc:oracle:thin:@(DESCRIPTION = ' ...
       '(ADDRESS = (PROTOCOL = TCP)(HOST = sname)' ...
       '(PORT = 123456)) (CONNECT_DATA = ' ...
       '(SERVER = DEDICATED) (SERVICE_NAME = dbname) ) )']);
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Oracle JDBC for Linux

This tutorial shows how to set up a data source and connect to a Oracle database using the Database Explorer app or the command line. This tutorial uses the Oracle Database 11g Release 2 (11.2.0.3) JDBC driver for use with JDK 1.6 to connect to a Oracle 11g Enterprise Edition Release 11.2.0.1.0 database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for Oracle is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/ojdbc6.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

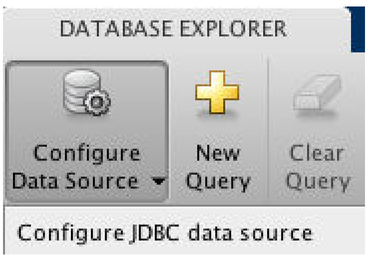
Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to Oracle Using JDBC Driver and Command Line” on page 2-104.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

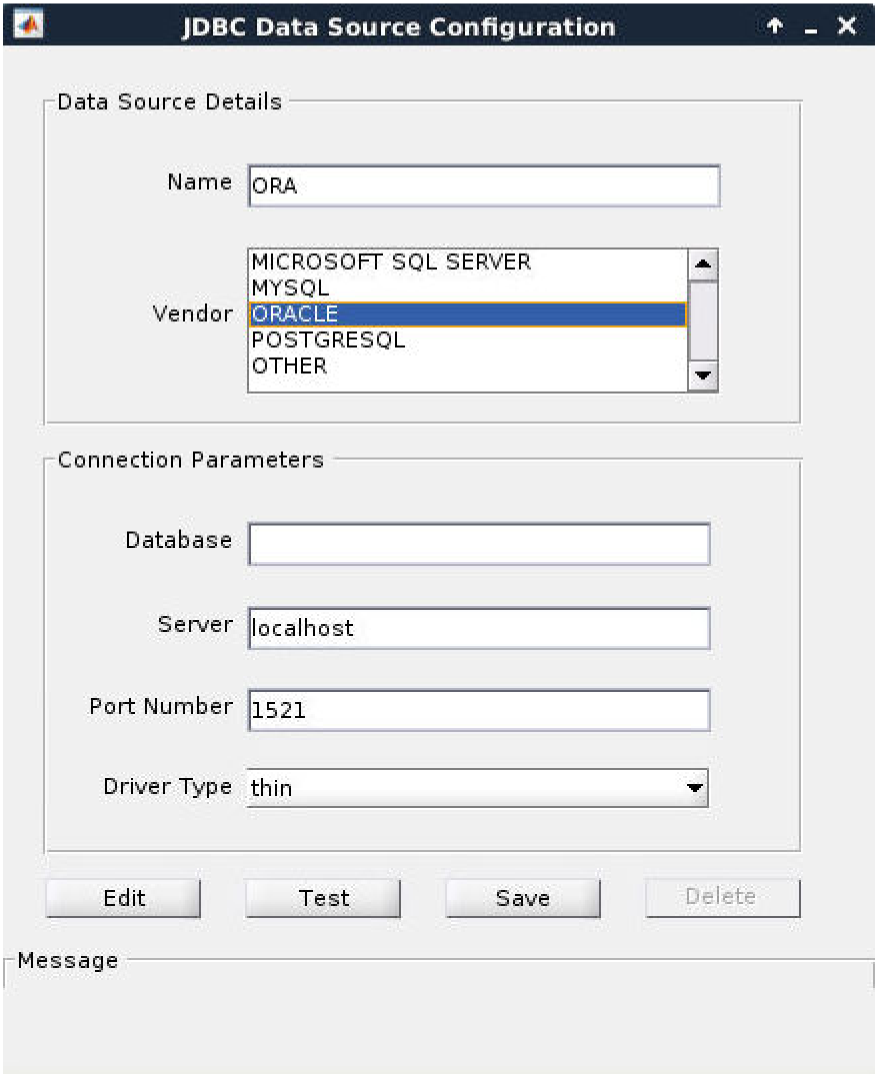
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.

3 In the **Name** box, enter a data source name. (This example uses a data source named `ORA`.)

4 From the **Vendor** list, select `ORACLE`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-100.



5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number. From the **Driver Type** list, select `thin` or `oci`. (Use `thin` as the default driver. Use `oci` if you installed an OCI driver.)

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the Oracle database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to Oracle Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 In the **Schema** list, select the schema. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query and the database connection.

> **Tip** To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `ORA`, and two tabs named `ORA` and `ORA1` are open, then close both tabs.
>
> To close all database connections, close the Database Explorer app.

Connect to Oracle Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1. Use the `Vendor` name-value pair argument of the `database` function to specify a connection to an Oracle database. Set the `DriverType` name-value pair argument to `thin`. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the user name `username`, the password `pwd`, and the port number `123456`.

   ```
   conn = database('dbname','username','pwd', ...
       'Vendor','Oracle','DriverType','thin', ...
       'Server','sname','PortNumber',123456);
   ```

   `dbname` can be the service name or the Oracle system identifier (SID), depending on your specific Oracle database setup. For details, see your `tnsnames.ora` file, which is often in <ORACLE_HOME>/NETWORK/ADMIN where <ORACLE_HOME> is the folder containing the installed database or the Oracle client.

   If you have trouble using the `database` function, use the full entry from your `tnsnames.ora` file in the URL string as one consecutive line. Leave the first argument blank. For example, this code assumes that the value of the `URL` name-value pair argument is set to the specified `tnsnames.ora` file entry for an Oracle database.

   ```
   conn = database('','username','pwd', ...
       'Vendor','Oracle', ...
       'URL',['jdbc:oracle:thin:@(DESCRIPTION = ' ...
       '(ADDRESS = (PROTOCOL = TCP)(HOST = sname)' ...
       '(PORT = 123456)) (CONNECT_DATA = ' ...
       '(SERVER = DEDICATED) (SERVICE_NAME = dbname) ) )']);
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

MySQL JDBC for macOS

This tutorial shows how to set up a data source and connect to a MySQL database using the Database Explorer app or the command line. This tutorial uses the MySQL Connector/J 5.1.46 driver to connect to a MySQL Version 5.5.16 database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for MySQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/mysql-connector-java-5.1.46-bin.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

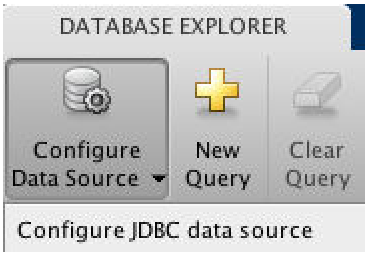
Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see "Java Class Path" (MATLAB).

Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to MySQL Using JDBC Driver and Command Line” on page 2-110.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.

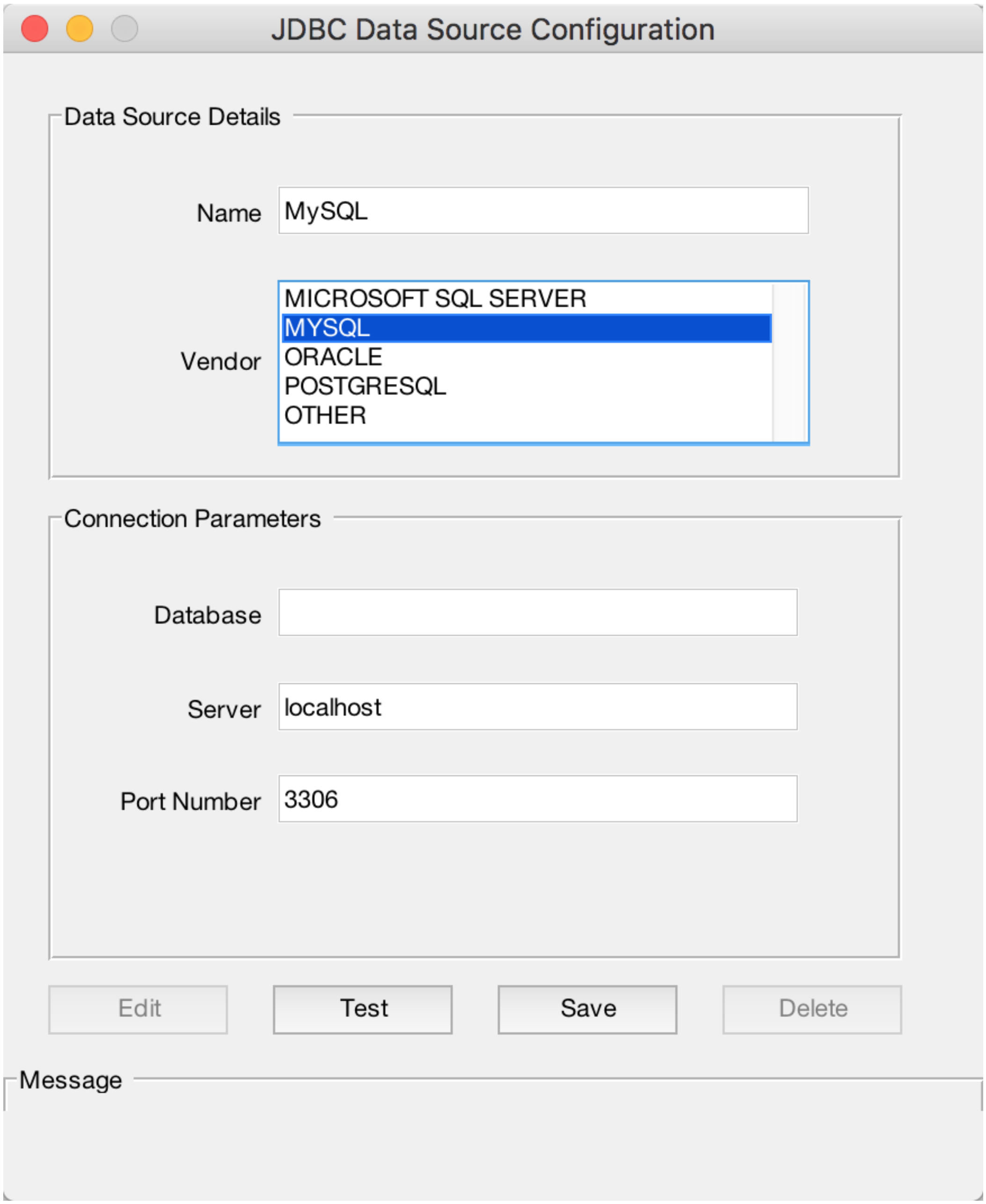
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.

3 In the **Name** box, enter a data source name. (This example uses a data source named `MySQL`.)

4 From the **Vendor** list, select `MYSQL`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-106.


JDBC Data Source Configuration
Data Source Details
Name
MySQL
Vendor
MICROSOFT SQL SERVER
MYSQL
ORACLE
POSTGRESQL
OTHER
Connection Parameters
Database
Server
localhost
Port Number
3306
Edit
Test
Save
Delete
Message

5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 In the **Catalog** list, select the catalog. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `MySQL`, and two tabs named `MySQL` and `MySQL1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to MySQL Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1 Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a MySQL database. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the user name `username` and the password `pwd`.

```
conn = database('dbname','username','pwd', ...
    'Vendor','MySQL', ...
    'Server','sname');
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

MySQL JDBC for Linux

This tutorial shows how to set up a data source and connect to a MySQL database using the Database Explorer app or the command line. This tutorial uses the MySQL Connector/J 5.1.46 driver to connect to a MySQL Version 5.5.16 database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for MySQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

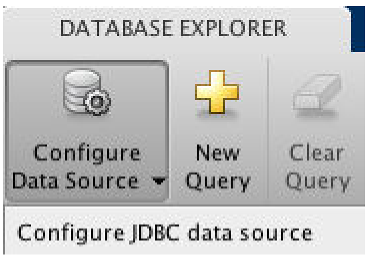
1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/mysql-connector-java-5.1.46-bin.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see "Java Class Path" (MATLAB).

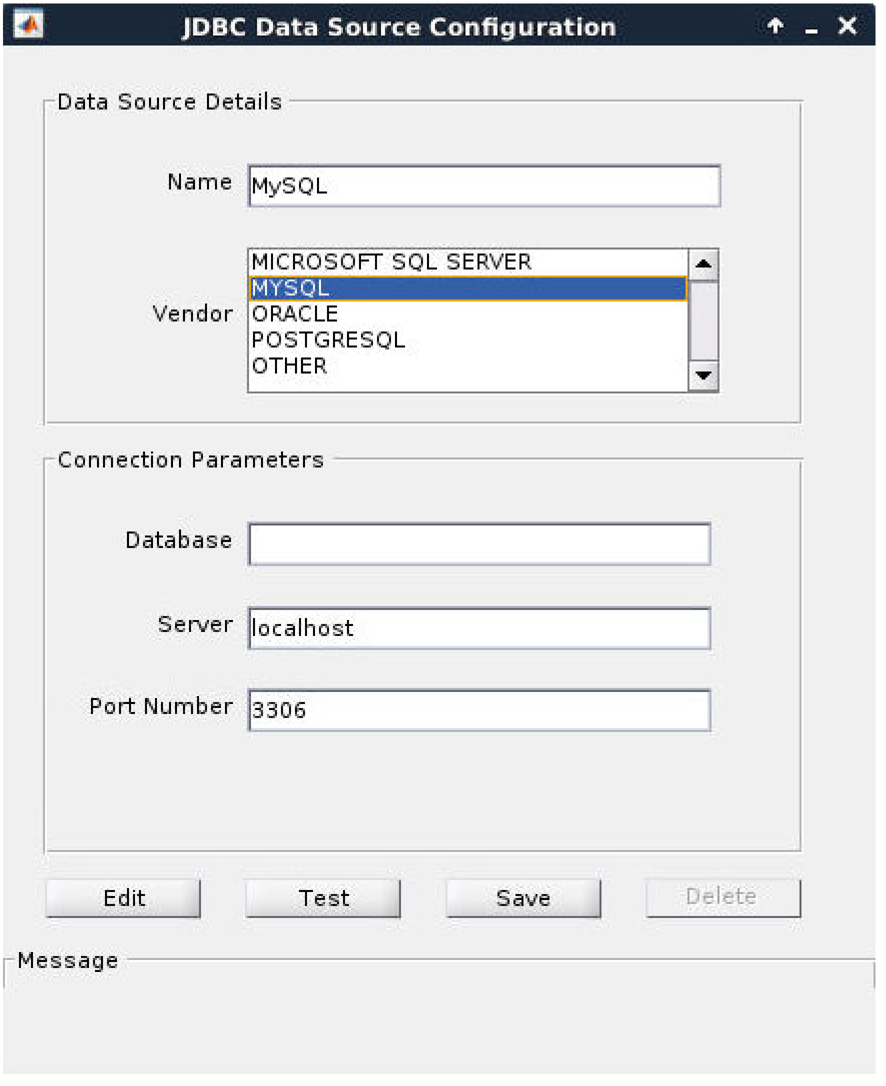
Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see "Connect to MySQL Using JDBC Driver and Command Line" on page 2-115.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.
3 In the **Name** box, enter a data source name. (This example uses a data source named `MySQL`.)
4 From the **Vendor** list, select `MYSQL`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-111.



5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Catalog** list, select the catalog. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `MySQL`, and two tabs named `MySQL` and `MySQL1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to MySQL Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1 Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a MySQL database. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the user name `username` and the password `pwd`.

```
conn = database('dbname','username','pwd', ...
    'Vendor','MySQL', ...
    'Server','sname');
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

PostgreSQL JDBC for macOS

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the Database Explorer app or the command line. This tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database.

Step 1. Verify the driver installation.

If the JDBC driver for PostgreSQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

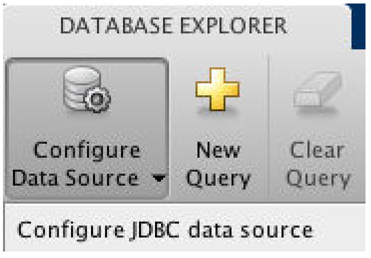
1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/postgresql-8.4-702.jdbc4.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see "Java Class Path" (MATLAB).

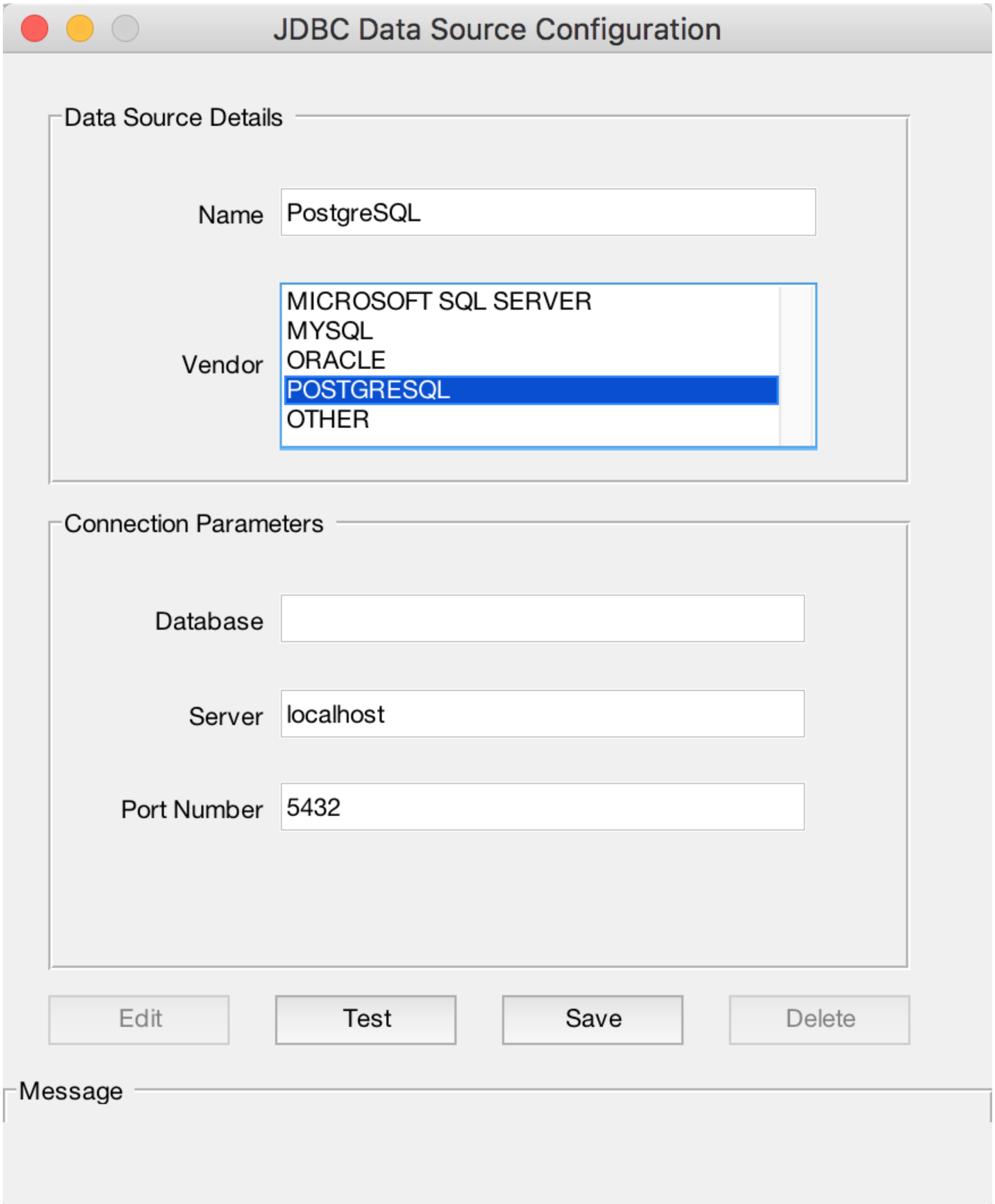
Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see "Connect to PostgreSQL Using JDBC Driver and Command Line" on page 2-120.

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. Select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a data source name. (This example uses a data source named `PostgreSQL`.)
4. From the **Vendor** list, select `POSTGRESQL`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-116.


JDBC Data Source Configuration
Data Source Details
Name
PostgreSQL
Vendor
MICROSOFT SQL SERVER
MYSQL
ORACLE
POSTGRESQL
OTHER
Connection Parameters
Database
Server
localhost
Port Number
5432
Edit
Test
Save
Delete
Message

5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is

PostgreSQL, and two tabs named PostgreSQL and PostgreSQL1 are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to PostgreSQL Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1. Use the Vendor name-value pair argument of the database function to specify a connection to a PostgreSQL database. For example, this code assumes that you are connecting to a database named dbname, on a database server named sname, with the user name username and the password pwd.

```
conn = database('dbname','username','pwd', ...
    'Vendor','PostgreSQL', ...
    'Server','sname');
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
close | database | javaaddpath

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15

- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

PostgreSQL JDBC for Linux

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the Database Explorer app or the command line. This tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for PostgreSQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

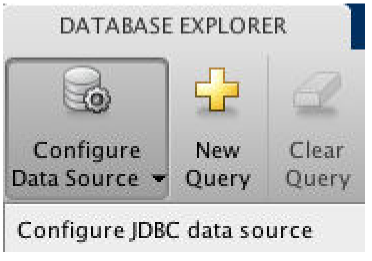
1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/postgresql-8.4-702.jdbc4.jar`. Save and close `javaclasspath.txt`.
5. Restart MATLAB.

Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see "Java Class Path" (MATLAB).

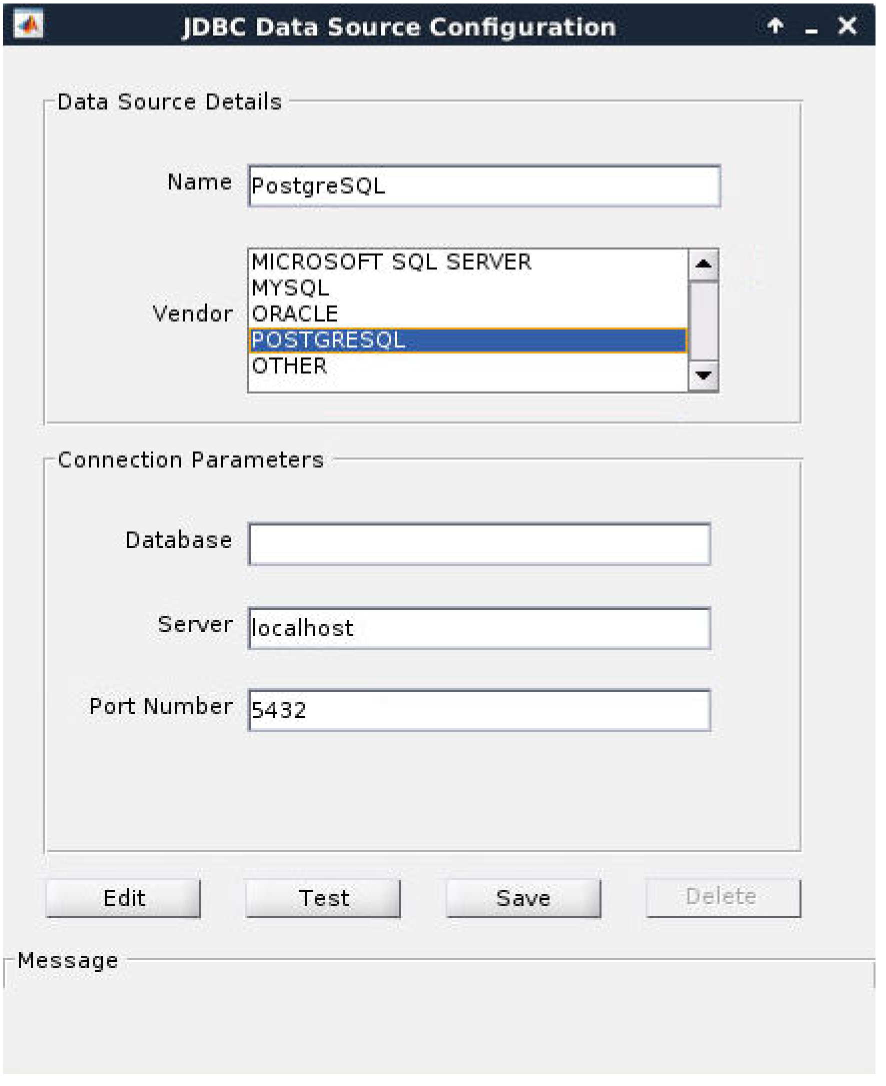
Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see "Connect to PostgreSQL Using JDBC Driver and Command Line" on page 2-126.

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. Select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a data source name. (This example uses a data source named `PostgreSQL`.)
4. From the **Vendor** list, select `POSTGRESQL`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-122.



5 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

6. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
7. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `PostgreSQL`, and two tabs named `PostgreSQL` and `PostgreSQL1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to PostgreSQL Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1. Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a PostgreSQL database. For example, this code assumes that you are connecting to a database named `dbname`, on a database server named `sname`, with the user name `username` and the password `pwd`.

   ```
   conn = database('dbname','username','pwd', ...
       'Vendor','PostgreSQL', ...
       'Server','sname');
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

SQLite JDBC for macOS

This tutorial shows how to set up a data source and connect to a SQLite database using the Database Explorer app or the command line. This tutorial uses the SQLite JDBC 3.7.2 Driver to connect to a SQLite Version 3.7.17 database.

In this section...

Step 1. Verify the driver installation.

If the JDBC driver for SQLite is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

If you do not want to install a driver and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see “Working with MATLAB Interface to SQLite” on page 2-6.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/sqlite-jdbc-3.7.2.jar`. Save and close `javaclasspath.txt`.

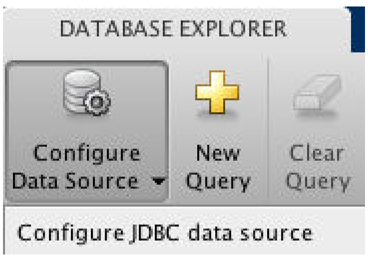
5 Restart MATLAB.

Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

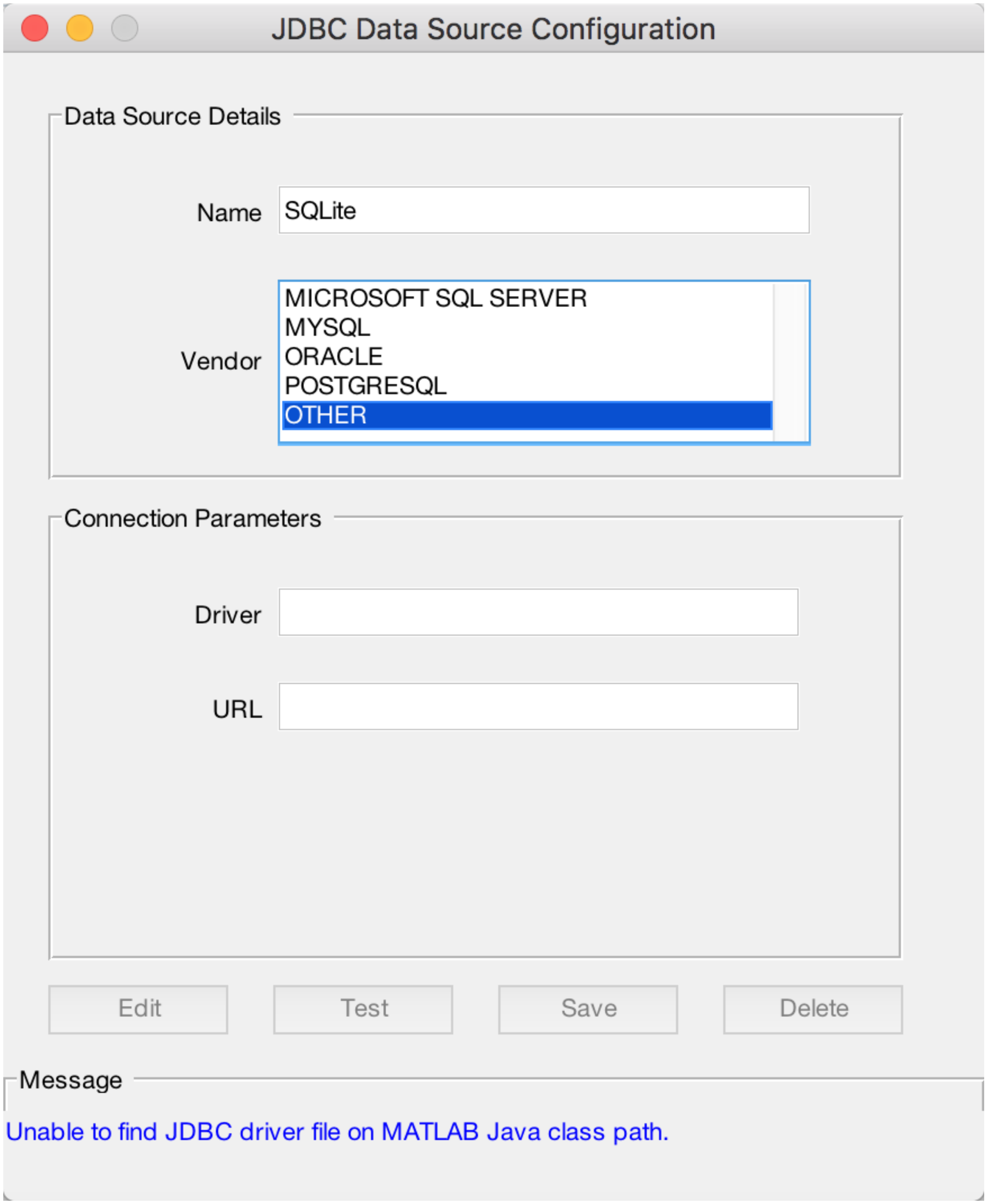
Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to SQLite Using JDBC Driver and Command Line” on page 2-131.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2 Select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.
3 In the **Name** box, enter a data source name. (This example uses a data source named `SQLite`.)
4 From the **Vendor** list, select `OTHER`.


JDBC Data Source Configuration
Data Source Details
Name
SQLite
Vendor
MICROSOFT SQL SERVER
MYSQL
ORACLE
POSTGRESQL
OTHER
Connection Parameters
Driver
URL
Edit
Test
Save
Delete
Message
Unable to find JDBC driver file on MATLAB Java class path.

Your entries for **Driver** and **URL** can vary depending on the type and version of the JDBC driver and your database. For details, see the JDBC driver documentation for your database.

5. In the **Driver** box, enter the SQLite driver Java class object. Here, use `org.sqlite.JDBC`. If you did not add the JDBC driver file path to the Java class path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-127.
6. Connect to the SQLite database by creating a URL string using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string stays constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. The last part of the URL string is `subname`. For SQLite, `subname` contains the location of the database. For example, your string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer. Enter your string in the **URL** box and press **Enter**.
7. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
8. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the SQLite database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to SQLite Using Database Explorer App

1. On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.
2. In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

3 Select tables in the **Data Browser** pane to query the database.

4 Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `SQLite`, and two tabs named `SQLite` and `SQLite1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to SQLite Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1 Connect to the SQLite database by using the `database` function.

- Enter the data source name that you defined for the first argument.
- Enter your user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.
- The fourth argument is the driver Java class object. This code assumes that the class object is `org.sqlite.JDBC`.
- The last argument is the URL string `URL` that you create using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string stays constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. The last part of the URL string is `subname`. For SQLite, `subname` contains the location of the database. For example, your string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer.

For example, this code assumes that you are connecting to a data source named `SQLite`.

```
conn = database('SQLite','username','pwd','org.sqlite.JDBC','URL');
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

SQLite JDBC for Linux

This tutorial shows how to set up a data source and connect to a SQLite database using the Database Explorer app or the command line. This tutorial uses the SQLite JDBC 3.7.2 Driver to connect to a SQLite Version 3.7.17 database.

Step 1. Verify the driver installation.

If the JDBC driver for SQLite is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

If you do not want to install a driver and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see "Working with MATLAB Interface to SQLite" on page 2-6.

Step 2. Add the JDBC driver to the MATLAB static Java class path.

1. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
2. Close MATLAB.
3. Navigate to the folder from step 1, and create a file named `javaclasspath.txt` in the folder.
4. Open `javaclasspath.txt`. Add the full path to the database driver JAR file in `javaclasspath.txt`. The full path includes the path to the folder where you downloaded the JAR file from the database provider followed by the JAR file name. The following is an example of the path: `/home/user/DB_Drivers/sqlite-jdbc-3.7.2.jar`. Save and close `javaclasspath.txt`.

5 Restart MATLAB.

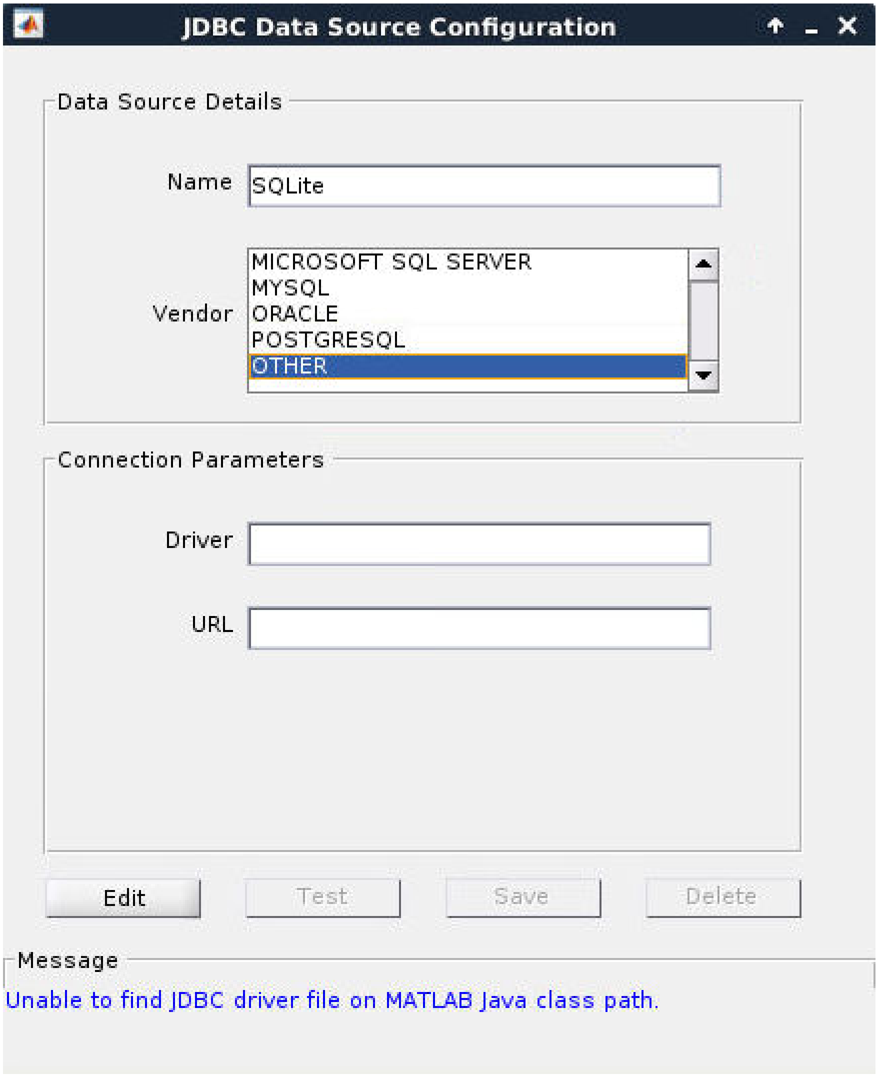
Alternatively, you can use `javaaddpath` to add a JDBC driver to the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).

Step 3. Set up the data source using the Database Explorer app.

This step is required only for connecting to a database using the Database Explorer app. If you want to use the command line to connect to your database, see “Connect to SQLite Using JDBC Driver and Command Line” on page 2-137.

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. Select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a data source name. (This example uses a data source named `SQLite`.)
4. From the **Vendor** list, select `OTHER`.



Your entries for **Driver** and **URL** can vary depending on the type and version of the JDBC driver and your database. For details, see the JDBC driver documentation for your database.

5 In the **Driver** box, enter the SQLite driver Java class object. Here, use `org.sqlite.JDBC`. If you did not add the JDBC driver file path to the Java class

path, the dialog box displays this message at the bottom: `Unable to find JDBC driver file on MATLAB Java class path`. Address this message by following the steps described in Step 2 on page 2-133.

6 Connect to the SQLite database by creating a URL string using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string stays constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. The last part of the URL string is `subname`. For SQLite, `subname` contains the location of the database. For example, your string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer. Enter your string in the **URL** box and press **Enter**.

7 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

8 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

After you complete the data source setup, connect to the SQLite database using the Database Explorer app or the command line with the JDBC connection.

Step 4. Connect using the Database Explorer app or the command line.

Connect to SQLite Using Database Explorer App

1 On the **Database Explorer** tab, in the **Data Source** section, click **New Query**.

2 In the Connect to a Data Source dialog box, select the data source you defined from the **Data Source** list. Enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Database Explorer app connects to the database and displays database tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

3 Select tables in the **Data Browser** pane to query the database.

4 Close the data source tab to close the SQL query and the database connection.

Tip To close the database connection, close all tabs that have titles beginning with the name of the corresponding data source. For example, if the data source name is `SQLite`, and two tabs named `SQLite` and `SQLite1` are open, then close both tabs.

To close all database connections, close the Database Explorer app.

Connect to SQLite Using JDBC Driver and Command Line

When using the command line, you do not have to set up a data source with the Database Explorer app. You can use the command line to pass all the required parameters for connection.

1. Connect to the SQLite database by using the `database` function.

   - Enter the data source name that you defined for the first argument.
   - Enter your user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.
   - The fourth argument is the driver Java class object. This code assumes that the class object is `org.sqlite.JDBC`.
   - The last argument is the URL string `URL` that you create using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string stays constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. The last part of the URL string is `subname`. For SQLite, `subname` contains the location of the database. For example, your string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer.

   For example, this code assumes that you are connecting to a data source named `SQLite`.

   ```
   conn = database('SQLite','username','pwd','org.sqlite.JDBC','URL');
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Java Class Path” (MATLAB)
- “Modify and Delete Data Sources” on page 4-15
- “Database Explorer App Error Messages” on page 3-17
- “Database Connection Error Messages” on page 3-10

Other ODBC-Compliant or JDBC-Compliant Databases

This tutorial provides steps for configuring data sources and connecting to other ODBC-compliant or JDBC-compliant databases that are not listed in “Configuring Driver and Data Source” on page 2-15. You can create a data source. Then, you can connect to your database using the Database Explorer app or the command line.

ODBC-Compliant Databases

These steps show how to configure a driver and connect to an ODBC-compliant database with MATLAB. Database Toolbox can connect to any ODBC-compliant database that is relational and uses ANSI® SQL. For example, if your database is Microsoft Excel® or IBM DB2®, follow these basic steps:

1. If your driver is not preinstalled on your computer, find a compatible driver and install it on your computer. You can view preinstalled drivers using the Microsoft ODBC Data Source Administrator dialog box. For details about this dialog box, see Driver Installation.
2. Create a data source by using the installed driver and the Microsoft ODBC Data Source Administrator dialog box.
3. Use the Database Explorer app to test your connection and connect to your database. For an example, see “MySQL ODBC for Windows” on page 2-55.

   Or, you can connect to your database using the `database` function at the command line.
4. For detailed assistance, contact your database administrator or refer to your database documentation.

JDBC-Compliant Databases

These steps show how to configure a driver and connect to a JDBC-compliant database with MATLAB. Database Toolbox can connect to any JDBC-compliant database that is relational and uses ANSI SQL. For example, if your database is Apache™ Derby or Microsoft Windows Azure®, follow these basic steps:

Note The details of these steps can vary depending on your database and database version. For detailed assistance, contact your database administrator or refer to your database documentation.

---

1. If your driver is not preinstalled on your computer, find a compatible driver and install it on your computer.
2. Add the JDBC driver path to the static Java class path or the dynamic Java class path. For details about static and dynamic class paths, see “Java Class Path” (MATLAB).
3. To connect to a JDBC-compliant database, you must know your database driver Java class object. For example, the Java class object for a SQLite database driver is `org.sqlite.JDBC`. Specify this driver value using either the **Driver** box in the JDBC Data Source Configuration dialog box or the `driver` input argument of the `database` function at the command line.

   Note For JDBC-compliant databases, specify the driver and URL in the JDBC Data Source Configuration dialog box of the Database Explorer app or in the `database` function. The driver and the URL string can vary depending on the type and version of the JDBC driver and the database you are working with. For details about the driver and URL, see the JDBC driver documentation for your database.

   ---

4. To connect to a JDBC-compliant database, you must create a URL string. The URL string is in the form `jdbc:subprotocol:subname`. The `jdbc` part of this string stays constant for any JDBC driver. `subprotocol` is the database type. The last part of the URL string is `subname`. The `subname` contains the location of the database and additional connection information, such as the port number. For example, if you are using SQLite, the string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer. Use this string for establishing a connection either with the Database Explorer app or the command line.
5. Use the Database Explorer app to test your connection and connect to your database. For an example, see “SQLite JDBC for Windows” on page 2-77.

   Or, you can connect to your database using the `database` function at the command line.

See Also

Apps
Database Explorer

Functions
`close` | `database` | `javaaddpath`

Related Examples

- "MySQL ODBC for Windows" on page 2-55
- "SQLite JDBC for Windows" on page 2-77

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-6
- "Data Preview Using Database Explorer App" on page 4-11
- "Java Class Path" (MATLAB)
- "Modify and Delete Data Sources" on page 4-15
- "Database Explorer App Error Messages" on page 3-17
- "Database Connection Error Messages" on page 3-10

Connecting to Database

To connect to a database from MATLAB, install an ODBC or JDBC driver and create a data source. For details about driver installation and data source setup, see "Configuring Driver and Data Source" on page 2-15. If you do not have an installed database and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see "Working with MATLAB Interface to SQLite" on page 2-6.

You can connect to a database using the **Database Explorer** or the command line. These two options enable you to perform different actions. For details about deciding which option to use, see "Connection Options" on page 2-9.

After deciding between the Database Explorer app and the command line, connect to your database by following the steps for the corresponding database and driver type, as given in this list.

Microsoft Access

- ODBC
  - "Connect to Access Using Database Explorer App" on page 2-21
  - "Connect to Access Using ODBC Driver and Command Line" on page 2-22

Microsoft SQL Server

- ODBC
  - "Connect to SQL Server Using Database Explorer App" on page 2-29
  - "Connect to SQL Server Using ODBC Driver and Command Line" on page 2-30
- JDBC
  - "Connect to SQL Server Using Database Explorer App" on page 2-39
  - "Connect to SQL Server Using JDBC Driver and Command Line" on page 2-40

Oracle

- ODBC

MySQL

PostgreSQL

SQLite

- No driver or database installation is required. To create a SQLite connection, use `sqlite` to create a new SQLite database file or connect to an existing SQLite database file.

Other ODBC-Compliant or JDBC-Compliant Databases

For an example of how to connect to a database that is not listed here, see “Other ODBC-Compliant or JDBC-Compliant Databases” on page 2-139.

See Also

`close` | `database`

More About

- “Setup Requirements for Database Connection” on page 2-12
- “Access Relational Database Data in MATLAB” on page 2-3
- “Connection Options” on page 2-9
- “Choosing Between ODBC and JDBC Drivers” on page 2-13
- “Configuring Driver and Data Source” on page 2-15
- “Working with MATLAB Interface to SQLite” on page 2-6

Data Import Using Database Explorer App or Command Line

You can import data from a database into MATLAB using the **Database Explorer** app or the command line. To select data for import, you can build an SQL query visually by using the Database Explorer app. Or, you can use the command line to write SQL queries. To achieve maximum performance with large data sets, use the command line instead of the Database Explorer app.

After importing data, you can repeat the steps in the process, such as connecting to a database, executing an SQL query, and so on, by using a MATLAB script to automate them.

To open multiple connections to the same database simultaneously, you can create multiple SQL queries using the Database Explorer app. Or, you can connect to the database using the command line.

If you do not have access to a database and want to import your data quickly, you can use the MATLAB interface to SQLite. For details, see "Working with MATLAB Interface to SQLite" on page 2-6.

Data Import Using Database Explorer App

If you have minimal proficiency writing SQL queries or want to browse the data in a database quickly, use the **Database Explorer** app. To build queries, see "Create SQL Queries Using Database Explorer App" on page 4-2. After creating a query using the Database Explorer app, you can generate the SQL code for the query. For details, see "Generate SQL Query" on page 4-18. You can embed the generated SQL code into the SQL query that you specify in the `fetch` function. Or, you can create an SQL script file to use with the `runsqlscript` function.

If you want to automate the current task after you create the SQL query, then generate a MATLAB script. For details, see “Generate MATLAB Script” on page 4-19.

Data Import Using Command Line

If you are not familiar with writing SQL queries, then use the **Database Explorer** app to select data to import from your database. Or, you can use the `sqlread` function at the command line. This function needs only a database connection and the database table name to import data. Furthermore, the `sqlread` function does not require you to set database preferences.

If you know how to write SQL queries, you can write basic SQL statements as character vectors or string scalars. For a simple example, see “Import Data from Database Table Using sqlread Function” on page 5-52. If you have variables in the MATLAB workspace, you can add them to the SQL query. For an example, see “Create Queries with Characters and Variables” on page 5-2.

When writing SQL queries, you can import data into MATLAB in one of two ways. Use the `select` function for maximum memory efficiency and quick access to imported data. Or, use the `fetch` function to import numeric data with double precision by default or define the import strategy for the SQL query.

For memory management, see “Data Import Memory Management” on page 5-28.

If you have a stored procedure that imports data, then use the `runstoredprocedure` or `fetch` functions.

Custom Data Types

When importing data from a database, Database Toolbox functions return custom data types, such as Oracle ref cursors, as Java objects. You can manually parse these objects to retrieve their data contents. Use the `methods` function to access all the methods of a Java object. Use the available methods to retrieve data from a Java object. The steps for your object are specific to your database. For details, refer to your JDBC driver or database documentation.

SQL Queries Saved in Scripts or Files

If you have a long SQL query or multiple SQL queries that you want to run sequentially to import data, create an SQL script file containing your SQL queries. To execute the SQL script file, use the `runsqlscript` function. If you have SQL queries stored in `.sql` or text files that you want to run from MATLAB, you can also use this function.

See Also

`database` | `fetch` | `select` | `sqlread`

More About

- “Connection Options” on page 2-9
- “Data Import Memory Management” on page 5-28
- “Working with Large Data Sets” on page 2-148
- “Working with MATLAB Interface to SQLite” on page 2-6
- “Data Type Support” on page 1-3
- “Data Retrieval Restrictions” on page 1-5

Working with Large Data Sets

In this section...

Connect to a Database with Maximum Performance

When you are using MATLAB with a database containing large volumes of data, you can experience out-of-memory issues or slow processing. To achieve the fastest performance, connect to your database using the native ODBC interface. If the native ODBC interface does not work, connect to your database using a JDBC driver. For details, see “Connecting to Database” on page 2-142.

Import Large Data Sets into MATLAB

If you are selecting large volumes of data in a database to import into MATLAB, you can experience out-of-memory issues or slow processing. To achieve the fastest performance, you can import the data in batches.

When working with a native ODBC connection, the amount of memory available to MATLAB can restrict you from processing your whole set of data at once. To manage the MATLAB memory, process your data in parts. Use the `fetch` function to limit the number of rows your query returns by using the `'MaxRows'` input argument. Using a MATLAB script, you can import data in increments until all data is retrieved. For an example, see `fetch`.

If you do not have access to a database and want to import large data sets, you can use the MATLAB interface to SQLite. For details, see “Working with MATLAB Interface to SQLite” on page 2-6.

Export Large Data Sets from MATLAB

When inserting large volumes of data into a database, you can experience slow processing. To achieve the fastest performance, use the `sqlwrite` function to export your data from MATLAB.

If you do not have access to a database and want to export large data sets, you can use the `insert` function with the MATLAB interface to SQLite. For details, see “Working with MATLAB Interface to SQLite” on page 2-6.

Access Large Data Using a DatabaseDatastore

An alternative for importing large data sets stored in a database into MATLAB is using a `DatabaseDatastore`. A `DatabaseDatastore` is a datastore that contains a collection of data stored in a database.

You can analyze data in a `DatabaseDatastore` using tall arrays with common MATLAB functions, such as `mean` and `histogram`. For details, see “Analyze Large Data in Database Using Tall Arrays”. Or, for more control, you can also write your own algorithms using MapReduce. For details, see “Analyze Large Data in Database Using MapReduce”.

See Also

More About

- “Choosing Between ODBC and JDBC Drivers” on page 2-13
- “Data Import Using Database Explorer App or Command Line” on page 2-145
- “Import Data from Database Table Using sqlread Function” on page 5-52
- “Insert Data into Database Table” on page 5-55

Deploying Database Application with MATLAB Compiler

In this section...

If you want to share your MATLAB code with others in your organization, then you must create a standalone database application using MATLAB Compiler™. After compiling the database application, you can deploy it to the target machines. Use this procedure and driver-specific information to create and deploy a database application.

Create and Deploy Database Application

1 Write your database application code and save it as a MATLAB function in a file. Do not save the code as a MATLAB script file. Write the code in function form for database application deployment. Further, you must keep certain things in mind as you write your database application code. For details, see “Write Deployable MATLAB Code” (MATLAB Compiler).
2 Compile your database application with MATLAB Compiler using the standalone application packaging process. For details, see “Create Standalone Application from MATLAB” (MATLAB Compiler).
3 The generated output from the compilation process contains a folder called `for_testing`. Conduct a test on a target machine using the files found in this folder.
4 After the test is successful, you can distribute the database application to the target machines in your organization.

About Driver Configurations

Ensure the target machines have the correct driver configuration for your database application. See the following driver-specific tasks to configure data sources and drivers.

Native ODBC and ODBC Drivers

After compiling your database application, you must define the data sources referenced in your code on the target machine using the ODBC Data Source Administrator. Then, you can run your database application on the target machine.

JDBC Drivers

For applications that use JDBC drivers, use either option to specify the JDBC driver on the target machine:

- Use `javaaddpath` in your function code to add your JDBC driver JAR file. Do not include the JAR file in the `javaclasspath.txt` file.
- Add the JDBC driver JAR file to your `javaclasspath.txt` file. Do not use `javaaddpath` in your function code. For Microsoft SQL Server operating system authentication, add the full path of the library file to the `javalibrarypath.txt` file. For details, see "Microsoft SQL Server JDBC for Windows" on page 2-32.

Caution: Do not add driver JAR files using `javaclasspath` as this might cause issues on the target machine. For details, see "Java Class Path" (MATLAB).

See Also

`javaaddpath`

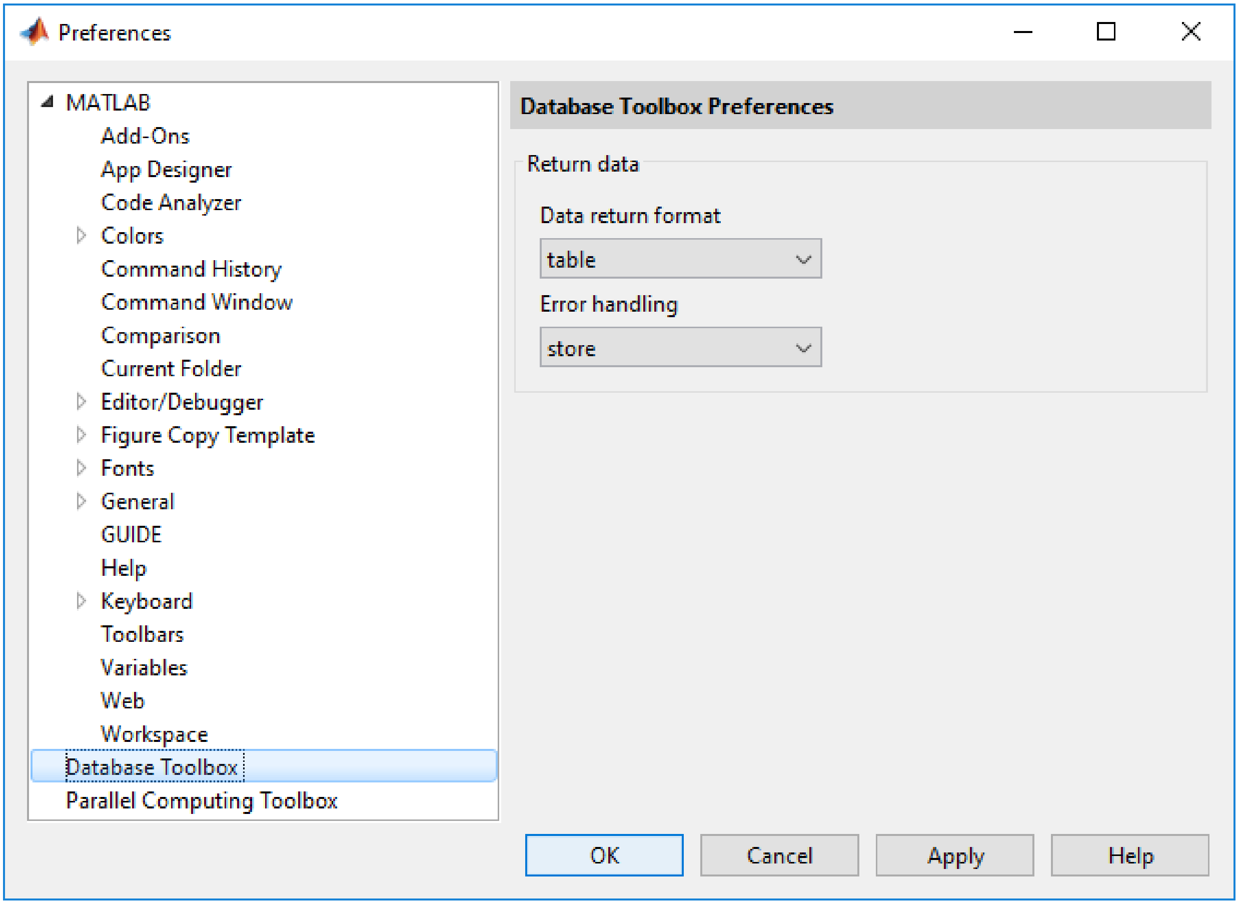
More About

- "Write Deployable MATLAB Code" (MATLAB Compiler)
- "Create Functions in Files" (MATLAB)
- "Create Standalone Application from MATLAB" (MATLAB Compiler)
- "Java Class Path" (MATLAB)

Working with Database Toolbox Preferences

Database Toolbox preferences enable you to specify the data return format of imported data and the method of error notification.

On the MATLAB Toolstrip, in the **Environment** section, click **Preferences** and select **Database Toolbox**.



Specify preferences as described in this table, and click **OK**. For details, see the `setdbprefs` function.

Preference	Acceptable Values	Description
Data return format	`cellarray` (default), `table`, `numeric`, or `structure`	Specifies a data format based on the type of data you are importing, memory considerations, and your preferred method of working with imported data. • `cellarray` — Imports nonnumeric data into MATLAB cell arrays. • `table` — Imports data into a MATLAB table. Use this value for all database data types. • `numeric` — Imports data into a MATLAB matrix of doubles. Nonnumeric data types are considered `NULL`. Use this value only when the format of the data to import is numeric, or when nonnumeric data to import is not relevant. • `structure` — Imports data into a MATLAB structure. Use this value for all database data types.
Error handling	`store` (default) or `report`	Specifies where error messages appear after connecting to a database or importing data. • `store` — Directs errors to the `Message` properties of the `connection` and `cursor` objects when you use the command line. • `report` — Displays query errors in the Command Window.

See Also

`database` | `fetch`

More About

- “Configuring Driver and Data Source” on page 2-15
- “Connecting to Database” on page 2-142
- “Import Data from Database Table Using sqlread Function” on page 5-52
- “Insert Data into Database Table” on page 5-55

3

Working with Data Sources

Writing Data Common Errors

This table describes how to address common errors you might encounter while working with the `sqlwrite` function. These errors apply to all database vendors.

Error Message	Probable Causes	Resolution
`columnname` column value must be a numeric array or cell array of numeric scalars.	The specified data type of the database column is invalid.	Specify a valid data type for the database column. For valid data types, see the `data` input argument description in the `sqlwrite` function.
`columnname` column value must be a datetime array, cell array of character vectors, or string array.		
`columnname` column value must be a logical array.		
`columnname` column value must be a cell array of character vectors or string array.		
JDBC/ODBC Error: *`errormessage`*	The JDBC or ODBC driver throws an error.	Consult your database driver documentation.
Unable to create *`tablename`* without column types. Specify 'ColumnType' for each variable in the table data.	You are creating an empty database table.	Specify the `'ColumnType'` name-value pair argument and provide the data type for all columns in the database table. For details, see the `sqlwrite` function.
Specify 'ColumnType' for each variable in the table data.	You did not specify the data type of at least one column in the database table.	Specify the `'ColumnType'` name-value pair argument and provide the data type for all columns in the database table. For details, see the `sqlwrite` function.

See Also

Importing Data Common Errors

Address common errors that you can encounter when importing data from databases and customizing import options.

Data Import Common Errors

The following table describes errors that can occur in either the Database Explorer app or the command line when you use the `fetch`, `sqlinnerjoin`, and `sqlouterjoin` functions.

Vendor	Error Message	Probable Causes	Resolution
All	Must provide either the "Keys" value, or both the "LeftKeys" and "RightKeys" values.	You specified only the `'LeftKeys'` or `'RightKeys'` name-value pair argument.	Specify the `'Keys'` name-value pair argument, or both the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.
	Multiple table entry found for *`tablename`*. Must provide *`LeftCatalog/RightCatalog`* and *`LeftSchema/RightSchema`* values.	The database contains multiple tables with the same name across catalogs and schemas.	Specify the `'LeftCatalog'` and `'LeftSchema'` or `'RightCatalog'` and `'RightSchema'` name-value pair arguments.
	Unable to find information for table *`tablename`*. Must provide either the "Keys" value, or both the "LeftKeys" and "RightKeys" values.	The function cannot find information about the specified database table.	Specify the `'Keys'` name-value pair argument, or both the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.

Vendor	Error Message	Probable Causes	Resolution
	Unable to find columns for table *`tablename`*. Must provide either the "Keys" value, or both the "LeftKeys" and "RightKeys" values.	The function cannot find information about the columns of the specified database table.	Specify the `'Keys'` name-value pair argument, or both the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.
	Unable to find common keys for table *`lefttable`* and *`righttable`*. Must provide either the "Keys" value, or both the "LeftKeys" and "RightKeys" values.	The function cannot find common keys between the specified left and right tables to join.	Specify the `'Keys'` name-value pair argument, or both the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.
	The number of key variables on the left and right must be the same.	The number of specified keys for the left and right tables do not match.	Specify the same number of keys for the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.
Microsoft SQL Server	The statement did not return a result set.	There are other SQL statements in the middle of the stored procedure. This error happens after you execute `exec` but before you execute `fetch`. This error happens only with the command line.	Add `'SET NOCOUNT ON'` at the beginning of your stored procedure. For details, see `exec`.

Vendor	Error Message	Probable Causes	Resolution
Microsoft SQL Server	JDBC Driver 3.0 returns incorrect date values when used with JRE™ 1.7 by a Java application.	There is an issue with the Microsoft SQL Server JDBC Driver 3.0. This error happens after you execute `fetch`. This error happens either with Database Explorer or the command line.	Install a hotfix from Microsoft for JDBC Driver 3.0. Alternatively, upgrade your Microsoft SQL Server JDBC driver to version 4.0.
Microsoft SQL Server	Connection is busy with results for another command.	You are connecting to Microsoft SQL Server using a driver that `preview` does not support.	Connect to Microsoft SQL Server using the JDBC driver.
Oracle	Stored procedures and functions return result sets as cursor types.	The JDBC driver returns stored procedure and function result sets as custom Java objects. This error happens after you execute `fetch`. This error happens only with the command line.	Write custom MATLAB code to process the Java objects into MATLAB variables.

Vendor	Error Message	Probable Causes	Resolution

PostgreSQL	Java exception occurred: java.lang.OutOfMemoryError: Java heap space	The JDBC driver caches results in the memory. There is not enough memory in the Java heap to store the large amount of data fetched from your database. This error happens after you execute `fetch`. This error happens either with Database Explorer or the command line.	Write custom code. Write the code for connecting to your database via the command line. Then write the following.
			
			`conn.AutoCommit = 'off';`
			
			`h = conn.Handle;`
			
			`stmt = h.createStatement();`
			
			`stmt.setFetchSize(50);`
			
			`rs = stmt.executeQuery(java.lang.String('SELECT * FROM largeData where productnumber <= 3000000'));`
			
			Modify the previous statement to include your SQL query instead.
			
			Then process the result set object `rs` in batches.

Custom Import Options Common Errors

The following table describes errors that can occur when you use the `SQLImportOptions` object to customize options for importing data from a database. These error messages apply across all database vendors.

Error Message	Probable Causes	Resolution
Calling *`function`* without an output argument has no effect. Use the following instead: opts = *`function`*(opts,...)	You did not specify an output argument when executing the `setoptions` function.	Use the `setoptions` function with an output argument.
`argument` must be a character vector or cell array of character vectors.	The specified input argument has an invalid data type.	The input argument must be a character vector or cell array of character vectors.
Unknown variable name: ''*`argument`*''.	The specified variable name is invalid.	Specify a variable name that exists in the `VariableNames` property of the `SQLImportOptions` object.
Variable selection out of range. Vector must contain integers between 1 and N, where N is the number of variables in the import options.	The specified index value is out of bounds within the number of selected variables.	Specify an index that is in the range of the number of variables in the `SelectedVariableNames` property of the `SQLImportOptions` object.
Expected a name or numeric index of a variable name.	The data type of the specified input argument is invalid.	The input argument must be a numeric index or a variable name.
Cell array of types must be a vector of length *`n`*.	The length of the specified data types is invalid.	When you set the `VariableTypes` property of the `SQLImportOptions` object, the length of the cell array must be equal to the number of variables.

Error Message	Probable Causes	Resolution
Cell array of names must be a vector of length *n*.	The length of the specified variable names is invalid.	When you set the `VariableNames` property of the `SQLImportOptions` object, the length of the cell array must be equal to the number of variables.

See Also

`fetch` | `getoptions` | `setoptions` | `sqlinnerjoin` | `sqlouterjoin`

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-6
- "Data Preview Using Database Explorer App" on page 4-11
- "Data Import Using Database Explorer App or Command Line" on page 2-145
- "Call Stored Procedure That Returns Data" on page 5-24

Database Connection Error Messages

This table describes how to address common errors you might encounter while connecting to the Database Toolbox using Database Explorer or the command line.

Connection Error Messages and Probable Causes

Vendor	Error Message	Probable Causes	Resolution
All	Undefined variable 'database' or class 'database.ODBCConnection'.	• Database Toolbox software is not installed. • You are connecting using the native ODBC interface with MATLAB R2013a or earlier.	• Ensure that Database Toolbox software is installed. • If you want to use the native ODBC interface, ensure that MATLAB R2013b or later is installed.
All ODBC-Compliant Databases	[Microsoft][ODBC Driver Manager] Data source name not found and no default driver specified	Data source name is not spelled correctly.	Verify your data source name.
All JDBC-Compliant Databases	Unable to find JDBC driver file on MATLAB Java class path.	• Path to the JDBC driver JAR file is not on the static or dynamic class path. • Incorrect driver name provided while using the `'driver'` and `'url'` syntax.	Verify that you added the path to your JDBC driver to the static or dynamic path. For an example, see "MySQL JDBC for Windows" on page 2-61. Ensure that you provide the correct JDBC driver name for the `driver` and `url` input arguments. For an example, see "SQLite JDBC for Windows" on page 2-77.

Vendor	Error Message	Probable Causes	Resolution
All ODBC-Compliant Databases	[Microsoft][ODBC Driver Manager] The specified DSN contains an architecture mismatch between Driver and Application	There is a difference in the bitness (32-bit or 64-bit) between the database, driver, and MATLAB.	Use a 64-bit driver. If you have issues working with the ODBC driver, use the JDBC driver instead. For details about driver installation, see "Configuring Driver and Data Source" on page 2-15. To address differences in bitness for Microsoft Access, see "Microsoft Access ODBC for Windows" on page 2-18.
Microsoft Access	[Microsoft][ODBC Microsoft Access Driver] '(unknown)' is not a valid path. make sure that the path name is spelled correctly and that you are connected to the server on which the file resides	Error occurs in the Connection Failure dialog box after clicking **Connect** in the Connect to a Data Source dialog box. The file location of the Microsoft Access database is incorrect.	Verify the location of the database file. If the database file is on a network drive, map to the network drive. Modify the existing file location by selecting **New > ODBC** and selecting the existing database name from the ODBC Data Source Administrator dialog box. Then select **Configure** to change the database file location.

Vendor	Error Message	Probable Causes	Resolution
Microsoft SQL Server	The TCP/IP connection to the host *`hostname`*, port *`portnumber`* has failed. Error: “null. Verify the connection properties, check that an instance of SQL Server is running on the host and accepting TCP/IP connections at the port, and that no firewall is blocking TCP connections to the port.”	Incorrect server name or port number.	Verify your database server name and your port number. Microsoft SQL Server uses a dynamic port for JDBC. Verify the value using Microsoft SQL Server Configuration Manager. For details, see “Step 2. Verify the port number.” on page 2-32
Microsoft SQL Server	This driver is not configured for integrated authentication.	The Microsoft SQL Server Windows authentication library is not added to `javalibrarypath.txt`.	Add the Microsoft SQL Server Windows authentication library to `javalibrarypath.txt`. For details about configuring a Microsoft SQL Server Authenticated Database Connection, see “Microsoft SQL Server JDBC for Windows” on page 2-32.
Microsoft SQL Server	Invalid string or buffer length.	64-bit ODBC driver error.	Use a JDBC driver or the native ODBC interface instead.

Vendor	Error Message	Probable Causes	Resolution
Microsoft SQL Server	JDBC Driver Error: com.microsoft.sqlserver.jdbc.SQLServerDriver.Driver Not Found/Loaded.	The full path to the JAR file was not added to the `javaclasspath.txt` file, or it was added using the `javaaddpath` command. Alternatively, the path to the JAR file is incorrect.	Ensure that the path to the JAR file is not misspelled. Ensure that you add the path to the static class path.
Microsoft SQL Server	com.microsoft.sqlserver.jdbc.AuthenticationJNI <clinit> WARNING: Failed to load the sqljdbc_auth.dll	The path to the folder containing the file `sqljdbc_auth.dll` was not added to the `javalibrarypath.txt` file. Or, the full path to the file was added instead of the path to the folder. This error also occurs when you add the path to the 32-bit version of the DLL using a 64-bit version of MATLAB.	Add the path to the folder containing the file `sqljdbc_auth.dll` to the `javalibrarypath.txt` file. For details about configuring a Microsoft SQL Server Authenticated Database Connection, see "Microsoft SQL Server JDBC for Windows" on page 2-32.
Microsoft SQL Server	Login failed for user 'DOMAIN\username'.	Either the login credentials you are using are incorrect or your user account does not have enough rights to access the remote machine. This error also occurs when the database server is not configured to accept Integrated Windows Authentication login credentials.	Ensure that your user name and password are correct. Refer to your system administrator for appropriate access rights to your machines. Contact your database administrator to see if your database is set up with Windows Authentication.

Vendor	Error Message	Probable Causes	Resolution
Microsoft SQL Server	`MSSQLSERVER_`*number*	The Microsoft SQL Server driver returns a numbered error message.	Find more information about the specific error in System Error Messages.
MySQL	Access denied for user `'user'@'machinename'` (using password: YES)	Incorrect user name and password combination.	Verify your user name and password.
MySQL	Communications link failure. The last packet sent successfully to the server was 0 milliseconds ago. The driver has not received any packets from the server.	Incorrect server name or port number.	Verify your database server name and port number.
MySQL	Unknown database `'databasename'`.	Provided database name is incorrect.	Verify your database name.
MySQL	`ERROR` *number* (*SQLSTATE*): *errormessage*	The MySQL driver returns an error that contains an error number, a `SQLSTATE` value, and an error message.	Navigate to the latest database documentation in the MySQL Documentation, and search for the specific error.

Oracle	Error when connecting to Oracle `oci8` database using JDBC driver:
	`Error using com.mathworks.toolbox.database.databaseConnect/makeDatabaseConnection`
	`Java exception occurred:`
	`java.lang.UnsatisfiedLinkError: no ocijdbc11 in`
	`java.library.pathat`
	`java.lang.ClassLoader.loadLibrary(Unknown Source)at`
	`java.lang.Runtime.loadLibrary0.......`
		MATLAB cannot find the Oracle DLL that the `oci8` drivers need.	Add the path for the location of the Oracle DLLs to `javalibrarypath.txt`. For details, see “Oracle JDBC for Windows” on page 2-48.

Vendor	Error Message	Probable Causes	Resolution
Oracle	Invalid Oracle URL specified: `OracleDataSource.makeURL`	The `DriverType` parameter is not specified.	Specify the `DriverType` parameter as either `thin` for connecting without Windows authentication or `oci` for connecting with Windows authentication.
Oracle	The Network Adapter could not establish the connection.	Either `Server` or `Portnumber` is not specified or has an incorrect value.	Verify the server name and port number for your Oracle database.
Oracle	TNS:listener does not currently know of SID given in connect descriptor: Incorrect database name or incorrect URL.	The service name for your database is incorrect.	Verify the service name for your Oracle database.
Oracle	`ORA-`*`number`*	The Oracle driver returns a numbered error message.	Navigate to the latest database documentation in the Oracle Documentation, and search for the specific error.

See Also

`database`

More About

- “Configuring Driver and Data Source” on page 2-15
- “Connecting to Database” on page 2-142

Database Explorer App Error Messages

This table describes how to address common errors you can encounter while working with the **Database Explorer** app. For Database Toolbox connection errors, see “Database Connection Error Messages” on page 3-10.

Error Category	Error Message	Probable Causes	Resolution
Database connection	No data sources found. Configure a data source before creating a new query.	You clicked **New Query** before configuring any data sources.	Configure at least one ODBC or JDBC data source. For details, see “Configuring Driver and Data Source” on page 2-15.
Configure JDBC data source	Unable to find the JDBC driver file on the MATLAB Java class path.	The JDBC Data Source Configuration dialog box displays this message at the bottom of the dialog box. This message is displayed when the JDBC driver for the database, or the driver specified for the **Driver** option when the **Vendor** option is set to `OTHER`, is not found on the MATLAB Java class path.	Add the JDBC driver to the MATLAB Java class path. For details, see “MySQL JDBC for Windows” on page 2-61.

Error Category	Error Message	Probable Causes	Resolution
SQL statements	Database Explorer supports one SELECT SQL statement only.	You entered an incompatible SQL query. The Database Explorer app accepts a single `SELECT` statement only. Other SQL statements are not supported.	Create one valid SQL `SELECT` statement in the **SQL Query** pane.
Data preview	Received the following message from the database:	If an error occurs on the database server when it executes the SQL query, an error message appears in the **Data Preview** pane. This text precedes the exact error message from the database server.	Refer to the error message to determine the issue. Consult your database administrator for further details.
Data preview	Error occurred while executing the query on the database.	The Database Explorer app returned a MATLAB error while trying to execute the SQL query.	Click the button to view the stack trace. For questions, contact technical support.

Error Category	Error Message	Probable Causes	Resolution
Data preview	No data was returned for this SQL Query.	The SQL query executed successfully but did not return any data. The Database Explorer app displays this error message in the **Data Preview** pane when previewing data or in a dialog box when importing data.	Use the Database Explorer app to modify the SQL query. Ensure that the selected table contains data by clicking it in the **Data Browser** pane.
Data import	`variable` not a valid MATLAB variable name.	You entered an invalid MATLAB variable name.	Enter a valid MATLAB variable name, such as `data`.

See Also

Apps
Database Explorer

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-6
- "Data Preview Using Database Explorer App" on page 4-11

Using Database Explorer

Create SQL Queries Using Database Explorer App

Using the **Database Explorer** app, you can open one or multiple database connections simultaneously by clicking **New Query** in the toolstrip. The Database Explorer app creates a data source tab for each connection.

On each data source tab, you can write an SQL query in one of two ways. If you are unfamiliar with the SQL query language or want to explore data in your database, then use the **Data Browser** pane along with the buttons in the toolstrip. Or, if you are already familiar with SQL, then enter an SQL query manually. When you enter a query, you can use more advanced SQL statements (for example, `AS`, `GROUP BY`, `HAVING`). You can also enter SQL code that is proprietary to the database and does not comply with the ANSI standard.

Create SQL Query Using Toolstrip Buttons

Use these steps as a general workflow for creating an SQL query by using buttons in the toolstrip.

- Connect to a data source in the Database Explorer app. For an example, see "MySQL ODBC for Windows" on page 2-55.
- Click a table in the **Data Browser** pane. The **SQL Query** pane in the data source tab updates with an SQL query that selects all columns and rows of the table. The **Data Preview** pane updates with a preview of the first 10 rows of data in the table.
- In the **Join** section, click **Join** to display the **Join** tab in the toolstrip. In the **Add** section, the name of the table selected in the **Data Browser** pane appears in the left **Table** list. From the left **Column** list, select the name of the shared column. Then, select the name of the table to join in the right **Table** list and select the name of the shared column in the right **Column** list. Click **Add Join**. The Database Explorer app creates an inner join by default. Close the **Join** tab. For details about joining tables, see "Join Tables Using Database Explorer App" on page 4-6.
- In the **Data Browser** pane, expand the table name node of the joined table and select specific check boxes to choose the table columns. The **SQL Query** and **Data Preview** panes update with the chosen columns.
- In the **Criteria** section, click **Where** to display the **Where** tab in the toolstrip. In the **Add** section, select an operator and value to enter an SQL `WHERE` condition. Click **Add Filter**. To represent strings in values, enclose text in single quotes. Close the **Where** tab.

- In the **Criteria** section, click **Order By** to display the **Order By** tab in the toolstrip. In the **Add** section, select the column to sort and click **Add Sort**. Close the **Order By** tab.
- In the **Import** section, click  to import all SQL query results into the MATLAB workspace as a table.
- In the **Edit** section, click **Clear Query** to clear the current SQL query and create a new one.
- To close the database connection, close all tabs whose names contain the data source name.

For detailed examples, see the **Database Explorer** app.

Enter SQL Query Manually

Use these steps as a general workflow for entering an SQL query manually.

- Connect to a data source in the Database Explorer app. For an example, see “MySQL ODBC for Windows” on page 2-55.
- In the **Edit** section, click **Manual** to open a new data source tab. The tab has the same data source name as the prior active tab, but the Database Explorer app appends the suffix `_manual` to the tab name. The manual data source tab keeps the same database connection as the prior active tab.
- Enter or paste an SQL query into the **SQL Query** pane.

  Note If you click **Manual** when the active data source tab contains an SQL query in the **SQL Query** pane, then you can modify the existing SQL query manually. Or, you can click **Clear Query** to clear the existing SQL query in the new tab and enter a new query.

  For each subsequent time you click **Manual**, the new tab contains a numbered suffix.

- In the **Preview** section, click **Preview Query**. The Database Explorer app executes the SQL query and updates the **Data Preview** pane with the results. If the SQL query is valid, the **Data Preview** pane displays the first 10 rows of data by default. To see more rows, adjust the value in the **Preview Size** box.
- Modify the SQL query and click **Preview Query**. The **Data Preview** pane shows the updated results.

- In the **Import** section, click  to import all SQL query results into the MATLAB workspace as a table.
- To close the database connection, close all tabs whose names contain the data source name.

For a detailed example of entering an SQL query manually, see the **Database Explorer** app.

Work with Multiple SQL Queries

To create different SQL queries using the same database, follow these steps:

1. Click **New Query** in the toolstrip. The Connect to a Data Source dialog box opens.
2. Select the data source name from the **Data Source** list. Enter the user name and password for your database, and click **Connect**.
3. Select the catalog and schema in the Catalog and Schema dialog box, and click **OK**. If only one catalog or schema is available in the database, the Catalog and Schema dialog box does not open.

   The Database Explorer app opens a new tab with the data source name as the tab name.

Repeat these steps to connect to the same database again and create a different SQL query. The Database Explorer app appends a numbered suffix to the data source tab name. The number increases by one for each subsequent database connection to the same data source.

Note The Microsoft Access database does not support multiple database connections.

Or, you can connect to different catalogs or schemas. Repeat these steps and select a different catalog or schema in the Catalog and Schema dialog box.

The database server settings control the maximum number of database connections you can create at a time. To increase the maximum number of database connections, contact your database administrator.

You can connect to different databases by repeating these steps and selecting a different data source name from the **Data Source** list.

SQL Query Limitations

The Database Explorer app has these limitations, which you can avoid by using the command line instead.

- You can connect to relational databases only.
- You can enter a single SQL `SELECT` statement only. You cannot enter other SQL statements or multiple SQL statements in the **SQL Query** pane.
- You cannot modify the database structure or the database data.
- You cannot execute stored procedures.

See Also

Functions
`database`

Apps
Database Explorer

More About

- “Configuring Driver and Data Source” on page 2-15
- “Connecting to Database” on page 2-142
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11
- “Generate SQL Query and MATLAB Script” on page 4-18
- “Database Explorer App Error Messages” on page 3-17

External Websites

- SQL Tutorial

Join Tables Using Database Explorer App

You can select and import data from multiple tables using the **Database Explorer** app. First, you must join tables, and then select the data to import. You can join tables using different join types that depend on the database.

Different Join Types

The Database Explorer app creates an inner join by default. To use another join type, click the corresponding button in the **Edit** section of the **Join** tab.

There are four join types:

- 

 — An inner join retrieves records that have matching values in the selected column of both tables.
- 

 — A full join retrieves records that have matching values in the selected column of both tables, and unmatched records from both the left and right tables.
- 

 — A left join retrieves records that have matching values in the selected column of both tables, and unmatched records from the left table only.
- 

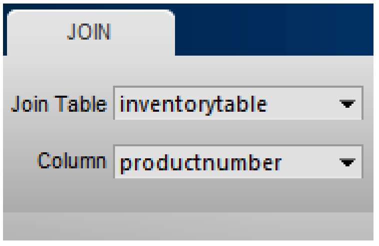
 — A right join retrieves records that have matching values in the selected column of both tables, and unmatched records from the right table only.

Join Tables

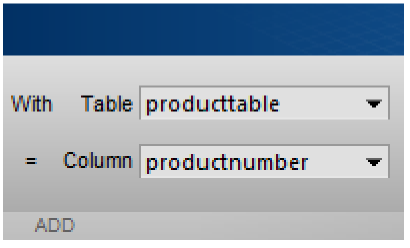
To join tables, you must know the names of each table and the names of the shared columns in the tables (that is, the primary keys). Use these steps as a general workflow for joining tables.

1 After connecting to a database, select a table in the **Data Browser** pane. In the **Join** section, click **Join** to display the **Join** tab in the toolstrip. In the **Add** section, the name of the table selected in the **Data Browser** pane appears in the left **Table** list.

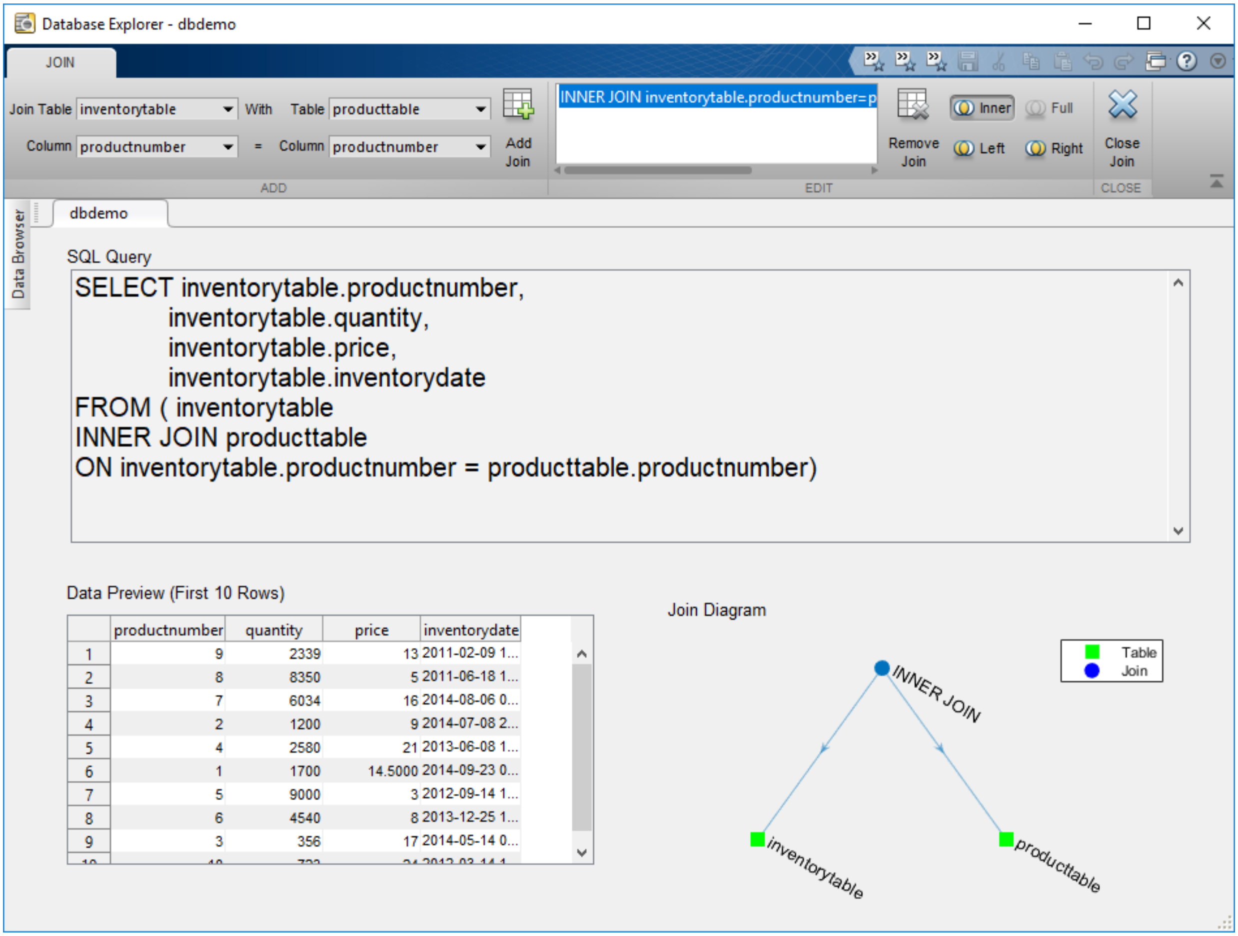
From the left **Column** list, select the name of the shared column.



2 From the right **Table** list, select the name of the table to join. From the right **Column** list, select the name of the shared column for this table.



3 In the **Add** section, click **Add Join**. The **SQL Query** pane updates the SQL query with the new join. If the **Automatic Preview** button (located in the **Preview** section of the **Database Explorer** tab) is toggled on, the **Data Preview** pane displays the updated SQL query results automatically. The **Join Diagram** pane displays a pictorial representation of the join between the selected tables.



4 To add another join, select another table and column name combination in the left and right lists. Then, click **Add Join** again.

5 In the **Edit** section, click one of the join types (for example, 

) to specify a different join type, if necessary.

6 To remove a join, select it in the list of joins in the **Edit** section, and click **Remove Join**.

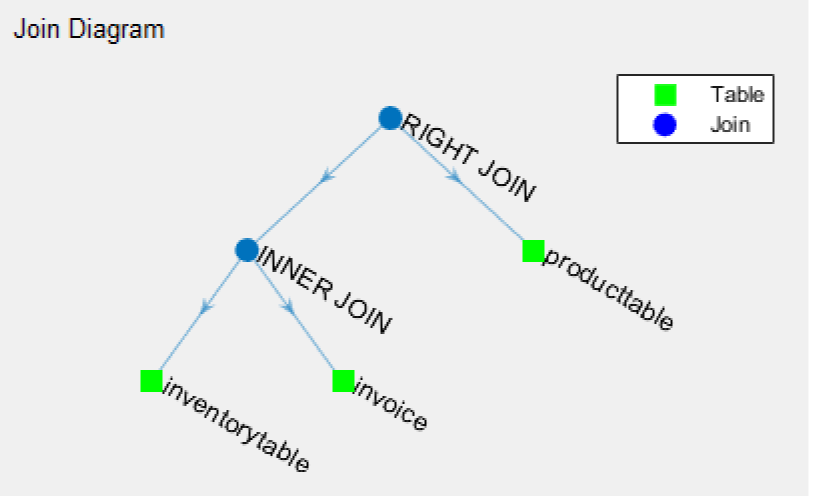
Note To change the order of joins, remove existing joins and create joins in another order.

7 In the **Close** section, click **Close Join** 

to close the **Join** tab.

Join Diagram

After you join at least two tables, the **Join Diagram** pane displays a pictorial representation of the joins between tables. Each blue circle shows the join type. Each green square shows a table in the join.



When working with multiple joins, use this diagram to see the hierarchy of joins. Ensure that you are using the correct join types for your data. As you modify join types, the diagram updates to reflect the new join types.

Join Type Limitations

Some database vendors do not support all join types. The Database Explorer app enables the corresponding buttons in the **Join** tab for the supported join types in these databases:

- SQLite supports only inner and left join types.
- Microsoft Access and MySQL support only inner, left, and right join types.

See Also

Apps
Database Explorer

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Data Preview Using Database Explorer App” on page 4-11
- “Generate SQL Query and MATLAB Script” on page 4-18
- “Database Explorer App Error Messages” on page 3-17

External Websites

- SQL Tutorial

Data Preview Using Database Explorer App

Using the **Database Explorer** app, you can preview data in the **Data Preview** pane when you:

- Select tables and columns in the **Data Browser** pane.
- Create an SQL query using the buttons in the toolstrip.
- Enter an SQL query manually.

After previewing the data, you can modify the SQL query or import the data into the MATLAB workspace.

Automatic Preview

The Database Explorer app previews data automatically, by default. With the **Automatic Preview** button toggled on in the **Preview** section and a valid SQL query in the **SQL Query** pane, the Database Explorer app executes the SQL query and previews the data in the **Data Preview** pane. You can control the number of rows displayed in this pane by entering a value in the **Preview Size** box in the toolstrip.

As you create an SQL query, the **Data Preview** pane updates the preview of the query results for each change you make to the query. When you change selections in the **Data Browser** pane, or add or remove a join, filter, or sort, the **SQL Query** pane updates along with the **Data Preview** pane.

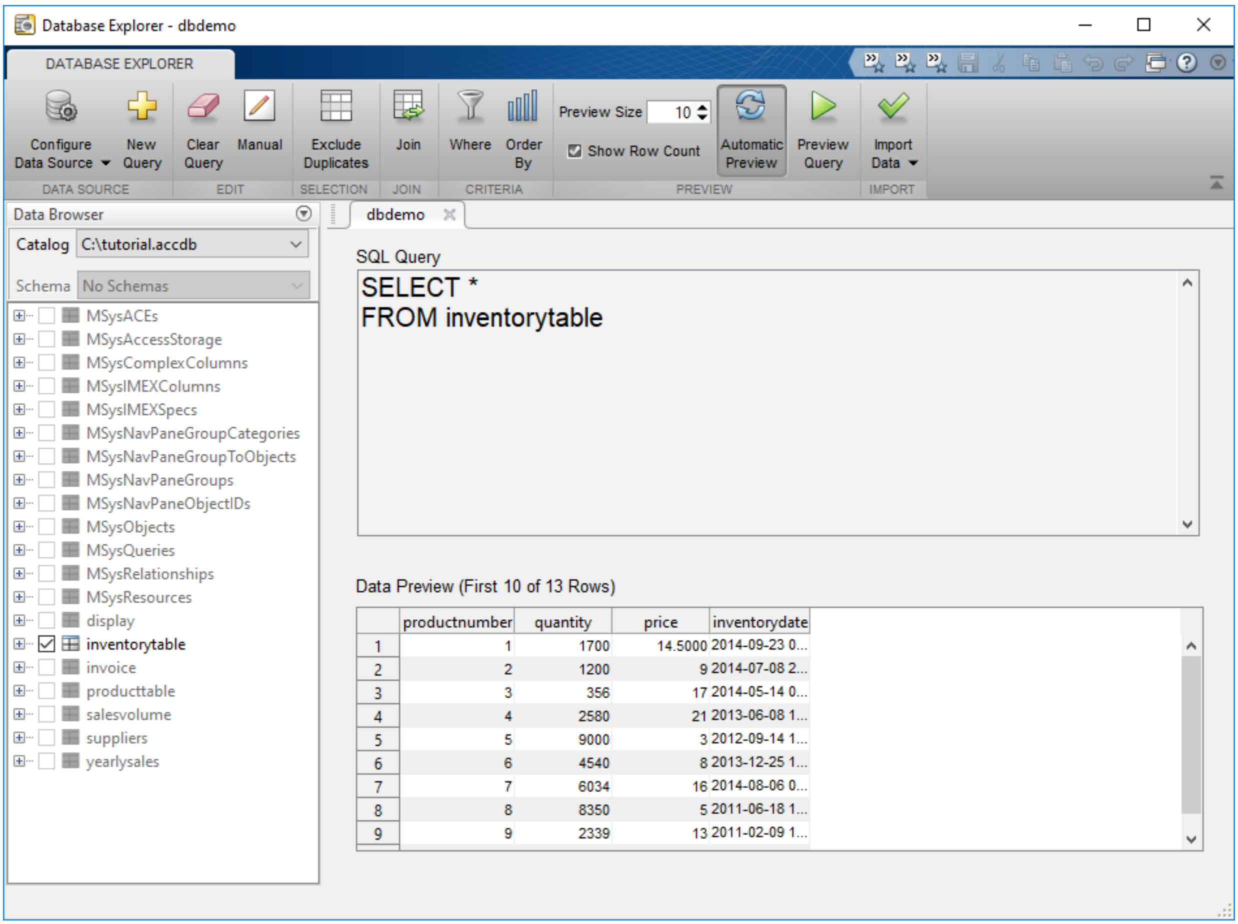
If your SQL query takes a long time to execute or you know that the query results contain a large amount of data, you can stop the automatic preview of data. Click the **Automatic Preview** button in the **Preview** section of the toolstrip. When this button is toggled off, you can modify the query in the **SQL Query** pane without updating the preview of data. After you finish modifying the query, click **Preview Query** in the **Preview** section to see the updated query results in the **Data Preview** pane.

Preview Size

To see more rows in the **Data Preview** pane, enter a larger value in the **Preview Size** box in the **Preview** section. The number of rows in the **Data Preview** pane matches the entered value. However, if the number of rows in the SQL query results is less than the entered value, then all rows are displayed in the **Data Preview** pane.

To see the count of the total number of rows in the SQL query results, select the **Show Row Count** check box in the **Preview** section. The **Data Preview** pane displays the row count of the SQL query results. For example, using the sample database connection:

1. In the **Data Browser** pane, select **inventorytable**. The **SQL Query** pane displays the SQL query that selects all data from the database table `inventorytable`.
2. In the **Preview** section, select the **Show Row Count** check box. The **Data Preview** pane displays the row count **13** in the note within parentheses.



Preview Data by Creating SQL Query

After you connect to a database, the tables in the database are displayed in the **Data Browser** pane. Use this pane along with buttons in the toolstrip to view the database structure and create an SQL query.

- Expand and collapse the tables to see the columns in each table.
- Click the box next to a table name to see a quick preview of the data in the table. If the **Automatic Preview** button is toggled on, the **Data Preview** pane displays the first 10 rows of data automatically.
- Click boxes next to column names to see a quick preview of data in those columns only.
- Use the buttons in the toolstrip to exclude duplicate rows, join tables, filter data, and sort data.

After you create a valid SQL query in the **SQL Query** pane, the Database Explorer app executes the query and previews the results as described earlier in Automatic Preview.

Preview Data by Entering SQL Query Manually

You can enter an SQL query manually or by pasting text into the **SQL Query** pane. Or, you can modify an existing SQL query in the **SQL Query** pane. To enter or modify an SQL query, click **Manual** in the **Edit** section.

Note When you enter or modify an SQL query manually, the Database Explorer app stops the automatic preview of data.

After you enter the SQL query, click **Preview Query** in the **Preview** section. The **Data Preview** pane displays the first 10 rows of data only after you click this button. If you modify the SQL query, then click **Preview Query** again to refresh the SQL query results.

See Also

Apps
Database Explorer

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-6
- "Generate SQL Query and MATLAB Script" on page 4-18
- "Database Explorer App Error Messages" on page 3-17

Modify and Delete Data Sources

You can modify and delete data sources using the **Database Explorer** app. For ODBC drivers, you create data sources using the ODBC Data Source Administrator dialog box. For JDBC drivers, you create data sources using the JDBC Data Source Configuration dialog box. You can modify and delete data sources using the same dialog boxes.

Modify Data Sources

Use the Database Explorer app to modify data sources by following these steps.

ODBC Data Sources

1. After opening the Database Explorer app, select **Configure Data Source > Configure ODBC data source**. The ODBC Data Source Administrator dialog box opens. For details about locating this dialog box on your computer, see Driver Installation.

   Alternatively, run the `configureODBCDataSource` function.
2. In the ODBC Data Source Administrator dialog box, select the data source to modify. Click **Configure**.
3. Modify the settings as needed, and close this dialog box.

JDBC Data Sources

1. After opening the Database Explorer app, select **Configure Data Source > Configure JDBC data source**. The JDBC Data Source Configuration dialog box opens.
2. Click **Edit**. In the list, select the data source to modify. Click **OK**.
3. Modify the settings in the JDBC Data Source Configuration dialog box. If you do not change the data source name, the Database Explorer app overwrites the existing data source with the new settings. To avoid overwriting the existing data source, enter a new data source name.
4. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box opens and displays a message indicating a successful connection. Otherwise, it displays an error message.

5 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved. Close this dialog box.

Delete Data Sources

Use the Database Explorer app to delete data sources by following these steps.

ODBC Data Sources

1 After opening the Database Explorer app, select **Configure Data Source** > **Configure ODBC data source**. The ODBC Data Source Administrator dialog box opens.
2 Select the data source to delete.
3 Click **Remove** and close this dialog box.

JDBC Data Sources

1 After opening the Database Explorer app, select **Configure Data Source** > **Configure JDBC data source**. The JDBC Data Source Configuration dialog box opens.
2 Click **Edit**.
3 In the list, select the name of the data source to delete. Click **OK**.
4 Click **Delete** and click **Yes**.

   The JDBC Data Source Configuration dialog box displays a message indicating a successful deletion.
5 Close this dialog box.

See Also

Apps
Database Explorer

More About

- “Choosing Between ODBC and JDBC Drivers” on page 2-13
- “Configuring Driver and Data Source” on page 2-15

- “Connecting to Database” on page 2-142

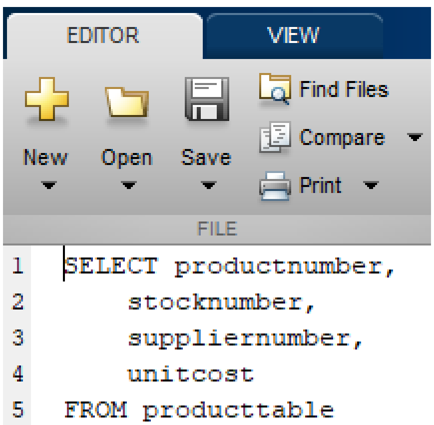
Generate SQL Query and MATLAB Script

You can generate SQL code from an SQL query or create a MATLAB script by using the **Database Explorer** app. After defining an SQL query in the **SQL Query** pane, you can generate the SQL code for running an SQL script. You can also generate a MATLAB script to automate connecting to a database, running an SQL query, and performing data analysis on the imported data.

Generate SQL Query

To generate SQL code from an SQL query, follow these steps:

1. Connect to a data source and create an SQL query. For details about creating SQL queries, see “Create SQL Queries Using Database Explorer App” on page 4-2.
2. Select **Import Data > Generate SQL Query**.
3. Save the SQL code to a `.txt` or `.sql` file. The MATLAB Editor opens the saved SQL code file.

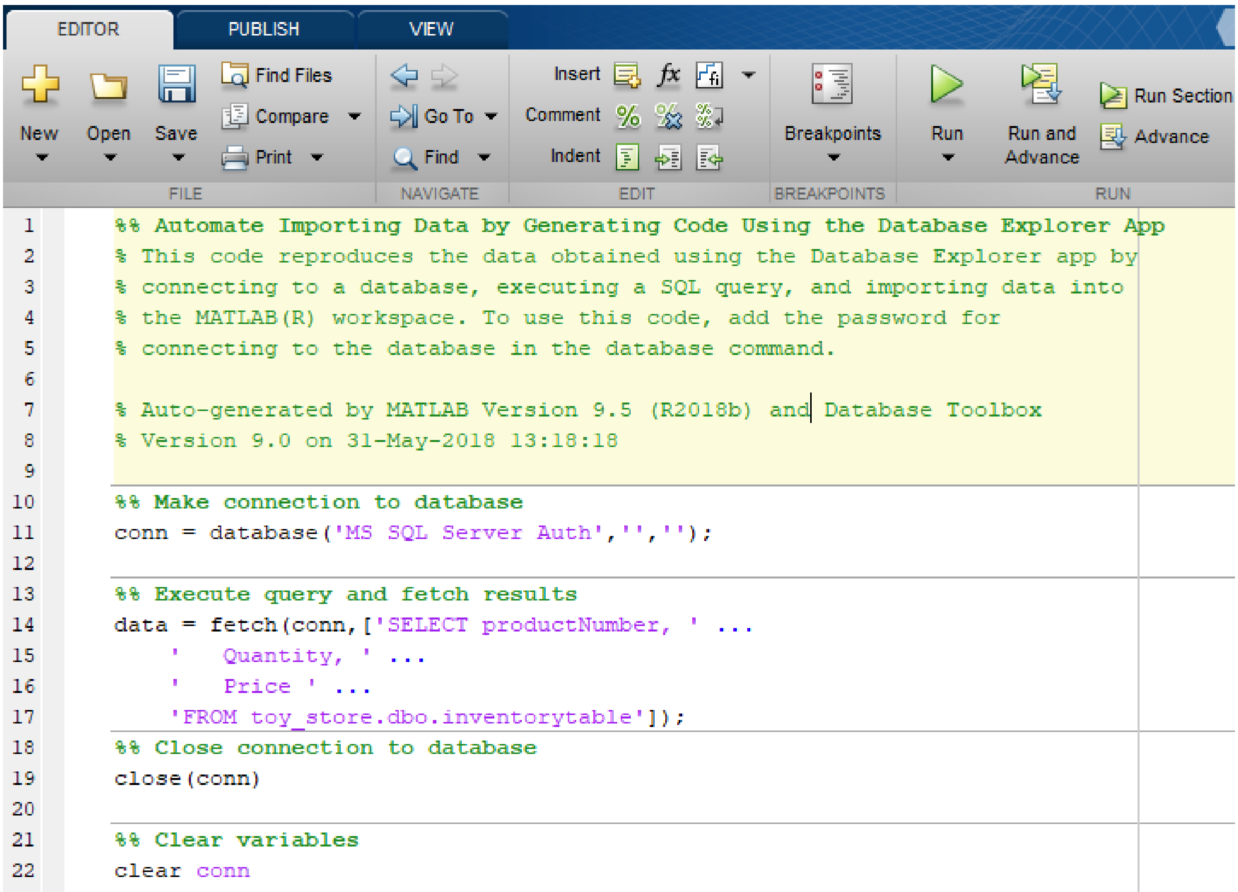
   You can use the SQL code to rebuild a query by using the **SQL Query** pane by entering the SQL code manually.

   Alternatively, you can use the `.sql` file to import data programmatically into MATLAB by using the `runsqlscript` function.

Generate MATLAB Script

To generate a MATLAB script that automates connecting to a data source, running an SQL query, and importing the SQL query results, follow these steps:

1. Connect to a data source and create an SQL query. For details about creating SQL queries, see “Create SQL Queries Using Database Explorer App” on page 4-2.
2. Select **Import Data** > **Generate MATLAB Script** to display a MATLAB script in the MATLAB Editor.



3. Save the MATLAB script. You can run this script at the command line.

Note To run the script, enter the database password as an input argument of the `database` function in the script.

For details about editing and running scripts, see “Scripts” (MATLAB).

See Also

Functions
`runsqlscript`

Apps
Database Explorer

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-6
- “Data Preview Using Database Explorer App” on page 4-11

Using Database Toolbox Functions

Create Queries with Characters and Variables

The following examples show how to create queries using a date, text, a MATLAB variable, and special characters. Construct these queries using the command line.

Create Query Using Date

This example shows how to format a date in an SQL query.

When you want to write an SQL statement that selects data from your database using a date, format the date according to your database specifications. Consult your database documentation for the right formatting. This example shows date formatting for an Oracle database.

Create the database connection `conn` to an Oracle database using an ODBC driver. For example, the following code assumes that you are connecting to a data source named `Oracle` with user name `username` and password `pwd`.

```
conn = database('Oracle','username','pwd');
```

Create an SQL statement `sqlquery` that contains the full query. Execute the query using `conn`. The following code uses the table `TEST_TYPES` and the column `TEST_DT1`. The `WHERE` clause contains Oracle SQL code for filtering the records based on the date. The `TEST_DT1` column data type is an Oracle date type. Filter records for the dates after June 9, 2013 using the `TEST_DT1` column. To convert your date to an Oracle date type, enter this date in the Oracle function `to_date`. For a date `'2013-06-09'`, specify the format as `'YYYY-MM-DD'`. `'YYYY-MM-DD'` is one way to format a date in Oracle. Consult your Oracle documentation for alternatives. Import the data using the SQL statement using the `fetch` function and display the rows of the results. The query returns the records where the date in the column `TEST_DT1` is after June 9, 2013.

```
sqlquery = ['SELECT * FROM TEST_TYPES ' ...
    'WHERE TEST_DT1 > to_date(''2013-06-09'',''YYYY-MM-DD'')'];
data = fetch(conn,sqlquery)

data =

  2×2 table

             TEST_DT1                        TEST_DT2
    _____________________________    _____________________________
```

```
    '2013-06-10 15:11:00.000000'    '2013-06-10 15:11:22.500000'
    '2013-06-10 15:13:00.000000'    '2013-06-10 15:13:21.870003'
```

Close the database connection.

```
close(conn)
```

Create Query Using Text

This example shows how to include text in your SQL query using a Microsoft Access database.

Create the database connection `conn` to a Microsoft Access database using an ODBC driver. For example, the following code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

Select all records from the table `producttable` where the product description is `'Slinky'`. Create an SQL query `sqlquery` that embeds the product description into the SQL query by using an extra pair of single quotes.

```
sqlquery = ['SELECT * FROM producttable ' ...
    'where productdescription = ''Slinky'''];
```

Or, you can write the SQL query as a concatenation of two character vectors using brackets.

```
sqlquery = ['SELECT * FROM producttable ' ...
    'where productdescription = ' '''Slinky'''];
```

Execute the SQL query `sqlquery` using the `fetch` function and import and display the data. `data` contains the product record where the product description is `'Slinky'`.

```
data = fetch(conn,sqlquery)
```

```
data =

  1×5 table

    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          3           4.01e+05           1009            17            'Slinky'
```

Close the database connection.

```
close(conn)
```

Create Query Using MATLAB Variable

This example shows how to include a MATLAB variable in your SQL query. This example uses a Microsoft SQL Server database.

Create the database connection `conn` to a Microsoft SQL Server database using a JDBC driver without operating system authentication. For example, this code assumes that you are connecting to a database named `dbname` with the user name `username`, password `pwd`, database server name `sname`, and port number `123456`.

```
conn = database('dbname','username','pwd', ...
    'Vendor','Microsoft SQL Server','Server','sname', ...
    'AuthType','Server','PortNumber',123456);
```

Suppose that you want to select all invoice data for the first product. Create a MATLAB variable `productID` and set it to the first product number.

```
productId = 1;
```

Select all records from the table `invoice` where the product number is equal to the first product. Create an SQL query `sqlquery` that concatenates the SQL query with the MATLAB variable `productID` by using brackets. `productID` is a numeric variable but the SQL query is a character vector. Convert the number to a character vector by using the `num2str` function.

```
sqlquery = ['SELECT * FROM invoice ' ...
    'where ProductNumber = ' num2str(productId)];
```

Execute the SQL query `sqlquery` using the `fetch` function and import and display the data. `data` contains the invoice data record for the first product.

```
data = fetch(conn,sqlquery)
```

```
data =

  1×5 table

    InvoiceNumber          InvoiceDate            ProductNumber    Paid          Receipt
    _____________    _________________________    _____________    _____    _________________

        2101         '2010-08-01 00:00:00.000'          1          false    [1948410×1 uint8]
```

Close the database connection.

```
close(conn)
```

Create Query Using Special Characters

This example shows how to write an SQL query for table names or columns names with special characters.

These characters require using escape characters that are specific to your database. Consult your database documentation for the right escape characters. This example uses a Microsoft SQL Server database.

Create the database connection `conn` to a Microsoft SQL Server database using a JDBC driver without operating system authentication. For example, this code assumes that you are connecting to a database named `dbname` with the user name `username`, password `pwd`, database server name `sname`, and port number `123456`.

```
conn = database('dbname','username','pwd', ...
    'Vendor','Microsoft SQL Server','Server','sname', ...
    'AuthType','Server','PortNumber',123456);
```

Suppose that you want to select all data in a column with a column name that contains spaces. This column resides in a table with a table name that contains spaces. A space is a special character. Enclose spaces with escape characters so that the SQL query executes. Brackets are the escape characters for a Microsoft SQL Server database. Create an SQL query `sqlquery` that contains the column name and table name enclosed by brackets.

```
sqlquery = 'SELECT [column with spaces] FROM [table with spaces]';
```

Execute the SQL query `sqlquery` using the `fetch` function and import and display the data.

```
data = fetch(conn,sqlquery)
```

```
data =

  2×1 table

        Data
     ___________

     'some text'
     'some text'
```

Close the database connection.

```
close(conn)
```

See Also

close | database | fetch | num2str

Related Examples

- "Import Data from Database Table Using sqlread Function" on page 5-52

External Websites

- SQL Tutorial

Roll Back Data in Database

This example shows how to connect to a database, update an existing row of data in the database, and roll back the update. Use the `execute` function to roll back the update after executing the `update` function.

Create a database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable` that contains these columns:

- `productnumber`
- `quantity`
- `price`
- `inventorydate`

Set the `AutoCommit` property of the `connection` object to `'off'`. Any updates you make after turning off this flag do not commit to the database automatically.

```
conn.AutoCommit = 'off';
```

Define a cell array containing the column names that you are updating in `inventorytable`.

```
colnames = {'price','inventorydate'};
```

Define a table that contains the data for insertion. Update the price to $15 and set the inventory timestamp to `'2014-12-01 08:50:15.000'`.

```
data = table(15,{'2014-12-01 08:50:15.000'}, ...
    'VariableNames',{'price','inventorydate'});
```

Update the columns `price` and `inventorydate` in the table `inventorytable` for the product number equal to `1`.

```
tablename = 'inventorytable';
whereclause = 'WHERE productnumber = 1';

update(conn,tablename,colnames,data,whereclause)
```

Roll back data for the update.

```
sqlquery = 'ROLLBACK';
execute(conn,sqlquery)
```

You can commit data to the database by replacing the `ROLLBACK` SQL statement with `COMMIT`. You can also roll back or commit data after executing an `INSERT` SQL statement using the `sqlwrite` function.

Close the database connection.

```
close(conn)
```

See Also

`close` | `database` | `execute`

Related Examples

- “Insert Data into Database Table” on page 5-55
- “Replace Existing Data in Database” on page 5-17

Change Database Connection Catalog

This example shows how to connect to a database and change the database catalog. You can work with data in a different catalog within the same database using the `execute` function.

Create an ODBC database connection to a Microsoft SQL Server database with Windowsauthentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Change the catalog for the database connection `conn` to `intlprice` by creating and executing an SQL query.

```
sqlquery = 'Use intlprice';
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`close` | `database` | `execute`

Related Examples

- "Retrieve Database Metadata" on page 5-58

External Websites

- SQL Tutorial

Create Table and Add Column

This example shows how to connect to a database and manage the database structure. You can manage the database structure using the `execute` function.

Create an ODBC database connection to a Microsoft SQL Server database with Windowsauthentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Use the SQL `CREATE` statement to create the table `Person`.

```
sqlquery = ['CREATE TABLE Person(LastName varchar, ' ...
    'FirstName varchar,Address varchar,Age int)'];
```

Create the table in the database using the database connection.

```
execute(conn,sqlquery)
```

Use the SQL `ALTER` statement to add the column `City` to the table `Person`.

```
sqlquery = 'ALTER TABLE Person ADD City varchar(30)';
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`close` | `database` | `execute`

Related Examples

- “Retrieve Database Metadata” on page 5-58

External Websites

- SQL Tutorial

Delete Data from Databases

This example shows how to delete data from your database using MATLAB.

Create the SQL statement with your deletion SQL syntax. Consult your database documentation for the correct SQL syntax. Execute the delete operation on your database using the `execute` function with your SQL statement. This example demonstrates deleting data records in a Microsoft Access database.

Connect to Database

Create the database connection `conn` to a Microsoft Access database using an ODBC driver and the data source name `dbdemo`. This database contains the table `inventorytable` with the column `productnumber`.

```
conn = database('dbdemo','','');
```

The SQL query `sqlquery` selects all rows of data in the table `inventorytable`. Execute this SQL query using `conn`. Import the data from the executed query using the `fetch` function and display the last few rows.

```
sqlquery = 'SELECT * FROM inventorytable';
data = fetch(conn,sqlquery);
tail(data)
```

```
ans =

  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
          9            2339        13     '2011-02-09 12:50:59'
         10             723        24     '2012-03-14 13:13:09'
         11             567         0     '2012-09-11 00:30:24'
         12            1278         0     '2010-10-29 18:17:47'
         13            1700      14.5     '2009-05-24 10:58:59'
```

Delete Specific Record

Delete the data for the product number 13 from the table inventorytable. Specify the product number using the WHERE clause in the SQL statement sqlquery.

```
sqlquery = 'DELETE * FROM inventorytable WHERE productnumber = 13';
execute(conn,sqlquery)
```

Display the data in the table inventorytable after the deletion. The record with product number 13 is missing.

```
sqlquery = 'SELECT * FROM inventorytable';
data = fetch(conn,sqlquery);
tail(data)
```

```
ans =

  8×4 table

    productnumber    quantity    price         inventorydate
    _____________    ________    _____    _____________________

          5            9000        3      '2012-09-14 15:00:25'
          6            4540        8      '2013-12-25 19:45:00'
          7            6034       16      '2014-08-06 08:38:00'
          8            8350        5      '2011-06-18 11:45:35'
          9            2339       13      '2011-02-09 12:50:59'
         10             723       24      '2012-03-14 13:13:09'
         11             567        0      '2012-09-11 00:30:24'
         12            1278        0      '2010-10-29 18:17:47'
```

Delete Record Using MATLAB Variable

Define a MATLAB variable productID by setting it to the product number 12.

```
productID = 12;
```

Delete the data using the MATLAB variable productID. Build an SQL statement sqlquery that combines the SQL for the delete operation with the MATLAB variable. Since the variable is numeric and the SQL statement is a character vector, convert the number to a character vector. Use the num2str function for the conversion. Concatenate the delete SQL statement and the numeric conversion using the square brackets.

```
sqlquery = ['DELETE * FROM inventorytable WHERE ' ...
    'productnumber = ' num2str(productID)];
execute(conn,sqlquery)
```

Display the data in the table `inventorytable` after the deletion. The record with product number `12` is missing.

```
sqlquery = 'SELECT * FROM inventorytable';
data = fetch(conn,sqlquery);
tail(data)
```

```
ans =

  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          4            2580       21      '2013-06-08 14:24:33'
          5            9000        3      '2012-09-14 15:00:25'
          6            4540        8      '2013-12-25 19:45:00'
          7            6034       16      '2014-08-06 08:38:00'
          8            8350        5      '2011-06-18 11:45:35'
          9            2339       13      '2011-02-09 12:50:59'
         10             723       24      '2012-03-14 13:13:09'
         11             567        0      '2012-09-11 00:30:24'
```

Close Database Connection

```
close(conn)
```

See Also

`execute` | `fetch` | `num2str`

Related Examples

- "Import Data from Database Table Using sqlread Function" on page 5-52

External Websites

- SQL Tutorial

Roll Back Data After Updating Record

This example shows how to update data in a database and roll back the changes. Rolling back the changes reinstates the data as it appears before running the update.

Create a database connection `conn`. For example, the following code uses the database `toy_store`, user name `username`, password `pwd`, server name `sname`, and port number `123456` to connect to a Microsoft SQL Server database. This database contains the table `inventoryTable` that contains these columns: `productNumber`, `Quantity`, and `Price`.

```
conn = database('toy_store','username','pwd',...
                'Vendor','Microsoft SQL Server',...
                'Server','sname',...
                'PortNumber',123456);
```

Set the `AutoCommit` property of the `connection` object to `'off'`. Any updates you make after turning off this flag do not commit to the database automatically.

```
conn.AutoCommit = 'off';
```

Display the data in the `inventoryTable` table before making updates. Import the data from the executed query using the `fetch` function and display the first few rows of imported data.

```
data = fetch(conn,'SELECT * FROM inventoryTable');
head(data)
```

```
ans =

  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          1            1700      14.5     '2014-09-23 09:38:34'
          2            1200         9     '2014-07-08 22:50:45'
          3             356        17     '2014-05-14 07:14:28'
          4            2580        21     '2013-06-08 14:24:33'
          5            9000         3     '2012-09-14 15:00:25'
          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
```

Define a cell array for the new price of the first product.

```
data(1,1) = {30.00};
```

Define the WHERE clause for the first product.

```
whereclause = 'where productNumber = 1';
```

Update the Price column in the inventoryTable for the first product.

```
tablename = 'inventoryTable';
colname = {'Price'};

update(conn,tablename,colname,data,whereclause)
```

Display the data in the inventoryTable table after making the update.

```
data = fetch(conn,'SELECT * FROM inventoryTable');
head(data)
```

```
ans =

  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          1            1700       30      '2014-09-23 09:38:34'
          2            1200        9      '2014-07-08 22:50:45'
          3             356       17      '2014-05-14 07:14:28'
          4            2580       21      '2013-06-08 14:24:33'
          5            9000        3      '2012-09-14 15:00:25'
          6            4540        8      '2013-12-25 19:45:00'
          7            6034       16      '2014-08-06 08:38:00'
          8            8350        5      '2011-06-18 11:45:35'
```

The first product has an updated price of 30. Though the data is updated, the change has not committed to the database.

Roll back the update.

```
rollback(conn)
```

Alternatively, you can roll back the update using an SQL ROLLBACK statement by using the execute function.

Display the data in the inventoryTable table after rolling back the update.

```
data = fetch(conn,'SELECT * FROM inventoryTable');
head(data)

ans =

  8×4 table

    productnumber    quantity    price        inventorydate    
    _____________    ________    _____    _____________________

          1            1700      14.5     '2014-09-23 09:38:34'
          2            1200         9     '2014-07-08 22:50:45'
          3             356        17     '2014-05-14 07:14:28'
          4            2580        21     '2013-06-08 14:24:33'
          5            9000         3     '2012-09-14 15:00:25'
          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
```

The first product has the old price of `14.50`.

Close the database connection.

```
close(conn)
```

See Also

`close` | `database` | `execute` | `fetch` | `rollback`

Related Examples

- "Insert Data into Database Table" on page 5-55
- "Replace Existing Data in Database" on page 5-17

External Websites

- SQL Tutorial

Replace Existing Data in Database

This example shows how to update a value of the month column in the table yearlysales using the data source named dbdemo. To access the example where you import the values of the month column, see “Insert Data into Database Table” on page 5-55.

To access the code for this example, see matlab\toolbox\database\dbdemos\dbupdatedemo.m.

Create a database connection conn to the Microsoft Access database using the ODBC driver. Here, this code assumes that you are connecting to a data source named dbdemo with blank user name and password.

```
conn = database('dbdemo','','');
```

To update the month, specify the month column that contains the months in the cell array colnames.

```
colnames = {'month'};
```

Assign the month value March2010 to the MATLAB variable data for the update. The data type of data is a table.

```
data = table({'March2010'},'VariableNames',{'month'});
```

Specify the record to update in the database by defining an SQL WHERE statement whereclause. The record to update is the record whose month is March. Embed March in two single quotation marks so that MATLAB interprets March as a character vector in the SQL WHERE statement.

```
whereclause = 'WHERE month = ''March'''
```

```
whereclause =

    'WHERE month = 'March''
```

Update the data for the record whose month is March in the database table yearlysales.

```
update(conn,'yearlysales',colnames,data,whereclause)
```

In Microsoft Access, view the yearlysales table to verify the results.

month	salestotal	revenue
March2010	14606	$0.00

Close the database connection.

```
close(conn)
```

See Also

`close` | `database` | `update`

Related Examples

- "Insert Data into Database Table" on page 5-55

External Websites

- SQL Tutorial

Export Data Using Bulk Insert

Bulk Insert Functionality

You can insert data into your database using the `sqlwrite` function at the command line.

If you experience performance issues, create a data file with every record in your data set. Then, you can use this data file as input into the bulk insert functionality of your database to process the large data set. Also, with this file, you can insert data with special characters such as double quotes. A bulk insert provides performance gains by using the bulk insert utilities that are native to different database systems. For details, see "Working with Large Data Sets" on page 2-148.

Bulk Insert into Oracle

This example uses a data file on the local machine where Oracle is installed and exports data to the Oracle server using bulk insert functionality.

1 Connect to the Oracle database.

```
javaaddpath 'path\ojdbc5.jar';
conn = database('databasename','user','password', ...
    'oracle.jdbc.driver.OracleDriver', ...
    'jdbc:oracle:thin:@machine:port:databasename');
```

2 Create a table named `BULKTEST` using the `execute` function.

```
execute(conn,['CREATE TABLE BULKTEST (salary number, ' ...
    'player varchar2(25), signed varchar2(25), ' ...
    'team varchar2(25))'])
```

3 Create a data record.

```
A = {100000.00,'KGreen','06/22/2011','Challengers'};
```

4 Expand `A` to a 10,000-record data set.

```
A = A(ones(10000,1),:);
```

5 Write data to a file for bulk insert functionality.

Tip When connecting to a database on a remote machine, you must write this file to the remote machine. Oracle has difficulty reading files that are not on the same machine as the instance of the database.

```
fid = fopen('c:\temp\tmp.txt','wt');
for i = 1:size(A,1)
    fprintf(fid,'%10.2f \t %s \t %s \t %s \n',A{i,1}, ...
    A{i,2},A{i,3},A{i,4});
end
fclose(fid);
```

6 Set the folder location using the `execute` function.

```
execute(conn, ...
    'CREATE OR REPLACE DIRECTORY ext AS ''C:\\Temp''')
```

7 Delete the temporary table, if it exists, using the `execute` function.

```
execute(conn,'DROP TABLE testinsert')
```

8 Create a temporary table and use bulk insert functionality to insert it into the table `BULKTEST`.

```
execute(conn,['CREATE TABLE testinsert (salary number, ' ...
    'player varchar2(25), signed varchar2(25), ' ...
    'team varchar2(25)) ORGANIZATION EXTERNAL ' ...
    '( TYPE ORACLE_LOADER DEFAULT DIRECTORY ext ACCESS ' ...
    'PARAMETERS ( RECORDS DELIMITED BY NEWLINE FIELDS ' ...
    'TERMINATED BY ''\t'') LOCATION (''tmp.txt'')) ' ...
    'REJECT LIMIT 10000'])

execute(conn,'INSERT INTO BULKTEST SELECT * FROM testinsert')
```

9 Confirm the number of variables in `BULKTEST`.

```
results = fetch(conn,'SELECT * FROM BULKTEST');
results.Properties.VariableNames

ans =

  1×4 cell array

    {'SALARY'}    {'PLAYER'}    {'SIGNED'}    {'TEAM'}
```

10 Close the database connection.

```
close(conn)
```

Bulk Insert into Microsoft SQL Server 2005

This example uses a data file on the local machine where Microsoft SQL Server is installed and exports data to the Microsoft SQL Server using bulk insert functionality.

1 Connect to the Microsoft SQL Server. For JDBC driver use, add the JAR file to the MATLAB Java class path.

```
javaaddpath 'path\sqljdbc4.jar';
conn = database('databasename','user','password', ...
    'com.microsoft.sqlserver.jdbc.SQLServerDriver', ...
    'jdbc:sqlserver://machine:port;database=databasename');
```

2 Create a table named BULKTEST using the execute function.

```
execute(conn,['CREATE TABLE BULKTEST (salary ' ...
    'decimal(10,2), player varchar(25), signed_date ' ...
    'datetime, team varchar(25))'])
```

3 Create a data record.

```
A = {100000.00,'KGreen','06/22/2011','Challengers'};
```

4 Expand A to a 10,000-record data set.

```
A = A(ones(10000,1),:);
```

5 Write data to a file for bulk insert functionality.

Tip When connecting to a database on a remote machine, you must write this file to the remote machine. Microsoft SQL Server has difficulty reading files that are not on the same machine as the instance of the database.

```
fid = fopen('c:\temp\tmp.txt','wt');
for i = 1:size(A,1)
   fprintf(fid,'%10.2f \t %s \t %s \t %s \n',A{i,1}, ...
   A{i,2},A{i,3},A{i,4});
end
fclose(fid);
```

6 Run the bulk insert functionality using the execute function.

```
execute(conn,['BULK INSERT BULKTEST FROM ' ...
    '''c:\temp\tmp.txt'' WITH (FIELDTERMINATOR = ''\t'', ' ...
    'ROWTERMINATOR = ''\n'')'])
```

7 Confirm the number of variables in BULKTEST.

```
results = fetch(conn,'SELECT * FROM BULKTEST');
results.Properties.VariableNames

ans =

  1×4 cell array
```

```
    {'SALARY'}    {'PLAYER'}    {'SIGNED_DATE'}    {'TEAM'}
```

8 Close the database connection.

```
close(conn)
```

Bulk Insert into MySQL

This example uses a data file on the local machine where MySQL is installed and exports data to a MySQL database using bulk insert functionality.

1 Connect to the MySQL server. For JDBC driver use, add the JAR file to the MATLAB Java class path.

```
javaaddpath 'path\mysql-connector-java-5.1.13-bin.jar';
conn = database('databasename', 'user', 'password', ...
    'com.mysql.jdbc.Driver', ...
    'jdbc:mysql://machine:port/databasename');
```

2 Create a table named `BULKTEST` using the `execute` function.

```
execute(conn,['CREATE TABLE BULKTEST (salary decimal, ' ...
    'player varchar(25), signed_date varchar(25), ' ...
    'team varchar(25))'])
```

3 Create a data record.

```
A = {100000.00,'KGreen','06/22/2011','Challengers'};
```

4 Expand `A` to be a 10,000-record data set.

```
A = A(ones(10000,1),:);
```

5 Write data to a file for bulk insert functionality.

Note MySQL reads files saved locally, even if you are connecting to a remote machine.

```
fid = fopen('c:\temp\tmp.txt','wt');
for i = 1:size(A,1)
   fprintf(fid,'%10.2f \t %s \t %s \t %s \n', ...
   A{i,1},A{i,2},A{i,3},A{i,4});
end
fclose(fid);
```

6 Run the bulk insert functionality. Note the use of the SQL statement `LOCAL INFILE`.

```
execute(conn,['LOAD DATA LOCAL INFILE ' ...
    ' ''C:\\temp\\tmp.txt'' INTO TABLE BULKTEST ' ...
    'FIELDS TERMINATED BY ''\t'' LINES TERMINATED ' ...
    'BY ''\n'''])
```

7 Confirm the number of variables in `BULKTEST`.

```
results = fetch(conn,'SELECT * FROM BULKTEST');
results.Properties.VariableNames

ans =

  1×4 cell array

    {'SALARY'}    {'PLAYER'}    {'SIGNED_DATE'}    {'TEAM'}
```

8 Close the database connection.

```
close(conn)
```

See Also

`close` | `database` | `execute` | `fetch`

Related Examples

- "Insert Data into Database Table" on page 5-55

External Websites

- SQL Tutorial

Call Stored Procedure That Returns Data

This example shows how to call a stored procedure that returns data using the `fetch` function. Use the JDBC interface to connect to a Microsoft SQL Server database, call a stored procedure, and return data. For this example, the Microsoft SQL Server database contains the stored procedure `getSupplierInfo`. This stored procedure returns the supplier information for suppliers of a given city. This code defines the procedure.

```
CREATE PROCEDURE dbo.getSupplierInfo
    (@cityName varchar(20))
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON

    SELECT * FROM dbo.suppliers WHERE City = @cityName
END
```

For Microsoft SQL Server, the statement `'SET NOCOUNT ON'` suppresses the results of `INSERT`, `UPDATE`, or any non-`SELECT` statements that might be before the final `SELECT` query, so you can import the results of the `SELECT` query.

Use the `fetch` function when the stored procedure returns one or more result sets. For procedures that return output parameters, use `runstoredprocedure`.

Create Database Connection

Using the JDBC interface, connect to the Microsoft SQL Server database called `'test_db'` with a user name and password using port number `1234`. This example assumes that your database server is on the machine `servername`.

```
conn = database('test_db','username','pwd', ...
    'Vendor','Microsoft SQL Server', ...
    'Server','servername','PortNumber',1234);
```

Call Stored Procedure

Call the stored procedure, `getSupplierInfo`, and display the supplier information for `New York` city using the `fetch` function and the database connection. `results` contains the supplier information.

```
sqlquery = '{call getSupplierInfo(''New York'')}';
results = fetch(conn,sqlquery)
```

```
ans =

  3×5 table

    SupplierNumber      SupplierName         City          Country          FaxNumber
    ______________    __________________    __________    _______________    ______________

    1001              'Wonder Products'     'New York'    'United States'    '212 435 1617'
    1006              'ACME Toy Company'    'New York'    'United States'    '212 435 1618'
    1012              'Aunt Jemimas'        'New York'    'USA'              '14678923104'
```

Close Database Connection

```
close(conn)
```

See Also

database | fetch | runstoredprocedure

External Websites

- SQL Tutorial

Run Custom Database Function

This example shows how to run a custom database function on Microsoft SQL Server.

Consider a database function `get_prodCount` that retrieves row counts in the table `productTable`. The table `productTable` contains 30 rows where each row represents a product. This code defines this database function and assumes a schema name `dbo`.

```
CREATE FUNCTION dbo.get_prodCount()
RETURNS int
AS
BEGIN
     DECLARE @PROD_COUNT int
     SELECT @PROD_COUNT = count(*) FROM productTable
     RETURN(@PROD_COUNT)
END
GO
```

Create Database Connection

Connect to Microsoft SQL Server using an ODBC driver. For example, this code assumes that you are connecting to a data source named `MS SQL Server` with user name `username` and password `pwd`.

```
conn = database('MS SQL Server','username','pwd');
```

Execute Custom Function

Construct an SQL query `sqlquery` that executes the custom function code. Execute the custom function and import the results by using the `fetch` function.

```
sqlquery = 'SELECT dbo.get_prodCount() as num_products';
results = fetch(conn,sqlquery);
```

Display the results. The custom function `get_prodCount` returns the product count `30`.

```
results
```

```
results =

  table

    num_products
    ____________
```

```
          30
```

Close Database Connection

```
close(conn)
```

See Also

close | database | fetch

External Websites

- SQL Tutorial

Data Import Memory Management

To import data with simple queries, you can use the **Database Explorer** app. For more complex queries and managing memory issues, use the command line to import data into the MATLAB workspace. To understand the differences between these two approaches, see “Data Import Using Database Explorer App or Command Line” on page 2-145.

Database Toolbox provides various ways to import data into the MATLAB workspace from a database.

sqlread Function

If you are not familiar with writing SQL queries, you can import data using the `sqlread` function. This function needs only a database connection and the database table name to import data. Furthermore, the `sqlread` function does not require you to set database preferences.

select Function

For memory savings, you can import and access data using the `select` function. With this function, you save memory by importing data using data types specified in a database. The table definitions in a database specify the data type for each column. The `select` function maps the data type in the database to a corresponding MATLAB data type for each variable during data import. Instead of importing every numeric value as a `double` in MATLAB, the `select` function allows the import of different integer data types. You no longer need to convert the data type of a numeric value to a specific numeric type after data import. The MATLAB memory size used by integer or unsigned integer data types is less than double precision. Therefore, the `select` function saves memory.

This table shows the numeric data types in a database and their MATLAB equivalents when using the `select` function.

Database Data Type	MATLAB Data Type
`SIGNED TINYINT`	`int8`
`UNSIGNED TINYINT`	`uint8`
`SIGNED SMALLINT`	`int16`
`UNSIGNED SMALLINT`	`uint16`

Database Data Type	MATLAB Data Type
SIGNED INT	int32
UNSIGNED INT	uint32
SIGNED BIGINT	int64
UNSIGNED BIGINT	uint64
REAL	single
FLOAT	single
DOUBLE	double
DECIMAL	double
NUMERIC	double
Boolean	logical
Date, time, or text	char

For example, create a table `Patients` with this database table definition:

```
CREATE TABLE Patients(
    LastName VARCHAR(50),
    Gender VARCHAR(10),
    Age TINYINT,
    Location VARCHAR(300),
    Height SMALLINT,
    Weight SMALLINT,
    Smoker BIT,
    Systolic FLOAT,
    Diastolic NUMERIC,
    SelfAssessedHealthStatus VARCHAR(20))
```

These table columns have numeric data types in the database:

- `Age`
- `Height`
- `Weight`
- `Systolic`
- `Diastolic`

The `fetch` function imports the columns of numeric data with double precision by default. However, the `select` function imports the columns into their matching integer data type. When you import using the `select` function, the corresponding MATLAB data types for these columns are:

- `uint8`
- `uint16`
- `uint16`
- `single`
- `double`

The `fetch` function imports the `Smoker` column as a `double` in MATLAB. However, the `select` function imports the `Smoker` column as a `logical` variable.

To see data types after data import, use the `select` function with the `metadata` output argument.

Define Import Strategy Using SQLImportOptions Object

You can customize the import options for importing data from a database into the MATLAB workspace by using the `SQLImportOptions` object with the `fetch` function. The `select` function specifies the MATLAB data type by default. However, with the `SQLImportOptions` object, you can define the import strategy for specific database columns and specify the MATLAB data type for the corresponding imported data.

Also, you can specify `categorical`, `datetime`, and integer data types for imported data using the `SQLImportOptions` object. The MATLAB memory size used to store these data types is less than the memory size used for alternative data types, such as `string` or `double`.

See Also

`fetch` | `runsqlscript` | `select` | `sqlread`

More About

- "Data Import Using Database Explorer App or Command Line" on page 2-145
- "Import Data from Database Table Using sqlread Function" on page 5-52
- "Working with Large Data Sets" on page 2-148

Import Large Data Using DatabaseDatastore Object

This example shows how to create a `databaseDatastore` object for accessing collections of data stored in a relational database. After creating a `DatabaseDatastore` object, you can preview data, read data in chunks, and read every record in the data set.

To analyze large data, you can run algorithms on large data sets using a tall array.

Alternatively, you can write a MapReduce algorithm that defines the chunking and reduction of the data.

Create DatabaseDatastore Object

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. Here, the code assumes that you are connecting to database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server',...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using the database connection and SQL query. This SQL query retrieves all data from the table.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Preview Data in DatabaseDatastore Object

Preview the first eight records in the data set returned by executing `sqlquery`.

```
preview(dbds)
```

```
ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1990    9        22            6            1801       1750          2005       193
    1990    9        11            2             908        910          1613       155
    1990    9         2            7             NaN       1805           NaN       190
    1990    9        29            6            1434       1435          1615       163
```

```
    1990    9       3           1          925       755        1258      114
    1990    9      22           6          900       900        1241      122
    1990    9      20           4         1338      1335        1853      190
    1990    9       3           1          710       711         837       84
```

Read Data in DatabaseDatastore Object

Read the first 10 records.

```
dbds.ReadSize = 10;

read(dbds)
```

```
ans = 

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1987    10       28            3            1140       1140          1212       121
    1987    10        9            5            1155       1155          1250       130
    1987    10       22            4             715        715           807        80
    1987    10       16            5            1553       1555          1641       164
    1987    10       30            5            1821       1815          1956       195
    1987    10       12            1            1300       1300          1529       152
    1987    10        7            3             810        810           904        90
    1987    10       19            1             733        735           827        83
    1987    10       15            4             828        830           916        92
    1987    10        4            7            1750       1735          1837       181
```

Read the `DatabaseDatastore` object two more times by using counter `n`. Read 10 records at a time.

```
n = 0;

while(hasdata(dbds) && n~=2)
    read(dbds)
    n = n+1;
end
```

```
ans = 
```

```
    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1987    10       16            5             959       1000          1212       121
    1987    10       17            6            2020       2020          2100       205
    1987    10        6            2            1132       1135          1426       141
    1987    10       24            6             944        945          1211       121
    1987    10       18            7             833        835          1003       101
    1987    10       26            1            2356       2355           730        72
    1987    10       29            4            1056       1055          1208       121
    1987    10        1            4            2304       2255          2340       232
    1987    10       30            5            1329       1329          1434       143
    1987    10        3            6            1040       1040          1125       112


ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1987    10       23            5            1855       1855          2158       220
    1987    10       30            5            1055       1055          1302       131
    1987    10       28            3             NaN       1850           NaN       205
    1987    10       26            1            1600       1600          1649       164
    1987    10        6            2             745        745           833        82
    1987    10       31            6            1350       1350          1612       161
    1987    10       12            1            1253       1200          1359       131
    1987    10       19            1             650        645           852        81
    1987    10       10            6            1640       1640          1712       172
    1987    10        2            5            2030       2030          2127       213
```

Reset `DatabaseDatastore` Object

Reset the `DatabaseDatastore` object to the state where no data has been read from it. Resetting allows rereading from the same `DatabaseDatastore` object.

```
reset(dbds)
```

Read Every Record in `DatabaseDatastore` Object

Read every record in the `DatabaseDatastore` object in increments of 50,000 records at a time.

```
dbds.ReadSize = 50000;
data = readall(dbds);
```

Display the first three records of the full data set.

```
data(1:3,:)
```

```
ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1987    10       28            3            1140       1140          1212       121
    1987    10        9            5            1155       1155          1250       130
    1987    10       22            4             715        715           807        80
```

Close DatabaseDatastore Object and Database Connection

```
close(dbds)
```

See Also

close | database | databaseDatastore | hasdata | preview | read | readall | reset

Related Examples

- "Analyze Large Data in Database Using Tall Arrays"
- "Analyze Large Data in Database Using MapReduce"
- Building Effective Algorithms with MapReduce (MATLAB)

External Websites

- SQL Tutorial

Import Data Using MATLAB® Interface to SQLite

This example shows how to move data between MATLAB® and the MATLAB® interface to SQLite. Suppose that you have product data that you want to import into MATLAB®. You can load this data quickly into a SQLite database file. You do not need to install a database or driver. For details about the MATLAB® interface to SQLite, see “Working with MATLAB Interface to SQLite” on page 2-6. For more functionality, connect to the SQLite database file using the JDBC driver. For details, see “Configuring Driver and Data Source” on page 2-15.

To access the code for this example, enter `edit SQLiteWorkflow.m`.

Create SQLite Connection

Create a SQLite connection `conn` to a new SQLite database file `tutorial.db`. Specify the file name in the current working folder.

```
dbfile = fullfile(pwd,'tutorial.db');

conn = sqlite(dbfile,'create');
```

Create Tables in SQLite Database File

Create the tables `inventoryTable`, `suppliers`, `salesVolume`, and `productTable` using `exec`. Clear the MATLAB® workspace variables.

```
createInventoryTable = ['create table inventoryTable ' ...
    '(productNumber NUMERIC, Quantity NUMERIC, ' ...
    'Price NUMERIC, inventoryDate VARCHAR)'];
exec(conn,createInventoryTable)

createSuppliers = ['create table suppliers ' ...
    '(SupplierNumber NUMERIC, SupplierName varchar(50), ' ...
    'City varchar(20), Country varchar(20), ' ...
    'FaxNumber varchar(20))'];
exec(conn,createSuppliers)

createSalesVolume = ['create table salesVolume ' ...
    '(StockNumber NUMERIC, January NUMERIC, ' ...
    'February NUMERIC, March NUMERIC, April NUMERIC, ' ...
    'May NUMERIC, June NUMERIC, July NUMERIC, ' ...
    'August NUMERIC, September NUMERIC, October NUMERIC, ' ...
    'November NUMERIC, December NUMERIC)'];
```

```
exec(conn,createSalesVolume)

createProductTable = ['create table productTable ' ...
    '(productNumber NUMERIC, stockNumber NUMERIC, ' ...
    'supplierNumber NUMERIC, unitCost NUMERIC, ' ...
    'productDescription varchar(20))'];
exec(conn,createProductTable)

clear createInventoryTable createSuppliers createSalesVolume ...
    createProductTable
```

`tutorial.db` contains four empty tables.

Load Data into SQLite Database File

Load the MAT-file named `sqliteworkflowdata.mat`. The variables `CinvTable`, `Csuppliers`, `CsalesVol`, and `CprodTable` contain data for export. Export data into the tables in `tutorial.db` using `insert`. Clear the MATLAB® workspace variables.

```
load('sqliteworkflowdata.mat')

insert(conn,'inventoryTable', ...
    {'productNumber','Quantity','Price','inventoryDate'},CinvTable)

insert(conn,'suppliers', ...
    {'SupplierNumber','SupplierName','City','Country','FaxNumber'}, ...
    Csuppliers)

insert(conn,'salesVolume', ...
    {'StockNumber','January','February','March','April','May','June', ...
    'July','August','September','October','November','December'}, ...
    CsalesVol)

insert(conn,'productTable', ...
    {'productNumber','stockNumber','supplierNumber','unitCost', ...
    'productDescription'},CprodTable)

clear CinvTable Csuppliers CsalesVol CprodTable
```

Close the SQLite connection. Clear the MATLAB® workspace variable.

```
close(conn)

clear conn
```

Create a read-only SQLite connection to `tutorial.db`.

```
conn = sqlite('tutorial.db','readonly');
```

Import Data into MATLAB®

Import the product data into the MATLAB® workspace using `fetch`. Variables `inventoryTable_data`, `suppliers_data`, `salesVolume_data`, and `productTable_data` contain data from the tables `inventoryTable`, `suppliers`, `salesVolume`, and `productTable`.

```
inventoryTable_data = fetch(conn,'SELECT * FROM inventoryTable');

suppliers_data = fetch(conn,'SELECT * FROM suppliers');

salesVolume_data = fetch(conn,'SELECT * FROM salesVolume');

productTable_data = fetch(conn,'SELECT * FROM productTable');
```

Display the first three rows of data in each table.

```
inventoryTable_data(1:3,:)
```

```
ans = 3x4 cell array
    {[1]}    {[1700]}    {[14.5000]}    {'9/23/2014 9:38...'}
    {[2]}    {[1200]}    {[ 9.3000]}    {'7/8/2014 10:50...'}
    {[3]}    {[ 356]}    {[17.2000]}    {'5/14/2014 7:14...'}
```

```
suppliers_data(1:3,:)
```

```
ans = 3x5 cell array
  Columns 1 through 4

    {[1001]}    {'Wonder Products'}    {'New York'}    {'United States' }
    {[1002]}    {'Terrific Toys'  }    {'London'  }    {'United Kingdom'}
    {[1003]}    {'Wacky Widgets'  }    {'Adelaide'}    {'Australia'     }

  Column 5

    {'212 435 1617' }
    {'44 456 9345'  }
    {'618 8490 2211'}
```

```
salesVolume_data(1:3,:)

ans = 3x13 cell array
  Columns 1 through 6

    {[125970]}    {[1400]}    {[1100]}    {[ 981]}    {[ 882]}    {[794]}
    {[212569]}    {[2400]}    {[1721]}    {[1414]}    {[1191]}    {[983]}
    {[389123]}    {[1800]}    {[1200]}    {[ 890]}    {[ 670]}    {[550]}

  Columns 7 through 12

    {[752]}    {[654]}    {[773]}    {[809]}    {[980]}    {[3045]}
    {[825]}    {[731]}    {[653]}    {[723]}    {[790]}    {[1400]}
    {[450]}    {[400]}    {[410]}    {[402]}    {[450]}    {[1200]}

  Column 13

    {[19000]}
    {[ 5000]}
    {[16000]}
```

```
productTable_data(1:3,:)

ans = 3x5 cell array
    {[9]}    {[125970]}    {[1003]}    {[13]}    {'Victorian Doll'}
    {[8]}    {[212569]}    {[1001]}    {[ 5]}    {'Train Set'     }
    {[7]}    {[389123]}    {[1007]}    {[16]}    {'Engine Kit'    }
```

Close SQLite Connection

```
close(conn)
```

Clear the MATLAB® workspace variable.

```
clear conn
```

See Also

`close` | `exec` | `fetch` | `insert` | `sqlite`

More About

- "Access Relational Database Data in MATLAB" on page 2-3
- "Working with MATLAB Interface to SQLite" on page 2-6
- "Configuring Driver and Data Source" on page 2-15

External Websites

- SQL Tutorial

Retrieve Image Data Types

This example shows how to retrieve images from a Microsoft Access database. To run this example, define the function `parsebinary` using this code.

```
function [x,map] = parsebinary(o,f)
%PARSEBINARY Write binary object to disk and display if image.
%   [X,MAP] = PARSEBINARY(O,F) writes the binary object in O to disk
%   in the format specified by F. If the object is an image,
%   display the image. This file was released for demonstration
%   purposes only. A Microsoft(R) Access(TM) database contains image data.
%   Use an ODBC driver to read the data. This function writes
%   any temporary files to the current working directory.
%
%   Valid file formats are:
%
%   BMP     Bitmap
%   DOC     Microsoft(R) Word document
%   GIF     GIF file
%   PPT     Microsoft(R) Powerpoint(R) file
%   TIF     TIF file
%   XLS     Microsoft(R) Excel(R) spreadsheet
%   PNG     Portable Network Graphics

% Transform object into vector of data
v = java.util.Vector;
v.addElement(o);
bdata = v.elementAt(0);

% Open file to write data to disk
fid = fopen(['testfile.' lower(f)],'wb');

% n specifies the end point of data written to disk
n = length(bdata);

% File type determines how many bytes of header data that
% the ODBC driver prepended to the data.

switch lower(f)

    case 'bmp'
      m = 79;

    case 'doc'
      m = 86;

    case 'gif'
      m = 5722;

    case 'png'

      m = 182;
      n = length(bdata)-285;

    case 'ppt'
      m = 94;

    case 'tif'
      m = 6472;
```

```
    case 'xls'
      m = 83;

    otherwise
      error(message('database:parsebinary:unknownFormat'))

end

% Write data to disk
fwrite(fid,bdata(m:n),'int8');
fclose(fid);

% Display if image
switch lower(f)

  case {'bmp','tif','gif','png'}

    [x,map] = imread(['testfile.' lower(f)]);
    imagesc(x)
    colormap(map)

  case {'doc','xls','ppt'}

    % Microsoft(R) Office formats
    % Insert path to Microsoft(R) Word or Microsoft(R) Excel(R)
    % executable here to run from MATLAB(R) prompt.
    % For example:
    % !d:\msoffice\winword testfile.doc
end
```

1 Connect to the Microsoft Access data source using the ODBC driver. The database contains the table `Invoice`.

   ```
   conn = database('datasource','','');
   ```

2 Import the `InvoiceNumber` and `Receipt` columns of data from `Invoice`.

   ```
   sqlquery = 'SELECT InvoiceNumber,Receipt FROM Invoice';
   results = fetch(conn,sqlquery);
   ```

3 View the imported data.

   ```
   results
   ```

   ```
   ans =

     10×2 table

       InvoiceNumber         Receipt
       _____________    _________________

           2101         [1948410×1 uint8]
           3546         [2059994×1 uint8]
          33116         [ 487034×1 uint8]
          34155         [2059994×1 uint8]
   ```

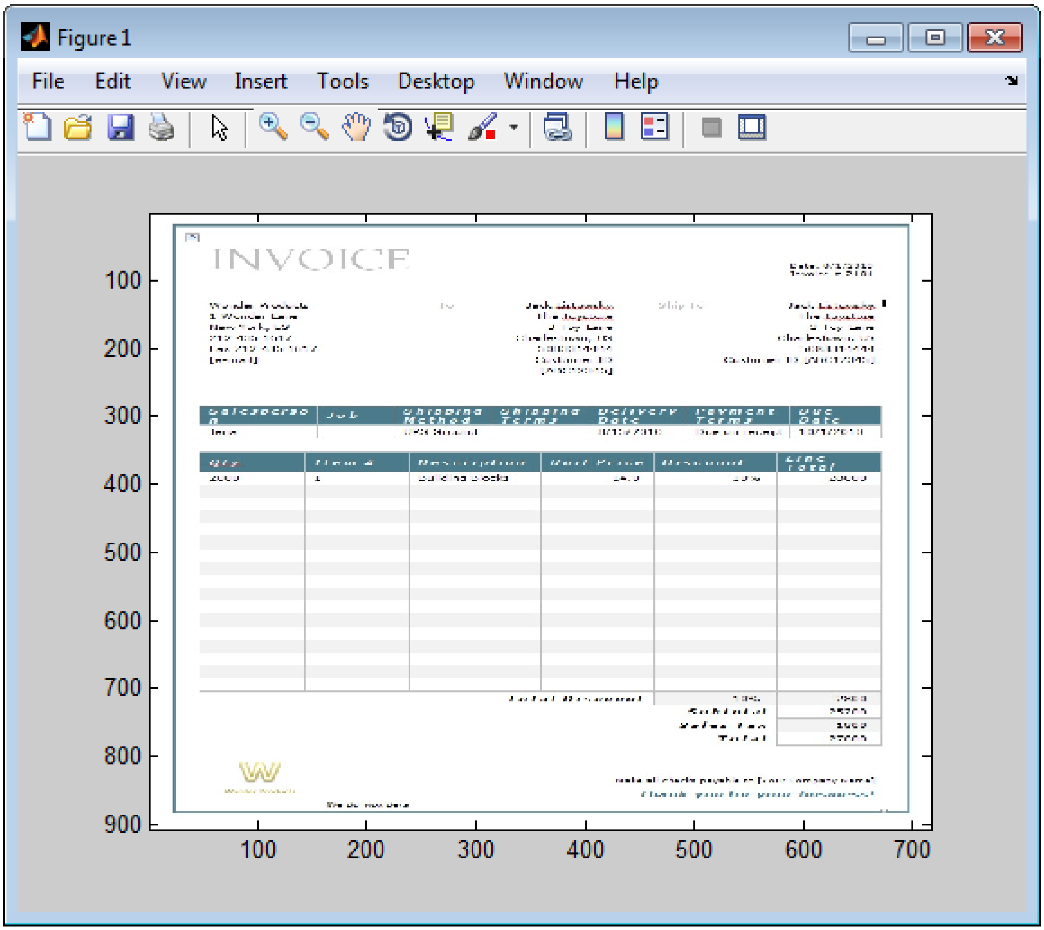
```
34267        [2454554×1 uint8]
37197        [1926362×1 uint8]
37281        [2403674×1 uint8]
41011        [1920474×1 uint8]
61178        [2378330×1 uint8]
62145        [ 492314×1 uint8]
```

4. Assign the image element you want to the variable `receipt`.

   ```
   receipt = results.Receipt{1};
   ```

5. Run the `parsebinary` function. The function writes retrieved data to a file, strips ODBC header information from it, and displays `receipt` as a bitmap image in a figure window. Ensure that your current folder is writable so that the `parsebinary` function can write the output data.

   ```
   cd 'I:\MATLABFiles\myfiles'
   parsebinary(receipt,'BMP');
   ```



See Also

`database` | `fetch`

Related Examples

- "Import Data from Database Table Using sqlread Function" on page 5-52

External Websites

- SQL Tutorial

Import Boolean Data from Database

Import Boolean data from a database table into the MATLAB® workspace. MATLAB® imports Boolean data from databases into the MATLAB® workspace as data type `logical`. This data has values of `true` or `false`. You can store Boolean data in a table, structure, or cell array. Perform a simple data analysis on the imported data.

The code assumes that you have a database table `Invoice` stored in a Microsoft® SQL Server® database. Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create Database Connection

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import Boolean Data

Select the paid data from the `Invoice` table using a SQL `SELECT` statement. The database stores paid data as a Boolean to specify whether or not an invoice has been paid. Import and display the data using the `select` function.

```
selectquery = 'SELECT Paid FROM Invoice';
data = select(conn,selectquery)
```

```
data =

  11×1 table

    Paid 
    _____

    false
    true 
    true 
    false
    true 
    true 
    false
```

```
    true
    false
    true
    false
```

Database Toolbox™ imports the data into the workspace variable `data`. The MATLAB® table `data` contains `Paid` as a `logical` variable.

Perform Data Analysis

Count the number of unpaid invoices.

```
unpaid = data.Paid == false;
sum(unpaid)
```

```
ans =

     5
```

Close Database Connection

```
close(conn)
```

See Also

`close` | `database` | `select`

Related Examples

- "Import Data from Database Table Using sqlread Function" on page 5-52
- "Insert Data into Database Table" on page 5-55

External Websites

- SQL Tutorial

Append Data to Existing Database Table Using Insert Functionality

To append data to an existing database table, you can use the `sqlwrite` function. The `datainsert` and `fastinsert` functions will be removed in a future release. When using the `sqlwrite` function, you no longer have to preprocess or convert the data, as required by the `datainsert` function. The following short examples show how to append the same data using both the `sqlwrite` and `datainsert` functions. Use these examples for migrating to the `sqlwrite` function for data insertion.

Append data to an existing database table by using the `sqlwrite` function.

```
% Read from 'airlinesmall.csv'
impObj = detectImportOptions('airlinesmall.csv');
impObj = setvartype(impObj, ...
    {'DepTime','ArrTime','ActualElapsedTime','CRSElapsedTime', ...
    'ArrDelay','DepDelay','Distance'},'double');

airlines_data = readtable('airlinesmall.csv',impObj);

% Insert using sqlwrite function
sqlwrite(conn,'airlinesmall',airlines_data);
```

Append the same data to the database table by using the `datainsert` function.

```
% Read from 'airlinesmall.csv'
impObj = detectImportOptions('airlinesmall.csv');
impObj = setvartype(impObj, ...
    {'DepTime','ArrTime','ActualElapsedTime','CRSElapsedTime', ...
    'ArrDelay','DepDelay','Distance'},'double');

airlines_data = readtable('airlinesmall.csv',impObj);
variablenames = airlines_data.Properties.VariableNames;
airlines_data = table2cell(airlines_data);

% Convert to compatible data
columns = size(airlines_data,2);
for i = 1:columns
    a = airlines_data(:,i);
    if all(cellfun(@(x)isnumeric(x),a)) == true
        a(cellfun(@isnan,a)) = {Inf};
        airlines_data(:,i) = a;
    end
```

```
end

airlines_data = cell2table(airlines_data,'VariableNames',variablenames);

% Insert using datainsert function
datainsert(conn,'airlinesmall',variablenames,airlines_data);
```

When using the `datainsert` function, you must complete additional steps to preprocess the data to insert. Use the `sqlwrite` function instead to avoid these extra steps.

See Also

`cell2table` | `detectImportOptions` | `readtable` | `setvartype` | `sqlwrite` | `table2cell`

More About

- "Insert Data into New Database Table Using Insert Functionality" on page 5-49
- "Insert Data into Database Table" on page 5-55
- "Writing Data Common Errors" on page 3-2

Insert Data into New Database Table Using Insert Functionality

To insert data into a new database table, you can use the `sqlwrite` function. The `datainsert` and `fastinsert` functions will be removed in a future release. When using the `sqlwrite` function, you no longer have to preprocess or convert the data, as required by the `datainsert` function. The following short examples show how to insert the same data using both the `sqlwrite` and `datainsert` functions. Use these examples for migrating to the `sqlwrite` function for data insertion.

Insert data in a new database table by using the `sqlwrite` function.

```
% Read from patient.xls file
patient_data = readtable('patient.xls');

% Insert using sqlwrite function
sqlwrite(conn,'patient',patient_data);
```

Insert the same data by using the `datainsert` function.

```
% Create a database table equivalent to data stored in patients.xls file
sqlquery = ['CREATE TABLE patients(LastName varchar, Gender varchar, ' ...
    'Age numeric, Location varchar, Height numeric, Weight numeric, ' ...
    'Smoker Boolean, Systolic numeric, Diastolic numeric, ' ...
    'SelfAssessedHealthStatus varchar)'];
exec(conn,sqlquery);

% Read from patients.csv file
patient_data = readtable('patients.csv');
variablenames = patient_data.Properties.VariableNames;
patient_data = table2cell(patient_data);

% Convert to compatible data
columns = size(patient_data,2);
for i = 1:columns
    a = patient_data(:,i);
    if all(cellfun(@(x)isnumeric(x),a)) == true
        a(cellfun(@isnan,a)) = {Inf};
        patient_data(:,i) = a;
    end
end

patient_data = cell2table(patient_data,'VariableNames',variablenames);
```

```
% Insert using datainsert function
datainsert(conn,'patient',variablenames,patient_data);
```

When using the `datainsert` function, you must complete additional steps to preprocess the data to insert. Use the `sqlwrite` function instead to avoid these extra steps.

See Also

`cell2table` | `exec` | `readtable` | `sqlwrite` | `table2cell`

More About

- "Append Data to Existing Database Table Using Insert Functionality" on page 5-47
- "Insert Data into Database Table" on page 5-55
- "Writing Data Common Errors" on page 3-2

Join Tables Using Command Line

You can join data in database tables and import the results interactively by using the **Database Explorer** app. Or, you can join two database tables by using the `sqlinnerjoin` and `sqlouterjoin` command line functions. The following short examples show how to join tables using the command line.

Enter this code to create an inner join between two database tables (the left table and right table of the join). An inner join retrieves records that have matching values in the shared column of both tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable);
```

To create an outer join, enter this code at the command line. An outer join retrieves the matched and unmatched rows between the two tables. This code shows a right outer join that uses different left and right keys in the corresponding database tables.

```
lefttable = 'employees';
righttable = 'departments';
data = sqlouterjoin(conn,lefttable,righttable, ...
    'LeftKey','MANAGER_ID','RightKey','DEPT_MANAGER_ID', ...
    'Type','right');
```

To join more than two database tables at a time, use the Database Explorer app. For details, see “Join Tables Using Database Explorer App” on page 4-6. Or, you can create and run an SQL script using the `runsqlscript` function.

See Also

`sqlinnerjoin` | `sqlouterjoin`

More About

- “Join Tables Using Database Explorer App” on page 4-6
- “Importing Data Common Errors” on page 3-4

Import Data from Database Table Using sqlread Function

This example shows how to import data from a table in a Microsoft® Access™ database into the MATLAB® workspace using the `sqlread` function. The example then shows how to use an SQL script to import data from an SQL query that contains multiple joins.

Connect to Database

Create a Microsoft Access database connection with the data source name `dbdemo` using an ODBC driver and a blank user name and password. This database contains the table `producttable`.

```
conn = database('dbdemo','','');
```

If you are connecting to a database using a JDBC connection, then specify a different syntax for the database function.

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import Data from Database Table

Import product data from the database table `producttable` by using the `sqlread` function and the database connection. This function imports data as a MATLAB table.

```
tablename = 'producttable';
data = sqlread(conn,tablename);
```

Display the product number and description in the imported data.

```
data(:,[1 5])
```

```
ans =

  10×2 table
```

```
productnumber    productdescription
_____________    __________________

      9          'Victorian Doll'
      8          'Train Set'
      7          'Engine Kit'
      2          'Painting Set'
      4          'Space Cruiser'
      1          'Building Blocks'
      5          'Tin Soldier'
      6          'Sail Boat'
      3          'Slinky'
     10          'Teddy Bear'
```

Import Data Using Multiple Joins in SQL Query

Create an SQL script file named `salesvolume.sql` with the following SQL query. This SQL query uses multiple joins to join these tables in the `dbdemo` database:

- `producttable`
- `salesvolume`
- `suppliers`

The purpose of the query is to import sales volume data for suppliers located in the United States.

```
SELECT  salesvolume.january
,   salesvolume.february
,   salesvolume.march
,   salesvolume.april
,   salesvolume.may
,   salesvolume.june
,   salesvolume.july
,   salesvolume.august
,   salesvolume.september
,   salesvolume.october
,   salesvolume.november
,   salesvolume.december
,   suppliers.country
FROM     ((producttable
INNER JOIN salesvolume
```

```
ON  producttable.stocknumber = salesvolume.stocknumber)
INNER JOIN suppliers
ON  producttable.suppliernumber = suppliers.suppliernumber)
WHERE suppliers.country LIKE 'United States%'
```

Run the SQL script file named `salesvolume.sql` by using the `runsqlscript` function. `results` is a `cursor` object array with the data returned from running the SQL query in the SQL script file.

```
results = runsqlscript(conn,'salesvolume.sql');
```

Display the first three rows in the `Data` table. Access this table as a property of the `cursor` object by using dot notation.

```
head(results(1).Data,3)
```

```
ans =

  3×13 table

    january    february    march    april    may     june    july    august    septembe
    _______    ________    _____    _____    ____    ____    ____    ______    ________

     5000        3500      2800     2300     1700    1400    1000     900          1600
     2400        1721      1414     1191      983     825     731     653           723
     1200         900       800      500      399     345     300     175           760
```

Close Database Connection

```
close(conn)
```

See Also

`close` | `database` | `sqlread`

More About

- "Import Data from Database Table Using sqlread Function" on page 5-52
- "Data Import Memory Management" on page 5-28

Insert Data into Database Table

This example shows how to import data from a database into MATLAB®, perform calculations on the data, and export the results to a database table.

The example assumes that you are connecting to a Microsoft® Access™ database that contains tables named `salesvolume` and `yearlysales`. Also, the example assumes that you start MATLAB as an administrator. The `salesvolume` table contains the column names for each month. The `yearlysales` table contains the column names `month` and `salestotal`.

Connect to Database

Create a database connection to the Microsoft Access database. For example, this code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Calculate Sum of Sales Volume for One Month

Import sales volume data for the month of March using the database connection. The `salesvolume` database table contains sales volume data.

```
tablename = 'salesvolume';
data = sqlread(conn,tablename);
```

Display the first three rows of sales volume data. The fourth variable contains the data for the month of March.

```
head(data(:,4),3)
```

```
ans =
```

```
  3×1 table

    march
    _____

     981
    1414
     890
```

Calculate the sum of the March sales. Assign the result to the MATLAB workspace variable `total` and display the result.

```
total = sum(data.march)
```

```
total =

       14606
```

Insert Total Sales for One Month into Database

Retrieve the name of the month from the sales volume data.

```
month = data.Properties.VariableNames(4);
```

Define the names of the columns for the data to insert as a cell array of character vectors.

```
colnames = {'month' 'salestotal'};
```

Create a MATLAB table that stores the data to export.

```
results = table(month,total,'VariableNames',colnames);
```

Determine the status of the `AutoCommit` database flag. This status determines whether or not the insert action can be undone.

```
conn.AutoCommit
```

```
ans =

    'on'
```

The AutoCommit flag is set to on. The database commits the exported data automatically to the database, and this action cannot be undone.

Insert the sum of sales for the month of March into the yearlysales table.

```
tablename = 'yearlysales';
sqlwrite(conn,tablename,results)
```

Import the data from the yearlysales table. This data contains the calculated result.

```
data = sqlread(conn,tablename)
```

```
data =

  1×3 table

     month      salestotal    revenue
    _______    ___________    _______

    'march'       14606          0
```

Close Database Connection

```
close(conn)
```

See Also

close | database | sqlread | sqlwrite

More About

- “Export Data Using Bulk Insert” on page 5-19

Retrieve Database Metadata

This example shows how to retrieve database information using the `connection` object and the `sqlfind` function.

The example assumes that you are connecting to a Microsoft® SQL Server® database that contains a table named `productTable`.

Connect to Database

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Find Catalogs and Schemas

Display the catalogs in the database by using the `Catalogs` property of the `connection` object.

```
conn.Catalogs
```

```
ans =

  1×4 cell array

    {'master'}    {'msdb'}    {'tempdb'}    {'toy_store'}
```

Display the first three schemas in the database by using the `Schemas` property of the `connection` object.

```
conn.Schemas{1:3}
```

```
ans =

    'dbo'


ans =

    'guest'


ans =

    'INFORMATION_SCHEMA'
```

Find Table Types

Find all table types in the database by using the `sqlfind` function with the `connection` object.

```
tables = sqlfind(conn,'');
```

Display the first three table types.

```
tables(1:3,:)
```

```
ans =

  3×5 table

      Catalog              Schema                      Table                  Columns        Typ
    ___________    ____________________    _____________________    ___________    ____

    'toy_store'    'INFORMATION_SCHEMA'    'CHECK_CONSTRAINTS'      {1×4  cell}    'VIE
    'toy_store'    'INFORMATION_SCHEMA'    'COLUMNS'                {1×23 cell}    'VIE
    'toy_store'    'INFORMATION_SCHEMA'    'COLUMN_DOMAIN_USAGE'    {1×7  cell}    'VIE
```

Find the table type of the table `productTable`.

```
tablename = 'productTable';
data = sqlfind(conn,tablename);
data.Type
```

```
ans =

  1×1 cell array

    {'TABLE'}
```

Find Table Columns

Find all columns in the database table `productTable` and display them.

```
data = sqlfind(conn,tablename);
data.Columns{:}
```

```
ans =

  1×5 cell array

  Columns 1 through 4

    {'productNumber'}    {'stockNumber'}    {'supplierNumber'}    {'unitCost'}

  Column 5

    {'productDescript…'}
```

Close Database Connection

```
close(conn)
```

See Also

`close` | `database` | `sqlfind` | `sqlread`

More About

- "Import Data from Database Table Using sqlread Function" on page 5-52

Customize Options for Importing Data from Database into MATLAB

This example shows how to customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for multiple database columns. Import data using the `sqlread` function.

The example uses the `patients.xls` spreadsheet, which contains patient information. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create Database Connection

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load Example Data

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create `SQLImportOptions` Object

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Display the default data types of the variables by accessing the `VariableNames` and `VariableTypes` properties of the `SQLImportOptions` object using dot notation.

```
disp([opts.VariableNames' opts.VariableTypes'])
```

```
    'LastName'                      'char'
    'Gender'                        'char'
    'Age'                           'double'
    'Location'                      'char'
    'Height'                        'double'
    'Weight'                        'double'
    'Smoker'                        'double'
    'Systolic'                      'double'
    'Diastolic'                     'double'
    'SelfAssessedHealthStatus'      'char'
```

Customize Import Options

Change the data types of multiple variables. Convert the data type for all text variables to `string`. Also, convert the data type for all numeric variables to `single`.

```
textvars = {'LastName','Gender','Location','SelfAssessedHealthStatus'};
opts = setoptions(opts,textvars,'Type','string');

numvars = {'Age','Height','Weight','Systolic','Smoker','Diastolic'};
opts = setoptions(opts,numvars,'Type','single');
```

Display the updated data types of the variables.

```
disp([opts.VariableNames' opts.VariableTypes'])
```

```
    'LastName'                      'string'
    'Gender'                        'string'
    'Age'                           'single'
    'Location'                      'string'
    'Height'                        'single'
    'Weight'                        'single'
    'Smoker'                        'single'
    'Systolic'                      'single'
    'Diastolic'                     'single'
    'SelfAssessedHealthStatus'      'string'
```

Set the import options to replace missing data in the specified variables with the fill value `unknown`.

```
varnames = {'LastName','Location'};
opts = setoptions(opts,varnames,'FillValue',"unknown");
```

Import Data Using Import Options

Import the variables with the customized data types by using the `sqlread` function, and display the first eight rows of imported data.

```
T = sqlread(conn,tablename,opts);
head(T)
```

```
ans=8×10 table
     LastName      Gender     Age              Location              Height    Weight
    __________    ________    ___    ___________________________    ______    ______

    "Smith"       "Male"      38     "County General Hospital"        71       176
    "Johnson"     "Male"      43     "VA Hospital"                    69       163
    "Williams"    "Female"    38     "St. Mary's Medical Center"      64       131
    "Jones"       "Female"    40     "VA Hospital"                    67       133
    "Brown"       "Female"    49     "County General Hospital"        64       119
    "Davis"       "Female"    46     "St. Mary's Medical Center"      68       142
    "Miller"      "Female"    33     "VA Hospital"                    64       142
    "Wilson"      "Male"      40     "VA Hospital"                    68       180
```

Delete Example Data and Close Database Connection

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`close` | `database` | `databaseImportOptions` | `execute` | `getoptions` | `setoptions` | `sqlread` | `sqlwrite`

More About

- “Importing Data Common Errors” on page 3-4

External Websites

- SQL Tutorial

Database Toolbox Interface for Apache Cassandra Database Topics

Convert CQL Data Types to MATLAB Data Types

When importing data into MATLAB, the `partitionRead` and `executecql` functions convert the Cassandra Query Language (CQL) data types to MATLAB data types. This table describes the CQL data types and shows their corresponding MATLAB data types after the data import into MATLAB.

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable
`ascii`	US-ASCII character string	`string`
`bigint`	64-bit signed long integer	`int64`
`blob`	Arbitrary bytes (no validation)	`uint8`
`boolean`	`true` or `false`	`logical`
`counter`	Distributed counter value (64-bit long integer)	`int64`
`date`	Value is a date with no corresponding time value. Cassandra encodes the date as a 32-bit integer representing days since epoch (January 1, 1970).	`datetime` array without the time component and time zone
`decimal`	Variable-precision decimal	`java.math.BigDecimal`
`double`	64-bit IEEE®-754 floating point	`double`
`float`	32-bit IEEE-754 floating point	`single`
`inet`	IP address string in IPv4 or IPv6 format	`string`
`int`	32-bit signed integer	`int32`

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable
list<*type*>	Collection of one or more ordered elements (for example, [literal, literal, literal])	Array of data types, one for each item in the collection. For example, if a Cassandra database table column has the list<int> data type, then each row in the MATLAB table contains an array of int32 data types. In this case, the data type of the MATLAB table variable is a cell array of arrays.
map<*keyType*,*valueType*>	JSON-style array of literals (for example, { literal : literal, literal : literal, ...})	An *n*-by-2 MATLAB table where *n* is the number of key-value pairs in the map. The first variable Keys has the keys of the map. The data type for this variable depends on the key type defined for the map. Similarly, the Values variable has the values that correspond to each key. The data type for the Values variable depends on the value type defined for the map. For example, if a Cassandra database table column has the map<text,double> data type, then the partitionRead and executecql functions convert this data type into a MATLAB table. The table has the Keys variable as string scalars and the Values variable as a double array. In this case, the data type of the MATLAB table variable is a cell array of tables.

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable
`set<type>`	Collection of one or more elements (for example, `{literal, literal, literal}`)	Array of data types, one for each item in the collection. For example, if a Cassandra database column has the `set<float>` data type, then each row in the resulting MATLAB table contains an array of `single` values. In this case, the data type of the MATLAB table variable is a cell array of arrays.
`smallint`	2-byte integer	`int16`
`text`	UTF-8 encoded string	`string`
`time`	Cassandra database encodes this value as a 64-bit signed integer that represents the number of nanoseconds since midnight.	`duration` array
`timestamp`	Date and time with millisecond precision, encoded as 8 bytes since epoch (January 1, 1970)	`datetime` array with the date component and time zone as UTC or GMT
`timeuuid`	Version 1 UUID only	`string`
`tinyint`	1-byte integer	`int8`

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable
`tuple<`*`Type1,...,TypeN`*`>`	Group of unnamed but typed fields	A 1-by-*n* MATLAB table, where *n* is the number of fields in the tuple. The variable names are `Var1`, `Var2`, `Var3`, and so on, until `Var(`*`n`*`)`. The data type of each variable depends on the Cassandra data types defined in the tuple. For example, if a Cassandra database column has the `tuple<text,smallint,timestamp>` data type, then the `partitionRead` and `executecql` functions convert this data type into a MATLAB table. The table has the `Var1` variable as a `string` array, `Var2` as an `int16` array, and `Var3` as a `datetime` array. In this case, the data type of the MATLAB table variable is a table.
user-defined type (UDT)	Group of named fields	A 1-by-*n* MATLAB table, where *n* is the number of fields in the UDT. Variable names match the field names of the UDT. The data type of each variable depends on the Cassandra data types defined in the UDT. The data type of the MATLAB table variable is a table.
`uuid`	UUID in standard UUID format	`string`
`varchar`	UTF-8 encoded string	`string`
`varint`	Arbitrary-precision integer	`java.math.BigInteger`

Note For the CQL data type, if the data type is a collection (for example, `list`, `map`, and so on), then the value contains angle brackets (`<>`). These brackets surround the data types of the items in the collection. For details about valid Cassandra data types, see CQL data types.

See Also

`executecql` | `partitionRead`

More About

- "Fill Values for Missing Data from Apache Cassandra Database" on page 6-9
- "Import Data from Cassandra Database Table Using CQL" on page 6-18

External Websites

- Apache Cassandra Documentation
- CQL data types

Database Toolbox Interface for Apache Cassandra Database Installation

To use the Database Toolbox Interface for Apache Cassandra Database, you must first install it. Ensure that the interface supports your Cassandra database version.

Supported Cassandra Database Versions

The Database Toolbox Interface for Apache Cassandra Database supports these versions of the Cassandra database:

- 2.1
- 2.2
- 3.0

Installation

To install the Database Toolbox Interface for Apache Cassandra Database, follow these steps:

1. In the **Environment** section of the MATLAB toolstrip, select **Add-Ons** > **Get Add-Ons**.
2. In the Add-On Explorer, search for the Database Toolbox Interface for Apache Cassandra Database.
3. Install the Database Toolbox Interface for Apache Cassandra Database.

The installer downloads and installs the Cassandra Java driver. Then, the installer adds the driver to the static Java class path as part of the installation.

For details about installing add-ons, see “Get Add-Ons” (MATLAB). For other information, see “Add-Ons” (MATLAB).

See Also

`cassandra` | `columninfo` | `executecql` | `partitionRead` | `tablenames`

More About

- “Explore and Import Data from Cassandra Database Table” on page 6-14
- “Import Data from Cassandra Database Table Using CQL” on page 6-18

External Websites

- Apache Cassandra
- Apache Cassandra Documentation

Fill Values for Missing Data from Apache Cassandra Database

When you import data from a Cassandra database into MATLAB using the `partitionRead` or `executecql` functions, these functions convert the fill values for missing data from the Cassandra column to the corresponding MATLAB values. This table identifies the data types in a Cassandra database column (Cassandra Query Language (CQL) data type) and the corresponding fill value for missing data in the MATLAB table.

CQL Data Type	MATLAB Fill Value
`ascii`	`<missing>`
`bigint`	`0`
`blob`	`[]`
`boolean`	`false`
`counter`	`0`
`date`	`NaT`
`decimal`	`[]`
`double`	`NaN`
`float`	`NaN`
`inet`	`<missing>`
`int`	`0`
`list<type>`	`[]`
`map<keyType,valueType>`	`0x2 table` (empty table)
`set<type>`	`[]`
`smallint`	`0`
`text`	`<missing>`
`time`	`NaN`

CQL Data Type	MATLAB Fill Value
timestamp	NaT
timeuuid	<missing>
tinyint	0
tuple<*Type1*,...,*TypeN*>	1x*n* table, where the missing value in each variable is the MATLAB fill value for the corresponding CQL data type
user-defined type (UDT)	1x*n* table, where the missing value in each variable is the MATLAB fill value for the corresponding CQL data type
uuid	<missing>
varchar	<missing>
varint	[]

See Also

cassandra | executecql | partitionRead

More About

- “Database Toolbox Interface for Apache Cassandra Database Installation” on page 6-7
- “Explore and Import Data from Cassandra Database Table” on page 6-14
- “Import Data from Cassandra Database Table Using CQL” on page 6-18
- “Database Toolbox Interface for Apache Cassandra Database Error Messages” on page 6-11

External Websites

- Apache Cassandra Documentation
- CQL data types

Database Toolbox Interface for Apache Cassandra Database Error Messages

This table describes how to address common errors you can encounter while working with the Database Toolbox Interface for Apache Cassandra Database.

Error Message	Probable Causes	Resolution
Cassandra exception: *`error message`*	The Cassandra Java driver throws an error. Sometimes the error can result from an invalid Cassandra Query Language (CQL) query.	Use the error message to troubleshoot the issue. If you are using a CQL query, ensure that you enter a valid CQL query in the `query` input argument of the `executecql` function.
Invalid Cassandra connection.	The Cassandra database connection is closed.	Create a new Cassandra database connection using the `cassandra` function.
Unable to find *`keyspacename`* keyspace. View the Keyspaces property to list the keyspaces in the cluster.	The specified keyspace does not exist in the Cassandra database.	Specify a keyspace that exists in the Cassandra database. To view the keyspaces, access the `Keyspaces` property of the `cassandra` object.
Unable to find *`tablename`* table. View the tablenames function to list the tables in the keyspace.	The specified Cassandra database table does not exist in the Cassandra database.	Specify a Cassandra database table that exists in the Cassandra database. To view the Cassandra database tables, use the `tablenames` function.
Incorrect number of inputs. Table *`tablename`* contains *`{1,number,integer}`* partition keys, but *`{2,number,integer}`* values were specified.	You specify more key values than partition keys in the `partitionRead` function. Or, you do not specify key values for all partition keys.	Specify the correct number of key values for the partition keys. To view the key values, use the `keyValues` output argument of the `columninfo` function.

Error Message	Probable Causes	Resolution
Partition keys of type *datatype* must be a string vector, character vector, or a 1-dimensional cell array of character vectors.	You specify a value that does not contain text data for a key that has a `text` data type.	Use a string scalar, character vector, or one-dimensional cell array of character vectors to specify text data.
Partition keys of type *datatype* must be a numeric vector.	You specify a value that does not contain numeric data for a key that has a numeric data type.	Use a numeric vector to specify numeric data.
Partition keys of type *datatype* must be either a numeric vector or a 1-dimensional cell array of numeric vectors.	You specify a value that does not contain numeric data for a key that has a `blob` data type.	Use a numeric vector or one-dimensional cell array of numeric vectors to specify data that has the `blob` data type.
Partition keys of type *datatype* must be a logical or numeric vector.	You specify a value that does not contain numeric or logical data for a key that has a `boolean` data type.	Use a numeric or logical vector to specify data that has the `boolean` data type.
Partition keys of type *datatype* must be a datetime vector, string vector, character vector, or cell array of character vectors.	You specify a value that does not contain numeric or text data for a key that has a `date` or `timestamp` data type.	Use a `datetime` array, string scalar, character vector, or cell array of character vectors to specify data that has the `date` or `timestamp` data type.
Partition keys of type *datatype* must be a duration vector, string vector, character vector, or cell array of character vectors.	You specify a value that does not contain numeric or text data for a key that has a `time` data type.	Use a `duration` array, string scalar, character vector, or cell array of character vectors to specify data that has the `time` data type.

Error Message	Probable Causes	Resolution
Partition keys of type *`datatype`* are not supported by the partitionRead function. To import data from *`tablename`* table, either use the partitionRead function with no partition key values, or use the executecql function to execute a CQL query.	You specify a data type of a partition key that is not supported in the `partitionRead` function (for example, user-defined type (UDT) or `tuple`).	Execute a CQL query using the `executecql` function to filter for the partition keys that the `partitionRead` function does not support.

See Also

`cassandra` | `columninfo` | `executecql` | `partitionRead` | `tablenames`

More About

- “Explore and Import Data from Cassandra Database Table” on page 6-14
- “Import Data from Cassandra Database Table Using CQL” on page 6-18

External Websites

- Apache Cassandra
- Apache Cassandra Documentation
- CQL Reference Documentation
- CQL data types

Explore and Import Data from Cassandra Database Table

This example shows how to explore the structure of an Apache Cassandra® database and import data from a Cassandra database table into MATLAB® using a Cassandra database connection. The Cassandra database stores database tables according to the partition key. The partition key affects how the data is filtered in the database.

In this example, the Cassandra database contains the `employees_by_job` database table with employee data and the `job_id` partition key.

To run this example, you must first install the Database Toolbox™ Interface for Apache Cassandra® Database. For details, see "Database Toolbox Interface for Apache Cassandra Database Installation" on page 6-7.

Create Cassandra Database Connection

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Explore Cassandra Database Structure

View the keyspaces in the Cassandra database using the Cassandra database connection. The returned string array contains the keyspaces. A keyspace contains one or more database tables and defines how the database replicates the data in the tables.

```
conn.Keyspaces
```

```
ans = 1×6 string array
    "employeedata"    "system"    "system_auth"    "system_distributed"    "system_sche
```

Return the names of the Cassandra database tables in the `employeedata` keyspace. `t` is a string array that contains the names of the database tables in the `employeedata` keyspace.

```
keyspace = "employeedata";
t = tablenames(conn,keyspace)
```

```
t = 3×1 string array
    "employees_by_job"
```

```
    "employees_by_id"
    "employees_by_name"
```

Return the names of the Cassandra database columns in the `employees_by_job` database table.

```
tablename = "employees_by_job";
cols = columninfo(conn,keyspace,tablename);
```

Display the first few names of the Cassandra database columns in the `employees_by_job` database table.

```
head(cols)
```

```
ans=8×4 table
          Name            DataType     PartitionKey     ClusteringColumn
    ________________     ________     ____________     ________________

    "job_id"             "text"          true                ""
    "hire_date"          "date"          false               "DESC"
    "employee_id"        "int"           false               "ASC"
    "commission_pct"     "double"        false               ""
    "department_id"      "int"           false               ""
    "email"              "text"          false               ""
    "first_name"         "text"          false               ""
    "last_name"          "text"          false               ""
```

`cols` is a table with these variables:

- `Name` — Cassandra database column name
- `DataType` — Cassandra Query Language (CQL) data type of the Cassandra database column
- `PartitionKey` — Partition key indicator
- `ClusteringColumn` — Clustering column indicator

The value in the `PartitionKey` variable indicates whether the database column is a partition key. The column `job_id` (job identifier) is a partition key in this database table.

Import Data from Cassandra Database

Import data from the `employees_by_job` database table into MATLAB using the partition key value for shop clerk, `SH_CLERK`.

```
keyValue = "SH_CLERK";
results = partitionRead(conn,keyspace,tablename, ...
    keyValue);
```

Display the first few rows of the returned employee data.

```
head(results)
```

```
ans=8×13 table
      job_id        hire_date      employee_id    commission_pct    department_id      en
    __________    ___________    ___________    ______________    _____________    ____

    "SH_CLERK"    03-Feb-2008        183              NaN               50         "GGE
    "SH_CLERK"    13-Jan-2008        199              NaN               50         "DGF
    "SH_CLERK"    19-Dec-2007        191              NaN               50         "RPE
    "SH_CLERK"    21-Jun-2007        182              NaN               50         "MSU
    "SH_CLERK"    21-Jun-2007        198              NaN               50         "DOO
    "SH_CLERK"    17-Mar-2007        195              NaN               50         "VJO
    "SH_CLERK"    07-Feb-2007        187              NaN               50         "ACA
    "SH_CLERK"    11-Jul-2006        190              NaN               50         "TGA
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close Cassandra Database Connection

```
close(conn)
```

See Also

`cassandra` | `close` | `columninfo` | `partitionRead` | `tablenames`

More About

- “Database Toolbox Interface for Apache Cassandra Database Installation” on page 6-7
- “Import Data from Cassandra Database Table Using CQL” on page 6-18
- “Fill Values for Missing Data from Apache Cassandra Database” on page 6-9
- “Database Toolbox Interface for Apache Cassandra Database Error Messages” on page 6-11

External Websites

- Apache Cassandra
- Apache Cassandra Documentation
- CQL data types

Import Data from Cassandra Database Table Using CQL

This example shows how to import data from an Apache Cassandra® database table into MATLAB® using the Cassandra Query Language (CQL) and a Cassandra database connection.

Use the `executecql` function to execute CQL queries that filter by clustering columns or limit rows in the query results, for example. Also, you can use the `executecql` function to write non-`SELECT` CQL statements. For easy data import using the partition key values of a Cassandra database table, use the `partitionRead` function instead.

In this example, the Cassandra database contains the `employees_by_job` database table with employee data and the `job_id` partition key. The `hire_date` database column is a clustering column.

To run this example, you must first install the Database Toolbox™ Interface for Apache Cassandra® Database. For details, see "Database Toolbox Interface for Apache Cassandra Database Installation" on page 6-7.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Write a CQL query that selects all employees who are programmers or shop clerks, and retrieves their job identifiers, hire dates, and email addresses. Filter the query by those employees hired before April 30, 2006 using the `hire_date` clustering column. Limit the returned data to four rows.

```
query = strcat("SELECT job_id,hire_date,email ", ...
    "FROM employeedata.employees_by_job ", ...
    "WHERE job_id IN ('IT_PROG','SH_CLERK') ", ...
    "AND hire_date < '2006-04-30'", ...
    "LIMIT 4;");
```

Execute the CQL query using the Cassandra database connection and display the results.

```
results = executecql(conn,query)
```

```
results=4×3 table
      job_id       hire_date       email
    __________    ___________    __________
```

```
"IT_PROG"     05-Feb-2006    "VPATABAL"
"IT_PROG"     03-Jan-2006    "AHUNOLD"
"IT_PROG"     25-Jun-2005    "DAUSTIN"
"SH_CLERK"    24-Apr-2006    "AWALSH"
```

`results` is a table with the `job_id`, `hire_date`, and `email` variables. The `hire_date` variable is a `datetime` array and the `job_id` and `email` variables are string arrays.

Close the Cassandra database connection.

```
close(conn)
```

See Also

`cassandra` | `close` | `executecql`

More About

- “Database Toolbox Interface for Apache Cassandra Database Installation” on page 6-7
- “Explore and Import Data from Cassandra Database Table” on page 6-14
- “Fill Values for Missing Data from Apache Cassandra Database” on page 6-9
- “Database Toolbox Interface for Apache Cassandra Database Error Messages” on page 6-11

External Websites

- Apache Cassandra
- Apache Cassandra Documentation
- CQL Reference Documentation
- CQL data types

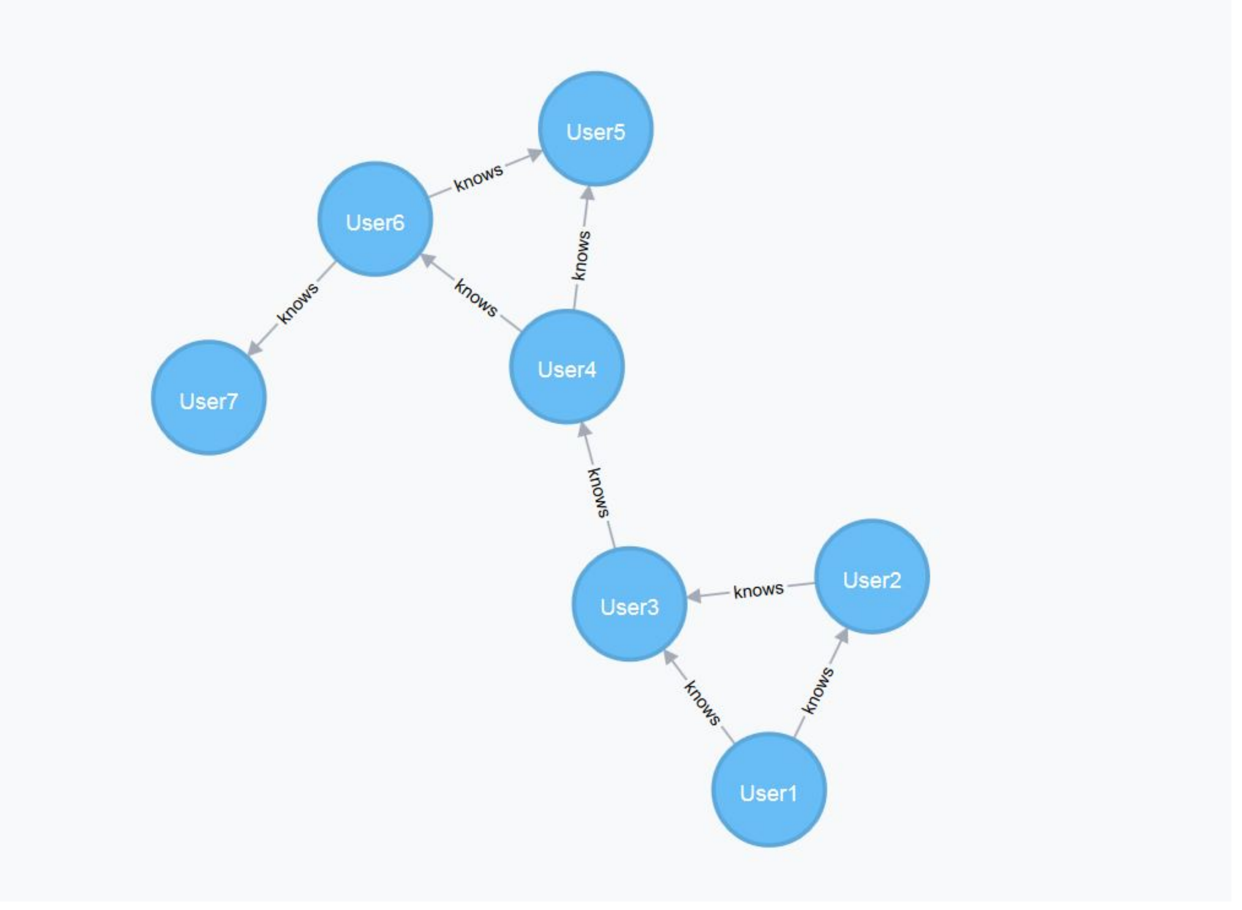
Neo4j Topics

Explore Graph Database Structure

This example shows how to traverse a graph and explore its structure using the MATLAB® interface to Neo4j®. For details about the MATLAB interface to Neo4j, see “Working with MATLAB Interface to Neo4j” on page 7-9.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

The local machine hosts the Neo4j database with the port number `7474`, user name `neo4j`, and password `matlab`. This figure provides a visual representation of the data in the database.



Connect to Neo4j Database

Create a Neo4j connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Explore Structure of Entire Graph

Find all the node labels in the Neo4j database using the Neo4j connection object `neo4jconn`.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels =

  1×1 cell array

    {'Person'}
```

Find all the relationship types in the Neo4j database.

```
reltypes = relationTypes(neo4jconn)
```

```
reltypes =

  1×1 cell array

    {'knows'}
```

Find the property keys in the Neo4j database.

```
propkeys = propertyKeys(neo4jconn)
```

```
propkeys =

  12×1 cell array
```

```
    {'Address'    }
    {'Title'      }
    {'property'   }
    {'Location'   }
    {'Description'}
    {'name'       }
    {'Name'       }
    {'Date'       }
    {'Project'    }
    {'StartDate'  }
    {'Weight'     }
    {'title'      }
```

Search for Nodes

Search for all the nodes with the node label `Person`.

```
nlabel = 'Person';
```

```
nodesinfo = searchNode(neo4jconn,nlabel)
```

```
nodesinfo =

  7×3 table

         NodeLabels      NodeData                NodeObject
         __________    ____________    ________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    4     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    5     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    9     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

`nodesinfo` contains node labels, node data, and the `Neo4jNode` objects for each matched node.

Search for the node with the node identifier `2`.

```
nodeid = 2;

nodeinfo = searchNodeByID(neo4jconn,nodeid)
```

```
nodeinfo = 

  Neo4jNode with properties:

        NodeID: 2
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

`nodeinfo` contains the node identifier, node data, and node labels for the node with node identifier `2`.

Search for Relationships

Search for incoming relationship types that belong to the node `nodeinfo`.

```
nodereltypes = nodeRelationTypes(nodeinfo,'in')
```

```
nodereltypes = 

  1×1 cell array

    {'knows'}
```

Search for the degree of all incoming relationships that belong to the node `nodeinfo`.

```
degree = nodeDegree(nodeinfo,'in')
```

```
degree = 

  struct with fields:

    knows: 1
```

Search for the relationship with the node identifier `4`.

```
relationid = 4;

relationinfo = searchRelationByID(neo4jconn,relationid)
```

```
relationinfo = 

  Neo4jRelation with properties:

      RelationID: 4
    RelationData: [1×1 struct]
     StartNodeID: 3
    RelationType: 'knows'
       EndNodeID: 5
```

Search for all incoming relationships that belong to the node `nodeinfo`.

```
relinfo = searchRelation(neo4jconn,nodeinfo,'in')
```

```
relinfo = 

  struct with fields:

       Origin: 2
        Nodes: [2×3 table]
    Relations: [1×5 table]
```

`relinfo` contains data about the start and end nodes and all matched relationships from the origin node.

Retrieve Entire Graph

Retrieve the entire graph using node labels `nlabels`.

```
graphinfo = searchGraph(neo4jconn,nlabels)
```

```
graphinfo = 

  struct with fields:

        Nodes: [7×3 table]
```

```
    Relations: [8×5 table]
```

`graphinfo` contains node data for all start and end nodes for each matched relationship. `graphinfo` also contains relationship data for each matched relationship.

See Also

`neo4j` | `nodeDegree` | `nodeLabels` | `nodeRelationTypes` | `propertyKeys` | `relationTypes` | `searchNode` | `searchNodeByID` | `searchRelation` | `searchRelationByID`

More About

- "Searching Graph Database Using MATLAB Interface to Neo4j" on page 7-12
- "Working with MATLAB Interface to Neo4j" on page 7-9

External Websites

- Neo4j Documentation

Working with MATLAB Interface to Neo4j

The MATLAB interface to Neo4j enables you to:

- Create a Neo4j database connection.
- Import graph data from a Neo4j database into MATLAB.
- Perform graph network analysis by creating a directed graph from the imported graph data.
- Create, update, and delete the nodes and relationships in the graph database.
- Export a directed graph from MATLAB into a Neo4j database.
- Execute Cypher® queries on the Neo4j database, if you are familiar with the Cypher query language.

About Neo4j Graph Databases

A graph database stores data using a graph data model. This model consists of nodes and relationships. A relationship describes how two or more nodes are related to each other.

Nodes can have one or more node labels and property keys, or zero labels and property keys. Neo4j assigns unique identifiers to nodes and relationships.

Relationships are always directed and have a relationship type. A relationship always has a start node and an end node. A node can have incoming and outgoing relationships. Two nodes can have multiple relationships between them of different relationship types.

For details about graphs, see “Directed and Undirected Graphs” (MATLAB). For details about the Neo4j database, see Why Graph Databases?

MATLAB Interface to Neo4j Workflow

This workflow shows how to connect to a Neo4j database, search and update the graph database, store a directed graph, and perform graph network analysis.

1. Connect to a Neo4j database using `neo4j`.
2. Search the graph database.

   Conduct a general search in the graph database with any of these functions:

- `nodeLabels`
- `propertyKeys`
- `relationTypes`
- `searchGraph`

Or, conduct a targeted search in the graph database with any of these functions:

- `searchNode`
- `searchNodeByID`
- `searchRelation`
- `searchRelationByID`
- `nodeDegree`
- `nodeRelationTypes`

3 Update the graph database.

Create nodes and relationships with these functions:

- `createNode`
- `createRelation`

Update nodes and relationships with these functions:

- `updateNode`
- `updateRelation`

Delete nodes and relationships with these functions:

- `deleteNode`
- `deleteRelation`

4 Export a directed graph from MATLAB into a Neo4j database using the `storeDigraph` function.

5 To perform graph network analysis, you can convert output structures to `digraph` objects using `neo4jStruct2Digraph`. For details, see "Directed and Undirected Graphs" (MATLAB).

Or, if you know the Cypher query language, you can execute a Cypher query using `executeCypher`. For details, see Cypher Query Language.

See Also

`digraph` | `neo4j` | `neo4jStruct2Digraph`

More About

- “Find Friends of Friends in Social Neighborhood”
- “Visualize Breadth-First and Depth-First Search” (MATLAB)
- “Directed and Undirected Graphs” (MATLAB)
- “Update Friend Information in Social Neighborhood” on page 7-15
- “Add and Query Group of Colleagues in Social Neighborhood” on page 7-20
- “Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12
- “MATLAB Interface to Neo4j Error Messages” on page 7-28

External Websites

- Neo4j Documentation
- Cypher Query Language

Searching Graph Database Using MATLAB Interface to Neo4j

Search the Neo4j graph database using functions provided by the MATLAB interface to Neo4j. You can explore the graph data or perform graph network analysis using MATLAB directed graphs.

MATLAB Interface to Neo4j Search Functions

Search graph data in the Neo4j graph database using different parts of the graph:

- To search for nodes, use one of two functions. Search for one or more nodes using `searchNode`. Search for a node with a specific identifier using `searchNodeByID`.
- Search for relationships from an origin node using `searchRelation`.
- Search for the entire graph database or a subgraph using `searchGraph`.

To access the part of the graph database that you want to analyze, combine these functions and explore the graph data in the output arguments.

General and Targeted Search Workflows

You can search the Neo4j graph database in a general or targeted way. A general search starts from a subgraph or the entire graph. A targeted search starts from an origin node and traverses its relationships.

After finding a part of the graph, you can create a MATLAB directed graph and perform graph network analysis.

Conduct General Search

1. Conduct a general search for a subgraph using `searchGraph`.

   For example, to find the subgraph `graphinfo`, enter this code, which assumes a successful Neo4j database connection `neo4jconn`.

   ```
   nlabel = {'Person'};

   graphinfo = searchGraph(neo4jconn,nlabel);
   ```
2. Convert the output structure `graphinfo` into a `digraph` object `G` using `neo4jStruct2Digraph`.

```
G = neo4jStruct2Digraph(graphinfo);
```

3. Perform graph network analysis using G. For details, see "Directed and Undirected Graphs" (MATLAB).

   For example, determine the shortest path between nodes using distances.

   ```
   d = distances(G);
   ```

   Or, explore the graph data by accessing the output structure graphinfo.

Conduct Targeted Search

1. To start your search, find the origin node using searchNode or searchNodeByID.

   For example, to find the origin node nodeinfo, enter this code, which assumes a successful Neo4j database connection neo4jconn and the node identifier 2.

   ```
   nodeinfo = searchNodeByID(neo4jconn,2);
   ```

2. Search for graph data by using the origin node and searchRelation. Or, if you know the relationship identifier, then use the searchRelationByID function.

   For example, this code assumes that you are searching for incoming relationships.

   ```
   relinfo = searchRelation(neo4jconn,nodeinfo,'in');
   ```

3. Convert the output structure relinfo into a digraph object G by using neo4jStruct2Digraph.

   ```
   G = neo4jStruct2Digraph(relinfo);
   ```

4. Perform graph network analysis using the digraph object G. For details, see "Directed and Undirected Graphs" (MATLAB).

   For example, determine the shortest path between nodes using distances.

   ```
   d = distances(G);
   ```

   Or, explore the graph data by accessing the output structures nodeinfo and relinfo.

See Also

nodeDegree | searchGraph | searchNode | searchNodeByID | searchRelation

More About

- "Explore Graph Database Structure" on page 7-2
- "Find Shortest Path Between People in Social Neighborhood"
- "Working with MATLAB Interface to Neo4j" on page 7-9
- "MATLAB Interface to Neo4j Error Messages" on page 7-28

External Websites

- Neo4j Documentation

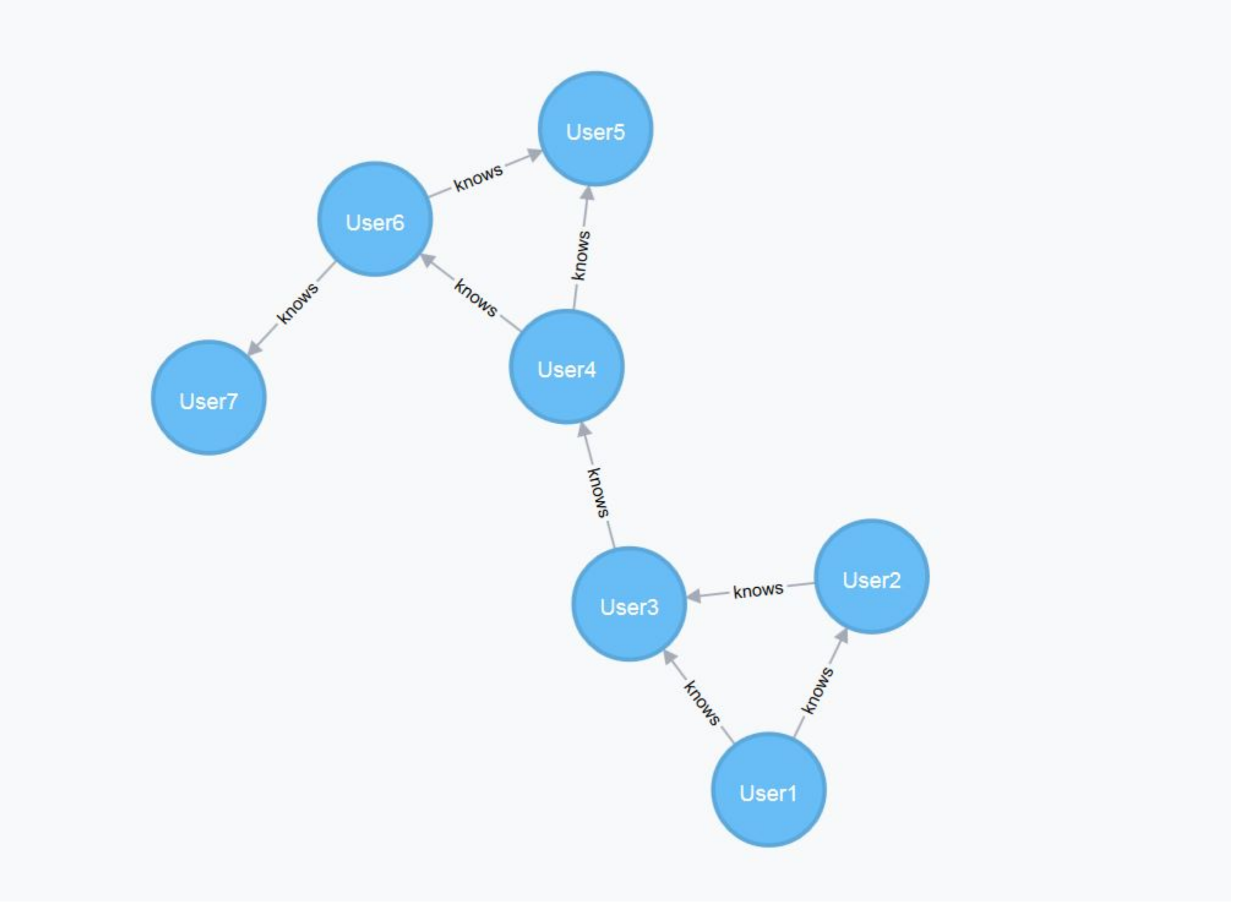
Update Friend Information in Social Neighborhood

This example shows how to create, update, and delete information in a social neighborhood, which is represented by a Neo4j® database, using the MATLAB® interface to Neo4j.

For details about the MATLAB interface to Neo4j, see "Working with MATLAB Interface to Neo4j" on page 7-9.

Assume that you have graph data stored in a Neo4j database that represents the social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

The local machine hosts the Neo4j® database with the port number `7474`, user name `neo4j`, and password `matlab`. This figure provides a visual representation of the data in the database.



Connect to Neo4j® Database

Create a Neo4j® connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Add Two Friends to Social Neighborhood

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
user8 = createNode(neo4jconn,'Labels',label);
user9 = createNode(neo4jconn,'Labels',label);
```

Search for the node with the node label `Person` and the property key `name` set to the value `User7` by using the Neo4j database connection.

```
nlabel = 'Person';
user7 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7');
```

Create two relationships using the Neo4j database connection. Specify the relationship types as `works with` and `studies with`. The two relationships are:

- `User8` works with `User7`
- `User8` studies with `User9`

The relationship `relationinfo` is a table that contains the relationship and node information.

```
startnode = [user8,user8];
endnode = [user7,user9];
relationtype = {'works with','studies with'};
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype);
```

Update Node Information for Added Friend

Update the properties of the node `User8`. Create a table with one row that contains the name and job title for this person. `nodeinfo` is a `Neo4jNode` object.

```
properties = table("User8","Analyst",'VariableNames',{'Name','Title'});
nodeinfo = updateNode(neo4jconn,user8,'Properties',properties);
```

Update Relationship Information for Added Friends

Create a table that defines the relationship properties. Here, `User8` works with `User7` in the workplace, and `User8` studies with `User9` in the library. Also, `User8` started working with `User7` on January 2, 2017, and `User8` started studying with `User9` on March 6, 2017.

```
properties = table(["Workplace";"Library"],["01/02/2017";"03/06/2017"], ...
    'VariableNames',{'Location','Date'});
```

Update both relationships with these properties. `relationinfo` is a table that contains the updated relationships.

```
relations = relationinfo.RelationObject;
relationinfo = updateRelation(neo4jconn,relations,properties);
```

Delete Relationship for Added Friend

Delete the relationship that connects `User8` to `User7`.

```
relation = relations(1);
deleteRelation(neo4jconn,relation)
```

Delete Friends

Delete the added nodes and any associated relationships.

```
nodes = [user8,user9];
deleteNode(neo4jconn,nodes,'DeleteRelations',true)
```

See Also

`Neo4jNode` | `createNode` | `createRelation` | `deleteNode` | `deleteRelation` | `neo4j` | `updateNode` | `updateRelation`

More About

- “Find Shortest Path Between People in Social Neighborhood”
- “Find Friends of Friends in Social Neighborhood”

- “Working with MATLAB Interface to Neo4j” on page 7-9

External Websites

- Neo4j Documentation

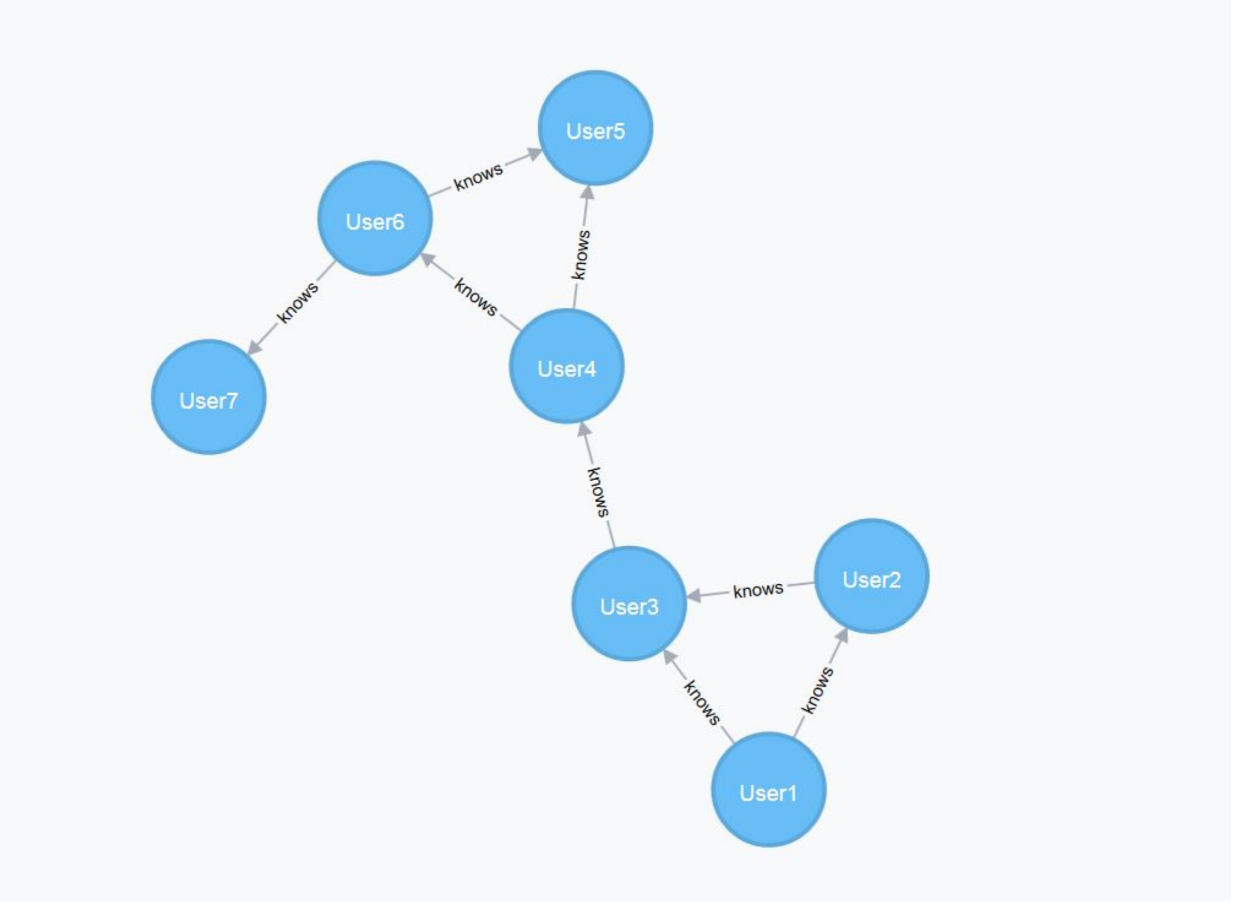
Add and Query Group of Colleagues in Social Neighborhood

This example shows how to add a group of colleagues, stored as a directed graph, to a group of friends in a social neighborhood, stored as nodes and relationships in a Neo4j® database. The example then shows how to query the graph in the database by using the Cypher® query language, which enables you to create custom queries.

For details about the MATLAB® interface to Neo4j, see “Working with MATLAB Interface to Neo4j” on page 7-9.

Assume that you have graph data stored in a Neo4j database that represents the social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

The local machine hosts the Neo4j® database with the port number `7474`, user name `neo4j`, and password `matlab`. This figure provides a visual representation of the data in the database.



Connect to Neo4j® Database

Create a Neo4j® connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create Directed Graph

Define a group of four colleagues by creating a directed graph in MATLAB. Create a `digraph` object that has four nodes and three edges.

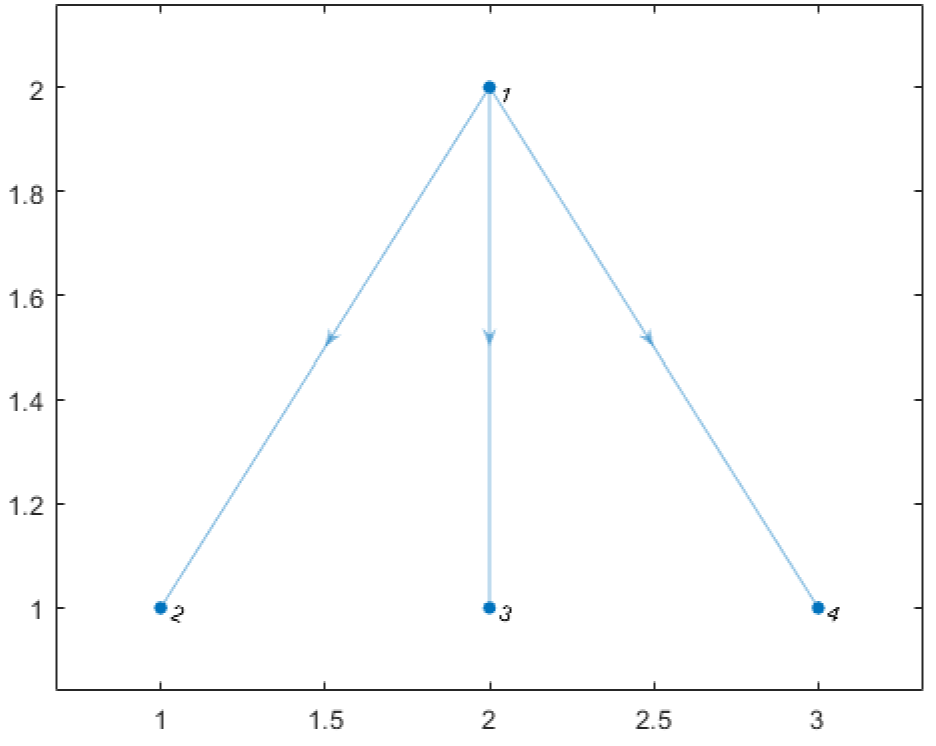
```
s = [1 1 1];
t = [2 3 4];
G = digraph(s,t);
```

Specify names for the nodes.

```
G.Nodes.name = {'User8';'User9';'User10';'User11'};
```

Plot the digraph to view the nodes and edges.

```
plot(G)
```



Store Directed Graph in Neo4j Database

Store the directed graph as a Neo4j graph. Specify two labels for all nodes in the resulting Neo4j graph by using the `GlobalNodeLabel` name-value pair argument. Also, specify the type `works with` for all relationships in the resulting Neo4j graph by using the `GlobalRelationType` name-value pair argument.

```
graphinfo = storeDigraph(neo4jconn,G, ...
    'GlobalNodeLabel',{'Colleague','Person'}, ...
    'GlobalRelationType','works with');
```

Display the node labels of the first node in the graph.

```
graphinfo.Nodes.NodeLabels{1}
```

```
ans =

  2×1 cell array

    {'Person'   }
    {'Colleague'}
```

The result is a cell array of character vectors. Each character vector is a node label for the first node.

Display the relationships in the graph.

```
graphinfo.Relations
```

```
ans =

  3×5 table

          StartNodeID    RelationType    EndNodeID    RelationData          Relatio
          ___________    ____________    _________    ____________    _________________

    14        14         'works with'       18        [1×1 struct]    [1x1 database.neo
    13        14         'works with'       17        [1×1 struct]    [1x1 database.neo
    12        14         'works with'       15        [1×1 struct]    [1x1 database.neo
```

`Relations` is a table that contains these variables:

- Start node identifiers
- Relationship types
- End node identifiers
- Relationship properties
- `Neo4jRelation` objects

Connect Group of Colleagues to Friends in Existing Graph

Search for the nodes with the node label `Person` and the property key `name` set to the values `User7` and `User8` by using the Neo4j database connection.

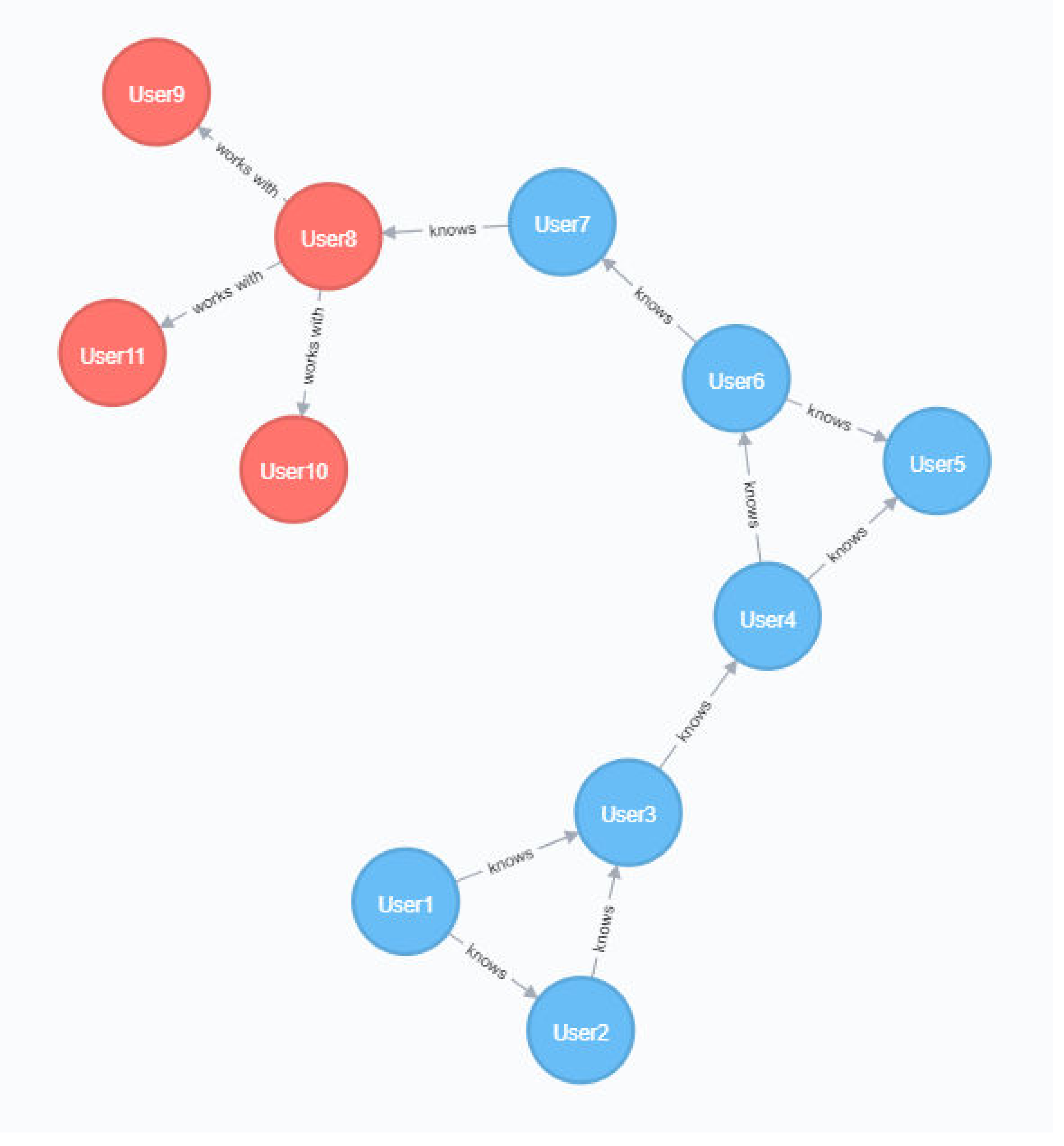
```
nlabel = 'Person';
user7 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
```

```
    'PropertyValue','User7');
user8 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User8');
```

Add a relationship between the nodes `User7` and `User8` to connect the group of colleagues to the group of friends.

```
relationtype = 'knows';
relation = createRelation(neo4jconn,user7,user8,relationtype);
```

Display the resulting graph in the Neo4j database.


User9
works with
User8
knows
User7
works with
User11
works with
User10
knows
User6
knows
User5
knows
knows
User4
knows
User3
knows
User1
knows
knows
User2

Execute Cypher Query on Neo4j Database

Create a Cypher query to find the people who work with people `User7` knows. Display the names of those people.

```
query = ['MATCH (:Person {name: "User7"})-[:knows]->(:Person)-[:`works with`]' ...
    '->(potentialContact:Person) RETURN potentialContact.name'];
results = executeCypher(neo4jconn,query)
```

```
results =

  3×1 table

    potentialContact_name
    _____________________

          'User11'
          'User10'
          'User9'
```

`User9`, `User10`, and `User11` all work with someone that `User7` knows. `User7` knows `User8`, who works with `User9`, `User10`, and `User11`.

See Also

`neo4j` | `storeDigraph`

More About

- “Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12
- “Explore Graph Database Structure” on page 7-2

External Websites

- Neo4j Documentation
- Cypher Query Language

MATLAB Interface to Neo4j Error Messages

Both the MATLAB interface to Neo4j and the Neo4j database return error messages.

The Neo4j database error messages always have a status code that starts with: `Neo.ClientError`. To troubleshoot these errors, consult the Neo4j Documentation.

The MATLAB interface to Neo4j returns error messages in plain text. This table describes how to address common errors you can encounter while working with the MATLAB interface to Neo4j.

Error Message	Probable Causes	Resolution
Invalid connection.	The Neo4j database connection is invalid.	Connect to the Neo4j database using `neo4j`.
Unable to connect. Please try again.	The Neo4j database connection is invalid.	Connect to the Neo4j database using `neo4j`.
No Nodes found with matching criteria.	The search cannot find nodes for the specified node label or property keys and values.	Verify the node label or property keys and values. Then, run `searchNode`.
Unable to find “relationship” relationships for node with id “node identifier” in database.	The search cannot find relationships for the specified relationships and node in the Neo4j database.	Verify the origin node and direction. Then, run `searchRelation`.
No node labels found.	The Neo4j database has no node labels.	Open the Neo4j database and add node labels. For details, see the Neo4j Operations Manual in the Neo4j Documentation. Then, run `nodeLabels`.
No relationship types found.	The Neo4j database has no relationship types.	Open the Neo4j database and add relationship types. For details, see the Neo4j Operations Manual in the Neo4j Documentation. Then, run `relationTypes`.

Error Message	Probable Causes	Resolution
No property keys found.	The Neo4j database has no property keys.	Open the Neo4j database and add property keys. For details, see the Neo4j Operations Manual in the Neo4j Documentation. Then, run `propertyKeys`.
Unable to execute Cypher query.	The Cypher query is invalid.	Verify the Cypher query. Then, run `executeCypher`. For details about writing Cypher queries, see Cypher Query Language.
Unable to find one or more of the specified nodes in the database.	When you update or delete nodes, the specified node does not exist in the Neo4j database. Or, when you create a relationship, the specified start or end node does not exist in the Neo4j database.	Find nodes in the Neo4j database using the `searchNode` function.
Unable to find one or more of the specified relations in the database.	When you update or delete relationships, the specified relationship does not exist in the Neo4j database.	Find relationships in the Neo4j database using the `searchRelation` function.

One or more nodes have relations. Explicitly delete relations. Or, to delete both nodes and all associated relations, set 'DeleteRelations' to true.	When you delete nodes, the specified nodes have associated relationships.	Delete the node and its associated relationships by using this syntax of the `deleteNode` function:
		
		`deleteNode(neo4jconn,`
		`node,'DeleteRelations`
		`',true)`

See Also

`neo4j` | `searchGraph`

More About

- “Working with MATLAB Interface to Neo4j” on page 7-9
- “Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12
- “Find Friends of Friends in Social Neighborhood”
- “Explore Graph Database Structure” on page 7-2

External Websites

- Neo4j Documentation
- Cypher Query Language

Database Toolbox Interface For MongoDB Topics

Import and Analyze Data from MongoDB

This example shows how to import employee data from a collection in MongoDB into the MATLAB workspace using the Database Toolbox interface for MongoDB. The example then shows how to conduct a simple data analysis based on the imported data.

To run this example, you must first install the Database Toolbox interface for MongoDB. For details, see "Database Toolbox Interface for MongoDB Installation" on page 8-19.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

             Database: 'mongotest'
             UserName: ''
               Server: {'dbtb01'}
                 Port: 27017
      CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
       TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =
```

```
  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Specify the `employee` collection for document retrieval. Retrieve all documents in the collection by using the MongoDB connection. `documents` is a structure array.

```
collection = "employee";
documents = find(conn,collection);
```

Using all documents, determine the unique department names. `deplist` contains a cell array of character vectors for the department names. The `employee` collection contains seven departments.

```
departments = {documents(:).department};
deplist = unique(departments)'
```

```
deplist =

  7×1 cell array

    {'Application Engineering'}
    {'Consulting'             }
    {'Development'            }
    {'Marketing'              }
    {'Sales'                  }
    {'Support'                }
    {'Training'               }
```

Determine the maximum salary among all employees.

```
salaries = [documents(:).salary];
max(salaries)
```

```
ans =

      150000
```

Close the MongoDB connection.

```
close(conn)
```

See Also

`close` | `find` | `isopen` | `max` | `mongo` | `unique`

More About

- "Import Filtered Data from MongoDB" on page 8-5
- "Import Large Data from MongoDB" on page 8-8
- "Export MATLAB Data into MongoDB" on page 8-11
- "Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

- MongoDB Manual

Import Filtered Data from MongoDB

This example shows how to import flight data from a MongoDB collection into the MATLAB workspace using the Database Toolbox interface for MongoDB. The example then shows how to use a MongoDB query with filter criteria and a field list, and how to perform a simple data analysis based on the filtered flight data.

To run this example, you must first install the Database Toolbox interface for MongoDB. For details, see “Database Toolbox Interface for MongoDB Installation” on page 8-19.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Specify the `airlinesmall` collection. Define the MongoDB query to filter the flight data for the years 1998 through 1999. Specify fields to retrieve from the collection.

```
collection = "airlinesmall";
mongoquery = '{"Year":{$gte:1998,$lt:2000}}';
fields = ['{"Year":1.0,"Month":1.0,"DayofMonth":1.0,"DayOfWeek":1.0,' ...
    '"DepTime":1.0,"ArrTime":1.0}'];
```

Retrieve flight data using the MongoDB connection. `documents` is a structure array with fields that correspond to the specified fields.

```
documents = find(conn,collection,'Query',mongoquery,'Projection',fields)
```

```
documents =

  10911×1 struct array with fields:

    x_id
    Year
    Month
    DayofMonth
    DayOfWeek
    DepTime
    ArrTime
```

Determine the unique years in the data.

```
years = [documents(:).Year];
unique(years)
```

```
ans =

        1998        1999
```

Close the MongoDB connection.

```
close(conn)
```

See Also

`close` | `find` | `isopen` | `mongo` | `unique`

More About

- “Import and Analyze Data from MongoDB” on page 8-2
- “Import Large Data from MongoDB” on page 8-8
- “Export MATLAB Data into MongoDB” on page 8-11
- “Database Toolbox Interface for MongoDB Error Messages” on page 8-21

External Websites

- MongoDB Manual

Import Large Data from MongoDB

This example shows how to import a large set of flight data from a MongoDB collection into the MATLAB workspace using the Database Toolbox interface for MongoDB. To avoid out-of-memory issues with the Java heap when retrieving many documents, use a loop to import large data in batches.

To run this example, you must first install the Database Toolbox interface for MongoDB. For details, see “Database Toolbox Interface for MongoDB Installation” on page 8-19.

Connect to MongoDB

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn =

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)

ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Determine Number of Documents to Import

Find the total number of documents `totaldocs` in the `airlinesmall` collection for the years 1997 through 2010. Use a MongoDB query to filter the flight data for the specified years.

```
collection = "airlinesmall";
mongoquery = '{"Year":{$gte:1997,$lte:2010}}';
totaldocs = count(conn,collection,'Query',mongoquery);
```

Retrieve Large Data in Batches

Estimate the batch size to be 15,000 documents. Define the MATLAB workspace variable for storing the retrieved data.

```
batchsize = 15000;
flightdata = [];
```

You can change the batch size depending on the performance and memory capacity of your system.

Use a `while` loop to retrieve flight data from the collection. The variable `flightdata` accumulates each batch of retrieved data.

```
% Track number of documents read
index = 0;

while index < totaldocs

    % Retrieve documents in a batch
    localdata = find(conn,collection,'Query',mongoquery, ...
        'Skip',index,'Limit',batchsize);

    % Store retrieved documents locally
```

```
    flightdata = [flightdata; localdata];

    % Move to the next batch
    index = index + batchsize;

end
```

Display information about the `flightdata` variable. The retrieved data is a structure array that contains 75,603 structures. Each structure contains 30 fields of flight data.

```
whos flightdata

  Name                    Size                 Bytes  Class     Attributes

  flightdata      75603x1              285102752  struct
```

Close MongoDB Connection

```
close(conn)
```

See Also

`close` | `count` | `find` | `isopen` | `mongo` | `while`

More About

- “Import and Analyze Data from MongoDB” on page 8-2
- “Import Filtered Data from MongoDB” on page 8-5
- “Export MATLAB Data into MongoDB” on page 8-11
- “Database Toolbox Interface for MongoDB Error Messages” on page 8-21

External Websites

- MongoDB Manual

Export MATLAB Data into MongoDB

This example shows how to export table and structure data from the MATLAB workspace into new MongoDB collections using the Database Toolbox interface for MongoDB. The example then shows how to count the number of documents in the collections, remove documents from the collections, and drop the collections.

To run this example, you must first install the Database Toolbox interface for MongoDB. For details, see "Database Toolbox Interface for MongoDB Installation" on page 8-19.

The example uses two data sets: `patients.xls`, which contains patient data, and `tsunamis.xlsx`, which contains tsunami data. You can find files for these data sets in the `toolbox/matlab/demos` folder.

Connect to MongoDB

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.

- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Create Collections and Export Data into MongoDB

Load the data sets using the `readtable` function. Convert tsunami data to a structure using the `table2struct` function. The MATLAB workspace contains the `patientdata` table and the `tsunamidata` structure.

```
patientdata = readtable('patients.xls');
data = readtable('tsunamis.xlsx');
tsunamidata = table2struct(data);
```

Create collections to store the patient and tsunami data using the MongoDB connection.

```
patientcoll = "patients";
tsunamicoll = "tsunamis";

createCollection(conn,patientcoll)
createCollection(conn,tsunamicoll)
```

Export table data into the `patients` collection. `n` contains the number of documents inserted.

```
n = insert(conn,patientcoll,patientdata)
```

```
n =

   100
```

Export structure data into the `tsunamis` collection. `n` contains the number of documents inserted.

```
n = insert(conn,tsunamicoll,tsunamidata)
```

```
n =

   162
```

Count Documents in Collections

Display the names of all the collections in the `mongotest` database. The new collections `patients` and `tsunamis` appear in the cell array of character vectors.

```
conn.CollectionNames'
```

```
ans =

  9×1 cell array

    {'airlinesmall'    }
    {'employee'        }
    {'largedata'       }
    {'nyctaxi'         }
    {'patients'        }
    {'product'         }
    {'restaurants'     }
    {'tsunamis'        }
    {'updateCollection'}
```

Count the number of documents in the two new collections.

```
npatients = count(conn,patientcoll)
ntsunamis = count(conn,tsunamicoll)
```

```
npatients =

   100


ntsunamis =

   162
```

Remove Documents and Drop Collections

Remove all documents from both collections. `npatients` and `ntsunamis` contain the number of documents removed from each collection.

```
npatients = remove(conn,patientcoll,'{}')
ntsunamis = remove(conn,tsunamicoll,'{}')
```

```
npatients =

   100


ntsunamis =

   162
```

Drop both collections from the `mongotest` database.

```
dropCollection(conn,patientcoll)
dropCollection(conn,tsunamicoll)
```

Close MongoDB Connection

```
close(conn)
```

See Also

`close` | `count` | `createCollection` | `dropCollection` | `insert` | `isopen` | `mongo` | `remove`

More About

- “Import and Export MATLAB Objects Using MongoDB” on page 8-15
- “Import and Analyze Data from MongoDB” on page 8-2
- “Database Toolbox Interface for MongoDB Error Messages” on page 8-21

External Websites

- MongoDB Manual

Import and Export MATLAB Objects Using MongoDB

This example shows how to export objects from the MATLAB workspace into MongoDB using the Database Toolbox interface for MongoDB. The export serializes the objects in MongoDB. Then, the example shows how to import objects back into the MATLAB workspace. The import deserializes the objects and recreates them in MATLAB for method execution. After the export and import, the example shows how to drop the collection.

To run this example, you must first install the Database Toolbox interface for MongoDB. For details, see “Database Toolbox Interface for MongoDB Installation” on page 8-19.

In this example, the objects belong to the `TensileData` class. This class is a sample class in MATLAB. The data used to create the objects is sample data. For details, see “Class to Represent Structured Data” (MATLAB). To run the code in this example, define the class in the current folder.

The data represents tensile stress or strain measurements. To calculate the elastic modulus of various materials, use this data. In simple terms, stress is the force applied to a material, and strain is the resulting deformation. The ratio of stress to strain defines a characteristic of the material.

Create Objects

Create the `TensileData` objects `tdcs` for carbon steel materials and `tdss` for stainless steel materials.

```
tdcs = TensileData('carbon steel',1, ...
    [2e4 4e4 6e4 8e4],[.12 .20 .31 .40]);
tdss = TensileData('stainless steel',1, ...
    [2e4 4e4 6e4 8e4],[.06 .10 .16 .20]);
```

Connect to MongoDB

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn =
```

```
  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Create Collection in MongoDB

Create the `TensileData` collection using the MongoDB connection.

```
collection = "TensileData";
createCollection(conn,collection)
```

Export Objects into MongoDB

Export the `TensileData` objects into the collection. The `insert` function serializes the `TensileData` objects into a JSON-style structure. `ntdcs` and `ntdss` contain the number of objects exported into the collection.

```
ntdcs = insert(conn,collection,tdcs);
ntdss = insert(conn,collection,tdss);
```

Import Objects into MATLAB Workspace

Import the `TensileData` objects into the MATLAB workspace. The `find` function deserializes the `TensileData` objects into the `documents` structure array.

```
documents = find(conn,collection);
```

Recreate the objects in the MATLAB workspace.

```
tdcs = TensileData(documents(1).Material,documents(1).SampleNumber, ...
    documents(1).Stress,documents(1).Strain);
tdss = TensileData(documents(2).Material,documents(2).SampleNumber, ...
    documents(2).Stress,documents(2).Strain);
```

You can execute methods of the objects after they appear in the MATLAB workspace.

Remove Documents and Drop Collection

Remove all documents from the collection. `n` contains the number of documents removed from the collection.

```
n = remove(conn,collection,'{}')
```

```
n =

     2
```

Drop the collection.

```
dropCollection(conn,collection)
```

Close MongoDB Connection

```
close(conn)
```

See Also

`close` | `createCollection` | `dropCollection` | `find` | `insert` | `isopen` | `mongo` | `remove`

More About

- “Export MATLAB Data into MongoDB” on page 8-11
- “Import and Analyze Data from MongoDB” on page 8-2
- “Database Toolbox Interface for MongoDB Error Messages” on page 8-21

External Websites

- MongoDB Manual

Database Toolbox Interface for MongoDB Installation

To use the Database Toolbox interface for MongoDB, you must first install it. Ensure that the interface supports your MongoDB version and that you have administrator privileges on your machine.

Installation

To install the Database Toolbox interface for MongoDB, follow these steps:

1. In the **Environment** section of the MATLAB toolstrip, select **Add-Ons** > **Get Add-Ons**.
2. In the Add-On Explorer, search for the Database Toolbox interface for MongoDB.
3. Install the Database Toolbox interface for MongoDB.

The installer downloads and installs the MongoDB Java driver. Then, the installer adds the driver to the static Java class path as part of the installation.

For details about installing add-ons, see “Get Add-Ons” (MATLAB). For other information, see “Add-Ons” (MATLAB).

Supported MongoDB Versions

The Database Toolbox interface for MongoDB supports these versions of MongoDB:

- MongoDB 2.4
- MongoDB 2.6
- MongoDB 3.0
- MongoDB 3.2
- MongoDB 3.4

See Also

`close` | `find` | `isopen` | `mongo`

More About

- "Import and Analyze Data from MongoDB" on page 8-2
- "Import Filtered Data from MongoDB" on page 8-5
- "Import Large Data from MongoDB" on page 8-8
- "Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

- MongoDB Manual

Database Toolbox Interface for MongoDB Error Messages

This table describes how to address common errors you can encounter while working with the Database Toolbox interface for MongoDB.

Error Category	Error Message	Probable Causes	Resolution
Installation and configuration	Unable to verify MongoDB Java driver installation.	The installation did not install the MongoDB Java driver successfully.	Reinstall the Database Toolbox interface for MongoDB. For details, see “Database Toolbox Interface for MongoDB Installation” on page 8-19.
	Unable to configure MATLAB Java class path.	The installation did not create or modify the Java class path in the MATLAB preferences folder.	Reinstall the Database Toolbox interface for MongoDB using administrator privileges. For details, see “Database Toolbox Interface for MongoDB Installation” on page 8-19.

Error Category	Error Message	Probable Causes	Resolution
	Unable to find MongoDB Java driver file on MATLAB Java class path. Install the Database Toolbox interface for MongoDB again.	After installation, the MATLAB preferences folder is missing the `javaclasspath.txt` file.	Reinstall the Database Toolbox interface for MongoDB. For details, see "Database Toolbox Interface for MongoDB Installation" on page 8-19.
MongoDB connection	Invalid Mongo connection.	The MongoDB connection is closed.	Use the `mongo` function to connect to MongoDB.
Input validation	Valid input types for server are string scalars and string array.	In the `mongo` function, the specified data type for the input argument `server` is not a string scalar or string array.	Specify the input argument `server` as a string scalar or string array.
	Each server must have a port.	In the `mongo` function, the number of servers specified in the `mongo` function does not match the number of ports specified.	Ensure that you specify a port number for each specified server in the `mongo` function. For example, if the `server` input argument is set to `{"dbtb01","dbtb02"}`, then the `port` input argument must have two port numbers, such as `[27017,27018]`.

Error Category	Error Message	Probable Causes	Resolution
	Valid input type is cell array of structures.	In the `insert` function, the `documents` input argument is specified as a cell array. The cell array contains data types that are not structures.	In the `documents` input argument of the `insert` function, specify only structures in the cell array.
MongoDB Java driver	[Mongo Driver Error]: *`Error message`*.	The MongoDB Java driver throws an error.	Use the MongoDB Manual to search for the MongoDB error message.
MongoDB CRUD operations	Unable to access MongoDB collection *`collectionname`*.	The database does not contain the specified collection.	Access the `CollectionNames` property of the `mongo` object to retrieve a list of all collections in the database. Then, specify an existing collection name.
	MongoDB collection *`collectionname`* already exists in the database.	The database already contains a collection with the specified name.	Access the `CollectionNames` property of the `mongo` object to retrieve a list of all collections in the database. Then, specify a unique name to create a collection.

See Also

`createCollection` | `dropCollection` | `insert` | `mongo` | `remove` | `update`

More About

- “Database Toolbox Interface for MongoDB Installation” on page 8-19
- “Import and Analyze Data from MongoDB” on page 8-2
- “Export MATLAB Data into MongoDB” on page 8-11

External Websites

- MongoDB Manual

Functions — Alphabetical List

attr

Package: database.odbc

(Not recommended) Retrieve attributes of columns in fetched data set

---

Note The `attr` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see "Compatibility Considerations".

Syntax

```
attributes = attr(curs)
attributes = attr(curs,colnum)
```

Description

`attributes = attr(curs)` retrieves attribute information for all columns in the fetched data set `curs`.

`attributes = attr(curs,colnum)` retrieves attribute information for the column number `colnum` in the fetched data set `curs`.

Examples

Retrieve Attribute Data for a Fetched Data Set

Create the database connection `conn` to an Oracle database using an ODBC connection. This code assumes that you are connecting a data source named `dbname` with user name `username` and password `pwd`. The data source identifies an Oracle database that contains the table `inventoryTable` with these columns: `productNumber`, `Quantity`, `Price`, and `inventoryDate`.

```
conn = database(dbname,username,pwd);
```

Import all the data from the table `inventoryTable`. The `cursor` object `curs` contains the executed query. Import the data from the executed query using the `fetch` function.

```
sqlquery = 'SELECT * FROM inventoryTable';

curs = exec(conn,sqlquery);
curs = fetch(curs);
```

Retrieve attribute information for all the fetched data using `curs`.

```
attributes = attr(curs)
```

```
attributes =

1x4 struct array with fields:

    fieldName
    typeName
    typeValue
    columnWidth
    precision
    scale
    currency
    readOnly
    nullable
    Message
```

`attributes` contains a structure array for three columns in the table `inventoryTable`.

Display the attribute data for the first column in the table `inventoryTable`.

```
attributes(1)
```

```
ans =

      fieldName: 'PRODUCTNUMBER'
       typeName: 'NUMBER'
      typeValue: 2.00
    columnWidth: 39.00
      precision: 38.00
          scale: 0
       currency: 'true'
       readOnly: 'false'
       nullable: 'true'
        Message: []
```

After you finish working with the `cursor` object, close it. Close the database connection.

```
close(curs)
close(conn)
```

Input Arguments

`curs` — Database cursor
`cursor` object

Database cursor, specified as a `cursor` object created using the `exec` function.

`colnum` — Column number
numeric scalar

Column number, specified as a numeric scalar to denote the column in the fetched data set `curs` for retrieving attribute information.

Data Types: `double`

Output Arguments

`attributes` — Attribute data
structure array

Attribute data, returned as a structure array containing attribute information for each column in the fetch data set `curs`. The following attributes are available.

Attribute	Description
`fieldName`	Name of the column.
`typeName`	Data type.
`typeValue`	Numerical representation of the data type.
`columnWidth`	Size of the field.
`precision`	Precision value for floating and double data types; an empty value is returned for character vectors or string scalars.

Attribute	Description
scale	Precision value for real and numeric data types; an empty value is returned for character vectors or string scalars.
currency	If this attribute equals true, the data format is currency.
readOnly	If this attribute equals true, the data cannot be overwritten.
nullable	If this attribute equals true, the data can be NULL.
Message	Error message returned by fetch.

Compatibility Considerations

attr function is not recommended

Not recommended starting in R2018b

The attr function is not recommended. Use the fetch function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the attr function at this time.

Use the fetch function with the connection object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the cursor object, import data, and find the attributes of the database columns. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
attributes = attr(curs);
close(curs)
```

Now you can import data in one step using the fetch function.

```
results = fetch(conn,sqlquery);
```

If you return imported data as a table, access details about the variables in the table by using a function such as summary.

There is no replacement functionality for the `attr` function.

See Also

`close` | `cols` | `columnnames` | `columns` | `database` | `dmd` | `fetch` | `get` | `tables` | `width`

Introduced before R2006a

close

Package: database.odbc

Close and invalidate database and driver resource utilizer

Syntax

```
close(object)
```

Description

`close(object)` closes and invalidates the database and driver resource utilizer `object` to free up database and driver resources.

Examples

Close `connection` Object

Connect to a Microsoft® SQL Server® database and verify the database connection. Then, import data from the database into MATLAB®. Determine the highest unit cost among the retrieved products in the table. Close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select all data from `productTable` and sort it by the product number. `data` is a table containing the imported data that results from executing the SQL `SELECT` statement.

```
selectquery = 'SELECT * FROM productTable ORDER BY productNumber';
data = select(conn,selectquery);
```

Display the first three rows of data.

```
data(1:3,:)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans =

    24
```

Close the database connection.

```
close(conn)
```

Close DatabaseDatastore Object

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to the database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using the database connection and SQL query. This SQL query retrieves all data from the table.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Close the `DatabaseDatastore` object.

```
close(dbds)
```

Input Arguments

object — Database and driver resource utilizer
`connection` object | `DatabaseDatastore` object

Database and driver resource utilizer, specified as one of the objects described in this table.

Object Argument Name	Object Name	Object Description	Object Creation Function
`conn`	`connection`	Create a connection between an installed database and MATLAB. For details, see “Connecting to Database” on page 2-142.	`database`

Object Argument Name	Object Name	Object Description	Object Creation Function
`dbds`	`DatabaseDatastore`	Create a connection to a type of datastore for working with large data.	`databaseDatastore`

- `connection` objects and `DatabaseDatastore` objects remain open until you close them using the `close` function. Always close these objects when you finish using them.
- Executing `close` with a `DatabaseDatastore` object releases the MATLAB resources associated with the `connection` object.

Note When you close the MATLAB session, MATLAB closes open `DatabaseDatastore` objects and connections. However, the database might not free up the connections. Consult your database administrator about the remaining connections.

See Also

`database` | `databaseDatastore` | `fetch`

Topics

"Import Data from Database Table Using sqlread Function" on page 5-52
"Import Large Data Using DatabaseDatastore Object" on page 5-31
"Insert Data into Database Table" on page 5-55
"Configuring Driver and Data Source" on page 2-15
"Connecting to Database" on page 2-142

Introduced before R2006a

cols

Package: database.odbc

(Not recommended) Retrieve number of columns in fetched data set

---

Note The `cols` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see "Compatibility Considerations".

Syntax

`numcols = cols(curs)`

Description

`numcols = cols(curs)` returns the number of columns in the fetched data set `curs`.

Examples

Display Number of Columns in Data

Create the database connection `conn` using the `dbdemo` data source.

```
conn = database('dbdemo','','');
```

Working with the `dbdemo` data source, use `fetch` to import all data into `Database Cursor Object` `curs`. Store the data in a cell array contained in the `cursor` object field `curs.Data`.

```
curs = exec(conn,'SELECT * FROM producttable');
curs = fetch(curs);
```

View the contents of the `Data` property in the `cursor` object.

```
curs.Data
```

```
ans = 

    [ 9]    [125970]    [1003]    [13]    'Victorian Doll'
    [ 8]    [212569]    [1001]    [ 5]    'Train Set'
    [ 7]    [389123]    [1007]    [16]    'Engine Kit'
    [ 2]    [400314]    [1002]    [ 9]    'Painting Set'
    [ 4]    [400339]    [1008]    [21]    'Space Cruiser'
    [ 1]    [400345]    [1001]    [14]    'Building Blocks'
    [ 5]    [400455]    [1005]    [ 3]    'Tin Soldier'
    [ 6]    [400876]    [1004]    [ 8]    'Sail Boat'
    [ 3]    [400999]    [1009]    [17]    'Slinky'
    [10]    [888652]    [1006]    [24]    'Teddy Bear'
```

`Data` contains the `producttable` data.

Display the number of columns in the `Data` property in the `cursor` object.

```
numcols = cols(curs)
```

```
numcols =

     5
```

The data in the `cursor` object contains five columns.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Input Arguments

curs — Database cursor
`cursor` object

Database cursor, specified as a `cursor` object created using the `exec` function.

Output Arguments

`numcols` — Number of columns
numeric scalar

Number of columns in a data set, returned as a numeric scalar.

Compatibility Considerations

`cols` function is not recommended

Not recommended starting in R2018b

The `cols` function is not recommended. Use the `fetch` function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the `cols` function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object, import data, and find the number of database columns in the imported data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
numcols = cols(curs);
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
sz = size(results);
```

If you return imported data as a table, access details about the variables in the table by using functions such as `summary` or `size`. Or, view the dimensions of the returned data in the Workspace browser.

There is no replacement functionality for the `cols` function.

See Also

`attr` | `close` | `columnnames` | `columnprivileges` | `columns` | `database` | `fetch` | `get` | `rows` | `width`

Introduced before R2006a

columnnames

Package: database.odbc

(Not recommended) Retrieve names of columns in fetched data set

---

Note The `columnnames` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see "Compatibility Considerations".

Syntax

```
columnlist = columnnames(curs)
columnlist = columnnames(curs,returnCellArray)
```

Description

`columnlist = columnnames(curs)` returns the column names of the data selected from a database table in the `cursor` object `curs`. The `columnnames` function is not supported for a `cursor` object returned by the `fetchmulti` function.

`columnlist = columnnames(curs,returnCellArray)` returns the column names as a cell array of character vectors when `returnCellArray` is set to `true`.

Examples

Return Column Names from Selected Data

Create the database connection `conn` using the `dbdemo` data source.

```
conn = database('dbdemo','','');
```

Working with the `dbdemo` data source, use `fetch` to import all data into `Database Cursor Object` `curs`.

```
curs = exec(conn,'SELECT * FROM suppliers');
curs = fetch(curs);
```

Return the column names in the `suppliers` table.

```
columnlist = columnnames(curs)
```

```
columnlist =

'SupplierNumber','SupplierName','City','Country','FaxNumber'
```

`columnlist` contains one long character vector with the column names in the `suppliers` table in quotes and separated by commas.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Input Arguments

`curs` — Database cursor
`cursor` object

Database cursor, specified as a `cursor` object created using the `exec` function.

`returnCellArray` — Return format
`true` | `false`

Return format, specified as Boolean values `true` or `false`. When set to `true`, `columnnames` returns the column names as a cell array of character vectors. When set to `false`, `columnnames` returns the column names as a long character vector.

Data Types: `logical`

Output Arguments

`columnlist` — Column name list
character vector | cell array

Column name list of columns in the selected data, returned as a character vector or a cell array of character vectors. Without the argument `returnCellArray`, `columnnames` returns the list of column names as a long character vector. The character vector encloses the column names in quotes and separates the column names by commas. If you use the argument `returnCellArray` and set it to `true`, then `columnnames` returns the column names as a cell array.

Compatibility Considerations

`columnnames` function is not recommended

Not recommended starting in R2018b

The `columnnames` function is not recommended. Use the `fetch` function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the `columnnames` function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object, import data, and find the names of the database columns. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
columnlist = columnnames(curs);
close(curs)
```

Now you can import data in one step using the `fetch` function, and then access properties of the output table.

```
results = fetch(conn,sqlquery);
results.Properties.VariableNames
```

If you return imported data as a table, access details about the variables in the table by using the table properties or a function such as `summary`.

There is no replacement functionality for the `columnnames` function.

See Also

`attr` | `close` | `cols` | `columnprivileges` | `columns` | `database` | `fetch` | `get` | `width`

Introduced before R2006a

columnprivileges

(To be removed) List database column privileges

Note The `columnprivileges` function will be removed in a future release without replacement.

Syntax

```
lp = columnprivileges(dbmeta,'cata','sch','tab')
lp = columnprivileges(dbmeta,'cata','sch','tab','l')
```

Description

`lp = columnprivileges(dbmeta,'cata','sch','tab')` returns a list of privileges for all columns in the table `tab`, in the schema `sch`, in the catalog `cata` for the database whose database metadata object is `dbmeta`.

`lp = columnprivileges(dbmeta,'cata','sch','tab','l')` returns a list of privileges for column `l` in the table `tab`, in the schema `sch`, in the catalog `cata` for the database whose database metadata object is `dbmeta`.

Examples

Return a list of privileges for the given database, catalog, schema, table, and column name:

```
lp = columnprivileges(dbmeta,'msdb','geck','builds',...
'build_id')
lp =
     'builds'    'build_id'    {1x4 cell}
```

View the contents of the third column in `lp`:

```
lp{1,3}
ans = 
    'INSERT'    'REFERENCES'    'SELECT'    'UPDATE'
```

See Also

`cols` | `columnnames` | `columns` | `dmd` | `get` | `sqlfind`

Topics

"Retrieve Database Metadata" on page 5-58

Introduced before R2006a

columns

Package: database.odbc

(To be removed) Return database table column names

Note The `columns` function will be removed in a future release. Use the `sqlfind` function or access the properties of the `connection` object instead. For details, see "Compatibility Considerations".

Syntax

```
columnlist = columns(conn,catalog)
columnlist = columns(conn,catalog,schema)
columnlist = columns(conn,catalog,schema,tablename)
```

```
columnlist = columns(dbmeta,catalog)
columnlist = columns(dbmeta,catalog,schema)
columnlist = columns(dbmeta,catalog,schema,tablename)
```

Description

`columnlist = columns(conn,catalog)` returns a list of all column names in the catalog `catalog` for the database with the database connection `conn`.

`columnlist = columns(conn,catalog,schema)` returns a list of all column names in the schema `schema`.

`columnlist = columns(conn,catalog,schema,tablename)` returns a list of all column names for the table `tablename`.

`columnlist = columns(dbmeta,catalog)` returns a list of all column names in the catalog `catalog` for the database whose database metadata object is `dbmeta`.

`columnlist = columns(dbmeta,catalog,schema)` returns a list of all column names in the schema `schema`.

`columnlist = columns(dbmeta,catalog,schema,tablename)` returns a list of all column names for the table `tablename`.

Examples

Retrieve Column List for Catalog Using Database Connection

Create a database connection `conn` using the native ODBC interface to the Microsoft SQL Server database. This code assumes that you are connecting to a data source named `MS SQL Server` with user name `username` and password `pwd`.

```
conn = database('MS SQL Server','username','pwd');
```

Retrieve the column names for each table in a catalog. Here, this code assumes that the database contains the catalog name `toy_store`.

```
catalog = 'toy_store';

columnlist = columns(conn,catalog)

columnlist = 

    'salesVolume'                                        {1x13  cell}
    'suppliers'                                          {1x5   cell}
    'yearlySales'                                        {1x3   cell}
    ...
```

`columns` returns a cell array. The first column contains the table names as character vectors. The second column contains the corresponding column name lists as cell arrays.

Display the column names for the `suppliers` table.

```
columnlist{2,2}

ans = 

    'SupplierNumber'    'SupplierName'    'City'    'Country'    'FaxNumber'
```

Close the database connection.

```
close(conn)
```

Input Arguments

`conn` — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

`dbmeta` — Database metadata
database metadata object

Database metadata, specified as a database metadata object created using `dmd`. To use this object, create a database connection using the `database` function first.

Note Support for the database metadata object will be removed in a future release. Use the `sqlfind` function and access the properties of the `connection` object instead.

`catalog` — Database catalog name
character vector | string scalar

Database catalog name, specified as a character vector or string scalar.

Data Types: `char` | `string`

`schema` — Database schema name
character vector | string scalar

Database schema name, specified as a character vector or string scalar.

Data Types: `char` | `string`

`tablename` — Database table name
character vector | string scalar

Database table name, specified as a character vector or string scalar denoting the name of a table in the database.

Example: `'employees'`

Data Types: `char` | `string`

Output Arguments

`columnlist` — List of columns
cell array

List of columns, returned as a cell array.

Compatibility Considerations

`columns` function will be removed

Not recommended starting in R2018b

The `columns` function will be removed in a future release. Use the `sqlfind` function or access the properties of the `connection` object instead. Some differences between the workflows require updates to your code.

In prior releases, you retrieved information about database columns using the `columns` function. For example:

```
conn = database(datasource,username,password);
columnlist = columns(conn,catalog);
```

Now the `sqlfind` function returns information about the table types in the database.

```
conn = database(datasource,username,password);
data = sqlfind(conn,pattern);
```

Also, you can access the database properties and catalog and schema information using the `connection` object. For example:

```
conn = database(datasource,username,password);
catalogs = conn.Catalogs;
schemas = conn.Schemas;
```

See Also

`attr` | `close` | `cols` | `columnnames` | `columnprivileges` | `database` | `get` | `sqlfind`

Introduced in R2010a

commit

Package: database.odbc

Make database changes permanent

Syntax

```
commit(conn)
```

Description

`commit(conn)` makes permanent changes made to the database connection `conn` since the last `commit` or `rollback` function was run. To run this function, the `AutoCommit` flag for `conn` must be `off`.

Examples

Example 1 — Check the Status of the Autocommit Flag

Check that the status of the `AutoCommit` flag for connection `conn` is `off`.

```
conn.AutoCommit
ans =
    'off'
```

Example 2 — Commit Data to a Database

1 Insert `exdata` into the columns `DEPTNO`, `DNAME`, and `LOC` in the table `DEPT`, for the data source `conn`.

   ```
   datainsert(conn,'DEPT',...
   {'DEPTNO';'DNAME';'LOC'},exdata)
   ```

2 Commit this data.

```
commit(conn)
```

Tips

For ODBC connections, you can use the `commit` function with the native ODBC interface. For details, see `database`.

See Also

`database` | `datainsert` | `exec` | `get` | `rollback` | `update`

Topics

“Import Data from Database Table Using sqlread Function” on page 5-52
“Insert Data into Database Table” on page 5-55
“Roll Back Data After Updating Record” on page 5-14

Introduced before R2006a

configureODBCDataSource

Open ODBC Data Source Administrator dialog box

Syntax

```
configureODBCDataSource
```

Description

`configureODBCDataSource` opens the ODBC Data Source Administrator dialog box on Windows systems.

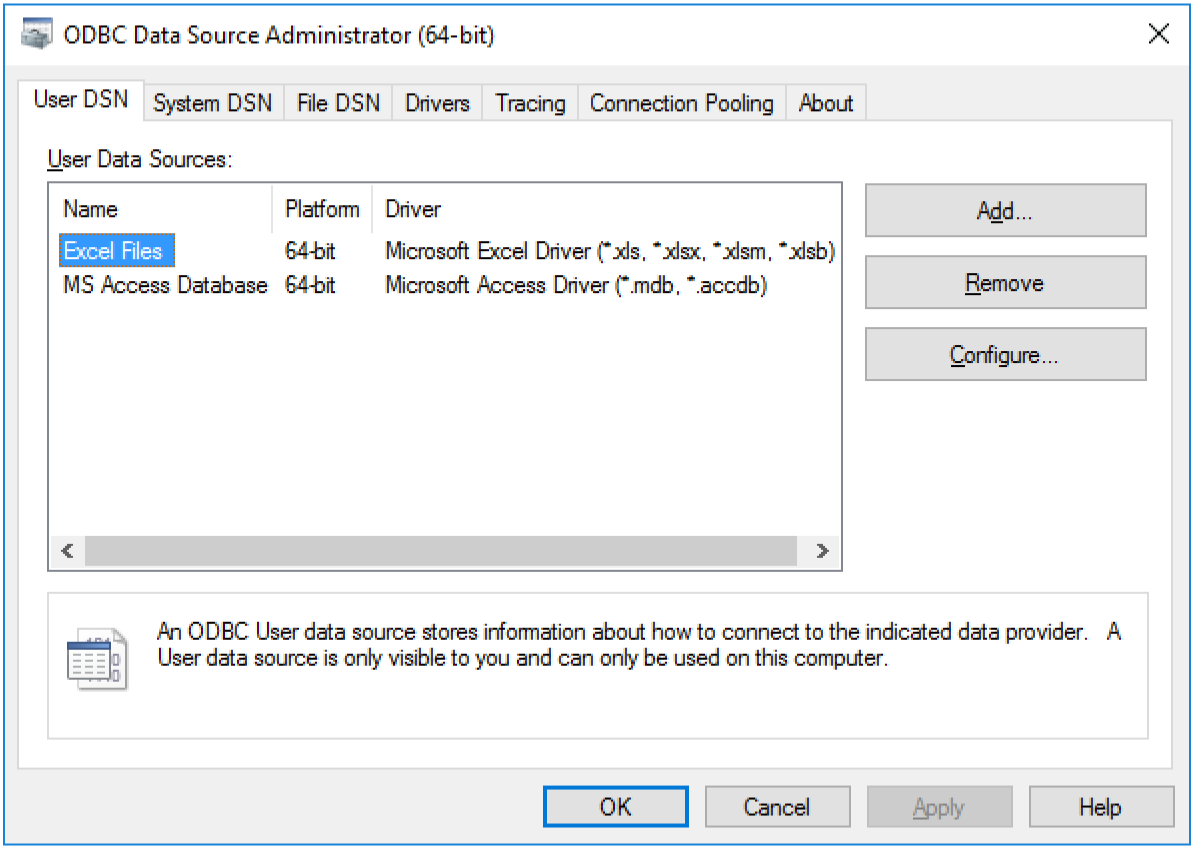
Examples

Open ODBC Data Source Administrator Dialog Box

Use the `configureODBCDataSource` function to open the ODBC Data Source Administrator dialog box on Windows systems.

```
configureODBCDataSource
```

The ODBC Data Source Administrator dialog box opens.



Tips

- Database Toolbox no longer supports connecting to a database using a 32-bit driver. For Microsoft Access, use the 64-bit version. Or, to connect to the 32-bit version of Microsoft Access, see https://www.mathworks.com/matlabcentral/answers/235949-how-to-connect-to-32-bit-microsoft-access-database-from-64-bit-matlab. For details about working with the 64-bit version of Windows, see https://www.mathworks.com/products/matlab/preparing-for-64-bit-windows.html.

Alternative Functionality

App

You can open the ODBC Data Source Administrator dialog box using the **Database Explorer** app. Select **Configure Data Source > Configure ODBC data source**. For configuring ODBC data sources, see “Configuring Driver and Data Source” on page 2-15.

See Also

Apps
Database Explorer

Functions
`database`

Topics
“Configuring Driver and Data Source” on page 2-15

Introduced in R2017b

connection

Relational database connection

Description

Create a database connection using either ODBC or JDBC drivers. For information on which connection option is best in your situation, see “Choosing Between ODBC and JDBC Drivers” on page 2-13.

You can use the `connection` object to connect to various databases using different drivers that you install and administer. For details, see “Connecting to Database” on page 2-142.

Creation

Create a `connection` object using the `database` function.

Properties

ODBC and JDBC Connection Properties

`DataSource` — Data source name
`''` (default) | character vector

This property is read-only.

Data source name for ODBC connection or database name for JDBC connection, specified as a character vector. For an ODBC driver, `DataSource` is the name you provide for your data source when you create a data source using the Microsoft ODBC Administrator. For a JDBC driver, `DataSource` is the name of your database. The name differs for different database systems. For example, `DataSource` is the SID or the service name when you are connecting to an Oracle database. Or, `DataSource` is the catalog name when you are connecting to a MySQL database. For details about your database name, contact your database administrator or refer to your database documentation.

The data source name is an empty character vector when the connection is invalid.

Example: `'MS SQL Server'`

Data Types: `char`

`UserName` — User name
`''` (default) | character vector

This property is read-only.

User name required to access the database, specified as a character vector. If no user name is required, specify an empty value `''`.

Example: `'username'`

Data Types: `char`

`Message` — Database connection status message
`''` (default) | character vector

This property is read-only.

Database connection status message, specified as a character vector. The status message is empty when the database connection is successful. Otherwise, this property contains an error message.

Example: `'ODBC Driver Error: [Micro ...'`

Data Types: `char`

Type — Database connection type
`'JDBC Connection Object'` | `'ODBC Connection Object'`

This property is read-only.

Database connection type, specified as one of these values:

- `'JDBC Connection Object'` — Database connection is created using a JDBC driver.
- `'ODBC Connection Object'` — Database connection is created using an ODBC driver.

Data Types: `char`

JDBC Connection Properties

`Driver` — JDBC driver

`''` (default) | character vector

This property is read-only.

JDBC driver, specified as a character vector when connecting to a database using a JDBC driver URL. This property depends on the `URL` property.

Example: `'com.mysql.jdbc.jdbc2.opti ...'`

Data Types: `char`

URL — Database connection URL

`''` (default) | character vector

This property is read-only.

Database connection URL, specified as a character vector for a vendor-specific string. This property depends on the `Driver` property.

Example: `'jdbc:mysql://sname:1234/ ...'`

Data Types: `char`

Database Properties

`AutoCommit` — Auto-commit transactions

`'on'` (default) | `'off'`

Auto-commit transactions, specified as one of these values:

- `'on'` — Database transactions are automatically committed to the database.
- `'off'` — Database transactions must be committed to the database manually.

Data Types: `char`

`ReadOnly` — Read-only database data

`'off'` (default) | `'on'`

Read-only database data, specified as one of these values:

- `'on'` — Database data is read-only.

- `'off'` — Database data is writable.

Data Types: `char`

`LoginTimeout` — Login timeout
`0` (default) | positive numeric scalar

This property is read-only.

Login timeout, specified as a positive numeric scalar. The login timeout specifies the number of seconds that the driver waits while trying to connect to a database before throwing an error.

When no login timeout for the connection attempt is specified, the value is `0`.

When login timeout is not supported by the database, the value is `-1`.

Data Types: `double`

`MaxDatabaseConnections` — Maximum database connections
`-1` (default) | positive numeric scalar

This property is read-only.

Maximum database connections, specified as a positive, numeric scalar.

The value is `0` when there is no upper limit to the maximum number of database connections.

When the maximum number of database connections is not supported by the database, the value is `-1`.

Data Types: `double`

Catalog and Schema Information

`DefaultCatalog` — Default catalog name
`''` (default) | character vector

This property is read-only.

Default catalog name, specified as a character vector.

When a database does not specify a default catalog, the value is an empty character vector `''`.

Example: `'catalog'`

Data Types: `char`

`Catalogs` — Catalog names
`{}` (default) | cell array of character vectors

This property is read-only.

Catalog names, specified as a cell array of character vectors.

When a database does not contain catalogs, the value is an empty cell array `{}`.

Example: `{'catalog1', 'catalog2'}`

Data Types: `cell`

`Schemas` — Schema names
`{}` (default) | cell array of character vectors

This property is read-only.

Schema names, specified as a cell array of character vectors.

When a database does not contain schemas, the value is an empty cell array `{}`.

Example: `{'schema1', 'schema2', 'schema3'}`

Data Types: `cell`

Database and Driver Information

`DatabaseProductName` — Database product name
`''` (default) | character vector

This property is read-only.

Database product name, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'Microsoft SQL Server'`

Data Types: `char`

`DatabaseProductVersion` — Database product version
`''` (default) | character vector

This property is read-only.

Database product version, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'11.00.2100'`

Data Types: `char`

`DriverName` — Driver name
`''` (default) | character vector

This property is read-only.

Driver name of an ODBC or JDBC driver, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'sqlncli11.dll'`

Data Types: `char`

`DriverVersion` — Driver version
`''` (default) | character vector

This property is read-only.

Driver version of an ODBC or JDBC driver, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'11.00.5058'`

Data Types: `char`

Object Functions

ODBC and JDBC Connection Functions

close	Close and invalidate database and driver resource utilizer
commit	Make database changes permanent
execute	Execute SQL statement using relational database connection

fetch	Import data into MATLAB workspace from execution of SQL statement
isopen	Determine if database connection is open
rollback	Undo database changes
runsqlscript	Run SQL script on database
select	Execute SQL SELECT statement and import data into MATLAB
sqlfind	Find information about all table types in database
sqlinnerjoin	Inner join between two database tables
sqlouterjoin	Outer join between two database tables
sqlread	Import data into MATLAB from database table
sqlwrite	Insert MATLAB data into database table
update	Replace data in database table with MATLAB data

JDBC Connection Function

runstoredprocedure	Call stored procedure with and without input and output arguments

Examples

Connect to MySQL Using ODBC Driver

First, create an ODBC connection to the MySQL database. Then, import data from the database into MATLAB and perform simple data analysis. Close the database connection. The code assumes that you are connecting to a MySQL database version 5.5.46 using the MySQL ODBC 5.3 ANSI Driver.

Connect to the database using the data source name, user name, and password.

```
datasource = 'dsname';
username = 'username';
password = 'pwd';

conn = database(datasource,username,password)
```

```
conn = 

  connection with properties:

                  DataSource: 'MySQLdb'
                    UserName: 'username'
```

```
                   Message: ''
                      Type: 'ODBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: 'catalog'
                  Catalogs: {'catalog1', 'catalog2'}
                   Schemas: {}

  Database and Driver Information:

       DatabaseProductName: 'MySQL'
    DatabaseProductVersion: '5.5.46-0+deb7u1'
                DriverName: 'myodbc5a.dll'
             DriverVersion: '05.03.0004'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `select` function. Display the data.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery)
```

```
ans = 

    productnumber    quantity    price          inventorydate      
    _____________    ________    _____    _________________________

     1               1700        14.5     '2014-09-23 09:38:34.0'
```

```
    2                1200          9.3     '2014-07-08 22:50:45.0'
    3                 356         17.2     '2014-05-14 07:14:28.0'
    ...
```

Determine the highest product quantity from the table.

```
max(data.Quantity)
```

```
ans =

        9000
```

Close the database connection `conn`.

```
close(conn)
```

Connect to Oracle Using JDBC Driver

First, create a JDBC connection to the Oracle database. Then, import data from the database into MATLAB and perform simple data analysis. Close the database connection. The code assumes that you are connecting to a Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 using the Oracle JDBC Driver 12.1.0.1.0.

Connect to the database using the data source name, user name, and password.

```
datasource = 'dsname';
username = 'username';
password = 'pwd';

conn = database(datasource,username,password,'Vendor','Oracle', ...
    'Server','remotehost','DriverType','thin','PortNumber',1234)
```

```
conn =

  connection with properties:

                DataSource: 'datasource'
                  UserName: 'username'
                    Driver: 'oracle.jdbc.pool.OracleDa ...'
                       URL: 'jdbc:oracle:thin:@(DESCRI ...'
                   Message: ''
                      Type: 'JDBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 0
```

```
  Catalog and Schema Information:

              DefaultCatalog: ''
                    Catalogs: {}
                     Schemas: {'schema1', 'schema2', 'schema3' ... and 39 more}

  Database and Driver Information:

         DatabaseProductName: 'Oracle'
      DatabaseProductVersion: 'Oracle Database 12c Enter ...'
                  DriverName: 'Oracle JDBC driver'
               DriverVersion: '12.1.0.1.0'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `select` function. Display the data.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery)
```

```
ans =

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _______________________

     1               1700        14.5     '2014-09-23 09:38:34.0'
     2               1200         9.3     '2014-07-08 22:50:45.0'
     3                356        17.2     '2014-05-14 07:14:28.0'
     ...
```

Determine the highest product quantity from the table.

```
max(data.Quantity)
```

```
ans =

        9000
```

Close the database connection `conn`.

```
close(conn)
```

Alternative Functionality

A `connection` object is one of the two available database connection types. The other creates a `sqlite` object that connects to a SQLite database file using the MATLAB interface to SQLite without installing or administering a database or driver. For details, see “Working with MATLAB Interface to SQLite” on page 2-6.

See Also

`close` | `fetch` | `select`

Topics

“Configuring Driver and Data Source” on page 2-15
“MySQL ODBC for Windows” on page 2-55
“Oracle JDBC for Windows” on page 2-48
“Connecting to Database” on page 2-142
“Import Data from Database Table Using sqlread Function” on page 5-52
“Insert Data into Database Table” on page 5-55
“Database Connection Error Messages” on page 3-10

Introduced before R2006a

cursor

(Not recommended) Database cursor

Note The `cursor` object is not recommended. Use the `fetch` function instead. For details, see “Compatibility Considerations”.

The scrollable cursor functionality has no replacement.

Description

After connecting to a relational database using either ODBC or JDBC drivers, you can perform actions using the database connection. To import data into MATLAB from a database and perform database operations, you must create a `cursor` object. Database Toolbox uses this object to retrieve rows from database tables and execute SQL statements.

There are two types of database cursors, basic and scrollable. Basic cursors let you import data in an SQL query in a sequential way. However, scrollable cursors enable data import from a specified offset in the data set.

To import data quickly using a SQL `SELECT` statement, use the `select` function. To import data with full functionality, use the `exec` and `fetch` functions. For differences, see “Data Import Using Database Explorer App or Command Line” on page 2-145.

A `cursor` object stays open until you close it using the `close` function.

Creation

Create a `cursor` object using the `exec` function.

Properties

ODBC and JDBC Driver Properties

`Data` — SQL query results

cell array (default) | table | structure | numeric | dataset

SQL query results, specified as a cell array, table, structure, numeric, or dataset array. After running the `exec` function, this property is blank. The `fetch` function populates this property with imported data from the executed SQL query.

To set the data return format, use the `setdbprefs` function.

Note The dataset array value will be removed in a future release. Use table instead.

Example: `[15×5 table]`

Data Types: `double` | `struct` | `table` | `cell`

`RowLimit` — Number of rows to import

`0` (default) | positive numeric scalar

This property is read-only.

Number of rows to import at a time, specified as a positive numeric scalar.

Data Types: `double`

`SQLQuery` — SQL query

character vector

This property is read-only.

SQL query, specified as a character vector. To change the SQL query, create a `cursor` object and specify the SQL query in the input argument `sqlquery` of the `exec` function.

For information about the SQL query language, see the SQL Tutorial.

Example: `'SELECT * FROM productTable'`

Data Types: `char`

`Message` — Error message
`''` (default) | character vector

This property is read-only.

Error message, specified as a character vector. An empty character vector specifies that the `exec` or `fetch` functions executed successfully. If this property is empty after running `exec`, then the SQL statement executed successfully. If this property is empty after running `fetch`, then the data import completed successfully. Otherwise, the property populates with the returned error message.

To throw error messages to the Command Window, use the `setdbprefs` function. Enter this code:

```
setdbprefs('ErrorHandling','report');
sqlquery = 'SELECT * FROM invalidtablename';
curs = exec(conn,sqlquery)
```

To store error messages in the `Message` property instead, enter this code:

```
setdbprefs('ErrorHandling','store');
sqlquery = 'SELECT * FROM invalidtablename';
curs = exec(conn,sqlquery)
```

Example: `'Table 'schame.InvalidTableName' doesn't exist'`

Data Types: `char`

`Type` — Database cursor type
`'ODBCCursor Object'` | `'Database Cursor Object'`

This property is read-only.

Database cursor type, specified as one of these values.

Value	Database Cursor Type
`'ODBCCursor Object'`	`cursor` object created using an ODBC database connection
`'Database Cursor Object'`	`cursor` object created using a JDBC database connection

`Statement` — Statement
C statement object | Java statement object

This property is read-only.

Statement, specified as a C statement object or Java statement object.

Example: `[1×1 com.mysql.jdbc.StatementImpl]`

`Scrollable` — Scrollable cursor
`0` (default) | `1`

This property is read-only.

Scrollable cursor, specified as a logical value. The value `0` identifies the `cursor` object as basic. The value `1` identifies the `cursor` object as scrollable.

Note This property is hidden.

Data Types: `logical`

`Position` — Cursor position
`0` (default) | numeric scalar

This property is read-only.

Cursor position of a scrollable cursor in the data set, specified as a numeric scalar. Only scrollable cursors have this property. The cursor position behaves differently depending on the database driver used to establish the database connection.

Data Types: `double`

JDBC Driver Properties

`DatabaseObject` — JDBC connection
`connection` object

This property is read-only.

JDBC connection, specified as a `connection` object created by connecting to a database using the JDBC driver.

Example: `[1×1 database.jdbc.connection]`

`ResultSet` — Result set
Java result set object

This property is read-only.

Result set, specified as a Java result set object.

Example: `[1×1 com.mysql.jdbc.JDBC4ResultSet]`

`Cursor` — Database cursor
Java object

This property is read-only.

Database cursor, specified as an internal Java object that represents the `cursor` object.

Example: `[1×1 com.mathworks.toolbox.database.sqlExec]`

`Fetch` — Imported data
Java object

This property is read-only.

Imported data, specified as an internal Java object that represents the imported data.

Example: `[1×1 com.mathworks.toolbox.database.fetchTheData]`

Object Functions

attr	(Not recommended) Retrieve attributes of columns in fetched data set
close	(Not recommended) Close cursor
cols	(Not recommended) Retrieve number of columns in fetched data set
columnnames	(Not recommended) Retrieve names of columns in fetched data set
fetch	(Not recommended) Import data into MATLAB workspace from database cursor
fetchmulti	(Not recommended) Import data from multiple result sets
get	(Not recommended) Retrieve object properties
isopen	(Not recommended) Determine if database cursor is open
querytimeout	(Not recommended) Get time specified for SQL queries to succeed
rows	(Not recommended) Return number of rows in fetched data set
set	(Not recommended) Set properties for database cursor
width	(Not recommended) Return field size of column in fetched data set

Examples

Select Data Using Native ODBC Driver

Use a native ODBC connection to import product data from a Microsoft SQL Server database into MATLAB. Then, determine the highest unit cost among products.

Create an ODBC database connection to a Microsoft SQL Server database with Windowsauthentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message

ans =

     []
```

Select all data from the table `productTable` using the `connection` object. Assign the SQL `SELECT` statement to the variable `sqlquery`. The `cursor` object contains the executed SQL query.

```
sqlquery = 'SELECT * FROM productTable';
curs = exec(conn,sqlquery)

curs =

   cursor with properties:

         Data: 0
     RowLimit: 0
     SQLQuery: 'SELECT * FROM productTable'
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

For an ODBC connection, the `Type` property contains `ODBCCursor Object`. For JDBC connections, the `Type` property contains `Database Cursor Object`.

Import data from the table into MATLAB.

```
curs = fetch(curs);
data = curs.Data;
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans =

    24
```

After you finish working with the `cursor` object, close it. Close the database connection.

```
close(curs)
close(conn)
```

Compatibility Considerations

`cursor` object is not recommended

Not recommended starting in R2018b

The `cursor` object is not recommended. Use the `fetch` function instead. Some differences between the workflows might require updates to your code.

There are no plans to remove the `cursor` object at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

See Also

`close` | `database` | `fetch` | `setdbprefs`

Introduced before R2006a

close

Package: database.odbc

(Not recommended) Close cursor

Note The `close` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see “Compatibility Considerations”.

Syntax

```
close(curs)
```

Description

`close(curs)` closes and invalidates the database cursor and driver resource utilizer to free up database and driver resources.

Examples

Close `cursor` Object

Connect to a Microsoft SQL Server database and verify the database connection. Then, import data from the database into MATLAB. Determine the highest unit cost among the retrieved products in the table. Close the database cursor and database connection.

Create an ODBC database connection to a Microsoft SQL Server database with Windowsauthentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the Message property is empty, the connection is successful.

```
conn.Message

ans =

     []
```

Select all data from the table productTable by using the connection object, and sort the data by product number. Assign the SQL SELECT statement to the variable sqlquery. The cursor object contains the executed SQL query.

```
sqlquery = 'SELECT * FROM productTable ORDER BY productNumber';
curs = exec(conn,sqlquery);
```

Import the data from the executed SQL query and display the first three rows.

```
curs = fetch(curs);
curs.Data(1:3,:)

ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    1                4.0035e+05     1001              14          'Building Blocks'
    2                4.0031e+05     1002               9          'Painting Set'
    3                  4.01e+05     1009              17          'Slinky'
```

Determine the highest unit cost in the table.

```
data = curs.Data;
max(data.unitCost)

ans =

    24
```

After you finish working with the cursor object, close it.

```
close(curs)
```

After you close the `cursor` object, MATLAB deletes the object. Use the `clear` function to remove the `curs` variable from the MATLAB workspace.

```
curs
clear curs
```

```
curs =

  handle to deleted cursor
```

Close the database connection.

```
close(conn)
```

Input Arguments

curs — Database cursor
`cursor` object

Database cursor, specified as a `cursor` object created using the `exec` function.

Compatibility Considerations

close function is not recommended

Not recommended starting in R2018b

The `close` function is not recommended. Use the `fetch` function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the `close` function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
```

```
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the `close` function.

See Also

`close` | `database` | `fetch`

External Websites

SQL Tutorial

Introduced before R2006a

fetch

Package: database.odbc

(Not recommended) Import data into MATLAB workspace from database cursor

---

Note The `fetch` function with the `cursor` object is not recommended. Use the `fetch` function with the `connection` object or the `select` function instead. For details, see "Compatibility Considerations".

The scrollable cursor functionality has no replacement.

Syntax

```
curs = fetch(curs)
curs = fetch(curs,rowlimit)
curs = fetch(___,Name,Value)
```

Description

`curs = fetch(curs)` imports all rows of data from an executed SQL query into the `Data` property of the `cursor` object. Use the `cursor` object to investigate imported data and its structure.

Caution: Leaving `cursor` and `connection` objects open or overwriting open objects can result in unexpected behavior. After you finish working with these objects, you must close them using `close`.

`curs = fetch(curs,rowlimit)` imports the maximum number of rows of data, as specified in `rowlimit`, from an executed SQL query.

`curs = fetch(___,Name,Value)` specifies options using one or more name-value pair arguments in addition to the input arguments in previous syntaxes. For example, `curs = fetch(curs,'AbsolutePosition',5);` imports data using an absolute position offset in a scrollable cursor, whereas `curs = fetch(curs,'RelativePosition',10);` imports data using a relative position offset.

Examples

Import All Data Using `cursor` Object

Import product data from a Microsoft SQL Server database into MATLAB by using the `cursor` object. Then, determine the highest unit cost among products in the table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message

ans =

     []
```

Execute the SQL query using the `exec` function and the database connection. Then, import all the data from `productTable`.

```
sqlquery = 'SELECT * FROM productTable';
curs = exec(conn,sqlquery);
curs = fetch(curs)

curs =

  cursor with properties:

         Data: [15×5 table]
     RowLimit: 0
     SQLQuery: 'SELECT * FROM productTable'
      Message: []
```

```
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

For an ODBC connection, the `Type` property contains `ODBCCursor Object`. For JDBC connections, this property contains `Database Cursor Object`.

Display the data in the `cursor` object property `Data`.

```
curs.Data
```

```
ans =

  15×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

     9               1.2597e+05     1003              13          'Victorian Doll'
     8               2.1257e+05     1001               5          'Train Set'
     7               3.8912e+05     1007              16          'Engine Kit'
     2               4.0031e+05     1002               9          'Painting Set'
     4               4.0034e+05     1008              21          'Space Cruiser'
     1               4.0035e+05     1001              14          'Building Blocks'
     5               4.0046e+05     1005               3          'Tin Soldier'
     6               4.0088e+05     1004               8          'Sail Boat'
     3                 4.01e+05     1009              17          'Slinky'
    10               8.8865e+05     1006              24          'Teddy Bear'
    11               4.0814e+05     1004              11          'Convertible'
    12               2.1046e+05     1010              22          'Hugsy'
    13               4.7082e+05     1012              17          'Pancakes'
    14                5.101e+05     1011              19          'Shawl'
    15               8.9975e+05     1011              20          'Snacks'
```

Determine the highest unit cost in the table.

```
data = curs.Data;
max(data.unitCost)
```

```
ans =

    24
```

After you finish working with the `cursor` object, close it. Close the database connection.

```
close(curs)
close(conn)
```

Input Arguments

curs — Database cursor
cursor object

Database cursor, specified as a cursor object created using the exec function.

rowlimit — Row limit
numeric scalar

Row limit, specified as a positive numeric scalar that indicates the maximum number of rows of data to import from the database.

If rowlimit is 0, fetch returns all the rows of data.

Data Types: double

Name-Value Pair Arguments

Specify optional comma-separated pairs of Name,Value arguments. Name is the argument name and Value is the corresponding value. Name must appear inside quotes. You can specify several name and value pair arguments in any order as Name1,Value1,...,NameN,ValueN.

Example: curs = fetch(curs,'RelativePosition',10);

AbsolutePosition — Absolute position offset
numeric scalar

Absolute position offset, specified as the comma-separated pair consisting of 'AbsolutePosition' and a numeric scalar that indicates the absolute position offset value. When you specify an absolute position offset value, fetch imports data starting from the cursor position equal to this value, regardless of the current cursor location. The scalar can be a positive number to signify fetching data from the start of the data set, or a negative number to signify fetching data from the end of the data set. This name-value pair argument is available only when you create a scrollable cursor object using exec.

Example: 'AbsolutePosition',5

Data Types: double

RelativePosition — Relative position offset
numeric scalar

Relative position offset, specified as the comma-separated pair consisting of 'RelativePosition' and a numeric scalar that indicates the relative position offset value. When you specify a relative position offset value, fetch adds the current cursor position value to the relative position offset value. Then, fetch imports data starting from the resulting value. The scalar can be a positive number to signify importing data after the current cursor position in the data set, or a negative number to signify importing data before the current cursor position in the data set. This name-value pair argument is available only when you create a scrollable cursor object using exec.

Example: 'RelativePosition',10

Data Types: double

Output Arguments

curs — Database cursor
cursor object

Database cursor, returned as a cursor object populated with imported data in the Data property. You can specify the output data format in the Data property by using the setdbprefs function.

Tips

- If you have a native ODBC connection that you established using database, then running fetch on the cursor object updates the input cursor object itself. Depending on whether you provide an output argument, the same object gets copied over to the output. Therefore, only one cursor object exists in memory for any of these usages:

  ```
  % First use
  curs = fetch(curs)
  % Second use
  fetch(curs)
  ```

```
% Third use
curs2 = fetch(curs)
```

Compatibility Considerations

`fetch` function with the `cursor` object is not recommended

Not recommended starting in R2018b

The `fetch` function with the `cursor` object is not recommended. Use the `fetch` function with the `connection` object instead. Some differences between the workflows might require updates to your code.

There are no plans to remove the `fetch` function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

You can also import data in one step using the `select` function.

```
data = select(conn,selectquery);
```

The scrollable cursor functionality has no replacement.

See Also

`close` | `database` | `exec` | `fetch` | `fetchmulti` | `setdbprefs`

External Websites

SQL Tutorial

Introduced before R2006a

isopen

Package: database.odbc

(Not recommended) Determine if database cursor is open

Note The `isopen` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see “Compatibility Considerations”.

Syntax

```
i = isopen(curs)
```

Description

`i = isopen(curs)` returns `1` if the database cursor is open and `0` if the database cursor is closed or invalid.

Examples

Determine If Database Cursor Is Open

Connect to a Microsoft SQL Server database and verify the database cursor. Then, import data from the database into MATLAB. Determine the highest unit cost among the retrieved products in the table. Close the database cursor and database connection.

Create an ODBC database connection to a Microsoft SQL Server database with Windowsauthentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the Message property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a cursor object by executing an SQL query in the database. Select all the data from the table productTable by using the connection object, and then sort the data by the product number.

```
sqlquery = 'SELECT * FROM productTable ORDER BY productNumber';
curs = exec(conn,sqlquery);
```

Determine if the database cursor is open. The isopen function returns the numeric scalar 1, which means the database cursor is open.

```
i = isopen(curs)
```

```
i =

     1
```

Import data from the executed SQL query and display the first three rows.

```
curs = fetch(curs);
curs.Data(1:3,:)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    1                4.0035e+05     1001              14          'Building Blocks'
    2                4.0031e+05     1002               9          'Painting Set'
    3                  4.01e+05     1009              17          'Slinky'
```

Determine the highest unit cost in the table.

```
data = curs.Data;
max(data.unitCost)
```

```
ans =

    24
```

After you finish working with the cursor object, close it.

```
close(curs)
```

Determine if the database cursor is closed. The isopen function returns the numeric scalar 0, which means the database cursor is closed. If the cursor object is invalid, the isopen function returns the same result.

```
i = isopen(curs)
```

```
i =

     0
```

Close the database connection.

```
close(conn)
```

Input Arguments

curs — Database cursor
cursor object

Database cursor, specified as a cursor object created using the exec function.

Compatibility Considerations

isopen function is not recommended

Not recommended starting in R2018b

The isopen function is not recommended. Use the fetch function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the isopen function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object, determine if the `cursor` object is open, and import data. For example:

```
curs = exec(conn,sqlquery);
i = isopen(curs);
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the `isopen` function.

See Also

`close` | `database` | `fetch`

External Websites

SQL Tutorial

Introduced in R2015b

database

Connect to database

Syntax

```
conn = database(datasource,username,password)
conn = database(datasource,username,password,driver,url)
conn = database( ___ ,Name,Value)
```

Description

`conn = database(datasource,username,password)` creates an ODBC database connection to a data source with a user name and password. The database connection is a `connection` object.

`conn = database(datasource,username,password,driver,url)` creates a JDBC database connection specified by the JDBC driver name and database connection URL.

`conn = database( ___ ,Name,Value)` includes any of the input argument combinations in the previous syntaxes and adds options that you specify by one or more `Name,Value` pair arguments.

To specify optional database properties for ODBC or JDBC drivers, use the ODBC and JDBC connection options. For example, `conn = database(datasource,username,password,'LoginTimeout',5);` creates an ODBC connection with a login timeout of 5 seconds.

To create a JDBC connection without using the database connection URL, use the JDBC connection options. For example, `conn = database(datasource,username,password,'Vendor','MySQL','Server','remotehost');` creates a JDBC connection to a MySQL database.

Note The `database.ODBCConnection` syntax will be removed in a future release. Use the `database` syntax instead.

Examples

Connect to Microsoft® SQL Server® Using ODBC Driver

First, connect to the Microsoft® SQL Server® database. Then, import data from the database into MATLAB®. Perform simple data analysis. Close the database connection.

The code assumes that you are connecting to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','')
```

```
conn = 

  connection with properties:

                DataSource: 'MS SQL Server Auth'
                  UserName: ''
                   Message: ''
                      Type: 'ODBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 15
    MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: 'toy_store'
                  Catalogs: {'master', 'msdb', 'tempdb' ... and 1 more}
                   Schemas: {'dbo', 'INFORMATION_SCHEMA', 'sys'}

  Database and Driver Information:

       DatabaseProductName: 'Microsoft SQL Server'
    DatabaseProductVersion: '11.00.2100'
                DriverName: 'sqlncli11.dll'
```

```
        DriverVersion: '11.00.5058'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` -- Information about the database configuration
- `Catalog and Schema Information` -- Names of catalogs and schemas in the database
- `Database and Driver Information` -- Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB® using the `select` function. Display the first three rows of data.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery);
data(1:3,:)
```

```
ans =

    productNumber    Quantity    Price    inventoryDate
    _____________    ________    _____    _____________

    1                1700        15       '2014-09-23'
    2                1200         9       '2014-07-08'
    3                 356        17       '2014-05-14'
```

Determine the highest quantity in the table.

```
max(data.Quantity)
```

```
ans =

        9000
```

Close the database connection.

```
close(conn)
```

Connect to PostgreSQL Using JDBC Driver URL

First, connect to the PostgreSQL database. Then, import data from the database into MATLAB and perform simple data analysis. Close the database connection. The code assumes that you are connecting to a PostgreSQL 9.4.5 database using the JDBC PostgreSQL Native Driver 8.4.

Connect to the database using the database name, user name, and password. Use the JDBC driver `org.postgresql.Driver` to make the connection.

Use the URL defined by the driver vendor including your server name `host`, port number, and database name.

```
datasource = 'dbname';
username = 'username';
password = 'pwd';
driver = 'org.postgresql.Driver';
url = 'jdbc:postgresql://host:port/dbname';

conn = database(datasource,username,password,driver,url)
```

```
conn = 

  connection with properties:

                DataSource: 'dbname'
                  UserName: 'username'
                    Driver: 'org.postgresql.Driver'
                       URL: 'jdbc:postgresql://host: ...'
                   Message: ''
                      Type: 'JDBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 8192

  Catalog and Schema Information:

            DefaultCatalog: 'catalog'
                  Catalogs: {'catalog'}
                   Schemas: {'schema1', 'schema2', 'schema3' ... and 1 more}

  Database and Driver Information:

       DatabaseProductName: 'PostgreSQL'
    DatabaseProductVersion: '9.4.5'
```

```
     DriverName: 'PostgreSQL Native Driver'
  DriverVersion: 'PostgreSQL 8.4 JDBC4 (bui ...'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `select` function. Display the data.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery)
```

```
ans = 

    productnumber    quantity    price         inventorydate      
    _____________    ________    _____    _______________________

     1               1700        14.5     '2014-09-23 09:38:34.0'
     2               1200         9.3     '2014-07-08 22:50:45.0'
     3                356        17.2     '2014-05-14 07:14:28.0'
     ...
```

Determine the highest quantity in the table.

```
max(data.quantity)
```

```
ans =

    9000
```

Close the database connection.

```
close(conn)
```

Connect to Microsoft® SQL Server® Using JDBC Driver with Additional Options

First, connect to the Microsoft® SQL Server® database. Then, import data from the database into MATLAB®. Perform simple data analysis. Close the database connection.

The code assumes that you are connecting to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® JDBC Driver 4.0.2206.100.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication and a login timeout of 5 seconds. Specify a blank user name and password.

```
datasource = 'toy_store';
conn = database(datasource,'','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','AuthType','Windows','PortNumber',54317, ...
    'LoginTimeout',5)
```

```
conn = 

  connection with properties:

                  DataSource: 'toy_store'
                    UserName: ''
                      Driver: 'com.microsoft.sqlserver.j ...'
                         URL: 'jdbc:sqlserver://dbtb04:5 ...'
                     Message: ''
                        Type: 'JDBC Connection Object'
  Database Properties:

                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 5
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toy_store'
                    Catalogs: {'master', 'model', 'msdb' ... and 2 more}
                     Schemas: {'db_accessadmin', 'db_backupoperator', 'db_datareader'

  Database and Driver Information:

         DatabaseProductName: 'Microsoft SQL Server'
      DatabaseProductVersion: '11.00.2100'
```

```
         DriverName: 'Microsoft JDBC Driver 4.0 ...'
      DriverVersion: '4.0.2206.100'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` -- Information about the database configuration
- `Catalog and Schema Information` -- Names of catalogs and schemas in the database
- `Database and Driver Information` -- Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB® using the `select` function. Display the first three rows of data.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery);
data(1:3,:)
```

```
ans =

    productNumber    Quantity    Price    inventoryDate
    _____________    ________    _____    _____________

    1                1700        15       '2014-09-23'
    2                1200         9       '2014-07-08'
    3                 356        17       '2014-05-14'
```

Determine the highest quantity in the table.

```
max(data.Quantity)
```

```
ans =

        9000
```

Close the database connection.

```
close(conn)
```

Input Arguments

`datasource` — Data source name or database name
character vector | string scalar

Data source name or database name, specified as a character vector or string scalar. Specify a data source for ODBC connection, and the database name for JDBC connection.

- For an ODBC driver, `datasource` is the name you provide for your data source when you create a data source using the Microsoft ODBC Administrator.
- For a JDBC driver, `datasource` is the name of your database.

The name differs for different database systems. For example, `datasource` is the SID or the service name when you are connecting to an Oracle database. Or, `datasource` is the catalog name when you are connecting to a MySQL database.

For details about your database name, contact your database administrator or refer to your database documentation.

Data Types: `char` | `string`

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `''`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `''`.

Data Types: `char` | `string`

`driver` — JDBC driver name
character vector | string scalar

JDBC driver name, specified as a character vector or string scalar that refers to the name of the Java driver that implements the `java.sql.Driver` interface. For details, see JDBC driver name and database connection URL on page 9-76.

Data Types: `char` | `string`

`url` — Database connection URL
character vector | string scalar

Database connection URL, specified as a character vector or string scalar for the vendor-specific URL. This URL is typically constructed using connection properties such as server name, port number, and database name. For details, see JDBC driver name and database connection URL on page 9-76. If you do not know the driver name or the URL, you can use name-value pair arguments to specify individual connection properties.

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `'Vendor','MySQL','Server','remotehost'` connects to a MySQL database using a JDBC driver on a machine named `remotehost`.

Tip: When creating a JDBC connection using the JDBC connection options, you can omit:

- `'Server'` name-value pair argument when connecting to a database locally
- `'PortNumber'` name-value pair argument when connecting to a database server listening on the default port (except for Oracle connections)

ODBC and JDBC Connection Options

`AutoCommit` — Auto-commit transactions
`'on'` (default) | `'off'`

Auto-commit transactions, specified as the comma-separated pair consisting of `'AutoCommit'` and one of these values:

- `'on'` — Database transactions are automatically committed to the database.
- `'off'` — Database transactions must be committed to the database manually.

Example: `'AutoCommit','off'`

`LoginTimeout` — Login timeout
`0` (default) | positive numeric scalar

Login timeout, specified as the comma-separated pair consisting of `'LoginTimeout'` and a positive numeric scalar. The login timeout specifies the number of seconds that the driver waits while trying to connect to a database before throwing an error.

To specify no login timeout for the connection attempt, set the value to `0`.

When login timeout is unsupported by the database, the value is `-1`.

Example: `'LoginTimeout',5`

Data Types: `double`

`ReadOnly` — Read-only database data
`'off'` (default) | `'on'`

Read-only database data, specified as the comma-separated pair consisting of `'ReadOnly'` and one of these values:

- `'on'` — Database data is read-only.
- `'off'` — Database data is writable.

Example: `'ReadOnly','on'`

JDBC Connection Options

`Vendor` — Database vendor
`'MySQL'` | `'Oracle'` | `'Microsoft SQL Server'` | `'PostgreSQL'`

Database vendor, specified as the comma-separated pair consisting of `'Vendor'` and one of these values:

- `'MySQL'`
- `'Oracle'`
- `'Microsoft SQL Server'`

- 'PostgreSQL'

If you are connecting to a database system not listed here, use the `driver` and `url` syntax.

Example: `'Vendor','Oracle'`

`Server` — Database server
`'localhost'` (default) | character vector | string scalar

Database server name or address, specified as the comma-separated pair consisting of `'Server'` and a character vector or string scalar.

Example: `'Server','remotehost'`

Data Types: `char` | `string`

`PortNumber` — Server port number
numeric scalar

Server port number where the server is listening, specified as the comma-separated pair consisting of `'PortNumber'` and a numeric scalar.

Example: `'PortNumber',1234`

Data Types: `double`

`AuthType` — Authentication type
`'Server'` (default) | `'Windows'`

Authentication type (required only for Microsoft SQL Server), specified as the comma-separated pair consisting of `'AuthType'` and one of these values:

- `'Server'` — Microsoft SQL Server authentication
- `'Windows'` — Windows authentication

Example: `'AuthType','Windows'`

`DriverType` — Driver type
`'thin'` | `'oci'`

Driver type (required only for Oracle), specified as the comma-separated pair consisting of `'DriverType'` and one of these values:

- `'thin'` — Thin driver
- `'oci'` — Windows authentication

Example: `'DriverType','thin'`

Output Arguments

conn — Database connection
`connection` object

Database connection, returned as a `connection` object.

Definitions

JDBC Driver Name and Database Connection URL

The JDBC driver name and database connection URL take different forms for different databases. For details, consult your database driver documentation.

Database	JDBC Driver Name and Database URL Example Syntax
IBM® Informix®	**JDBC driver:** `com.informix.jdbc.IfxDriver` **Database URL:** `jdbc:informix-sqli://161.144.202.206:3000:INFORMIXSERVER=stars`
Microsoft SQL Server 2005	**JDBC driver:** `com.microsoft.sqlserver.jdbc.SQLServerDriver` **Database URL:** `jdbc:sqlserver://localhost:port;database=databasename`

Database	JDBC Driver Name and Database URL Example Syntax
MySQL	**JDBC driver:** `twz1.jdbc.mysql.jdbcMysqlDriver` **Database URL:** `jdbc:z1MySQL://natasha:3306/metrics` **JDBC driver:** `com.mysql.jdbc.Driver` **Database URL:** `jdbc:mysql://devmetrics.mrkps.com/testing` To insert or select characters with encodings that are not default, append the value `useUnicode=true&characterEncoding=`*`encoding`* to the URL, where *`encoding`* is any valid MySQL character encoding followed by &. For example, `useUnicode=true&characterEncoding=utf8&`. *The trailing & is required.*
Oracle oci7 drivers	**JDBC driver:** `oracle.jdbc.driver.OracleDriver` **Database URL:** `jdbc:oracle:oci7:@rex`
Oracle oci8 drivers	**JDBC driver:** `oracle.jdbc.driver.OracleDriver` **Database URL:** `jdbc:oracle:oci8:@111.222.333.44:1521:` **Database URL:** `jdbc:oracle:oci8:@frug`
Oracle 10 Connections with JDBC (Thin drivers)	**JDBC driver:** `oracle.jdbc.driver.OracleDriver` **Database URL:** `jdbc:oracle:thin:`
Oracle Thin drivers	**JDBC driver:** `oracle.jdbc.driver.OracleDriver` **Database URL:** `jdbc:oracle:thin:@144.212.123.24:1822:` **Database URL:** `jdbc:oracle:thin:@(DESCRIPTION = (ADDRESS = (PROTOCOL = TCP)(HOST = ServerName)(PORT = 1234)) (CONNECT_DATA = (SERVER = DEDICATED) (SERVICE_NAME = dbname) ) )`
PostgreSQL	**JDBC driver:** `org.postgresql.Driver` **Database URL:** `jdbc:postgresql://host:port/database`

Database	JDBC Driver Name and Database URL Example Syntax
PostgreSQL with SSL Connection	**JDBC driver:** `org.postgresql.Driver` **Database URL:** `jdbc:postgresql:servername:dbname:ssl=true&sslfactory=org.postgresql.ssl.NonValidatingFactory&` *The trailing & is required.*
Teradata®	**JDBC driver:** `com.teradata.jdbc.TeraDriver` **Database URL:** `jdbc:teradata://DatabaseServerName`

Alternative Functionality

Database Explorer App

The `database` function connects to a database using the command line. To connect to a database and explore its data in a visual way, use the **Database Explorer** app.

See Also

Functions
`close` | `datainsert` | `exec` | `fetch` | `isopen` | `select` | `update`

Apps
Database Explorer

Topics

“Setup Requirements for Database Connection” on page 2-12
“Connection Options” on page 2-9
“Configuring Driver and Data Source” on page 2-15
“Microsoft SQL Server ODBC for Windows” on page 2-24
“Microsoft SQL Server JDBC for Windows” on page 2-32
“PostgreSQL JDBC for Windows” on page 2-72
“Connecting to Database” on page 2-142
“Import Data from Database Table Using sqlread Function” on page 5-52
“Insert Data into Database Table” on page 5-55

“Retrieve Database Metadata” on page 5-58
“Retrieve Database Metadata” on page 5-58
“Database Connection Error Messages” on page 3-10
“Java Class Path” (MATLAB)

Introduced before R2006a

datastore

(Not recommended) Create datastore to access collection of data in a database

---

Note `datastore` is not recommended. Use `databaseDatastore` instead.

This `datastore` function creates a `DatabaseDatastore` object. You can use this object to read large volumes of data in a relational database.

A `DatabaseDatastore` is one of the available datastore types. You can create other types of datastores using the MATLAB function `datastore`. After creating any datastore, you can analyze data by writing custom functions to run MapReduce using the `mapreduce` function. For details, see “Getting Started with MapReduce” (MATLAB).

Syntax

```
dbds = datastore(conn,sqlquery)
```

Description

`dbds = datastore(conn,sqlquery)` creates a `DatabaseDatastore` object `dbds` using the database connection `conn`. This datastore contains query results from the executed SQL query `sqlquery`.

Examples

Create a DatabaseDatastore

Create a database connection `conn` using the ODBC driver. This code assumes that you are connecting to a MySQL database with the data source named `MySQL`, user name `username`, and password `pwd`. `MySQL` contains the table named `productTable` with 15 product records.

```
conn = database('MySQL','username','pwd');
```

Create a `DatabaseDatastore` object `dbds` using the database connection `conn` and SQL query `sqlquery`. This SQL query retrieves all products from the product table `productTable`.

```
sqlquery = 'SELECT * FROM productTable';

dbds = datastore(conn,sqlquery)
```

```
dbds = 

  DatabaseDatastore with properties:

       Connection: [1×1 database.odbc.connection]
            Query: 'SELECT * FROM productTable'
    VariableNames: {1×5 cell}
         ReadSize: 10000
```

`datastore` executes the SQL query `sqlquery` and creates a `cursor` object with the resulting data. `dbds` contains these properties:

- `connection` object
- Executed SQL query
- Column names of the executed SQL query
- Number of rows to read from the SQL query results

Display the database connection property `Connection`.

```
dbds.Connection
```

```
ans = 

  connection with properties:

                DataSource: 'MySQLdb'
                  UserName: 'username'
                   Message: ''
                      Type: 'ODBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
```

```
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toy_store'
                    Catalogs: {'information_schema', 'toy_store'}
                     Schemas: {}

  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '5.5.46-0+deb7u1'
                  DriverName: 'myodbc5a.dll'
               DriverVersion: '05.03.0004'
```

The `Message` property is blank when the database connection is successful.

Close the `DatabaseDatastore` and database connection.

```
close(dbds)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar.

For information about the SQL query language, see the SQL Tutorial.

Example: `SELECT * FROM invoice` selects all columns and rows from the `invoice` table.

Data Types: `char` | `string`

Output Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in database, returned as a `DatabaseDatastore` object.

See Also

`close` | `database` | `databaseDatastore` | `datastore` | `preview` | `read`

Topics

"Import Large Data Using DatabaseDatastore Object" on page 5-31
`DatabaseDatastore`
"Getting Started with Datastore" (MATLAB)

Introduced in R2014b

hasdata

Package: matlab.io.datastore

Determine if data in DatabaseDatastore is available to read

Syntax

```
tf = hasdata(dbds)
```

Description

tf = hasdata(dbds) returns logical 1 (true) if there is data available to read from the DatabaseDatastore object dbds. Otherwise, it returns logical 0 (false).

Note If there is no more data to read from the query, hasdata returns logical 0.

Examples

Determine If DatabaseDatastore Object Contains More Data

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to database toy_store, database server dbtb04, and port number 54317.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a DatabaseDatastore object using the database connection and SQL query. This SQL query reads the first 30 rows of data from the table.

```
sqlquery = 'select top 30 * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Read the first 10 rows.

```
dbds.ReadSize = 10;
read(dbds)
```

```
ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    __

    1990    9         4            2            1228       1230          1350       134
    1990    9        12            3            1125       1125          1231       123
    1990    9        23            7            1721       1719          2201       220
    1990    9        27            4             645        645           802        81
    1990    9         3            1             710        711           837        84
    1990    9        20            4            1338       1335          1853       190
    1990    9        22            6             900        900          1241       122
    1990    9         3            1             925        755          1258       114
    1990    9        29            6            1434       1435          1615       163
    1990    9         2            7             NaN       1805           NaN       190
```

Determine if the `DatabaseDatastore` object has additional data.

```
hasdata(dbds)
```

```
ans =

  logical

   1
```

When more data is available in `dbds`, `hasdata` returns `1`.

Read the rest of the data in `dbds` 10 rows at a time.

```
while(hasdata(dbds))
     read(dbds)
end
```

```
ans =
```

```
    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1990    9         4            2            1228       1230          1350       134
    1990    9        12            3            1125       1125          1231       123
    1990    9        23            7            1721       1719          2201       220
    1990    9        27            4             645        645           802        81
    1990    9         3            1             710        711           837        84
    1990    9        20            4            1338       1335          1853       190
    1990    9        22            6             900        900          1241       122
    1990    9         3            1             925        755          1258       114
    1990    9        29            6            1434       1435          1615       163
    1990    9         2            7             NaN       1805           NaN       190

ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1990    9        23            7            1721       1719          2201       220
    1990    9        27            4             645        645           802        81
    1990    9         3            1             710        711           837        84
    1990    9        20            4            1338       1335          1853       190
    1990    9        22            6             900        900          1241       122
    1990    9         3            1             925        755          1258       114
    1990    9        29            6            1434       1435          1615       163
    1990    9         2            7             NaN       1805           NaN       190
    1990    9        11            2             908        910          1613       155
    1990    9        22            6            1801       1750          2005       193
```

When no more data remains in `dbds`, `hasdata` returns logical `0` and the `while` loop stops.

Close the `DatabaseDatastore` object and database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

See Also

`close` | `database` | `databaseDatastore` | `read`

Topics

“Import Large Data Using DatabaseDatastore Object” on page 5-31
“Analyze Large Data in Database Using Tall Arrays”
“Analyze Large Data in Database Using MapReduce”
`DatabaseDatastore`

Introduced in R2014b

isopen

Package: database.odbc

Determine if database connection is open

Syntax

```
i = isopen(conn)
```

Description

`i = isopen(conn)` returns `1` if the database connection is open and `0` if the database connection is closed or invalid.

Examples

Determine If Database Connection Is Open

Connect to a Microsoft® SQL Server® database and verify the database connection. Then, import data from the database into MATLAB®. Determine the highest unit cost among the retrieved products in the table. Close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Determine if the database connection is open. The `isopen` function returns the numeric scalar `1`, which means the database connection is open.

```
i = isopen(conn)
```

```
i =

     1
```

Select all the data from `productTable` and sort it by the product number. `data` is a table containing the imported data that results from executing the SQL `SELECT` statement.

```
selectquery = 'SELECT * FROM productTable ORDER BY productNumber';
data = select(conn,selectquery);
```

Display the first three rows of data.

```
data(1:3,:)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans =
```

```
    24
```

Close the database connection.

```
close(conn)
```

Determine if the database connection is closed. The `isopen` function returns the numeric scalar `0`, which means the database connection is closed. If the database connection is invalid, the `isopen` function returns the same result.

```
i = isopen(conn)
```

```
i =

     0
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

See Also

`close` | `database` | `fetch`

Topics

“Import Data from Database Table Using sqlread Function” on page 5-52
“Insert Data into Database Table” on page 5-55
“Connecting to Database” on page 2-142

Introduced in R2015b

preview

Package: matlab.io.datastore

Return subset of data from `DatabaseDatastore`

Syntax

```
data = preview(dbds)
```

Description

`data = preview(dbds)` returns the first eight rows of data from the `DatabaseDatastore` object `dbds` without changing its current position.

Note `preview` returns data as a table only. `preview` ignores database preference settings for data return formatting.

If there is no data to read from the query, `preview` throws an error.

Examples

Preview Data

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using the database connection and SQL query. This SQL query reads all data from the table.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Preview the first eight records in the data set returned by executing the SQL query in the `DatabaseDatastore` object.

```
preview(dbds)
```

```
ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1990    9        22            6            1801       1750          2005       193
    1990    9        11            2             908        910          1613       155
    1990    9         2            7             NaN       1805           NaN       190
    1990    9        29            6            1434       1435          1615       163
    1990    9         3            1             925        755          1258       114
    1990    9        22            6             900        900          1241       122
    1990    9        20            4            1338       1335          1853       190
    1990    9         3            1             710        711           837        84
```

Close the `DatabaseDatastore` object and database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

Output Arguments

data — Query results
table

Query results, returned as a table of the first eight records in the data set. Executing the SQL statement specified in the `Query` property of the `DatabaseDatastore` object creates the data set.

If there is no data to read from the query, `preview` throws an error.

See Also

`close` | `database` | `databaseDatastore` | `read`

Topics

"Import Large Data Using DatabaseDatastore Object" on page 5-31
"Analyze Large Data in Database Using Tall Arrays"
"Analyze Large Data in Database Using MapReduce"
`DatabaseDatastore`

Introduced in R2014b

read

Package: matlab.io.datastore

Read data in `DatabaseDatastore`

Syntax

```
data = read(dbds)
[data,info] = read(dbds)
```

Description

`data = read(dbds)` returns data from the `DatabaseDatastore` object in increments specified by the `ReadSize` property of the `DatabaseDatastore` object. Subsequent calls to the `read` function continue reading from the endpoint of the previous call.

Note `read` returns data as a table only. `read` ignores database preference settings for data return formatting.

If there is no more data to read from the query, `read` throws an error.

`[data,info] = read(dbds)` returns database information `info`.

Note The syntax `data = read(dbds,rowcount)` has been removed. Set the `DatabaseDatastore` property `ReadSize` instead.

Examples

Read Data

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using the database connection and SQL query. This SQL query retrieves all data from the table. Specify reading a maximum of 10 records from the executed SQL query.

```
sqlquery = 'select * from airlinesmall';
```

```
dbds = databaseDatastore(conn,sqlquery,'ReadSize',10);
```

Read the data in the `DatabaseDatastore` object.

```
data = read(dbds)
```

```
data =

    Year     Month     DayofMonth     DayOfWeek     DepTime     CRSDepTime     ArrTime     CRS
    ____     _____     __________     _________     _______     __________     _______     ___

    1987     10        28             3             1140        1140           1212        121
    1987     10         9             5             1155        1155           1250        130
    1987     10        22             4              715         715            807         80
    1987     10        16             5             1553        1555           1641        164
    1987     10        30             5             1821        1815           1956        195
    1987     10        12             1             1300        1300           1529        152
    1987     10         7             3              810         810            904         90
    1987     10        19             1              733         735            827         83
    1987     10        15             4              828         830            916         92
    1987     10         4             7             1750        1735           1837        181
```

`data` contains the query results.

Close the `DatabaseDatastore` object and database connection.

```
close(dbds)
```

Read Data and Database Information

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using the database connection and SQL query. This SQL query retrieves all data from the table. Specify reading a maximum of 10 records from the executed SQL query.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery,'ReadSize',10);
```

Read the data in the `DatabaseDatastore` object and retrieve information about the database.

```
[data,info] = read(dbds)


data = 

    Year     Month     DayofMonth     DayOfWeek     DepTime     CRSDepTime     ArrTime     CRS
    ____     _____     __________     _________     _______     __________     _______     ___

    1987     10        28             3             1140        1140           1212        121
    1987     10         9             5             1155        1155           1250        130
    1987     10        22             4              715         715            807         80
    1987     10        16             5             1553        1555           1641        164
    1987     10        30             5             1821        1815           1956        195
    1987     10        12             1             1300        1300           1529        152
    1987     10         7             3              810         810            904         90
    1987     10        19             1              733         735            827         83
    1987     10        15             4              828         830            916         92
    1987     10         4             7             1750        1735           1837        181


info = 

  struct with fields:
```

```
    datasource: 'toy_store'
        offset: 10
```

`data` contains the query results. The structure `info` contains the data source name `datasource` and current cursor position `offset`.

Close the `DatabaseDatastore` object and database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

Output Arguments

data — Query results
table

Query results, returned as a table of the records in the data set. Executing the SQL statement specified in the `Query` property of the `DatabaseDatastore` object creates the data set. The `ReadSize` property of the `DatabaseDatastore` object specifies the number of rows in the table.

If there is no more data to read from the query, `read` throws an error.

`info` — Database information
structure

Database information, returned as a structure with these fields.

Field	Description
`datasource`	Data source name for ODBC drivers or a database name for JDBC drivers
`offset`	Current cursor position in the returned data set

See Also

`close` | `database` | `databaseDatastore` | `hasdata`

Topics

“Import Large Data Using DatabaseDatastore Object” on page 5-31
“Analyze Large Data in Database Using Tall Arrays”
“Analyze Large Data in Database Using MapReduce”
`DatabaseDatastore`

Introduced in R2014b

readall

Package: matlab.io.datastore

Read all data in `DatabaseDatastore`

Syntax

```
data = readall(dbds)
```

Description

`data = readall(dbds)` returns all the data in the `DatabaseDatastore` object `dbds`, and resets the `DatabaseDatastore` to the point where no data has been read from it.

Note `readall` returns data as a table only. `readall` ignores database preference settings for data return formatting.

Examples

Read All Data in `DatabaseDatastore` Object

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using the database connection and SQL query. This SQL query reads all data from the table.

```
sqlquery = 'select * from airlinesmall';
```

```
dbds = databaseDatastore(conn,sqlquery);
```

Read all data in the `DatabaseDatastore` object.

```
data = readall(dbds);
```

`data` contains the query results.

Display the first three rows of query results.

```
data(1:3,:)
```

```
ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1987    10       28            3            1140       1140          1212       121
    1987    10        9            5            1155       1155          1250       130
    1987    10       22            4             715        715           807        80
```

Close the `DatabaseDatastore` object and database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

Output Arguments

data — Query results
table

Query results, returned as a table of the records in the data set. Executing the SQL statement specified in the `Query` property of the `DatabaseDatastore` object creates the data set.

See Also

`close` | `database` | `databaseDatastore` | `preview` | `read`

Topics

"Import Large Data Using DatabaseDatastore Object" on page 5-31
"Analyze Large Data in Database Using Tall Arrays"
"Analyze Large Data in Database Using MapReduce"
`DatabaseDatastore`

Introduced in R2014b

reset

Package: matlab.io.datastore

Reset `DatabaseDatastore` to initial state

Syntax

```
reset(dbds)
```

Description

`reset(dbds)` resets the `DatabaseDatastore` object `dbds` to the state where no data has been read from it. Resetting allows re-reading from the same `DatabaseDatastore`.

Examples

Reset `DatabaseDatastore` Object to Initial State

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using the database connection and SQL query. This SQL query retrieves all data from the table. Specify reading a maximum of 10 records from the executed SQL query when using the `read` function.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery,'ReadSize',10);
```

Read data from the start of the data set.

```
read(dbds)
```

```
ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1987    10       28            3            1140       1140          1212       121
    1987    10        9            5            1155       1155          1250       130
    1987    10       22            4             715        715           807        80
    1987    10       16            5            1553       1555          1641       164
    1987    10       30            5            1821       1815          1956       195
    1987    10       12            1            1300       1300          1529       152
    1987    10        7            3             810        810           904        90
    1987    10       19            1             733        735           827        83
    1987    10       15            4             828        830           916        92
    1987    10        4            7            1750       1735          1837       181
```

`read` returns the first 10 records in the data set.

Reset the `DatabaseDatastore` object to the state where no data has been read from it. Resetting allows rereading from the same `DatabaseDatastore` object.

```
reset(dbds)
```

Read data from the start of the data set.

```
read(dbds)
```

```
ans =

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1987    10       28            3            1140       1140          1212       121
    1987    10        9            5            1155       1155          1250       130
    1987    10       22            4             715        715           807        80
    1987    10       16            5            1553       1555          1641       164
    1987    10       30            5            1821       1815          1956       195
    1987    10       12            1            1300       1300          1529       152
    1987    10        7            3             810        810           904        90
    1987    10       19            1             733        735           827        83
```

```
    1987    10       15            4             828        830           916        92
    1987    10        4            7            1750       1735          1837       181
```

`read` again returns the first 10 records in the data set.

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

See Also

`close` | `database` | `databaseDatastore` | `exec` | `read`

Topics

“Import Large Data Using DatabaseDatastore Object” on page 5-31
“Analyze Large Data in Database Using Tall Arrays”
“Analyze Large Data in Database Using MapReduce”
`DatabaseDatastore`

Introduced in R2014b

databaseDatastore

Datastore for data in database

Description

MATLAB has various datastores that let you import large data sets into MATLAB for analysis. A `DatabaseDatastore` object is a type of datastore that contains data from a database table or the results from executing an SQL query in a relational database. For details about other datastores, see “Getting Started with Datastore” (MATLAB).

With a `DatabaseDatastore` object, you can preview and read records or chunks in a data set and reset the `DatabaseDatastore` to its initial state. Also, you can analyze a large data set in a database using tall arrays or MapReduce.

Reading data from `DatabaseDatastore` objects is the same as executing the `fetch` function on the data set. Using `DatabaseDatastore` objects provides advantages that enable you to:

- Work with databases containing large amounts of data.
- Analyze large amounts of data using tall arrays with common MATLAB functions, such as `mean` and `histogram`. Create a tall array using the `tall` function. For details, see “Tall Arrays” (MATLAB).
- Write MapReduce algorithms that define the chunking and reduction of large amounts of data by using the `mapreduce` function. For details, see “Getting Started with MapReduce” (MATLAB). For an example, see “Analyze Large Data in Database Using MapReduce”. For more MapReduce examples, see Building Effective Algorithms with MapReduce (MATLAB).

Creation

Syntax

```
dbds = databaseDatastore(conn,source)
```

```
dbds = databaseDatastore(conn,source,Name,Value)

dbds = databaseDatastore(conn,source,opts)
dbds = databaseDatastore(conn,source,opts,Name,Value)
```

Description

`dbds = databaseDatastore(conn,source)` creates a `DatabaseDatastore` object using the database connection. This datastore contains data from a database table or the results from an executed SQL query.

`dbds = databaseDatastore(conn,source,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'ReadSize',100` retrieves 100 rows of data from the `DatabaseDatastore` object.

`dbds = databaseDatastore(conn,source,opts)` customizes the options for importing a large data set from a database using the `SQLImportOptions` object.

`dbds = databaseDatastore(conn,source,opts,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'Catalog','toy_store'` retrieves data from the `toy_store` database catalog.

Input Arguments

conn — Database connection

`connection` object

Database connection, specified as a `connection` object created with the `database` function.

source — Source

character vector | string scalar

Source, specified as a character vector or string scalar. The source indicates whether the `DatabaseDatastore` object stores data from a database table or the results from an executed SQL query.

Example: `'inventorytable'`

Example: `"SELECT productnumber,productname FROM producttable"`

Data Types: `char` | `string`

opts — Database import options
SQLImportOptions object

Database import options, specified as an SQLImportOptions object.

Specify optional comma-separated pairs of Name,Value arguments. Name is the argument name and Value is the corresponding value. Name must appear inside quotes. You can specify several name and value pair arguments in any order as Name1,Value1,...,NameN,ValueN.

Example: databaseDatastore(conn,source,'ReadSize',100,'Catalog','toy_store') creates a DatabaseDatastore object and stores 100 rows of data from a table or SQL query using the toy_store database catalog.

ReadSize — Number of rows to return
numeric scalar

Number of rows to return, specified as the comma-separated pair consisting of 'ReadSize' and a positive numeric scalar. Use this name-value pair argument to limit the number of rows for retrieval from the DatabaseDatastore object.

Example: 1000

Data Types: double

Catalog — Database catalog name
character vector | string scalar

Database catalog name, specified as the comma-separated pair consisting of 'Catalog' and a character vector or string scalar. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have numerous catalogs.

Use the 'Catalog' name-value pair argument only when source is a database table.

Example: 'Catalog','toy_store'

Data Types: char | string

Schema — Database schema name
character vector | string scalar

Database schema name, specified as the comma-separated pair consisting of 'Schema' and a character vector or string scalar. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Use the `'Schema'` name-value pair argument only when `source` is a database table.

Example: `'Schema','dbo'`

Data Types: `char` | `string`

Limitations

- The `DatabaseDatastore` object supports only Microsoft SQL Server 2012 and later versions.
- The `DatabaseDatastore` object does not support using a parallel pool with Parallel Computing Toolbox installed. To analyze data using tall arrays or to run MapReduce algorithms, set the global execution environment to be the local MATLAB session by using `mapreducer`. Enter this code:

  ```
  mapreducer(0)
  ```

  For details about controlling parallel resources, see "Run mapreduce on a Parallel Pool" (Parallel Computing Toolbox).

Properties

Connection — Database connection
`connection` object

This property is read-only.

Database connection, specified as a `connection` object created using `database`.

Query — SQL query
character vector

This property is read-only.

SQL query, specified as a character vector that specifies the SQL query to execute in the database.

Data Types: `char`

`VariableNames` — Column names of retrieved data table
cell array of character vectors

This property is read-only.

Column names of the retrieved data table, specified as a cell array of one or more character vectors.

Data Types: `char`

`ReadSize` — Number of rows to read
10000 (default) | numeric scalar

Number of rows to read from the retrieved data table, specified as a nonnegative numeric scalar. To specify the number of rows to read, set the `ReadSize` property.

Example: `dbds.ReadSize = 5000;`

Data Types: `double`

Object Functions

hasdata	Determine if data in DatabaseDatastore is available to read
preview	Return subset of data from DatabaseDatastore
read	Read data in DatabaseDatastore
readall	Read all data in DatabaseDatastore
reset	Reset DatabaseDatastore to initial state
close	Close and invalidate database and driver resource utilizer

Examples

Create `DatabaseDatastore` Object Using SQL Query Results

Create a `DatabaseDatastore` object using the results from a SQL query. Then, preview a large data set.

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to the database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using a database connection and SQL query. This SQL query retrieves all flight data from the `airlinesmall` table. `databaseDatastore` executes the SQL query.

```
sqlquery = 'select * from airlinesmall';
```

```
dbds = databaseDatastore(conn,sqlquery)
```

```
dbds = 

  DatabaseDatastore with properties:

       Connection: [1×1 database.jdbc.connection]
            Query: 'select * from airlinesmall'
    VariableNames: {1×29 cell}
         ReadSize: 10000
```

`dbds` is a `DatabaseDatastore` object with these properties:

- `Connection` -- Database connection object
- `Query` -- Executed SQL query
- `VariableNames` -- List of column names from the executed SQL query
- `ReadSize` -- Maximum number of records to read from the executed SQL query

Display the database connection property.

```
dbds.Connection
```

```
ans = 

  connection with properties:

                  DataSource: 'toy_store'
                    UserName: ''
                      Driver: 'com.microsoft.sqlserver.j ...'
                         URL: 'jdbc:sqlserver://dbtb04:5 ...'
                     Message: ''
                        Type: 'JDBC Connection Object'
```

```
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: 'toy_store'
                  Catalogs: {'master', 'model', 'msdb' ... and 2 more}
                   Schemas: {'db_accessadmin', 'db_backupoperator', 'db_datareader'

  Database and Driver Information:

       DatabaseProductName: 'Microsoft SQL Server'
    DatabaseProductVersion: '11.00.2100'
                DriverName: 'Microsoft JDBC Driver 4.0 ...'
             DriverVersion: '4.0.2206.100'
```

The `Message` property is blank when the database connection is successful.

Preview the first eight records in the large data set returned by executing the SQL query in the `DatabaseDatastore` object.

```
preview(dbds)
```

```
ans =

  8×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    ___

    1990      9          11            2         1810         1812         1939
    1990     10          27            6         1353         1355         1634
    1990     10          23            2         1057         1055         1205
    1990     10           8            1         1515         1440         1609
    1990     10          19            5         1130         1120         1203
    1990     10          12            5         1755         1733         1858
    2001     11          22            4         1345         1355         1530
    2001     11          26            1         2105         2110         2209
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Create `DatabaseDatastore` Object Using Database Table

Retrieve a large data set from a database table by creating a `DatabaseDatastore` object.

This example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load flight information in the MATLAB® workspace.

```
flights = readtable('airlinesmall_subset.xlsx');
```

Create the `flights` database table using the flight information.

```
tablename = 'flights';
sqlwrite(conn,tablename,flights)
```

Create a `DatabaseDatastore` object using a database connection and the `flights` database table.

```
dbds = databaseDatastore(conn,tablename)
```

```
dbds =
  DatabaseDatastore with properties:

       Connection: [1×1 database.odbc.connection]
            Query: 'SELECT * from flights'
    VariableNames: {1×29 cell}
         ReadSize: 10000
```

`dbds` is a `DatabaseDatastore` object with these properties:

- `Connection` — Database connection object
- `Query` — Executed SQL query
- `VariableNames` — List of column names from the executed SQL query
- `ReadSize` — Maximum number of records to read from the executed SQL query

Display the database connection property.

```
dbds.Connection
```

```
ans = 
  connection with properties:

                  DataSource: 'MS SQL Server Auth'
                    UserName: ''
                     Message: ''
                        Type: 'ODBC Connection Object'
  Database Properties:

                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 15
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toy_store'
                    Catalogs: {'master', 'msdb', 'tempdb' ... and 1 more}
                     Schemas: {'dbo', 'guest', 'INFORMATION_SCHEMA' ... and 2 more}

  Database and Driver Information:

         DatabaseProductName: 'Microsoft SQL Server'
      DatabaseProductVersion: '11.00.2100'
                  DriverName: 'sqlncli11.dll'
               DriverVersion: '11.00.6518'
```

The `Message` property is blank when the database connection is successful.

Preview the first eight records in the data set returned by executing the SQL query in the `DatabaseDatastore` object.

```
preview(dbds)
```

```
ans=8×29 table
    Year     Month     DayofMonth     DayOfWeek     DepTime     CRSDepTime     ArrTime     CRS
    ____     _____     __________     _________     _______     __________     _______     __

    1996       1           18             4           2117         2120           2305
    1996       1           12             5           1252         1245           1511
    1996       1           16             2           1441         1445           1708
    1996       1            1             1           2258         2300           2336
    1996       1            4             4           1814         1814           1901
    1996       1           31             3           1822         1820           1934
    1996       1           18             4            729          730            841
    1996       1           26             5           1704         1705           1829
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Create `DatabaseDatastore` Object with Specific Record Count

Create a `DatabaseDatastore` object by setting the `ReadSize` property. Then, preview a large data set.

Using a JDBC driver, create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The code assumes that you are connecting to the database `toy_store`, database server `dbtb04`, and port number `54317`.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Create a `DatabaseDatastore` object using a database connection and SQL query. This SQL query retrieves all flight data from the `airlinesmall` table. Specify reading a maximum of 1000 records from the executed SQL query. `databaseDatastore` executes the SQL query.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery,'ReadSize',1000)
```

```
dbds =
```

```
  DatabaseDatastore with properties:

       Connection: [1×1 database.jdbc.connection]
            Query: 'select * from airlinesmall'
    VariableNames: {1×29 cell}
         ReadSize: 1000
```

`dbds` is a `DatabaseDatastore` object with these properties:

- `Connection` -- Database connection object
- `Query` -- Executed SQL query
- `VariableNames` -- List of column names from the executed SQL query
- `ReadSize` -- Maximum number of records to read from the executed SQL query

Display the database connection property.

```
dbds.Connection
```

```
ans = 

  connection with properties:

                DataSource: 'toy_store'
                  UserName: ''
                    Driver: 'com.microsoft.sqlserver.j ...'
                       URL: 'jdbc:sqlserver://dbtb04:5 ...'
                   Message: ''
                      Type: 'JDBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: 'toy_store'
                  Catalogs: {'master', 'model', 'msdb' ... and 2 more}
                   Schemas: {'db_accessadmin', 'db_backupoperator', 'db_datareader'
```

```
  Database and Driver Information:

         DatabaseProductName: 'Microsoft SQL Server'
      DatabaseProductVersion: '11.00.2100'
                  DriverName: 'Microsoft JDBC Driver 4.0 ...'
               DriverVersion: '4.0.2206.100'
```

The `Message` property is blank when the database connection is successful.

Preview the first eight records in the large data set returned by executing the SQL query in the `DatabaseDatastore` object.

```
preview(dbds)
```

```
ans =

  8×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRS
    ____    _____    __________    _________    _______    __________    _______    __

    1990      9          11            2         1810         1812        1939
    1990     10          27            6         1353         1355        1634
    1990     10          23            2         1057         1055        1205
    1990     10           8            1         1515         1440        1609
    1990     10          19            5         1130         1120        1203
    1990     10          12            5         1755         1733        1858
    2001     11          22            4         1345         1355        1530
    2001     11          26            1         2105         2110        2209
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Create `DatabaseDatastore` Object Using Custom Import Options

Customize import options when importing a large data set from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database columns that contain logical data. Import and preview the data by creating a `DatabaseDatastore` object and using the `preview` function.

This example uses the `airlinesmall_subset.xls` spreadsheet, which contains the column `Cancelled`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load flight information into the MATLAB® workspace.

```
flights = readtable('airlinesmall_subset.xlsx');
```

Create the `flights` database table using the flight information.

```
tablename = 'flights';
sqlwrite(conn,tablename,flights)
```

Create an `SQLImportOptions` object using the `flights` database table with the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `Cancelled` variable.

```
varnames = 'Cancelled';
varOpts = getoptions(opts,varnames)
```

```
varOpts =
  SQLVariableImportOptions with properties:

  Variable Properties :
               Name: 'Cancelled'
               Type: 'double'
          FillValue: NaN
```

Set the import options for the data type of the specified variable to `logical`. Also, set the import options to replace missing data in the specified variable with the fill value `true`.

```
opts = setoptions(opts,varnames,'Type','logical', ...
    'FillValue',true);
```

Create the DatabaseDatastore object to import a large data set using the import options.

```
dbds = databaseDatastore(conn,tablename,opts);
```

Import the logical data in the selected variable and display a preview of the data. The imported data shows that the variable has the logical data type.

```
opts.SelectedVariableNames = varnames;
data = preview(dbds);
cancelled = data.Cancelled
```

```
cancelled = 8×1 logical array

   0
   0
   0
   0
   0
   0
   0
   0
```

Delete the flights database table using the execute function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Create DatabaseDatastore Object Using Custom Import Options and Database Catalog and Schema

Customize import options when importing a large data set from a database table. Control the import options by creating an SQLImportOptions object. Then, customize the import options for database columns that contain logical data. Create a DatabaseDatastore object using the specified database catalog and schema. Import the database data and preview it by using the preview function with the DatabaseDatastore object.

This example uses the `airlinesmall_subset.xls` spreadsheet, which contains the column `Cancelled`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load flight information into the MATLAB® workspace.

```
flights = readtable('airlinesmall_subset.xlsx');
```

Create the `flights` database table using the flight information and the `toy_store` database catalog and `dbo` database schema.

```
tablename = 'flights';
sqlwrite(conn,tablename,flights, ...
    'Catalog','toy_store','Schema','dbo')
```

Create an `SQLImportOptions` object using the `flights` database table and the `databaseImportOptions` function. Specify the `toy_store` database catalog and `dbo` database schema.

```
opts = databaseImportOptions(conn,tablename, ...
    'Catalog','toy_store','Schema','dbo');
```

Retrieve the default import options for the `Cancelled` variable.

```
varnames = 'Cancelled';
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
  SQLVariableImportOptions with properties:

  Variable Properties :
              Name: 'Cancelled'
              Type: 'double'
         FillValue: NaN
```

Set the import options for the data type of the specified variable to `logical`. Also, set the import options to replace missing data in the specified variable with the fill value `true`.

```
opts = setoptions(opts,varnames,'Type','logical', ...
    'FillValue',true);
```

Create the `DatabaseDatastore` object to import a large data set using import options, the `toy_store` database catalog, and the `dbo` database schema.

```
dbds = databaseDatastore(conn,tablename,opts, ...
    'Catalog','toy_store','Schema','dbo');
```

Import the logical data in the selected variable and display a preview of the data. The imported data shows that the variable has the `logical` data type.

```
opts.SelectedVariableNames = varnames;
data = preview(dbds);
cancelled = data.Cancelled
```

```
cancelled = 8×1 logical array

   0
   0
   0
   0
   0
   0
   0
   0
```

Delete the `flights` database table from the `toy_store` database catalog and the `dbo` database schema by using the `execute` function.

```
sqlquery = ['DROP TABLE toy_store.dbo.' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`database` | `databaseImportOptions` | `execute` | `fetch` | `getoptions` | `preview` | `reset` | `setoptions` | `sqlread`

Topics

“Import Large Data Using DatabaseDatastore Object” on page 5-31
“Analyze Large Data in Database Using Tall Arrays”
“Analyze Large Data in Database Using MapReduce”
“Getting Started with Datastore” (MATLAB)
“Getting Started with MapReduce” (MATLAB)
“Customize Options for Importing Data from Database into MATLAB” on page 5-61
“Importing Data Common Errors” on page 3-4

External Websites

SQL Tutorial

Introduced in R2014b

datainsert

Package: database.odbc

(To be removed) Export MATLAB data into database table

Note The `datainsert` function will be removed in a future release. Use the `sqlwrite` function instead.

Syntax

`datainsert(conn,tablename,colnames,data)`

Description

`datainsert(conn,tablename,colnames,data)` exports data from the MATLAB workspace and inserts it into existing columns of a database table using the database connection `conn`.

Examples

Export MATLAB Cell Array Data

Use an ODBC connection and a cell array to export inventory data from MATLAB into a MySQL database table.

Create a database connection `conn` to the MySQL database using the native ODBC interface. Here, this code assumes that you are connecting to an ODBC data source named `MySQL` with a user name and password. This database contains the table `inventoryTable` with these columns:

- `productNumber`
- `Quantity`

- Price
- inventoryDate

```
conn = database('MySQL','username','pwd');
```

Display the last rows in `inventoryTable` before inserting data.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [14]    [2000]    [19.1000]    '2014-10-22 10:52...'
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
```

Create a cell array of column names for the database table `inventoryTable`.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};
```

Define a cell array of input data to insert.

```
data = {50 100 15.50 datestr(now,'yyyy-mm-dd HH:MM:SS')};
```

Insert the input data into the table `inventoryTable` using the database connection.

```
tablename = 'inventoryTable';

datainsert(conn,tablename,colnames,data)
```

Display the inserted data in `inventoryTable`.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
    [50]    [ 100]    [15.5000]    '2014-10-22 11:29...'
```

The last row contains the inserted data.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Export MATLAB Table Data

Use a JDBC connection and a MATLAB table to export inventory data from MATLAB into a MySQL database table.

Create a database connection `conn` to the MySQL database using the JDBC driver. Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a MySQL database. Here, this code assumes that you are connecting to a database named `dbname` on a database server named `sname` with a user name and password. This database contains the table `inventoryTable` with these columns:

- `productNumber`
- `Quantity`
- `Price`
- `inventoryDate`

```
conn = database('dbname','username','pwd', ...
    'Vendor','MySQL', ...
    'Server','sname');
```

Display the last rows in `inventoryTable` before inserting data.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [14]    [2000]    [19.1000]    '2014-10-22 10:52...'
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
```

Create a cell array of column names for the database table `inventoryTable`.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};
```

Define the input data as a table.

```
data = table(50,100,15.50,{datestr(now,'yyyy-mm-dd HH:MM:SS')}, ...
    'VariableNames',colnames);
```

Insert the input data into the table `inventoryTable` using the database connection.

```
tablename = 'inventoryTable';
```

```
datainsert(conn,tablename,colnames,data)
```

Display the inserted data in `inventoryTable`.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
    [50]    [ 100]    [15.5000]    '2014-10-22 11:29...'
```

The last row contains the inserted data.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Export MATLAB Structure Data

Use an ODBC connection and a MATLAB structure to export inventory data from MATLAB into a MySQL database table.

Create a database connection `conn` to the MySQL database using the native ODBC interface. Here, this code assumes that you are connecting to an ODBC data source named `MySQL` with a user name and password. This database contains the table `inventoryTable` with these columns:

- `productNumber`
- `Quantity`
- `Price`
- `inventoryDate`

```
conn = database('MySQL','username','pwd');
```

Display the last rows in `inventoryTable` before inserting data.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [14]    [2000]    [19.1000]    '2014-10-22 10:52...'
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
```

Create a cell array of column names for the database table `inventoryTable`.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};
```

Define the input data as a structure.

```
data = struct('productNumber',50,'Quantity',100,'Price',15.50, ...
    'inventoryDate',datestr(now,'yyyy-mm-dd HH:MM:SS'));
```

Insert the input data into the table `inventoryTable` using the database connection.

```
tablename = 'inventoryTable';

datainsert(conn,tablename,colnames,data)
```

Display the inserted data in `inventoryTable`.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
    [50]    [ 100]    [15.5000]    '2014-10-22 11:29...'
```

The last row contains the inserted data.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Export MATLAB Numeric Matrix Data

Use a JDBC connection and a numeric matrix to export sales data from MATLAB into a MySQL database table.

Create a database connection `conn` to the MySQL database using the JDBC driver. Use the `Vendor` name-value pair argument of `database` to specify a connection to a MySQL database. Here, this code assumes that you are connecting to a database named `dbname` on a database server named `sname` with a user name and password. This database contains the table `salesVolume` with the column `stockNumber` and columns for each month of the year.

```
conn = database('dbname','username','pwd', ...
    'Vendor','MySQL', ...
    'Server','sname');
```

Display the last rows in `salesVolume` before inserting data.

```
curs = exec(conn,'SELECT * FROM salesVolume');
curs = fetch(curs);
curs.Data
```

```
ans =

  Columns 1 through 8

    ...
```

```
    [470816]    [3100]    [9400]    [1540]    [1500]    [1350]    [1190]    [ 900]
    [510099]    [ 235]    [1800]    [1040]    [ 900]    [ 750]    [ 700]    [ 400]
    [899752]    [ 123]    [1700]    [ 823]    [ 701]    [ 689]    [ 621]    [ 545]

  Columns 9 through 13

    ...
    [867]    [ 923]    [1400]    [ 3000]    [35000]
    [350]    [ 500]    [ 100]    [ 3000]    [18000]
    [421]    [ 495]    [ 650]    [ 4200]    [11000]
```

Create a cell array of column names for the database table `salesVolume`.

```
colnames = {'stockNumber','January','February' ...
    'March','April','May', ...
    'June','July','August', ...
    'September','October','November', ...
    'December'};
```

Define the numeric matrix `data` that contains the sales volume data.

```
data = [777666,0,350,400,450,250,450,500,515, ...
    235,100,300,600];
```

Insert the contents of `data` into the table `salesVolume` using the database connection.

```
tablename = 'salesVolume';

datainsert(conn,tablename,colnames,data)
```

Display the inserted data in `salesVolume`.

```
curs = exec(conn,'SELECT * FROM salesVolume');
curs = fetch(curs);
curs.Data
```

```
ans =

  Columns 1 through 8

    ...
    [510099]    [ 235]    [1800]    [1040]    [ 900]    [ 750]    [ 700]    [ 400]
    [899752]    [ 123]    [1700]    [ 823]    [ 701]    [ 689]    [ 621]    [ 545]
    [777666]    [   0]    [ 350]    [ 400]    [ 450]    [ 250]    [ 450]    [ 500]

Columns 9 through 13

    ...
    [350]    [ 500]    [ 100]    [ 3000]    [18000]
    [421]    [ 495]    [ 650]    [ 4200]    [11000]
    [515]    [ 235]    [ 100]    [  300]    [  600]
```

The last row contains the inserted data.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

tablename — Database table name
character vector | string scalar

Database table name, specified as a character vector or string scalar denoting the name of a table in the database.

Example: `'employees'`

Data Types: `char` | `string`

colnames — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table `tablename`.

Example: `{'col1','col2','col3'}`

Data Types: `cell` | `string`

data — Insert data
cell array | numeric matrix | table | structure | dataset

Insert data, specified as a cell array, numeric matrix, table, structure, or dataset array.

If you are connecting to a database using a JDBC driver, then convert the insert data to a supported format before running `datainsert`. If `data` contains MATLAB dates, times, or timestamps, use this formatting:

- Dates must be character vectors of the form `yyyy-mm-dd`.
- Times must be character vectors of the form `HH:MM:SS`.
- Timestamps must be character vectors of the form `yyyy-mm-dd HH:MM:SS.FFF`.

The database preference settings `NullNumberWrite` and `NullStringWrite` do not apply to this function. If `data` contains `null` entries and `NaN`s, convert these entries to an empty value `''`.

The `datainsert` function supports inserting MATLAB date numbers and `NaN`s when `data` is a numeric matrix. Date numbers inserted into database date and time columns convert to `java.sql.Date`. Upon insertion into the target database, any converted date and time data accurately reverts to the native database format.

If `data` is a structure, then field names in the structure must match `colnames`.

If `data` is a table or a dataset array, then the variable names in the table or dataset array must match `colnames`.

Tips

- When you establish a database connection using a JDBC driver, `datainsert` performs faster than `fastinsert`.
- `datainsert` uses the SQL `TRANSACTION` statement to insert records with faster performance for these databases:

  - Microsoft SQL Server
  - MySQL
  - Oracle
  - PostgreSQL

  For other databases, refer to your database documentation to start a transaction manually. Before running `datainsert`, use `exec` to start the transaction.
- The value of the `AutoCommit` property in the `connection` object determines whether `datainsert` automatically commits the data to the database.

  - To view the `AutoCommit` value, access it using the `connection` object; for example, `conn.AutoCommit`.

- To set the `AutoCommit` value, use the corresponding name-value pair argument in the `database` function.
- To commit the data to the database, use the `commit` function or issue an SQL `COMMIT` statement using the `exec` function.
- To roll back the data, use `rollback` or issue an SQL `ROLLBACK` statement using the `exec` function.

Alternative Functionality

To export MATLAB data into a database, you can use the `fastinsert` and `insert` functions. For maximum performance, use `datainsert`.

See Also

`close` | `database` | `fastinsert` | `insert` | `select` | `sqlwrite`

Topics

“Insert Data into Database Table” on page 5-55
“Export Data Using Bulk Insert” on page 5-19
“Replace Existing Data in Database” on page 5-17
“Roll Back Data After Updating Record” on page 5-14
“Data Type Support” on page 1-3

External Websites

SQL Tutorial

Introduced in R2011a

Database Explorer

Configure, explore, and import database data

Description

The **Database Explorer** app lets you quickly connect to a database, explore the database data, and import data into the MATLAB workspace in a visual way. If you have minimal proficiency writing SQL queries or want to browse the data in your database quickly, use this app to interact with your database.

You can:

- Create and configure ODBC and JDBC data sources.
- Establish multiple connections to the same or different databases.
- Select tables and columns of interest.
- Fine-tune selection using SQL query criteria.
- Preview selected data.
- Import selected data into the MATLAB workspace for analysis.
- Save generated SQL queries.
- Generate MATLAB code.

To watch an introductory video, see Using the Database Explorer App.

Open the Database Explorer App

- MATLAB Toolstrip: On the **Apps** tab, click the **Show more** arrow to open the apps gallery. Then, under **Database Connectivity and Reporting**, click **Database Explorer**.
- MATLAB command prompt: Enter `databaseExplorer`.

Examples

Preview Rows in Single Table

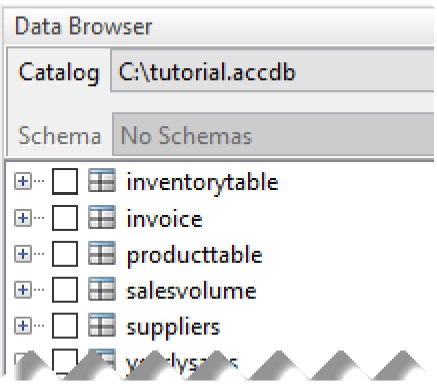
Connect to a Microsoft Access database using the Database Explorer app. Then, select columns from a single table and preview the data. The Database Explorer app previews query results by default.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see "Microsoft Access ODBC for Windows" on page 2-18.

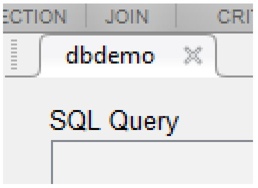
In the **Data Source** section of the **Database Explorer** tab, click **New Query**. The Connect to a Data Source dialog box opens. Select `dbdemo` from the **Data Source** list. Leave the user name and password blank, and click **Connect**.

Note For other databases, the Catalog and Schema dialog box opens. Select the name of the catalog and schema from the **Catalog** and **Schema** lists, as appropriate for your database.

The Database Explorer app creates a connection to the Microsoft Access database. The **Data Browser** pane displays the available tables in the database.



The data source tab, which is named **dbdemo**, appears to the right of the **Data Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



For any table, you can select the table information in these ways:

- To select tables, click the database table name in the **Data Browser** pane. The Database Explorer app updates the **SQL Query** pane with an SQL query that selects all columns and rows from the chosen table. Simultaneously, the Database Explorer app updates the **Data Preview** pane with a preview of the query results. The first 10 rows of data appear in the **Data Preview** pane by default.
- To select individual columns from a selected table, expand the table name node in the **Data Browser** tree view. Select specific check boxes to choose individual table columns and display them in the **Data Preview** pane. The SQL query adjusts to each selection automatically.

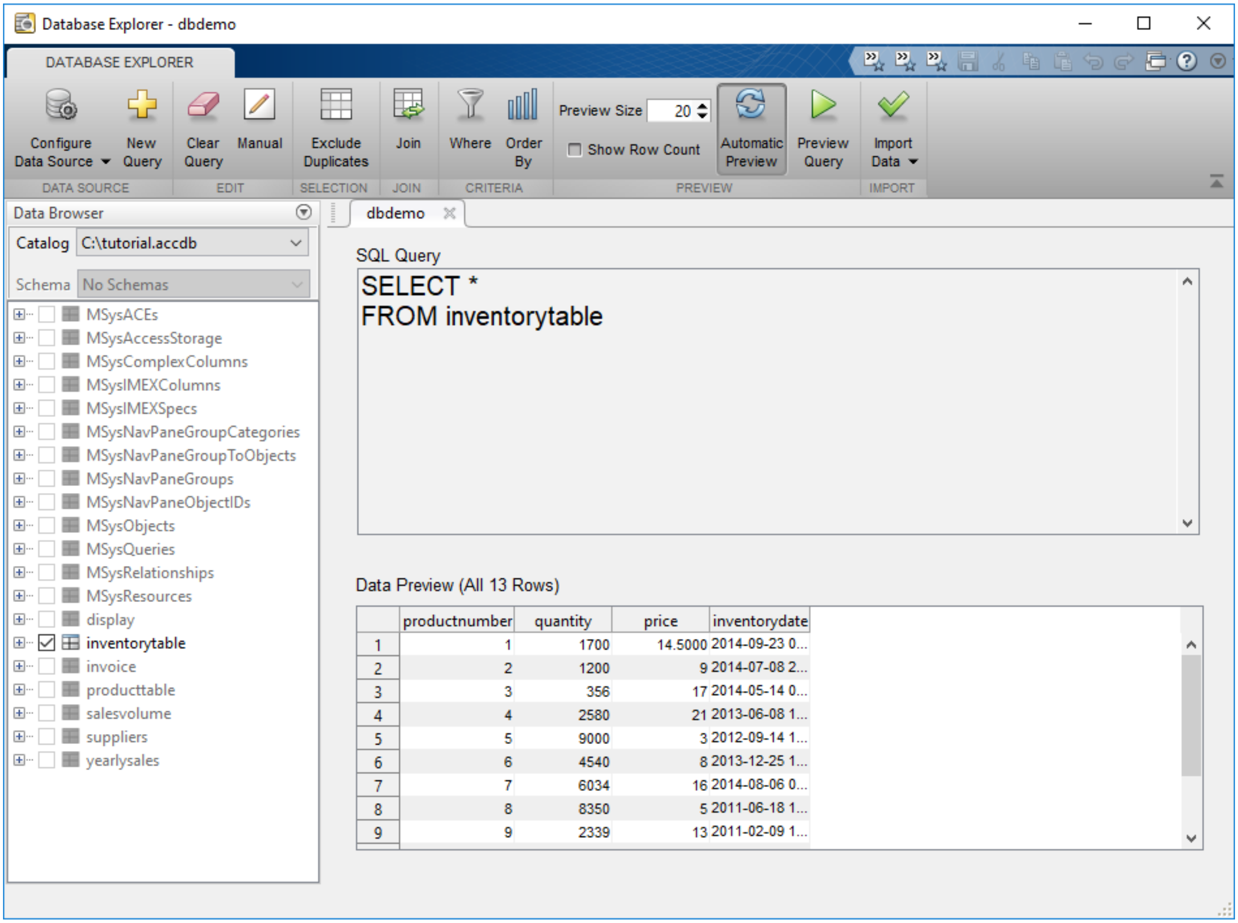
Note The order of the columns in the **Data Preview** pane matches the order in which you select them in the **Data Browser** pane.

Select the table name **inventorytable**.

To change the data you see, select or clear check boxes in the **Data Browser** pane. The SQL query updates in the **SQL Query** pane. The data updates in the **Data Preview** pane.

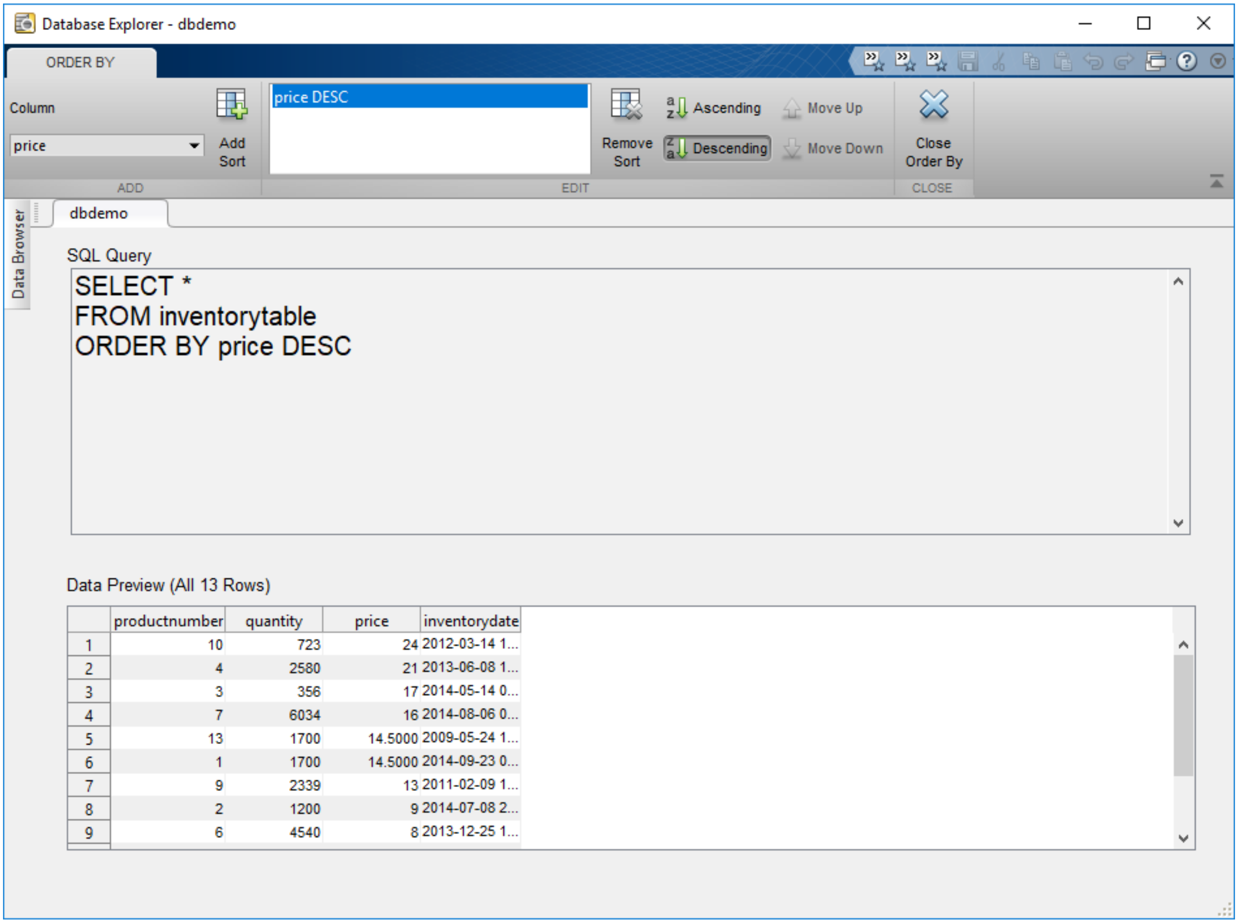
The **Data Preview** pane displays 10 rows. The total number of rows selected in the database appears, within parentheses, next to the name of the pane, **Data Preview**. Change the number of rows by selecting or entering a value in the **Preview Size** box in the **Preview** section of the **Database Explorer** tab. Select the value `20`. The number of rows adjusts in the **Data Preview** pane.

Note The value in the **Preview Size** box controls the maximum number of rows displayed in the **Data Preview** pane. If this value is larger than the total number of rows in the query results, then the total number of rows is displayed, within parentheses, next to the name of the pane, **Data Preview**.

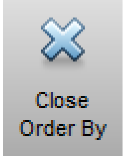


You can sort the rows of data by a specific column. In the **Criteria** section, click **Order By**. The **Order By** tab is displayed in the toolstrip.

In the **Add** section, in the **Column** list, select the column `price`. In the **Add** section, click **Add Sort**. The Database Explorer app sorts the data in ascending order in the **Data Preview** pane. To change the order, click **Descending** in the **Edit** section.



Note To add more sorts, select another column from the **Column** list and click **Add Sort**. You can change the position of the sort in the SQL query by clicking it in the list in the **Edit** section, and then clicking **Move Up** or **Move Down**.

In the **Close** section, click **Close Order By** 

to close the **Order By** tab.

Close the database connection by closing the data source tab.

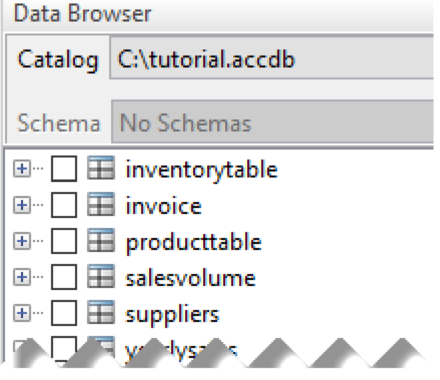
Join Multiple Tables and Import Query Results

Connect to a Microsoft Access database using the Database Explorer app. Then, select columns from multiple tables. The Database Explorer app previews query results by default. After previewing the data, import all query results into the MATLAB workspace and perform simple data analysis.

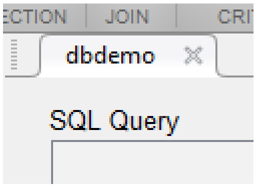
Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see "Microsoft Access ODBC for Windows" on page 2-18.

In the **Data Source** section of the **Database Explorer** tab, click **New Query**. The Connect to a Data Source dialog box opens. Select `dbdemo` from the **Data Source** list. Leave the user name and password blank, and click **Connect**.

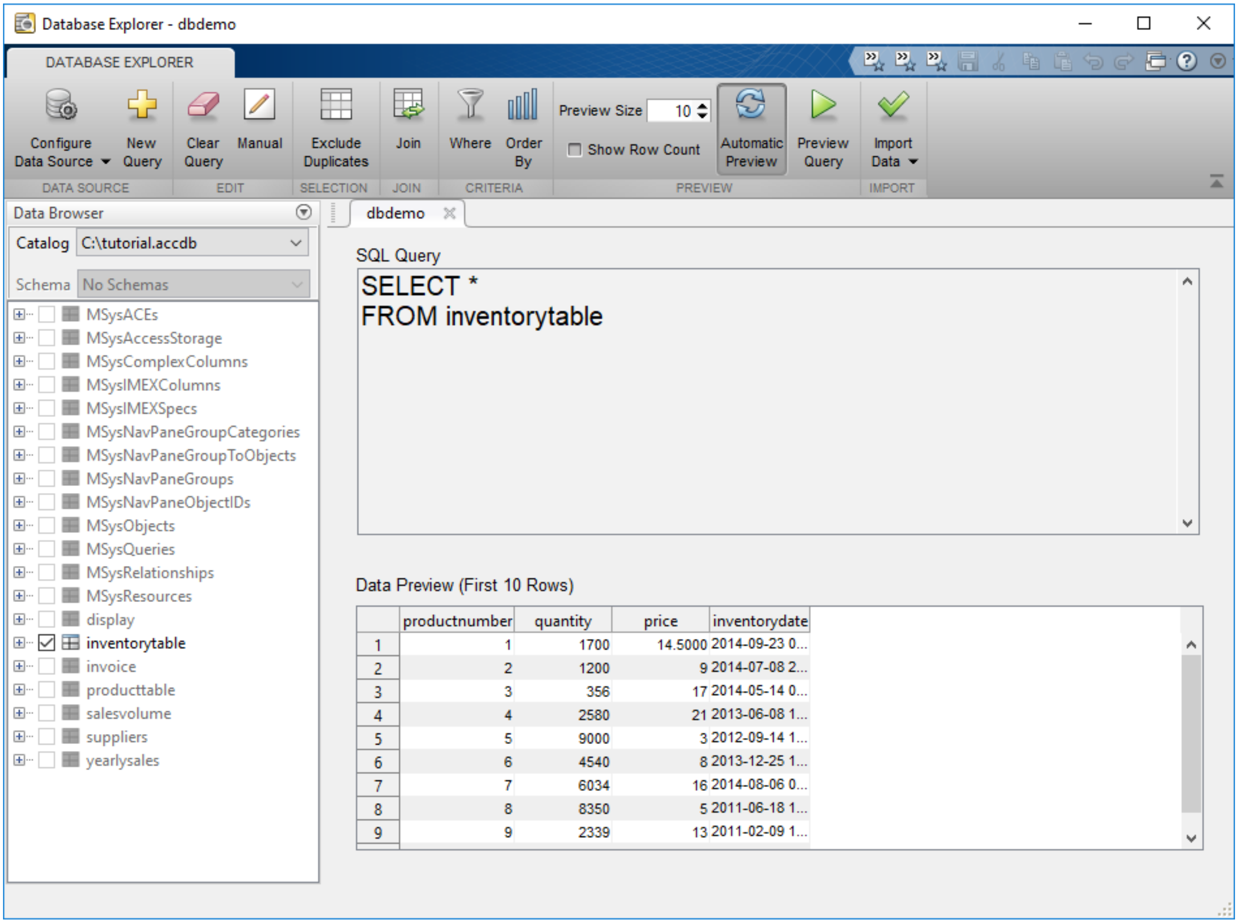
The Database Explorer app creates a connection to the Microsoft Access database. The **Data Browser** pane displays the available tables in the database.



The data source tab, which is named **dbdemo**, appears to the right of the **Data Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



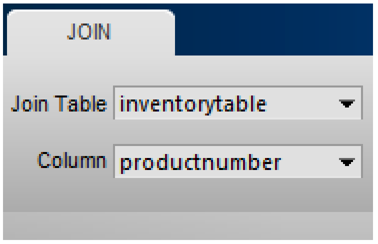
In the **Data Browser** pane, select the **inventorytable** table as the first table for the join. The Database Explorer app updates the **SQL Query** pane with an SQL query that selects all columns and rows from the **inventorytable** table. Simultaneously, the Database Explorer app updates the **Data Preview** pane with a preview of the query results. The first 10 rows of data appear in the pane by default.



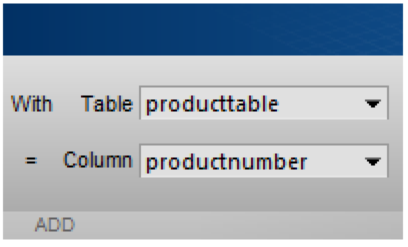
	productnumber	quantity	price	inventorydate
1	1	1700	14.5000	2014-09-23 0...
2	2	1200	9	2014-07-08 2...
3	3	356	17	2014-05-14 0...
4	4	2580	21	2013-06-08 1...
5	5	9000	3	2012-09-14 1...
6	6	4540	8	2013-12-25 1...
7	7	6034	16	2014-08-06 0...
8	8	8350	5	2011-06-18 1...
9	9	2339	13	2011-02-09 1...

In the **Join** section, click **Join** to display the **Join** tab in the toolstrip. In the **Add** section, the name of the table selected in the **Data Browser** pane appears in the left **Table** list. For details about joining tables, see “Join Tables Using Database Explorer App” on page 4-6.

In the left **Column** list, select the name of the shared column `productnumber`.



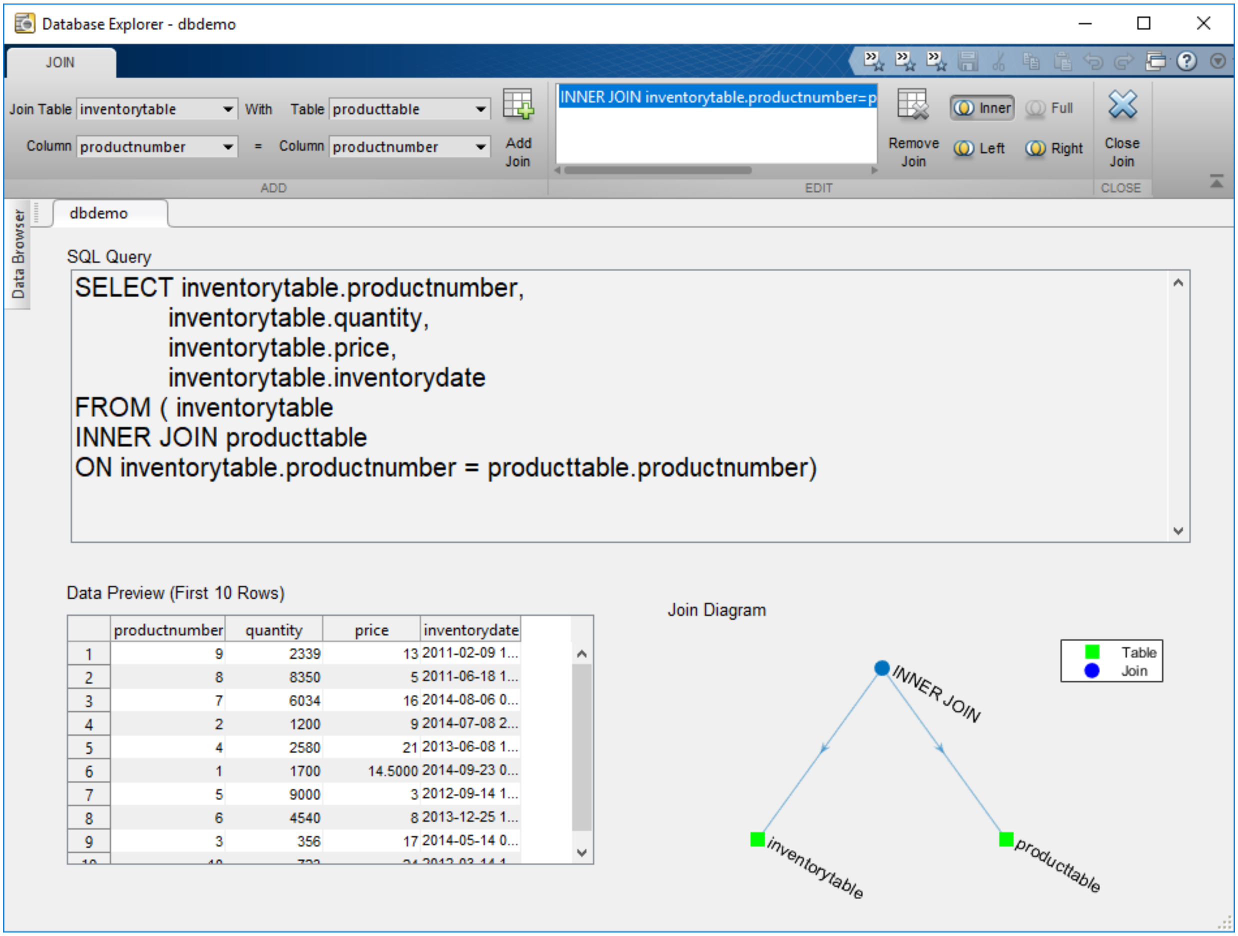
In the right **Table** list, select the table `producttable` as the table to join. Select the name of the shared column `productnumber` in this table in the right **Column** list.

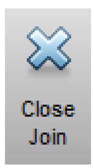


In the **Add** section, click **Add Join**. The **Join Diagram** pane displays a pictorial representation of the join between the selected tables. The **SQL Query** pane updates the SQL query with the new join. The **Data Preview** pane reflects the results of the updated SQL query.

The Database Explorer app selects the inner join by default.

Note Some databases do not support all join types.



In the **Close** section, click **Close Join** 

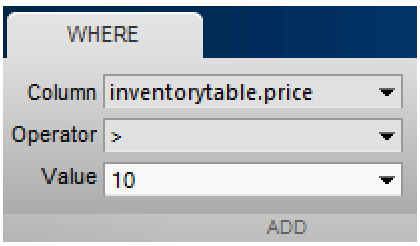
to close the **Join** tab.

In the tree view of the **Data Browser** pane, select **productdescription** under **producttable**. The **SQL Query** and **Data Preview** panes update with the selected table column.

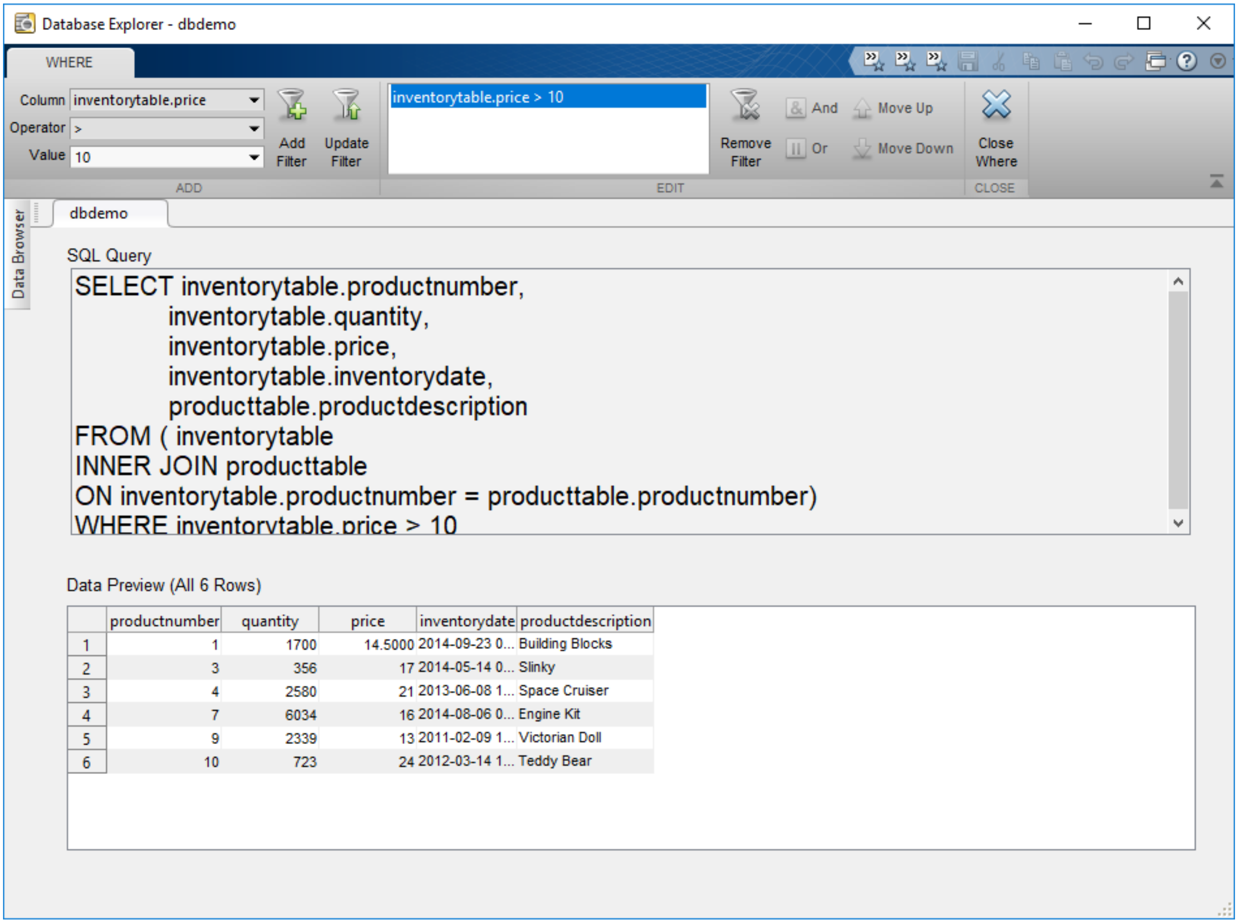
Add filter criteria to the SQL query. In the **Criteria** section, click **Where** to display the **Where** tab in the toolstrip.

Filter the SQL query results for prices greater than $10. In the **Add** section, in the **Column** list, select `inventorytable.price`. Select the `>` operator for the filter in the **Operator** list. Enter `10` in the **Value** list. Click **Add Filter**.

Note If you enter filters using the `LIKE` or `NOT LIKE` operators, then enter the value in single quotes to represent a string.



The **SQL Query** and **Data Preview** panes display the updated query results based on the new filter with the `WHERE` condition.



In the **Close** section, click **Close Where** 

to close the **Where** tab.

Import all SQL query results into the MATLAB workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB workspace variable, and click **OK**. The MATLAB workspace displays the table `data`.

Display the SQL query results at the command line.

```
data
```

```
data =

  6×5 table

    productnumber    quantity    price       inventorydate          productdescription
    _____________    ________    _____    _____________________    __________________

     1               1700        14.5     '2014-09-23 09:38:34'    'Building Blocks'
     3                356          17     '2014-05-14 07:14:28'    'Slinky'
     4               2580          21     '2013-06-08 14:24:33'    'Space Cruiser'

    ...
```

Find the maximum product price.

```
max(data.price)
```

```
ans =

    24
```

Close the database connection by closing the data source tab.

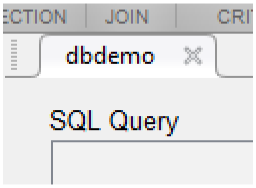
Join Tables Using Left Join and Import Query Results

Connect to a Microsoft Access database using the Database Explorer app. Then, create an SQL query that joins two tables using a left join. The Database Explorer app previews query results by default. After previewing the data, import all query results into the MATLAB workspace and perform simple data analysis.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see “Microsoft Access ODBC for Windows” on page 2-18.

In the **Data Source** section of the **Database Explorer** tab, click **New Query**. The Connect to a Data Source dialog box opens. Select `dbdemo` from the **Data Source** list. Leave the user name and password blank, and click **Connect**.

The Database Explorer app creates a connection to the Microsoft Access database. The **Data Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Data Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



In the **Data Browser** pane, select the **suppliers** table as the first table for the join.

The Database Explorer app updates the **SQL Query** pane with an SQL query that selects all columns and rows from the **suppliers** table. Simultaneously, the Database Explorer app updates the **Data Preview** pane with a preview of the query results. The first 10 rows of data appear in the pane by default.

In the **Join** section, click **Join** to display the **Join** tab in the toolstrip. In the **Add** section, the name of the table selected in the **Data Browser** pane appears in the left **Table** list. For details about joining tables, see “Join Tables Using Database Explorer App” on page 4-6.

In the left **Column** list, select the name of the shared column `suppliernumber`. In the right **Table** list, select the name `producttable` as the table to join. Select the name of the shared column `suppliernumber` in this table in the right **Column** list.

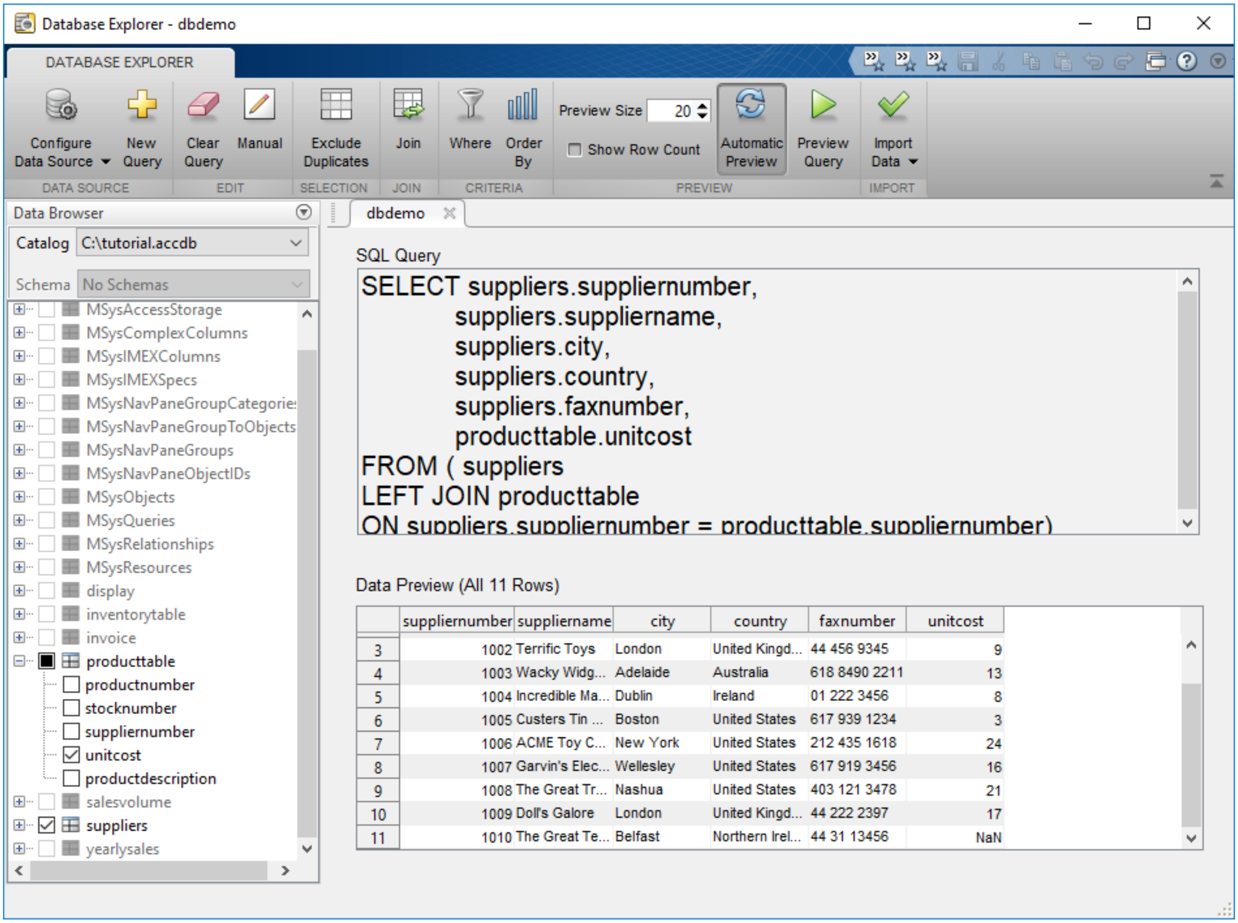
In the **Add** section, click **Add Join**. The Database Explorer app creates an inner join by default. In the **Edit** section, click **Left** to change the join from an inner join to a left join. The **Join Diagram** pane displays a pictorial representation of the join between the selected tables. The **SQL Query** pane updates the SQL query with the new join. The **Data Preview** pane reflects the results of the updated SQL query.

In the **Close** section, click 

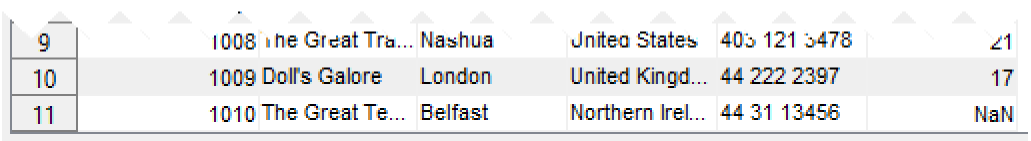
to close the **Join** tab.

Increase the number of rows displayed in the **Data Preview** pane. In the **Preview** section, enter `20` in the **Preview Size** box.

In the tree view of the **Data Browser** pane, select **unitcost** under **producttable**. The **Data Preview** pane updates with a new row.



The NaN value in the **unitcost** column indicates that the corresponding supplier does not supply products.



9	1008	The Great Tra...	Nashua	United States	403 121 3478	21
10	1009	Doll's Galore	London	United Kingd...	44 222 2397	17
11	1010	The Great Te...	Belfast	Northern Irel...	44 31 13456	NaN

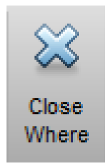
Add filter criteria to the SQL query. In the **Criteria** section, click **Where** to display the **Where** tab in the toolstrip.

Filter the SQL query results for products with a unit cost greater than $10. In the **Add** section, in the **Column** list, select the column name `producttable.unitcost`. Select the `>` operator for the filter in the **Operator** list. Enter `10` in the **Value** list. Click **Add Filter**.

Note If you enter filters using the `LIKE` or `NOT LIKE` operators, then enter the value in single quotes to represent a string.

The **SQL Query** and **Data Preview** panes display the updated query results based on the new filter with the `WHERE` condition.

Change the value of the filter from `10` to `20`. Click **Update Filter**. The **SQL Query** and **Data Preview** panes update with the results of the modified query.

In the **Close** section, click **Close Where** 

to close the **Where** tab.

Import all SQL query results into the MATLAB workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB workspace variable, and click **OK**. The MATLAB workspace displays the table `data`.

Display the SQL query results at the command line.

```
data
```

```
data =

  2×6 table

    suppliernumber         suppliername              city            country            faxnumber        unitcost
    ______________    _________________________    __________    _______________    ______________    ________

    1008              'The Great Train Company'    'Nashua'      'United States'    '403 121 3478'    21
    1006              'ACME Toy Company'           'New York'    'United States'    '212 435 1618'    24
```

Find the maximum product price.

```
max(data.unitcost)
```

```
ans =

    24
```

Close the database connection by closing the data source tab.

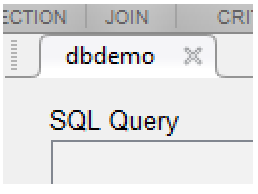
Sort Query Results

Connect to a Microsoft Access database using the Database Explorer app. Create a simple SQL query and sort the results by the data in one column. The Database Explorer app previews query results by default. Then, import the sorted data into the MATLAB workspace.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see "Microsoft Access ODBC for Windows" on page 2-18.

In the **Data Source** section of the **Database Explorer** tab, click **New Query**. The Connect to a Data Source dialog box opens. Select `dbdemo` from the **Data Source** list. Leave the user name and password blank, and click **Connect**.

The Database Explorer app creates a connection to the Microsoft Access database. The **Data Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Data Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.

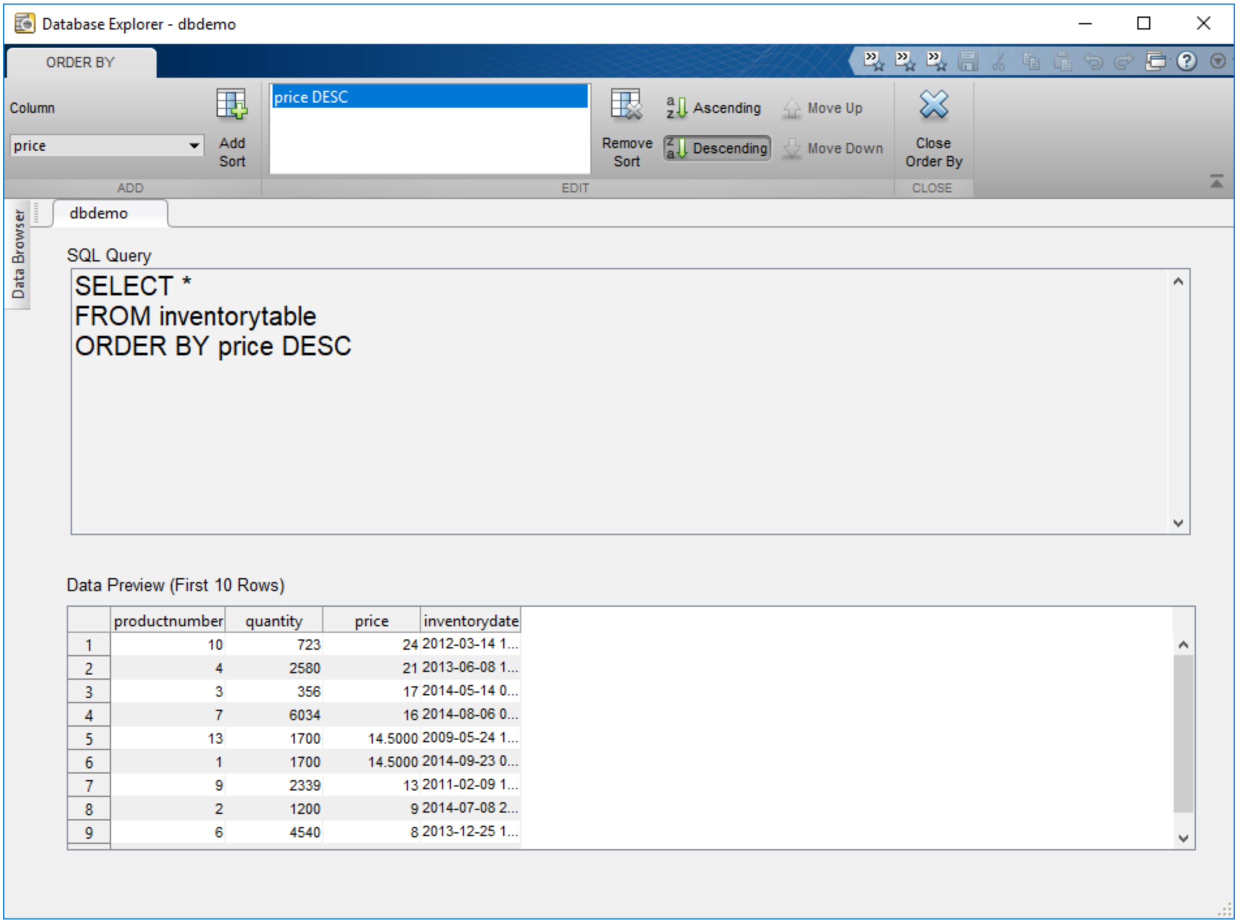


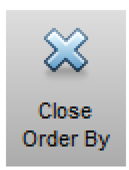
In the **Data Browser** pane, select the **inventorytable** table. The **SQL Query** pane displays the SQL query that selects all columns and rows from this table. The **Data Preview** pane displays the first 10 rows of the query results.

Sort the results of the SQL query. In the **Criteria** section, click **Order By** to display the **Order By** tab in the toolstrip.

In the **Add** section, in the **Column** list, select the `price` column. Click **Add Sort**.

In the **Edit** section, click **Descending** to sort the prices in decreasing order. The **Data Preview** pane displays the updated query results with sorted prices.



In the **Close** section, click **Close Order By**  to close the **Order By** tab.

Import all SQL query results into the MATLAB workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB workspace variable, and click **OK**. The MATLAB workspace displays the table `data`.

Close the database connection by closing the data source tab.

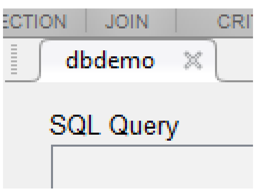
Filter Query Results

Connect to a Microsoft Access database using the Database Explorer app. Create a simple SQL query and filter the results. Use a text filter to retrieve specific rows of data. The Database Explorer app previews query results by default. Then, import the filtered data into the MATLAB workspace.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see "Microsoft Access ODBC for Windows" on page 2-18.

In the **Data Source** section of the **Database Explorer** tab, click **New Query**. The Connect to a Data Source dialog box opens. Select `dbdemo` from the **Data Source** list. Leave the user name and password blank, and click **Connect**.

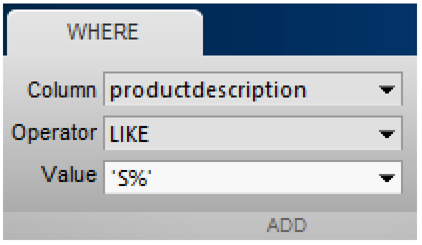
The Database Explorer app creates a connection to the Microsoft Access database. The **Data Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Data Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



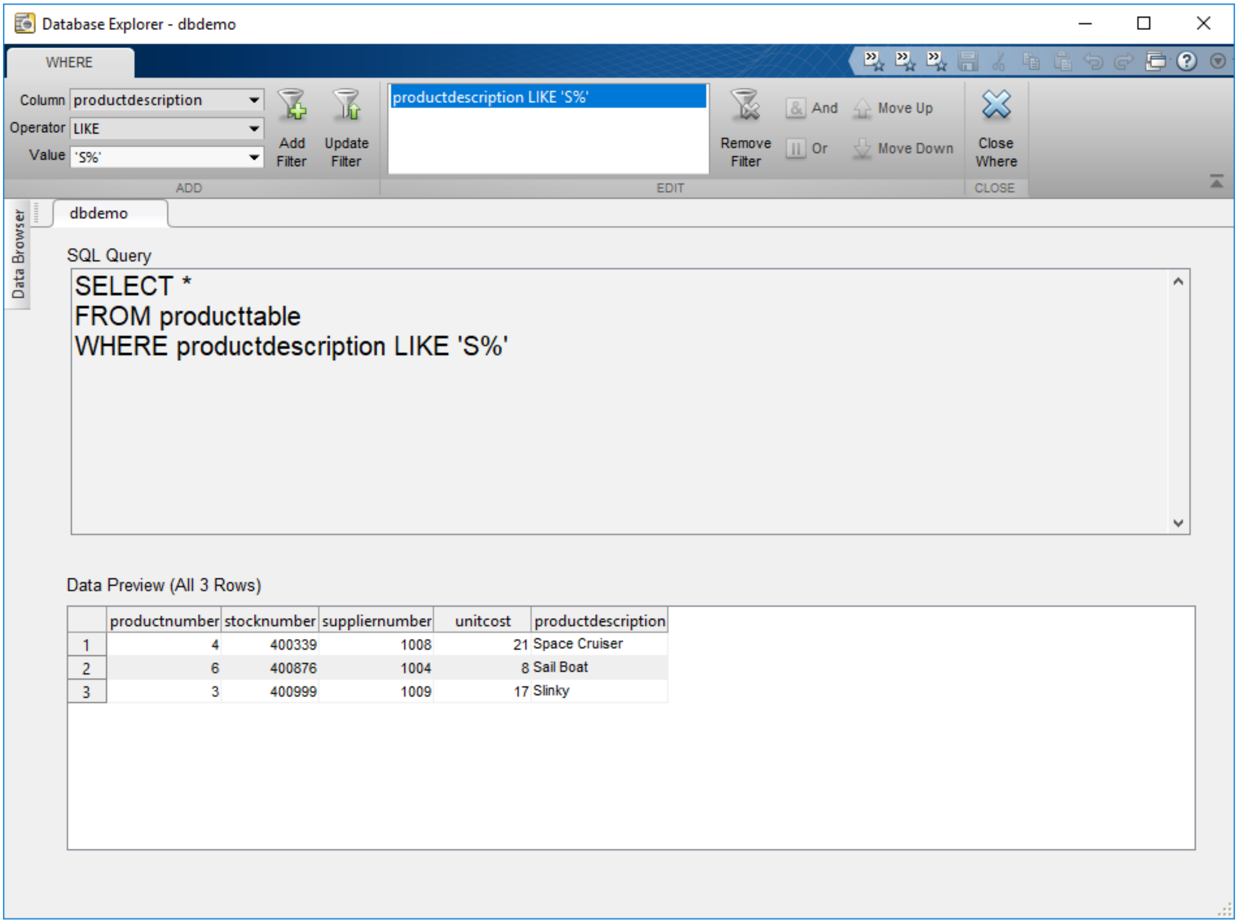
In the **Data Browser** pane, select the **producttable** table. The **SQL Query** pane displays the SQL query that selects all columns and rows from this table. The **Data Preview** pane displays the first 10 rows of the query results.

Add filter criteria to the SQL query. In the **Criteria** section, click **Where** to display the **Where** tab in the toolstrip.

Filter for products with a product description that starts with the letter `S`. In the **Add** section, in the **Column** list, select `productdescription`. In the **Operator** list, select `LIKE`. To filter for text, enclose the text in single quotes. In the **Value** list, enter `'S%'`.



Click **Add Filter**. The **Data Preview** pane displays three rows of data. The product description in each row starts with the letter `S`.



In the **Close** section, click **Close Where** 

to close the **Where** tab.

Import all SQL query results into the MATLAB workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB workspace variable, and click **OK**. The MATLAB workspace displays the table `data`.

Close the database connection by closing the data source tab.

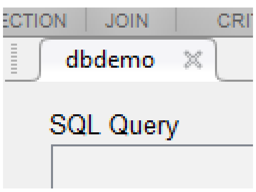
Remove Duplicate Rows from Query Results

Connect to a Microsoft Access database using the Database Explorer app. Create a simple SQL query and remove duplicate rows from the query results. The Database Explorer app previews query results by default. After removing duplicates, import the data into the MATLAB workspace.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see “Microsoft Access ODBC for Windows” on page 2-18.

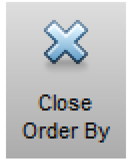
In the **Data Source** section of the **Database Explorer** tab, click **New Query**. The Connect to a Data Source dialog box opens. Select `dbdemo` from the **Data Source** list. Leave the user name and password blank, and click **Connect**.

The Database Explorer app creates a connection to the Microsoft Access database. The **Data Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Data Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



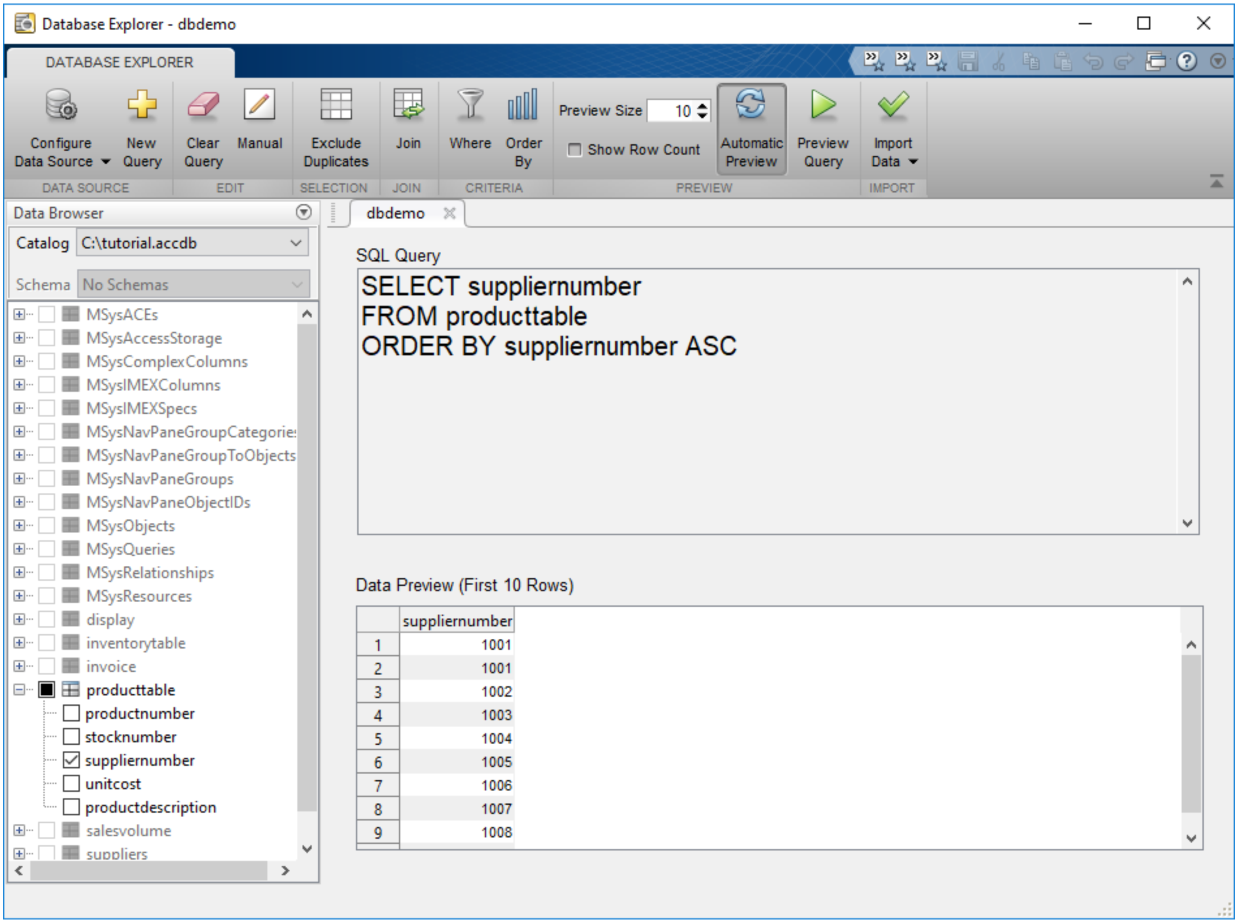
In the **Data Browser** pane, select the **producttable** table. Clear all the boxes for columns in the **producttable** table except for **suppliernumber**. The **SQL Query** pane displays the SQL query that selects the **suppliernumber** column from this table. The **Data Preview** pane displays the first 10 rows of the query results.

Sort the results of the SQL query. In the **Criteria** section, click **Order By** to display the **Order By** tab in the toolstrip. In the **Add** section, in the **Column** list, select the `suppliernumber` column, and click **Add Sort**.

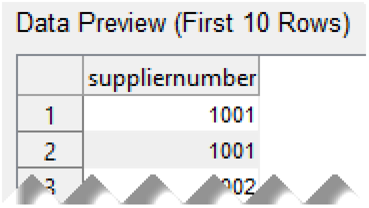
In the **Close** section, click **Close Order By** 

to close the **Order By** tab.

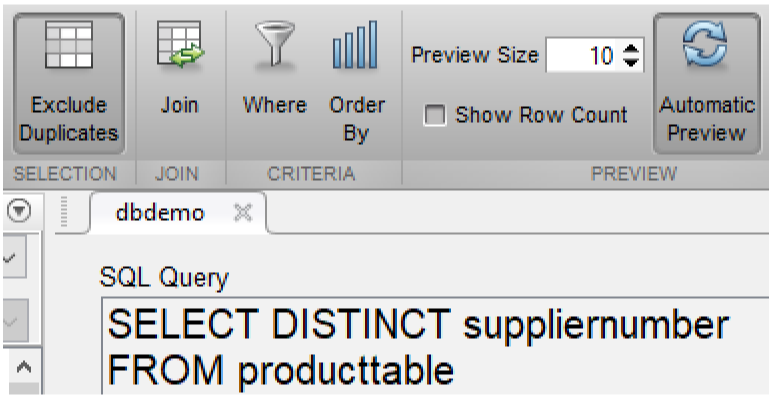
The **Data Preview** pane displays the rows sorted in increasing order, which is the default order.



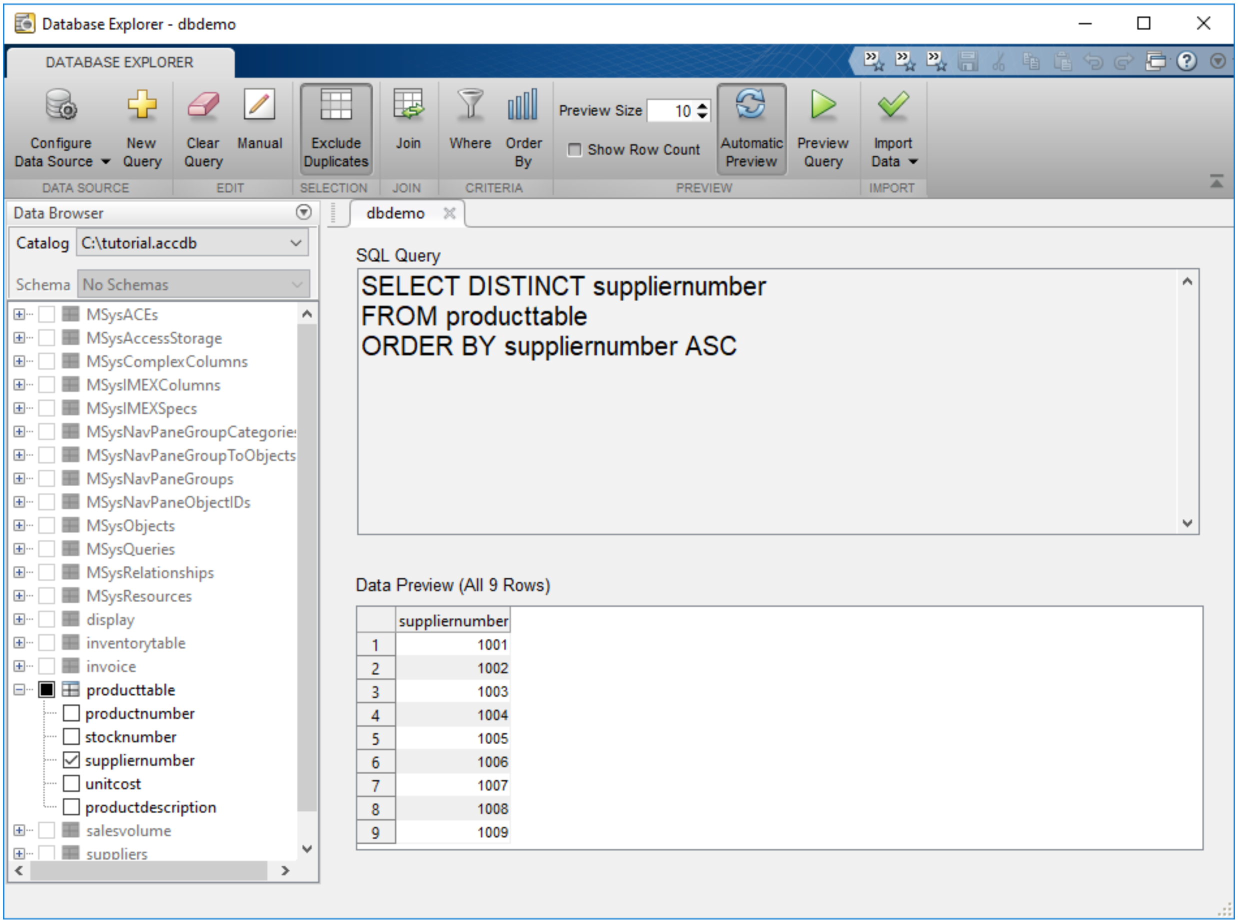
The **Data Preview** pane shows the duplicate supplier number `1001`.

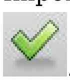


In the **Selection** section, click **Exclude Duplicates** to remove duplicate rows in the **Data Preview** pane. The Database Explorer App adds the SQL statement `DISTINCT` to the query in the **SQL Query** pane. This statement removes duplicate rows from the query results.



The **Data Preview** pane displays unique rows only.



Import all SQL query results into the MATLAB workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB workspace variable, and click **OK**. The MATLAB workspace displays the table `data`.

Close the database connection by closing the data source tab.

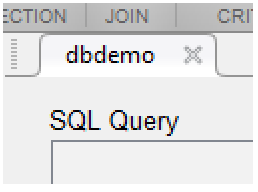
Enter SQL Query Manually

Connect to a Microsoft Access database using the Database Explorer app. Enter an SQL query manually or paste an existing SQL query into the **SQL Query** pane. Then, import the query results into the MATLAB workspace.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see “Microsoft Access ODBC for Windows” on page 2-18.

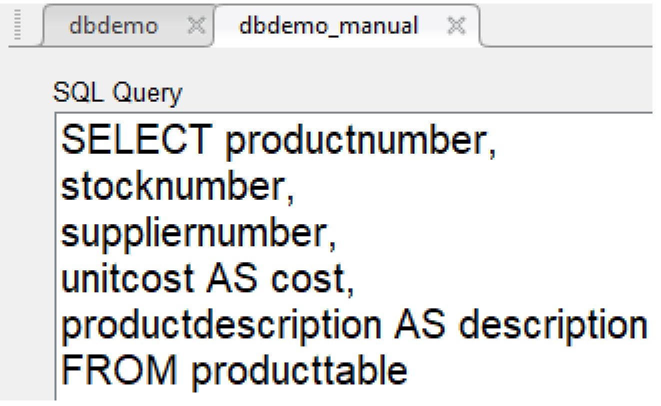
In the **Data Source** section of the **Database Explorer** tab, click **New Query**. The Connect to a Data Source dialog box opens. Select `dbdemo` from the **Data Source** list. Leave the user name and password blank, and click **Connect**.

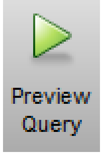
The Database Explorer app creates a connection to the Microsoft Access database. The **Data Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Data Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



In the **Edit** section, click **Manual**. A new data source tab appears to the right of the **dbdemo** tab with the name **dbdemo_manual**. The suffix `_manual` attached to the tab name indicates that you are entering an SQL query manually.

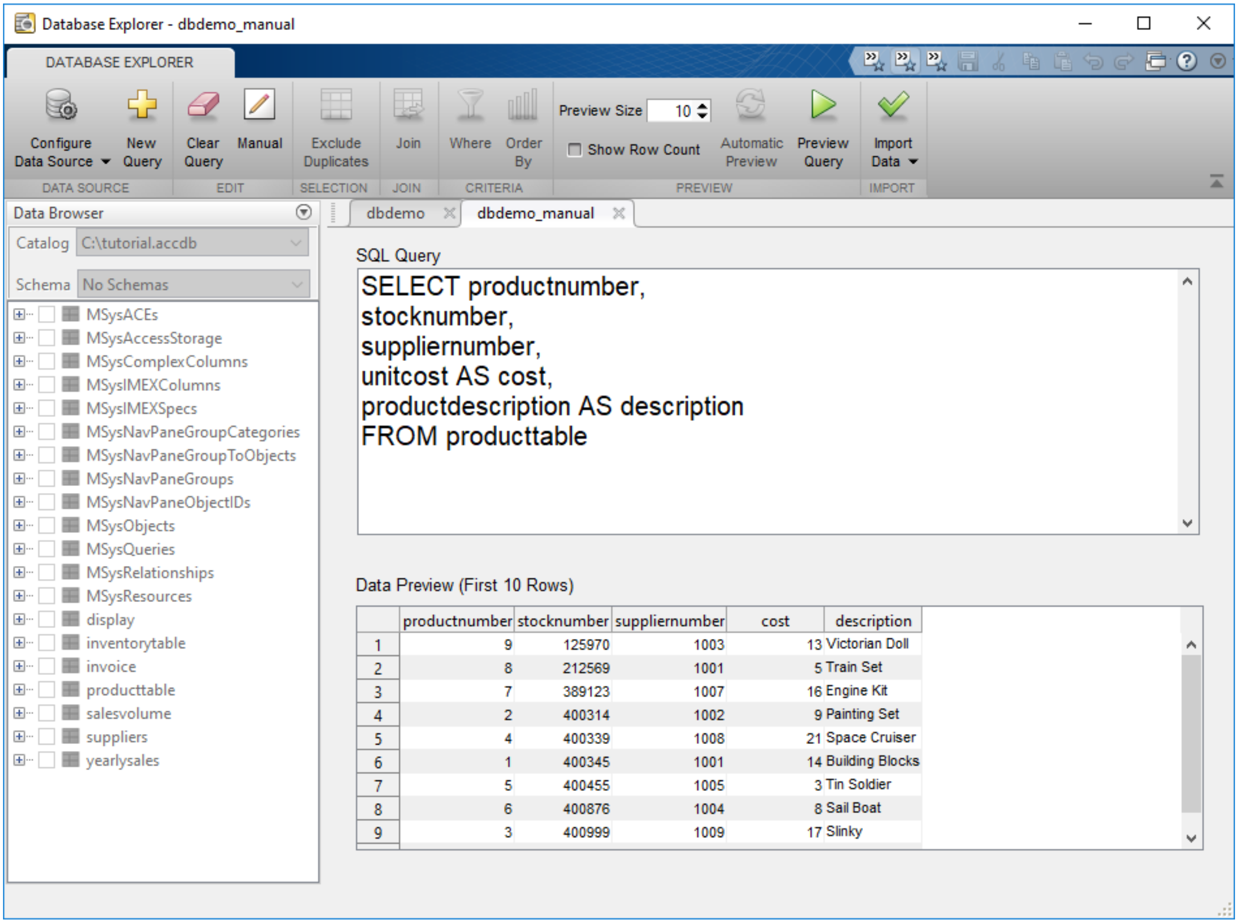
Enter an SQL query in the **SQL Query** pane. Here, select all columns and rows from the `producttable` table, and rename the `unitcost` and `productdescription` columns. Use the SQL statement `AS` to create aliases.

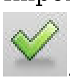


In the **Preview** section, click **Preview Query** 

to preview the query results.

The **Data Preview** pane shows the results of the SQL query. The pane displays the first 10 rows of data by default.



Import all SQL query results into the MATLAB workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB workspace variable, and click **OK**. The MATLAB workspace displays the table `data`.

Close the database connection by closing both the **dbdemo** and **dbdemo_manual** data source tabs.

See Also

Functions
`close` | `database` | `exec` | `fetch`

Topics

“Connection Options” on page 2-9
“Configuring Driver and Data Source” on page 2-15
“Create SQL Queries Using Database Explorer App” on page 4-2
“Join Tables Using Database Explorer App” on page 4-6
“Data Preview Using Database Explorer App” on page 4-11
“Generate SQL Query and MATLAB Script” on page 4-18
“Modify and Delete Data Sources” on page 4-15
“Database Explorer App Error Messages” on page 3-17

External Websites

SQL Tutorial

Introduced in R2017b

dmd

(To be removed) Construct database metadata object

Note The dmd function will be removed in a future release. Use the sqlfind function or access the properties of the connection object instead. For details, see "Compatibility Considerations".

Syntax

```
dbmeta = dmd(conn)
```

Description

dbmeta = dmd(conn) constructs a database metadata object for the database connection conn. Use get and supports to obtain properties of dbmeta. Use dmd and get(dbmeta) to obtain information you need about a database, such as table names required to retrieve data.

Examples

Create a database metadata object dbmeta for the database connection conn and list its properties:

```
dbmeta = dmd(conn);
v = get(dbmeta)
```

Compatibility Considerations

dmd function will be removed

Not recommended starting in R2018b

The `dmd` function will be removed in a future release. Use the `sqlfind` function or access the properties of the `connection` object instead.

Some differences between the workflows require updates to your code.

In prior releases, you retrieved information about a database connection using the `dmd` function. For example:

```
conn = database(datasource,username,password);
dbmeta = dmd(conn);
```

Now the `sqlfind` function returns information about the table types in the database.

```
conn = database(datasource,username,password);
data = sqlfind(conn,pattern);
```

Also, you can access the database properties and catalog and schema information using the `connection` object. For example:

```
conn = database(datasource,username,password);
catalogs = conn.Catalogs;
schemas = conn.Schemas;
```

See Also

`columns` | `database` | `sqlfind` | `tables`

Topics

"Retrieve Database Metadata" on page 5-58

Introduced before R2006a

get

Package: database.odbc

(To be removed) Retrieve object properties

Note The `get` function will be removed in a future release with no replacement.

Syntax

```
s = get(object)
v = get(object,property)
```

Description

`s = get(object)` returns the structure `s`, which contains the `object` and its corresponding properties.

`v = get(object,property)` returns the value `v` of `property` for the `object`.

Examples

Get Database Metadata Object Properties

Retrieve the properties of a database metadata object created using a `connection` object.

Establish an ODBC database connection to a MySQL database with the user name `username` and password `pwd`.

```
conn = database('MySQL','username','pwd');
```

Create a database metadata object using the `connection` object.

```
dbmeta = dmd(conn);
```

Retrieve the properties of `dbmeta` and assign them as fields in the structure `v`.

```
v = get(dbmeta)
```

```
v = 

  struct with fields:

                AllProceduresAreCallable: 0
                  AllTablesAreSelectable: 0
    DataDefinitionCausesTransactionCommit: 1
      DataDefinitionIgnoredInTransactions: 0
              DoesMaxRowSizeIncludeBlobs: 0
  ...
```

Display the names of the catalogs in the database.

```
v.Catalogs
```

```
ans =

  2×1 cell array

    'information_schema'
    'toy_store'
```

Close the database connection.

```
close(conn)
```

Input Arguments

`object` — Database Toolbox object
`dmd` object

Database Toolbox object, specified as a `dmd` object created using the `dmd` function.

`property` — Property of Database Toolbox object
character vector | string scalar

Property of the Database Toolbox object, specified as a character vector or string scalar.

The following table shows available property names and returned values.

Database Metadata Object Property	Description	Example of Value
'Catalogs'	List of database catalogs	{'toystore' 'dbo'}
'DatabaseProductName'	Database vendor name	'ACCESS'
'DatabaseProductVersion'	Database version number	'03.50.0000'
'DriverName'	Name of the JDBC or ODBC driver	'sqlncli11.dll'
'MaxColumnNameLength'	Maximum length of the database column name	64
'MaxColumnsInOrderBy'	Maximum number of database columns for sorting the data	10
'URL'	JDBC database URL for establishing a connection	'jdbc:odbc:dbdemo'

Data Types: char | string

Output Arguments

s — Object properties
structure

Object properties, returned as a structure that contains the object and its corresponding properties.

v — Object property value
character vector | numeric scalar | cell array | object

Object property value, returned as a character vector, numeric scalar, cell array, or object.

See Also

close | database | getdatasources | sqlfind

Topics

"Retrieve Database Metadata" on page 5-58

Introduced before R2006a

exec

Package: database.odbc

(Not recommended) Execute SQL statement and open cursor

Note The `exec` function is not recommended. For SQL statements that return data, use the `fetch` function or the `select` function instead. For other SQL statements, use the `execute` function instead. For details, see “Compatibility Considerations”.

The scrollable cursor functionality has no replacement.

Syntax

```
curs = exec(conn,sqlquery)
curs = exec(conn,sqlquery,Name,Value)
curs = exec(conn,sqlquery,qTimeOut)
```

Description

`curs = exec(conn,sqlquery)` creates the `cursor` object after executing the SQL statement `sqlquery` for the database connection `conn`.

`curs = exec(conn,sqlquery,Name,Value)` specifies options using one or more name-value pair arguments. For example, `'MaxRows',10` limits the number of rows to return to 10 before SQL query execution.

`curs = exec(conn,sqlquery,qTimeOut)` uses the timeout value `qTimeOut` for SQL query execution.

Examples

Select Data Using Native ODBC Driver

Use a native ODBC connection to import product data from a Microsoft SQL Server database into MATLAB. Then, determine the highest unit cost among products.

Create an ODBC database connection to a Microsoft SQL Server database with Windowsauthentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message

ans =

     []
```

Select all data from the table `productTable` using the `connection` object. Assign the SQL `SELECT` statement to the variable `sqlquery`. The `cursor` object contains the executed SQL query.

```
sqlquery = 'SELECT * FROM productTable';
curs = exec(conn,sqlquery)

curs =

   cursor with properties:

         Data: 0
     RowLimit: 0
     SQLQuery: 'SELECT * FROM productTable'
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

For an ODBC connection, the `Type` property contains `ODBCCursor Object`. For JDBC connections, this property contains `Database Cursor Object`.

Import data from the table into MATLAB.

```
curs = fetch(curs);
data = curs.Data;
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans =

    24
```

After you finish working with the `cursor` object, close it. Close the database connection.

```
close(curs)
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use `exec` function. For procedures that return output arguments, use `runstoredprocedure`.

For information about the SQL query language, see the SQL Tutorial.

Data Types: `char` | `string`

qTimeOut — Timeout value
numeric scalar

Timeout value, specified as a numeric scalar denoting the maximum amount of time, in seconds, that `exec` tries to execute the SQL statement `sqlquery`.

Data Types: double

Name-Value Pair Arguments

Specify optional comma-separated pairs of Name,Value arguments. Name is the argument name and Value is the corresponding value. Name must appear inside quotes. You can specify several name and value pair arguments in any order as Name1,Value1,...,NameN,ValueN.

Example: curs = exec(conn,sqlquery,'MaxRows',rowlimit);

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return before executing the SQL query, specified as the comma-separated pair consisting of 'MaxRows' and a positive numeric scalar. By default, the exec function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB from the SQL query execution. For details about this option and other memory management options, see “Data Import Memory Management” on page 5-28.

Data Types: double

CursorType — Cursor type
'forward_only' (default) | 'scrollable'

Cursor type, specified as the comma-separated pair consisting of 'CursorType' and one of the values in this table.

Value	Description
'forward_only'	Create a basic cursor.
'scrollable'	Create a scrollable cursor.

Output Arguments

curs — Database cursor
cursor object

Database cursor, returned as a cursor object.

Limitations

The name-value pair argument `'MaxRows'` has these limitations:

- If you are using Microsoft Access, the native ODBC interface is not supported.
- Not all database drivers support setting the maximum number of rows before query execution. For an unsupported driver, modify your SQL query to limit the maximum number of rows to return. The SQL syntax varies with the driver. For details, consult the driver documentation.

Tips

- The order of records in your database does not remain constant. Sort data using the SQL `ORDER BY` command in your `sqlquery` statement.
- For Microsoft Excel, tables in `sqlquery` are Excel worksheets. By default, some worksheet names include a `$` symbol. To select data from a worksheet with this name format, use an SQL statement of the form `SELECT * FROM "Sheet1$"` (or `'Sheet1$'`).
- Before you modify database tables, ensure that the database is not open for editing. If you try to edit the database while it is open, you receive this MATLAB error:

  ```
  [Vendor][ODBC Driver] The database engine could not lock
  table 'TableName' because it is already in use by
  another person or process.
  ```
- The PostgreSQL database management system supports multidimensional fields, but SQL `SELECT` statements fail when retrieving these fields unless you specify an index.
- Some databases require that you include a symbol, such as `#`, before and after a date in a query, as follows:

  ```
  curs = exec(conn,'SELECT * FROM mydb WHERE mydate > #03/05/2005#')
  ```

Alternative Functionality

App

The `exec` function executes SQL statements using the command line. To execute SQL statements interactively, use the **Database Explorer** app.

Compatibility Considerations

exec function is not recommended

Not recommended starting in R2018b

The `exec` function is not recommended. For SQL statements that return data, use the `fetch` function with the `connection` object or the `select` function instead. For other SQL statements, use the `execute` function instead. Some differences between the workflows might require updates to your code.

There are no plans to remove the `exec` function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

You can also import data in one step using the `select` function.

```
data = select(conn,selectquery);
```

The scrollable cursor functionality has no replacement.

See Also

`close` | `database` | `fetch` | `select` | `setdbprefs`

Topics

"Import Data from Database Table Using sqlread Function" on page 5-52
"Create Queries with Characters and Variables" on page 5-2

“Call Stored Procedure That Returns Data” on page 5-24
“Roll Back Data in Database” on page 5-7
“Change Database Connection Catalog” on page 5-9
“Create Table and Add Column” on page 5-10
“Run Custom Database Function” on page 5-26
“Data Import Memory Management” on page 5-28
“Data Retrieval Restrictions” on page 1-5

External Websites

SQL Tutorial

Introduced before R2006a

exec

Execute SQL statement using SQLite connection

Syntax

```
exec(conn,sqlquery)
```

Description

`exec(conn,sqlquery)` performs database operations on an SQLite database file by executing the SQL statement `sqlquery` for the SQLite connection `conn` using the MATLAB interface to SQLite. For example, use this syntax to create database tables in the SQLite database file. To import data into MATLAB from the SQLite database file, use the `fetch` function.

Examples

Create Table Using MATLAB® Interface to SQLite

Using the MATLAB® Interface to SQLite, create a table in a new SQLite database file.

Create the SQLite connection `conn` to the new SQLite database file `tutorial.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,'tutorial.db');

conn = sqlite(dbfile,'create');
```

Create the table `inventoryTable` using `exec`.

```
createInventoryTable = ['create table inventoryTable ' ...
    '(productNumber NUMERIC, Quantity NUMERIC, ' ...
    'Price NUMERIC, inventoryDate VARCHAR)'];

exec(conn,createInventoryTable)
```

`inventoryTable` is an empty table in `tutorial.db`.

To insert data into the database file, use the `insert` function.

Close the SQLite connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use `exec` function. For procedures that return output arguments, use `runstoredprocedure`.

For information about the SQL query language, see the SQL Tutorial.

Data Types: `char` | `string`

See Also

`close` | `fetch` | `insert` | `sqlite`

Topics

"Import Data Using MATLAB® Interface to SQLite" on page 5-35
"Working with MATLAB Interface to SQLite" on page 2-6

External Websites

SQL Tutorial

Introduced in R2016a

execute

Package: database.odbc

Execute SQL statement using relational database connection

Syntax

`execute(conn,sqlquery)`

Description

`execute(conn,sqlquery)` executes an SQL query that contains a non-`SELECT` SQL statement by using the relational database connection.

Examples

Execute Non-SELECT SQL Statement

Using a relational database connection, create and execute a non-`SELECT` SQL statement that deletes a database table.

This example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Import the data from the `patients` database table.

```
data = sqlread(conn,tablename);
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Call Stored Procedure Without Input and Output Arguments

Working with a Microsoft SQL Server database, run a stored procedure by using the native ODBC database connection `conn`.

Define a stored procedure named `create_table` that creates a table named `test_table` by executing the following code. This procedure has no input or output arguments. The code assumes that you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE create_table

AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

CREATE TABLE test_table
     (
        CATEGORY_ID     INTEGER     IDENTITY PRIMARY KEY,
        CATEGORY_DESC   CHAR(50)    NOT NULL
        );

END
GO
```

Connect to the Microsoft SQL Server database. This code assumes that you are connecting to a data source named `MS SQL Server` with a user name and password.

```
conn = database('MS SQL Server','username','pwd');
```

Call the stored procedure `create_table`.

```
execute(conn,'create_table')
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid non-`SELECT` SQL statement.

The SQL statement can be a stored procedure that does not return any result sets. For stored procedures that return one or more result sets, use the `fetch` function. For procedures that return output arguments, use the `runstoredprocedure` function.

For information about the SQL query language, see the SQL Tutorial.

Example: `'DROP TABLE patients'`

Data Types: `char` | `string`

See Also

`close` | `database` | `fetch` | `runstoredprocedure` | `sqlread`

Topics

"Create Table and Add Column" on page 5-10
"Delete Data from Databases" on page 5-11
"Roll Back Data in Database" on page 5-7

External Websites

SQL Tutorial

Introduced in R2018b

fastinsert

Package: database.odbc

(To be removed) Add MATLAB data to database tables

Note The `fastinsert` function will be removed in a future release. Use the `sqlwrite` function instead.

Syntax

`fastinsert(conn,tablename,colnames,data)`

Description

`fastinsert(conn,tablename,colnames,data)` exports data from the MATLAB workspace and inserts it into an existing database table using the database connection `conn`. You can specify the database table name and column names, and specify the data for insertion into the database.

You do not specify the type of data you are exporting. The data is exported in its current MATLAB format.

Examples

Insert Row into Table Using ODBC Driver

First, connect to the Microsoft® SQL Server® database. Then, export data from MATLAB® into the database and close the database connection.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select and display all rows in the table sorted by the product number using the `select` function.

```
selectquery = 'SELECT * FROM productTable ORDER BY productNumber';

data = select(conn,selectquery)
```

```
data =

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    1                4.0035e+05     1001              14          'Building Blocks'
    2                4.0031e+05     1002               9          'Painting Set'
    3                  4.01e+05     1009              17          'Slinky'
```

Store the column names of `productTable` in a cell array.

```
tablename = 'productTable';
colnames = {'productNumber','stockNumber','supplierNumber', ...
    'unitCost','productDescription'};
```

Store the data for the insert in a cell array that contains these values:

- `productNumber` equal to 4
- `stockNumber` equal to 500565
- `supplierNumber` equal to 1010

- `unitCost` equal to $20
- `productDescription` equal to `'Cooking Set'`

Then, convert the cell array to a table.

```
insertdata = {4,500565,1010,20,'Cooking Set'};
insertdata = cell2table(insertdata,'VariableNames',colnames)
```

```
insertdata = 

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    4                5.0057e+05     1010              20          'Cooking Set'
```

Insert data into the table.

```
fastinsert(conn,tablename,colnames,insertdata)
```

Select and display all rows in the table again.

```
data = select(conn,selectquery)
```

```
data = 

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    1                4.0035e+05     1001              14          'Building Blocks'
    2                4.0031e+05     1002               9          'Painting Set'
    3                  4.01e+05     1009              17          'Slinky'
    4                5.0057e+05     1010              20          'Cooking Set'
```

A new row appears in the `productTable` with data from `insertdata`.

Close the database connection.

```
close(conn)
```

Insert Multiple Rows into Table

First, connect to the Microsoft® SQL Server® database. Then, export multiple rows of data from MATLAB® into the database and close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select and display data in the table `inventoryTable`. Import data using the `select` function.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery)
```

```
data =

    productNumber    Quantity    Price    inventoryDate
    _____________    ________    _____    _____________

     1               1700        15       '2014-09-23'
     2               1200         9       '2014-07-08'
     3                356        17       '2014-05-14'
     4               2580        21       '2013-06-08'
     5               9000         3       '2012-09-14'
     6               4540         8       '2013-12-25'
     7               6034        16       '2014-08-06'
     8               8350         5       '2011-06-18'
     9               2339        13       '2011-02-09'
    10                723        24       '2012-03-14'
```

Assign multiple rows of data to the cell array `insertdata`. Each row contains data for the columns in `inventoryTable`. The first row of data contains:

- Product number is 11
- Quantity is 125
- Price is $23.00
- Inventory date is the current date

```
insertdata = {11,125,23.00,datestr(now,'yyyy-mm-dd'); ...
    12,1160,14.7,datestr(now,'yyyy-mm-dd'); ...
    13,150,54.5,datestr(now,'yyyy-mm-dd')};
```

Store the column names of `inventoryTable` in a cell array.

```
tablename = 'inventoryTable';
colnames = {'productNumber','Quantity','Price','inventoryDate'};
```

Insert data into the table.

```
fastinsert(conn,tablename,colnames,insertdata)
```

Select and display data in the table `inventoryTable` again.

```
data = select(conn,selectquery)
```

```
data = 

    productNumber    Quantity    Price    inventoryDate
    _____________    ________    _____    _____________

     1               1700        15       '2014-09-23'
     2               1200         9       '2014-07-08'
     3                356        17       '2014-05-14'
     4               2580        21       '2013-06-08'
     5               9000         3       '2012-09-14'
     6               4540         8       '2013-12-25'
     7               6034        16       '2014-08-06'
     8               8350         5       '2011-06-18'
     9               2339        13       '2011-02-09'
    10                723        24       '2012-03-14'
    11                125        23       '2016-11-02'
    12               1160        15       '2016-11-02'
```

```
    13                 150        55       '2016-11-02'
```

Three new rows appear in `inventoryTable` with data from `insertdata`.

Close the database connection.

```
close(conn)
```

Insert Numeric Data into Table

First, connect to the Microsoft® SQL Server® database. Then, export numeric data from MATLAB® into the database and close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Define the numeric matrix `numdata` that contains sales volume data.

```
numdata = [777666,0,350,400,450,250,450,500,515,235,100,300,600];
```

Select and display data in the `salesVolume` table before insertion. Import data using the `select` function.

```
selectquery = 'SELECT * FROM salesVolume';
data = select(conn,selectquery)
```

```
data =
```

```
    StockNumber    January    February    March    April    May     June    July    Aug
    ___________    _______    ________    _____    _____    ____    ____    ____    ___

    1.2597e+05     1400       1100         981      882      794     752     654    773
    2.1257e+05     2400       1721        1414     1191      983     825     731    653
    3.8912e+05     1800       1200         890      670      550     450     400    410
    4.0031e+05     3000       2400        1800     1500     1200     900     700    650
    4.0034e+05     4300          0        2600     1800     1600    1550     895    700
    4.0035e+05     5000       3500        2800     2300     1700    1400    1000    900
    4.0046e+05     1200        900         800      500      399     345     300    175
    4.0088e+05     3000       2400        1500     1500     1300    1100     900    867
      4.01e+05     3000       1500        1000      900      750     700     400    350
    8.8865e+05        0        900         821      701      689     621     545    421
    4.0814e+05     6000       3100        8800     2300     1700    1400    1000    900
    2.1046e+05     1800       9700         800      500     3997     349     300    175
    4.7082e+05     3100       9400        1540     1500     1350    1190     900    867
     5.101e+05      235       1800        1040      900      750     700     400    350
    8.9975e+05      123       1700         823      701      689     621     545    421
```

Store the column names of `salesVolume` in a cell array.

```
tablename = 'salesVolume';
colnames = {'stockNumber','January','February','March','April','May', ...
    'June','July','August','September','October','November', ...
    'December'};
```

Insert data into the table.

```
fastinsert(conn,tablename,colnames,numdata)
```

Select and display data in the `salesVolume` table again.

```
data = select(conn,selectquery)
```

```
data = 

    StockNumber    January    February    March    April    May     June    July    Aug
    ___________    _______    ________    _____    _____    ____    ____    ____    ___

    1.2597e+05     1400       1100         981      882      794     752     654    773
    2.1257e+05     2400       1721        1414     1191      983     825     731    653
    3.8912e+05     1800       1200         890      670      550     450     400    410
```

```
4.0031e+05     3000        2400         1800      1500      1200       900       700     650
4.0034e+05     4300           0         2600      1800      1600      1550       895     700
4.0035e+05     5000        3500         2800      2300      1700      1400      1000     900
4.0046e+05     1200         900          800       500       399       345       300     175
4.0088e+05     3000        2400         1500      1500      1300      1100       900     867
  4.01e+05     3000        1500         1000       900       750       700       400     350
8.8865e+05        0         900          821       701       689       621       545     421
4.0814e+05     6000        3100         8800      2300      1700      1400      1000     900
2.1046e+05     1800        9700          800       500      3997       349       300     175
4.7082e+05     3100        9400         1540      1500      1350      1190       900     867
 5.101e+05      235        1800         1040       900       750       700       400     350
8.9975e+05      123        1700          823       701       689       621       545     421
7.7767e+05        0         350          400       450       250       450       500     515
```

A new row appears in `salesVolume` with data from `numdata`.

Close the database connection.

```
close(conn)
```

Insert and Commit Data in Table

First, connect to the Microsoft® SQL Server® database. Then, export data from MATLAB® into the database and commit the insert transaction. Close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. Use the name-value pair argument `AutoCommit` to specify manually committing transactions to the database.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','','AutoCommit','off');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =
```

```
[]
```

Insert the cell array `data` into the table `inventoryTable` with column names `colnames`.

```
data = {157,358,740.00,datestr(now,'yyyy-mm-dd HH:MM:SS')};
colnames = {'productNumber','Quantity','Price','inventoryDate'};
tablename = 'inventoryTable';

fastinsert(conn,tablename,colnames,data)
```

Commit the insert transaction.

```
commit(conn)
```

Close the database connection.

```
close(conn)
```

Insert Boolean Data into Table

First, connect to the Microsoft® SQL Server® database. Then, export Boolean data from MATLAB® into the database. Close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

This database contains the table `Invoice` with these columns:

- `InvoiceNumber`
- `InvoiceDate`
- `productNumber`
- `Paid`
- `Receipt`

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Display the data in the `Invoice` table before insertion.

```
selectquery = 'SELECT * FROM Invoice';
data = select(conn,selectquery)
```

```
data =

  10×5 table

    InvoiceNumber            InvoiceDate            ProductNumber    Paid        Receipt
    _____________    ___________________________    _____________    _____    ____________

     2101            '2010-08-01 00:00:00.000'        1              false    [8000×1 uir
     3546            '2010-03-01 00:00:00.000'        2              true     [8000×1 uir
    33116            '2011-05-15 00:00:00.000'        3              true     [8000×1 uir
    34155            '2011-07-12 00:00:00.000'        4              false    [8000×1 uir
    34267            '2011-07-22 00:00:00.000'        5              true     [8000×1 uir
    37197            '2011-09-03 00:00:00.000'        6              true     [8000×1 uir
    37281            '2011-09-21 00:00:00.000'        7              false    [8000×1 uir
    41011            '2011-12-12 00:00:00.000'        8              true     [8000×1 uir
    61178            '2012-01-15 00:00:00.000'        9              false    [8000×1 uir
    62145            '2012-01-23 00:00:00.000'       10              true     [8000×1 uir
```

Create the variable `insertdata` as a structure containing the invoice number `2105`, product number `11`, and the Boolean data `false` to signify unpaid. Boolean data is represented as the MATLAB® data type `logical`. This code assumes that the receipt image is missing.

```
insertdata.InvoiceNumber{1} = 2105;
insertdata.InvoiceDate{1} = datestr(now,'yyyy-mm-dd HH:MM:SS');
insertdata.productNumber{1} = 11;
insertdata.Paid{1} = false;
```

Insert the paid invoice data into the `Invoice` table with column names `colnames` using the database connection.

```
colnames = {'InvoiceNumber';'InvoiceDate';'productNumber';'Paid'};
tablename = 'Invoice';

fastinsert(conn,tablename,colnames,insertdata)
```

View the new record in the database to verify that the `Paid` column value is Boolean. In some databases, the MATLAB® logical value `false` shows as a Boolean `false`, `No`, or a cleared check box.

```
data = select(conn,selectquery)
```

```
data =

  11×5 table

    InvoiceNumber           InvoiceDate           ProductNumber    Paid        Receipt
    _____________    _________________________    _____________    _____    ___________

     2101            '2010-08-01 00:00:00.000'     1               false    [8000×1 uin
     3546            '2010-03-01 00:00:00.000'     2               true     [8000×1 uin
    33116            '2011-05-15 00:00:00.000'     3               true     [8000×1 uin
    34155            '2011-07-12 00:00:00.000'     4               false    [8000×1 uin
    34267            '2011-07-22 00:00:00.000'     5               true     [8000×1 uin
    37197            '2011-09-03 00:00:00.000'     6               true     [8000×1 uin
    37281            '2011-09-21 00:00:00.000'     7               false    [8000×1 uin
    41011            '2011-12-12 00:00:00.000'     8               true     [8000×1 uin
    61178            '2012-01-15 00:00:00.000'     9               false    [8000×1 uin
    62145            '2012-01-23 00:00:00.000'    10               true     [8000×1 uin
     2105            '2017-01-04 10:19:42.000'    11               false    ''
```

The last row contains the Boolean data `false`.

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

`tablename` — Database table name
character vector | string scalar

Database table name, specified as a character vector or string scalar denoting the name of a table in the database.

Example: `'employees'`

Data Types: `char` | `string`

`colnames` — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table `tablename`.

Example: `{'col1','col2','col3'}`

Data Types: `cell` | `string`

`data` — Data to insert
numeric matrix | cell array | table | dataset | structure

Data to insert, specified as a numeric matrix, cell array, table, dataset array, or structure that contains all data for insertion into the existing database table `tablename`. If `data` is a structure, then field names in the structure must match `colnames`. If `data` is a table or a dataset array, then the variable names in the table or dataset array must match `colnames`.

To insert data into a structure, table, or dataset array, use this special formatting. Each field or variable in a structure, table, or dataset array must be a cell array or double vector. The double vector must be of size `n`-by-1, where `n` is the number of rows to be inserted.

To reduce conversion time, convert dates to serial date numbers using `datenum` before calling `fastinsert`.

Tips

- The value of the `AutoCommit` property in the `connection` object determines whether `fastinsert` automatically commits the data to the database.
  - To view the `AutoCommit` value, access it using the `connection` object; for example, `conn.AutoCommit`.
  - To set the `AutoCommit` value, use the corresponding name-value pair argument in the `database` function.
  - To commit the data to the database, use the `commit` function or issue an SQL `COMMIT` statement using the `exec` function.
  - To roll back the data, use `rollback` or issue an SQL `ROLLBACK` statement using the `exec` function.
- If an error message like the following appears when you run `fastinsert`, the table might be open in edit mode.

  ```
  [Vendor][ODBC Product Driver] The database engine could
  not lock table 'TableName' because it is already in use
  by another person or process.
  ```

  In this case, close the table in the database and rerun the `fastinsert` function.

Alternative Functionality

To export MATLAB data into a database, you can use the `datainsert` and `insert` functions. For maximum performance, use `datainsert`.

See Also

`close` | `commit` | `database` | `insert` | `logical` | `rollback` | `select` | `sqlwrite`

Topics

"Export Data Using Bulk Insert" on page 5-19
"Replace Existing Data in Database" on page 5-17
"Roll Back Data After Updating Record" on page 5-14
"Data Type Support" on page 1-3

External Websites

SQL Tutorial

Introduced before R2006a

fetch

Package: database.odbc

Import data into MATLAB workspace from execution of SQL statement

Syntax

```
results = fetch(conn,sqlquery)
results = fetch(conn,sqlquery,opts)
results = fetch(___,Name,Value)
```

Description

`results = fetch(conn,sqlquery)` returns all rows of data after executing the SQL statement `sqlquery` for the `connection` object. `fetch` imports data in batches.

`results = fetch(conn,sqlquery,opts)` customizes options for importing data from an executed SQL query by using the `SQLImportOptions` object.

`results = fetch(___,Name,Value)` specifies additional options using one or more name-value pair arguments and any of the previous input argument combinations. For example, `'MaxRows',5` imports five rows of data.

Examples

Import All Data Using connection Object

Import all product data from a Microsoft® SQL Server® database table into MATLAB® by using the `connection` object. Then, determine the highest unit cost among products in the table.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import all the data from `productTable` by using the `connection` object and SQL query, and display the imported data.

```
sqlquery = 'SELECT * FROM productTable';
results = fetch(conn,sqlquery)
```

```
results =

  15×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       'Victorian Doll'
          8          2.1257e+05          1001             5       'Train Set'
          7          3.8912e+05          1007            16       'Engine Kit'
          2          4.0031e+05          1002             9       'Painting Set'
          4          4.0034e+05          1008            21       'Space Cruiser'
          1          4.0035e+05          1001            14       'Building Blocks'
          5          4.0046e+05          1005             3       'Tin Soldier'
          6          4.0088e+05          1004             8       'Sail Boat'
          3            4.01e+05          1009            17       'Slinky'
         10          8.8865e+05          1006            24       'Teddy Bear'
         11          4.0814e+05          1004            11       'Convertible'
         12          2.1046e+05          1010            22       'Hugsy'
         13          4.7082e+05          1012            17       'Pancakes'
         14           5.101e+05          1011            19       'Shawl'
         15          8.9975e+05          1011            20       'Snacks'
```

Determine the highest unit cost for all products in the table.

```
max(results.unitCost)
```

```
ans =

    24
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query Using Import Options

Customize import options when importing data from the results of an SQL query on a database. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different columns in the SQL query. Import data using the `fetch` function.

This example uses the `employees_database.mat` file, which contains the columns `first_name`, `hire_date`, and `DEPARTMENT_NAME`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load employee information into the MATLAB® workspace.

```
employeedata = load('employees_database.mat');
```

Create the `employees` and `departments` database tables using the employee information.

```
emps = employeedata.employees;
depts = employeedata.departments;

sqlwrite(conn,'employees',emps)
sqlwrite(conn,'departments',depts)
```

Create an `SQLImportOptions` object using an SQL query and the `databaseImportOptions` function. This query retrieves all information for employees who are sales managers or programmers.

```
sqlquery = ['SELECT * from employees e join departments d ' ...
    'on (e.department_id = d.department_id) where job_id ' ...
    'in (''IT_PROG'',''SA_MAN'')'];
opts = databaseImportOptions(conn,sqlquery)
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:

   Variable Options:
                     (1) |          (2) |         (3) |     (4) |             (5) |
       Name: 'employee_id' | 'first_name' | 'last_name' | 'email' | 'phone_number' | 'h
       Type:      'double' |       'char' |      'char' |  'char' |          'char' |
  FillValue:         [NaN] |           '' |          '' |      '' |              '' |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `hire_date`, `DEPARTMENT_NAME`, and `first_name` variables using the `setoptions` function. Then, display the updated import options. Because `hire_date` stores date and time data, change the data type of this variable to `datetime`. Because `DEPARTMENT_NAME` designates a finite set of repeating values, change the data type of this variable to `categorical`. Also, change the name of this variable to lowercase. Because `first_name` stores text data, change the data type of this variable to `string`.

```
opts = setoptions(opts,'hire_date','Type','datetime');
opts = setoptions(opts,'DEPARTMENT_NAME','Name','department_name', ...
    'Type','categorical');
opts = setoptions(opts,'first_name','Type','string');

vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:
```

```
   Variable Options:
                         (1) |           (2) |          (3) |     (4) |              (5) | 'h
       Name: 'employee_id' | 'first_name' | 'last_name' | 'email' | 'phone_number' | 'h
       Type:      'double' |     'string' |      'char' |  'char' |          'char' |
  FillValue:           NaN |    <missing> |          '' |      '' |              '' |

    To access sub-properties of each variable, use getoptions
```

Select the three modified variables using the `SelectVariableNames` property.

```
opts.SelectedVariableNames = {'first_name','hire_date','department_name'};
```

Import and display the results of the SQL query using the `fetch` function.

```
employees_data = fetch(conn,sqlquery,opts)
```

```
employees_data=10×3 table
    first_name          hire_date           department_name
    ___________    ____________________    _______________

    "Alexander"    03-Jan-2006 00:00:00          IT
    "Bruce"        21-May-2007 00:00:00          IT
    "David"        25-Jun-2005 00:00:00          IT
    "Valli"        05-Feb-2006 00:00:00          IT
    "Diana"        07-Feb-2007 00:00:00          IT
    "John"         01-Oct-2004 00:00:00          Sales
    "Karen"        05-Jan-2005 00:00:00          Sales
    "Alberto"      10-Mar-2005 00:00:00          Sales
    "Gerald"       15-Oct-2007 00:00:00          Sales
    "Eleni"        29-Jan-2008 00:00:00          Sales
```

Delete the `employees` and `departments` database tables using the `execute` function.

```
execute(conn,'DROP TABLE employees')
execute(conn,'DROP TABLE departments')
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query as Structure

Specify the data return format and the number of imported rows for the results of an SQL query. Import data using an SQL query and the `fetch` function.

This example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Select all data from the `patients` database table and import five rows from the table as a structure. Use the `'DataReturnFormat'` name-value pair argument to specify returning the result data as a structure. Also, use the `'MaxRows'` name-value pair argument to specify five rows. Display the imported data.

```
sqlquery = ['SELECT * FROM ' tablename];
results = fetch(conn,sqlquery,'DataReturnFormat','structure', ...
    'MaxRows',5)
```

```
results = struct with fields:
                    LastName: {5×1 cell}
                      Gender: {5×1 cell}
                         Age: [5×1 double]
                    Location: {5×1 cell}
                      Height: [5×1 double]
                      Weight: [5×1 double]
                      Smoker: [5×1 double]
                    Systolic: [5×1 double]
                   Diastolic: [5×1 double]
    SelfAssessedHealthStatus: {5×1 cell}
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Select Data Using Variable in Query

Import product data from a Microsoft® SQL Server® database into MATLAB® by using an ODBC connection and a variable in the SQL `SELECT` statement.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select all the data from `productTable` by specifying the product description as a variable. Import the data from the executed query using the `fetch` function.

The SQL `SELECT` statement uses square brackets to concatenate the two character vectors. To create the pair of single quotation marks that appears in the SQL `SELECT` statement, specify two sets of four single quotation marks around `productdesc`. The outer two marks delineate the next character vector for concatenation. The two inner marks denote a quotation mark inside a character vector.

```
productdesc = 'Painting Set';
sqlquery = ['SELECT * FROM productTable ' ...
    'WHERE productDescription = ' '''' productdesc ''''];
results = fetch(conn,sqlquery)
```

```
results =

  1×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          2          4.0031e+05          1002             9         'Painting Set'
```

Instead of a variable, use the character vector `'Slinky'` to import data.

```
sqlquery = ['SELECT * FROM productTable ' ...
    'WHERE productDescription = ' '''Slinky'''];
results = fetch(conn,sqlquery)
```

```
results =

  1×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          3           4.01e+05           1009            17            'Slinky'
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use `fetch` function. For procedures that return output arguments, use `runstoredprocedure`.

For information about the SQL query language, see the SQL Tutorial.

Data Types: `char` | `string`

opts — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `results = fetch(conn,sqlquery,'MaxRows',50,'DataReturnFormat','structure')` imports 50 rows of data as a structure.

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `fetch` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

DataReturnFormat — Data return format
`'table'` (default) | `'cellarray'` | `'numeric'` | `'structure'`

Data return format, specified as the comma-separated pair consisting of 'DataReturnFormat' and one of these values:

- 'table'
- 'cellarray'
- 'numeric'
- 'structure'

Use the 'DataReturnFormat' name-value pair argument to specify the data type of the result data results. To specify integer classes for numeric data, use the opts input argument.

You can specify these values using character vectors or string scalars.

Example: 'DataReturnFormat','cellarray' imports data as a cell array.

Output Arguments

results — Result data
table (default) | cell array | structure | numeric matrix

Result data, returned as a table, cell array, structure, or numeric matrix. The result data contains all rows of data from the executed SQL statement by default.

Use the 'MaxRows' name-value pair argument to specify the number of rows of data to import. Use the 'DataReturnFormat' name-value pair argument to specify the data type of the result data.

When the executed SQL statement does not return any rows, the result data is an empty table.

Limitations

The name-value pair argument 'MaxRows' has these limitations:

- If you are using Microsoft Access, the native ODBC interface is not supported.
- Not all database drivers support setting the maximum number of rows before query execution. For an unsupported driver, modify your SQL query to limit the maximum

number of rows to return. The SQL syntax varies with the driver. For details, consult the driver documentation.

Tips

- The order of records in your database does not remain constant. Sort data using the SQL `ORDER BY` command in your `sqlquery` statement.
- For Microsoft Excel, tables in `sqlquery` are Excel worksheets. By default, some worksheet names include a `$` symbol. To select data from a worksheet with this name format, use an SQL statement of the form `SELECT * FROM "Sheet1$"` (or `'Sheet1$'`).
- Before you modify database tables, ensure that the database is not open for editing. If you try to edit the database while it is open, you receive this MATLAB error:

  ```
  [Vendor][ODBC Driver] The database engine could not lock
  table 'TableName' because it is already in use by
  another person or process.
  ```
- The PostgreSQL database management system supports multidimensional fields, but SQL `SELECT` statements fail when retrieving these fields unless you specify an index.
- Some databases require that you include a symbol, such as `#`, before and after a date in a query, as follows:

  ```
  curs = exec(conn,'SELECT * FROM mydb WHERE mydate > #03/05/2005#')
  ```
- Executing the `fetch` function with the `opts` input argument and the `'DataReturnFormat'` name-value pair argument set to the `'numeric'` value has no effect. A corresponding warning message appears in the Command Window.

Alternative Functionality

App

The `fetch` function imports data using the command line. To import data interactively, use the **Database Explorer** app.

Compatibility Considerations

`fetch` function returns results as a table

Behavior changed in R2018b

The `fetch` function returns results as a table instead of a cell array, by default. In prior releases, when the `fetch` function found no data to import, it returned a cell array containing the character vector `'No Data'`. Now, when the function finds no data to import, it returns an empty table.

`fetch` function ignores `'DataReturnFormat'`, `'NullNumberRead'`, and `'NullStringRead'` database preferences

Behavior changed in R2018b

The `fetch` function ignores these database preferences:

- `'DataReturnFormat'`
- `'NullNumberRead'`
- `'NullStringRead'`

You can set the data type of the imported data by using the `'DataReturnFormat'` name-value pair argument of the `fetch` function. For more customization of data types and fill values for missing data in the imported data, use the `SQLImportOptions` object.

See Also

`close` | `database` | `databaseImportOptions` | `execute` | `getoptions` | `reset` | `setoptions`

Topics

“Import Data from Database Table Using sqlread Function” on page 5-52
“Retrieve Image Data Types” on page 5-40
“Data Import Memory Management” on page 5-28
“Customize Options for Importing Data from Database into MATLAB” on page 5-61
“Importing Data Common Errors” on page 3-4

External Websites

SQL Tutorial

Introduced in R2006b

fetchmulti

Package: database.odbc

(Not recommended) Import data from multiple result sets

Note The `fetchmulti` function is not recommended. There is no replacement functionality.

There are no plans to remove the `fetchmulti` function at this time.

Syntax

```
curs = fetchmulti(curs)
```

Description

`curs = fetchmulti(curs)` imports all rows of data from multiple result sets into the `Data` property of the `cursor` object. To create multiple result sets, first execute a SQL query using the `exec` function. The SQL query can contain two or more `SELECT` statements or call a stored procedure that consists of two or more `SELECT` statements. Then, use the `fetchmulti` function to import data in each result set.

Examples

Import Multiple Result Sets

Import inventory and product data from a Microsoft SQL Server database into MATLAB by using the `cursor` object and two SQL queries. Then, determine the highest quantity among inventory items.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password. The database contains the tables `inventoryTable` and `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message

ans =

     []
```

Select all the data from `inventoryTable` and `productTable` by using two `SELECT` statements.

```
sqlquery = 'SELECT * FROM inventoryTable; SELECT * FROM productTable';
curs = exec(conn,sqlquery);
```

Import data from the two result sets. The `fetchmulti` function imports data into the `Data` property of the `cursor` object.

```
curs = fetchmulti(curs)

curs =

  cursor with properties:

         Data: {[13×4 table]  [15×5 table]}
     RowLimit: 0
     SQLQuery: 'SELECT * FROM inventoryTable; SELECT * FROM productTable'
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

The `Data` property is a cell array consisting of cell arrays, tables, structures, or numeric matrices as specified in the `setdbprefs` function. The data type is the same for all result sets. Here, `Data` is a cell array of two tables. The tables contain the data from both result sets. The first table contains data from the first `SELECT` statement. The second table contains data from the second `SELECT` statement.

Display data from both tables.

```
inventory = curs.Data{1,1}
products = curs.Data{1,2}
```

```
inventory =

  13×4 table

    productNumber    Quantity    Price    inventoryDate
    _____________    ________    _____    _____________

     1               1700        15       '2014-09-23'
     2               1200         9       '2014-07-08'
     3                356        17       '2014-05-14'
     4               2580        21       '2013-06-08'
     5               9000         3       '2012-09-14'
     6               4540         8       '2013-12-25'
     7               6034        16       '2014-08-06'
     8               8350         5       '2011-06-18'
     9               2339        13       '2011-02-09'
    10                723        24       '2012-03-14'
    11                567        11       '2012-09-11'
    12               1278        22       '2010-10-29'
    13               1700        17       '2009-05-24'


products =

  15×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

     9               1.2597e+05     1003              13          'Victorian Doll'
     8               2.1257e+05     1001               5          'Train Set'
     7               3.8912e+05     1007              16          'Engine Kit'
     2               4.0031e+05     1002               9          'Painting Set'
     4               4.0034e+05     1008              21          'Space Cruiser'
     1               4.0035e+05     1001              14          'Building Blocks'
     5               4.0046e+05     1005               3          'Tin Soldier'
     6               4.0088e+05     1004               8          'Sail Boat'
     3                 4.01e+05     1009              17          'Slinky'
    10               8.8865e+05     1006              24          'Teddy Bear'
    11               4.0814e+05     1004              11          'Convertible'
    12               2.1046e+05     1010              22          'Hugsy'
    13               4.7082e+05     1012              17          'Pancakes'
    14                5.101e+05     1011              19          'Shawl'
    15               8.9975e+05     1011              20          'Snacks'
```

Determine the highest quantity among inventory items.

```
max(inventory.Quantity)
```

```
ans =

        9000
```

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Input Arguments

curs — Database cursor
`cursor` object

Database cursor, specified as a `cursor` object created using the `exec` function.

Output Arguments

curs — Database cursor
`cursor` object

Database cursor, returned as a `cursor` object populated with imported data in the `Data` property. You can specify the output data format in the `Data` property by using the `setdbprefs` function.

See Also

`close` | `database` | `exec` | `fetch`

Topics

"Call Stored Procedure That Returns Data" on page 5-24
"Import Data from Database Table Using sqlread Function" on page 5-52

“Retrieve Database Metadata” on page 5-58
“Create Queries with Characters and Variables” on page 5-2

External Websites

SQL Tutorial

Introduced in R2006b

get

Package: database.odbc

(Not recommended) Retrieve object properties

Note The `get` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see “Compatibility Considerations”.

Syntax

```
s = get(object)
v = get(object,property)
```

Description

`s = get(object)` returns the structure `s`, which contains the `object` and its corresponding properties.

`v = get(object,property)` returns the value `v` of `property` for the `object`.

Examples

Get `cursor` Object Properties

Retrieve the properties of a `cursor` object.

Establish an ODBC database connection to a MySQL database with the user name `username` and password `pwd`.

```
conn = database('MySQL','username','pwd');
```

Create a `cursor` object.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
```

Retrieve the properties of `curs` and assign them as fields in the structure `v`.

```
v = get(curs)
```

```
v = 

  struct with fields:

          Data: 0
      RowLimit: 0
      SQLQuery: 'SELECT * FROM inventoryTable'
       Message: []
          Type: 'ODBCCursor Object'
     Statement: [1×1 database.internal.ODBCStatementHandle]
    Scrollable: 0
      Position: []
```

Display the SQL query in the `cursor` object.

```
v.SQLQuery
```

```
ans = 

    'SELECT * FROM inventoryTable'
```

Close the `cursor` object and database connection.

```
close(curs)
close(conn)
```

Input Arguments

`object` — Database Toolbox object
`cursor` object

Database Toolbox object, specified as a `cursor` object.

`property` — Property of Database Toolbox object
character vector | string scalar

Property of the Database Toolbox object, specified as a character vector or string scalar.

The following table shows available property names and returned values.

cursor Object Property	Description
'Data'	Data in the cursor object data element (the query results).
'RowLimit'	Maximum number of rows returned by fetch, as specified by set.
'SQLQuery'	SQL statement for a cursor object, as specified by exec.
'Message'	Error message returned from exec or fetch.
'Type'	Object type, specifically 'Database Cursor Object'.
'Statement'	Handle to Java statement object.
'Scrollable'	Logical value to identify the cursor object as scrollable or basic. This property is set to 1 for a scrollable cursor and 0 otherwise. This property is hidden and read-only.
'Position'	Current position of the cursor in the data set. This property is available only for a scrollable cursor. This property behaves differently for native ODBC, JDBC, and other database drivers. This property is read-only.

Data Types: char | string

Output Arguments

s — Object properties
structure

Object properties, returned as a structure that contains the object and its corresponding properties.

v — Object property value
character vector | numeric scalar | cell array | object

Object property value, returned as a character vector, numeric scalar, cell array, or object.

Compatibility Considerations

get function is not recommended

Not recommended starting in R2018b

The `get` function is not recommended. Use the `fetch` function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the `get` function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object, retrieve object properties, and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
s = get(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the `get` function.

See Also

`database` | `fetch` | `getdatasources` | `sqlfind`

Topics

"Retrieve Database Metadata" on page 5-58

External Websites

SQL Tutorial

Introduced before R2006a

getdatasources

Return names of ODBC and JDBC data sources

Syntax

```
d = getdatasources
```

Description

`d = getdatasources` returns the names of valid ODBC and JDBC data sources on the system.

Examples

Retrieve Data Source Names

Connect to a database using its data source name.

Retrieve all ODBC and JDBC data source names on the system.

```
d = getdatasources
```

```
d =

  1×11 cell array

  Columns 1 through 3

    'Excel Files'    'MS Access Database'    'MS SQL Server'

...
```

`d` is a cell array of character vectors. Each character vector is a data source name that is defined on the system.

Use the data source name in the `database` function to connect to a database at the command line. Or, in the Database Explorer app, click **New Query** and then select the data source name from the **Data Source** list.

Output Arguments

d — Data sources
cell array of character vectors

Data sources, returned as a cell array of character vectors.

`d` is empty when the `ODBC.INI` file is valid, but no defined data sources exist.

For ODBC data sources, the `getdatasources` function retrieves data source names from the `ODBC.INI` file located in the folder returned by running:

```
myODBCdir = getenv('WINDIR')
```

The function also retrieves the names of data sources that are in the system registry but not in the `ODBC.INI` file.

For JDBC data sources, the `getdatasources` function retrieves data source names that you define using the JDBC Data Source Configuration dialog box in the Database Explorer app.

Note If you define a JDBC data source with the same name as an existing ODBC data source, the Database Explorer app appends `_JDBC` to the data source name.

See Also

Functions
`database`

Apps
Database Explorer

Topics

"Connecting to Database" on page 2-142

"Configuring Driver and Data Source" on page 2-15

Introduced before R2006a

insert

Package: database.odbc

(To be removed) Add MATLAB data to database tables

Note The `insert` function will be removed in a future release. Use the `sqlwrite` function instead. For details, see “Compatibility Considerations”.

Syntax

`insert(conn,tablename,colnames,data)`

Description

`insert(conn,tablename,colnames,data)` exports data from the MATLAB workspace and inserts it into an existing database table using the database connection `conn`. You can specify the database table name and column names, and specify the data for insertion into the database.

If `conn` is a JDBC database connection, then the `insert` function has the same functionality as the `fastinsert` function.

Examples

Insert Table Record Using Native ODBC

Create an ODBC database connection to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with `admin` as the user name and password.

```
conn = database('dbdemo','admin','admin');
```

This database contains the table `producttable` with these columns:

- productnumber
- stocknumber
- suppliernumber
- unitcost
- productdescription

Select and display the data from the producttable table. The cursor object contains the executed query. Import the data from the executed query using the fetch function.

```
curs = exec(conn,'SELECT * FROM producttable');
curs = fetch(curs);
curs.Data
```

```
ans = 

    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    -------------    -----------    --------------    --------    ------------------
     9               125970         1003              13          'Victorian Doll'
     8               212569         1001               5          'Train Set'
     7               389123         1007              16          'Engine Kit'
     2               400314         1002               9          'Painting Set'
     4               400339         1008              21          'Space Cruiser'
     1               400345         1001              14          'Building Blocks'
     5               400455         1005               3          'Tin Soldier'
     6               400876         1004               8          'Sail Boat'
     3               400999         1009              17          'Slinky'
    10               888652         1006              24          'Teddy Bear'
```

Store the column names of producttable in a cell array.

```
colnames = {'productnumber','stocknumber','suppliernumber',...
    'unitcost','productdescription'};
```

Store data for insertion in the cell array data that contains these values:

- productnumber equal to 11
- stocknumber equal to 400565
- suppliernumber equal to 1010
- unitcost equal to $10
- productdescription equal to 'Rubik''s Cube'

Then, convert the cell array to the table data_table.

```
data = {11,400565,1010,10,'Rubik''s Cube'};
data_table = cell2table(data,'VariableNames',colnames)
```

```
data_table =

    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    -------------    -----------    --------------    --------    ------------------
    11               400565         1010              10          'Rubik's Cube'
```

Insert the table data into `producttable`.

```
tablename = 'producttable';
insert(conn,tablename,colnames,data_table)
```

Display the data from `producttable` again.

```
curs = exec(conn,'SELECT * FROM producttable');
curs = fetch(curs);
curs.Data
```

```
ans =

    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    -------------    -----------    --------------    --------    ------------------
     9               125970         1003              13          'Victorian Doll'
     8               212569         1001               5          'Train Set'
     7               389123         1007              16          'Engine Kit'
     2               400314         1002               9          'Painting Set'
     4               400339         1008              21          'Space Cruiser'
     1               400345         1001              14          'Building Blocks'
     5               400455         1005               3          'Tin Soldier'
     6               400876         1004               8          'Sail Boat'
     3               400999         1009              17          'Slinky'
    10               888652         1006              24          'Teddy Bear'
    11               400565         1010              10          'Rubik's Cube'
```

A new row appears in `producttable` with the data from `data_table`.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

`tablename` — Database table name
character vector | string scalar

Database table name, specified as a character vector or string scalar denoting the name of a table in the database.

Example: `'employees'`

Data Types: `char` | `string`

`colnames` — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table `tablename`.

Example: `{'col1','col2','col3'}`

Data Types: `cell` | `string`

`data` — Insert data
cell array | numeric matrix | table | dataset | structure

Insert data, specified as a cell array, numeric matrix, table, dataset array, or structure. These values depend on the type of database connection.

For a `connection` object, you do not specify the type of data that you are exporting. The `insert` function exports the data in its current MATLAB format. If `data` is a structure, then field names in the structure must match `colnames`. If `data` is a table or a dataset array, then the variable names in the table or dataset array must match `colnames`. If `data` is a structure, table, or dataset array, then specify each field or variable as a:

- Cell array
- Double vector of size m-by-1, where m is the number of rows to insert

For a `sqlite` object, the dataset array is not supported. Only `double`, `int64`, and `char` data types are supported.

Alternative Functionality

To export MATLAB data into a database, you can use the `datainsert` and `fastinsert` functions. For maximum performance, use `datainsert`.

Compatibility Considerations

`insert` function will be removed

Not recommended starting in R2018b

The `insert` function will be removed in a future release. Use the `sqlwrite` function instead. Some differences between the workflows require updates to your code.

In prior releases, you specified a cell array when exporting data from the MATLAB workspace into a database. For example:

```
colnames = {'month','salestotal','revenue'};
data = {'March',50,2000};
tablename = 'yearlysales';
insert(conn,tablename,colnames,data)
```

Now the `sqlwrite` function requires you to specify the data to export as a table.

```
colnames = {'month','salestotal','revenue'};
d = {'March',50,2000};
data = cell2table(d,'VariableNames',colnames);
tablename = 'yearlysales';
sqlwrite(conn,tablename,data)
```

See Also

`close` | `commit` | `database` | `rollback` | `sqlwrite`

Topics

"Insert Data into Database Table" on page 5-55
"Export Data Using Bulk Insert" on page 5-19
"Roll Back Data After Updating Record" on page 5-14
"Data Type Support" on page 1-3

External Websites

SQL Tutorial

Introduced before R2006a

insert

Add MATLAB data to SQLite database table

Syntax

```
insert(conn,tablename,colnames,data)
```

Description

`insert(conn,tablename,colnames,data)` exports data from the MATLAB workspace and inserts it into an existing database table by using the SQLite database connection `conn`. You can specify the database table name and column names, and specify the data to be inserted into the database.

Examples

Insert Table Record Using MATLAB® Interface to SQLite

Create a table in a new SQLite database file, and then insert a new row of data into the table.

Create the SQLite connection `conn` to the new SQLite database file `tutorial.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,'tutorial.db');
```

```
conn = sqlite(dbfile,'create');
```

Create the table `inventoryTable` using `exec`.

```
createInventoryTable = ['create table inventoryTable ' ...
    '(productNumber NUMERIC, Quantity NUMERIC, ' ...
    'Price NUMERIC, inventoryDate VARCHAR)'];
```

```
exec(conn,createInventoryTable)
```

`inventoryTable` is an empty table in `tutorial.db`.

Insert a row of data into `inventoryTable`.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};

insert(conn,'inventoryTable',colnames, ...
    {20,150,50.00,'11/3/2015 2:24:33 AM'})
```

Close the SQLite connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

tablename — Database table name
character vector | string scalar

Database table name, specified as a character vector or string scalar denoting the name of a table in the database.

Example: `'employees'`

Data Types: `char` | `string`

colnames — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table `tablename`.

Example: `{'col1','col2','col3'}`

Data Types: `cell` | `string`

data — Insert data
numeric matrix | structure | table | cell array

Insert data, specified as a numeric matrix, structure, table, or cell array.

See Also

`close` | `exec` | `fetch` | `sqlite`

Topics

“Import Data Using MATLAB® Interface to SQLite” on page 5-35
“Working with MATLAB Interface to SQLite” on page 2-6

External Websites

SQL Tutorial

Introduced in R2016a

querytimeout

Package: database.odbc

(Not recommended) Get time specified for SQL queries to succeed

---

Note The `querytimeout` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see "Compatibility Considerations".

Syntax

`timeout = querytimeout(curs)`

Description

`timeout = querytimeout(curs)` returns the amount of time, in seconds, allowed for SQL queries of the open `cursor` object `curs` to succeed. If a given query cannot complete in the specified time, the toolbox stops trying to perform the query.

The database administrator defines timeout values. If the timeout value is zero, queries must complete immediately.

Examples

Get the current database timeout setting for `curs`.

```
querytimeout(curs)
ans =
     10
```

To create a `cursor` object using an ODBC connection, you can use the native ODBC interface. For details, see `database`.

Limitations

- This error message displays if a given database does not have a database timeout feature:

  ```
  [Driver]Optional feature not implemented
  ```
- ODBC drivers for Microsoft Access and Oracle do not support `querytimeout`.

Compatibility Considerations

`querytimeout` function is not recommended

Not recommended starting in R2018b

The `querytimeout` function is not recommended. Use the `fetch` function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the `querytimeout` function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object, import data, and determine the current database timeout value. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
timeout = querytimeout(curs);
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the `querytimeout` function.

See Also

`exec` | `fetch`

Introduced before R2006a

rollback

Package: database.odbc

Undo database changes

Syntax

```
rollback(conn)
```

Description

`rollback(conn)` reverses changes made to a database using `datainsert`, `fastinsert`, `insert`, or `update` via the database connection `conn`. The `rollback` function reverses all changes made since the last `COMMIT` or `ROLLBACK` operation. To use `rollback`, the `AutoCommit` flag for `conn` must be `off`.

Note If the database engine is not `InnoDB`, `rollback` does not roll back data in MySQL databases.

Examples

1. Ensure that the `AutoCommit` flag for connection `conn` is `off` by running:

   ```
   conn.AutoCommit
   ans =
       'off'
   ```

2. Insert data contained in `exdata` into the columns `DEPTNO`, `DNAME`, and `LOC`, in the table `DEPT`, for the data source `conn`.

   ```
   datainsert(conn,'DEPT',...
   {'DEPTNO';'DNAME';'LOC'},exdata)
   ```

3. Roll back the data `exdata` that you inserted into the database by running:

   ```
   rollback(conn)
   ```

The database contains the original data present before running `datainsert`.

Tips

For ODBC connections, you can use the `rollback` function with the native ODBC interface. For details, see `database`.

See Also

`commit` | `database` | `datainsert` | `get` | `insert` | `update`

Topics

"Roll Back Data After Updating Record" on page 5-14
"Insert Data into Database Table" on page 5-55
"Replace Existing Data in Database" on page 5-17

Introduced before R2006a

rows

Package: database.odbc

(Not recommended) Return number of rows in fetched data set

Note The `rows` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see “Compatibility Considerations”.

Syntax

`numrows = rows(curs)`

Description

`numrows = rows(curs)` returns the number of rows in the fetched data set `curs`.

Examples

Return Number of Rows in `cursor` Object

After executing an SQL statement, return the number of rows in the `cursor` object generated by `fetch`.

Establish the connection `conn` to a MySQL database with the user name `username` and password `pwd`.

```
conn = database('MySQL','username','pwd');
```

Execute a `SELECT` query on the table `productTable` for product numbers 1 through 5 inclusive.

```
curs = exec(conn,['SELECT * FROM productTable'...
            ' WHERE productNumber >= 1 AND productNumber <= 5']);
```

exec returns the cursor object curs.

Fetch the data in curs.

```
curs = fetch(curs);
```

The Data property of curs contains the fetched data from the SELECT query.

Return the number of rows in the Data property of curs.

```
numrows = rows(curs)
```

```
numrows =

     5
```

Display the rows of data in the Data property of curs.

```
curs.Data
```

```
ans =

    [2]    [400314]    [1002]    [ 9]    'Painting Set'
    [4]    [400339]    [1008]    [21]    'Space Cruiser'
    [1]    [400345]    [1001]    [14]    'Building Blocks'
    [5]    [400455]    [1005]    [ 3]    'Tin Soldier'
    [3]    [400999]    [1009]    [17]    'Slinky'
```

After you finish working with the cursor object, close it.

```
close(curs)
```

Close the connection.

```
close(conn)
```

Input Arguments

curs — Database cursor
cursor object

Database cursor, specified as a cursor object created using the exec function.

Output Arguments

numrows — Number of rows in database cursor
numeric scalar

Number of rows in the database cursor, returned as a numeric scalar.

Compatibility Considerations

rows function is not recommended

Not recommended starting in R2018b

The rows function is not recommended. Use the fetch function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the rows function at this time.

Use the fetch function with the connection object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the cursor object, import data, and find the number of rows in the imported data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
numrows = rows(curs);
close(curs)
```

Now you can import data in one step using the fetch function.

```
results = fetch(conn,sqlquery);
sz = size(results);
```

If you return imported data as a table, access details about the variables in the table by using functions such as summary or size. Or, view the dimensions of the returned data in the Workspace browser.

There is no replacement functionality for the rows function.

See Also

`close` | `cols` | `database` | `exec` | `fetch` | `get`

Introduced before R2006a

runsqlscript

Package: database.odbc

Run SQL script on database

Syntax

```
results = runsqlscript(conn,scriptfile)
results = runsqlscript( ___ ,Name,Value)
```

Description

`results = runsqlscript(conn,scriptfile)` returns a `cursor` object array that contains a `cursor` object for each executed SQL command in the SQL script file `scriptfile` using the database connection. The `runsqlscript` function executes all SQL commands in the SQL script file.

`results = runsqlscript( ___ ,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'RowInc',5` returns results from the executed SQL statements in the SQL script file in increments of five rows at a time.

Examples

Run SQL Script

First, connect to the Microsoft® SQL Server® database. Then, run two SQL `SELECT` statements from a SQL script file. Perform simple sales data analysis. Close the database connection.

To find the SQL script file, navigate to `\toolbox\database\dbdemos\compare_sales.sql` in your MATLAB® root folder. Copy and paste the path into your current working folder.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Run the SQL script. The SQL script has two queries. When the SQL script executes, it returns two `cursor` objects that contain the imported data from each query in a `cursor` object array.

```
scriptfile = 'compare_sales.sql';

results = runsqlscript(conn,scriptfile)
```

```
results = 

  1×2 cursor array with properties:

    Data
    RowLimit
    SQLQuery
    Message
    Type
    Statement
    Position
```

Display the `cursor` object for the second query.

```
results(2)
```

```
ans = 
```

```
  cursor with properties:

         Data: [9×6 table]
     RowLimit: 0
     SQLQuery: 'select      productDescription, supplierName, city, January as Jan_Sale
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

Display the imported data for the second query.

```
data = results(2).Data
```

```
data =

  9×6 table

    productDescription              supplierName                  city       Jan_Sales
    __________________    ______________________________    __________    _________

    'Victorian Doll'      'Wacky Widgets'                     'Adelaide'    1400
    'Painting Set'        'Terrific Toys'                     'London'      3000
    'Sail Boat'           'Incredible Machines'               'Dublin'      3000
    'Slinky'              'Doll's Galore'                     'London'      3000
    'Convertible'         'Incredible Machines'               'Dublin'      6000
    'Hugsy'               'The Great Teddy Bear Company'      'Belfast'     1800
    'Pancakes'            'Aunt Jemimas'                      'New York'    3100
    'Shawl'               'Indian Export'                     'Mumbai'       235
    'Snacks'              'Indian Export'                     'Mumbai'       123
```

Retrieve the column names for the second query.

```
names = columnnames(results(2))
```

```
names =

    ''productDescription','supplierName','city','Jan_Sales','Feb_Sales','Mar_Sales''
```

Determine the highest sales amount in January.

```
max(data.Jan_Sales)
```

```
ans =

        6000
```

Close the `cursor` object array and database connection.

```
close(results)
close(conn)
```

Run SQL Script in Row Increments

First, connect to the Microsoft® SQL Server® database. Then, run two SQL `SELECT` statements from a SQL script file. Import data in one-row increments. Perform simple sales data analysis. Close the database connection.

To find the SQL script file, navigate to `\toolbox\database\dbdemos\compare_sales.sql` in your MATLAB® root folder. Copy and paste the path into your current working folder.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Run the SQL script and specify one-row increments. The SQL script has two queries. When the SQL script executes, it returns two `cursor` objects that contain the imported data from each query in a `cursor` object array.

```
results = runsqlscript(conn,'compare_sales.sql','RowInc',1)
```

```
results = 

  1×2 cursor array with properties:

    Data
    RowLimit
    SQLQuery
    Message
    Type
    Statement
    Position
```

Display the imported data for the second query.

```
results(2).Data
```

```
ans =

  1×6 table

    productDescription     supplierName        city       Jan_Sales    Feb_Sales    Ma
    __________________    _______________    __________    _________    _________    _

    'Victorian Doll'      'Wacky Widgets'    'Adelaide'    1400         1100         98
```

Because of the one-row increment specification, only the first row of data is displayed.

Import the next row of data using the `fetch` function and display it.

```
curs = fetch(results(2),1);
curs.Data
```

```
ans =

  1×6 table

    productDescription     supplierName       city      Jan_Sales    Feb_Sales    Mar_
    __________________    _______________    ________    _________    _________    ____
```

```
    'Painting Set'        'Terrific Toys'    'London'    3000         2400         180
```

Determine the highest sales amount among the months of January, February, and March.

```
data = curs.Data;
max([data.Jan_Sales data.Feb_Sales data.Mar_Sales])
```

```
ans =

        3000
```

Close the `cursor` object array, `cursor` object, and database connection.

```
close(results)
close(curs)
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

`scriptfile` — SQL script file name
character vector | string scalar

SQL script file name that contains SQL statements to run, specified as a character vector or string scalar. The file must be a text file and can contain comments along with SQL queries. Start single-line comments with `--`. Enclose multiline comments in `/*...*/`.

Example: `'C:\work\sql_file.sql'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes.

You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `results = runsqlscript(conn,scriptfile,'RowInc',3,'QTimeOut',60);`

`RowInc` — Row limit
`0` (default) | numeric scalar

Row limit indicating the number of rows to retrieve at a time, specified as the comma-separated pair consisting of `'RowInc'` and a positive numeric scalar. Use this name-value pair argument when importing large amounts of data. Importing data in increments helps reduce overall retrieval time.

By default, the `runsqlscript` function imports all rows of data from the executed SQL statements. The value `0` specifies to import all rows of data.

Example: `'RowInc',5`

Data Types: `double`

`QTimeOut` — Query timeout
`0` (default) | numeric scalar

Query timeout in seconds, specified as the comma-separated pair consisting of `'QTimeOut'` and a positive numeric scalar. By default, the `runsqlscript` function waits an unlimited number of seconds to execute SQL statements in the SQL script file. The value `0` specifies to wait an unlimited amount of time.

Example: `'QTimeOut',180`

Data Types: `double`

Output Arguments

`results` — Query results
`cursor` object array

Query results from executing the SQL commands in the SQL script file, returned as a `cursor` object array. The number of elements in `results` is equal to the number of batches on page 9-245 in the file `scriptfile`.

`results(M)` contains the results from executing the `M`th batch in the SQL script. If the batch returns a result set, then it is stored in `results(M).Data`.

Limitations

- Use `runsqlscript` to import data into MATLAB, especially if you have long and complex SQL queries that are difficult to convert into MATLAB character vectors or string scalars. `runsqlscript` is not designed to handle SQL scripts containing continuous PL/SQL blocks with `BEGIN` and `END`, such as stored procedure definitions or trigger definitions. However, table definitions do work.
- An SQL script containing any of the following can produce unexpected results:
  - Apostrophes that are not escaped, including the ones in comments. For example, write the character vector `'Here's the code'` as `'Here''s the code'`.
  - Nested comments.
- An SQL script containing more than 25,000 characters causes `runsqlscript` to return an error.

Definitions

Batch

One or more SQL statements terminated by either a semicolon or the keyword `GO`; for example:

```
SELECT productDescription, supplierName
FROM suppliers A, productTable B
WHERE A.SupplierNumber = B.SupplierNumber;

SELECT supplierName, Country
FROM suppliers;
```

Tips

- Any values assigned to `RowInc` or `QTimeOut` apply to all queries in the SQL script. For example, if `'RowInc'` is set to `5`, then all queries in the script return at most five rows in their respective query results.
- You can set preferences for the query results using the `setdbprefs` function. Preference settings apply to all queries in the SQL script. For example, if the `'DataReturnFormat'` is set to numeric, all query results return as numeric matrices.

See Also

`close` | `database` | `fetch` | `setdbprefs`

Topics

“Import Data from Database Table Using sqlread Function” on page 5-52
“Configuring Driver and Data Source” on page 2-15
“Generate SQL Query and MATLAB Script” on page 4-18
“Data Import Using Database Explorer App or Command Line” on page 2-145

Introduced in R2012a

runstoredprocedure

Package: database.odbc

Call stored procedure with and without input and output arguments

This function calls a stored procedure that has no input arguments, no output arguments, or any combination of input and output arguments. Define and instantiate this stored procedure in your database.

You can use this function if you connect to your database using a JDBC driver. For details, see "Connecting to Database" on page 2-142. If you are using the native ODBC interface to connect to your database, use `exec` to call the stored procedure.

Syntax

```
results = runstoredprocedure(conn,spname)
results = runstoredprocedure(conn,spname,inputargs)
results = runstoredprocedure(conn,spname,inputargs,outputtypes)
```

Description

`results = runstoredprocedure(conn,spname)` calls the stored procedure `spname` using the database connection `conn`. `results` is a logical `1` if the stored procedure returns a data set. Otherwise, `results` is a logical `0`.

`results = runstoredprocedure(conn,spname,inputargs)` calls the stored procedure that accepts one or more input arguments `inputargs`.

`results = runstoredprocedure(conn,spname,inputargs,outputtypes)` calls the stored procedure that returns output arguments by specifying the output argument data types `outputtypes`. `results` is a cell array that contains one or more output arguments.

Examples

Call a Stored Procedure Without Input and Output Arguments

Define a stored procedure named `create_table` that creates a table named `test_table` by executing this code. This procedure has no input or output arguments. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE create_table

AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

CREATE TABLE test_table
     (
        CATEGORY_ID     INTEGER     IDENTITY PRIMARY KEY,
        CATEGORY_DESC   CHAR(50)    NOT NULL
        );

END
GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see “Connecting to Database” on page 2-142. Then, call the stored procedure `create_table` using the database connection `conn`.

```
results = runstoredprocedure(conn,'create_table')
```

```
results =

   0
```

`results` returns 0 because calling `create_table` does not return a data set.

Check your database for a new table named `test_table`.

Close the database connection `conn`.

```
close(conn)
```

Call a Stored Procedure with Input Arguments

Define a stored procedure named `insert_data` that inserts a category description into a table named `test_create` by executing this code. This procedure has one input argument `data`. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE insert_data
    @data varchar(50)

AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

    INSERT INTO test_create (CATEGORY_DESC)
    VALUES (@data)
END
GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see "Connecting to Database" on page 2-142. Then, call the stored procedure `insert_data` using the database connection `conn` with the category description `Apples` as the input argument.

```
inputarg = {'Apples'};

results = runstoredprocedure(conn,'insert_data',inputarg)

results =

   0
```

`results` returns 0 because calling `insert_data` does not return a data set.

The table `test_create` adds a row where the column `CATEGORY_ID` equals `1` and the column `CATEGORY_DESCRIPTION` equals `Apples`.

`CATEGORY_ID` is the primary key of the table `test_create`. This primary key increments automatically. `CATEGORY_ID` equals `1` when calling `insert_data` for the first time.

Close the database connection `conn`.

```
close(conn)
```

Call a Stored Procedure with Output Arguments

Define a stored procedure named `maxDecVolume` that selects the maximum sales volume in December by executing this code. This procedure has one output argument `data` and no input arguments. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE maxDecVolume
    @data int OUTPUT
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

     SELECT @data = max(December) FROM salesVolume
END

GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see "Connecting to Database" on page 2-142. Then, call the stored procedure using:

- Database connection `conn`
- Stored procedure `maxDecVolume`
- Empty brackets to denote no input arguments
- Numeric Java data type `outputtype`

```
outputtype = {java.sql.Types.NUMERIC};

results = runstoredprocedure(conn,'maxDecVolume',[],outputtype)
```

```
results =

    [1x1 java.math.BigDecimal]
```

`results` returns a cell array that contains the maximum sales volume as a Java decimal data type.

Display the value in `results`.

```
results{1}
```

```
ans =

35000
```

The maximum sales volume in December is 35,000.

Close the database connection `conn`.

```
close(conn)
```

Call a Stored Procedure with Input and Output Arguments

Define a stored procedure named `getSuppCount` that counts the number of suppliers for a specified city by executing this code. This procedure has one input argument `cityName` and one output argument `suppCount`. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE getSuppCount
    (@cityName varchar(20),
     @suppCount int OUTPUT)
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

    SELECT @suppCount = count(supplierNumber)
 FROM suppliers WHERE City = @cityName;

END
GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see "Connecting to Database" on page 2-142. Then, call the stored procedure `getSuppCount` using the database connection `conn`. The input argument `inputarg` is a cell array containing the character vector `'New York'`. The output Java data type `outputtype` is numeric.

```
inputarg = {'New York'};
outputtype = {java.sql.Types.NUMERIC};
```

```
results = runstoredprocedure(conn,'getSuppCount',inputarg,outputtype)
```

```
results =

    [1x1 java.math.BigDecimal]
```

`results` is a cell array that contains the supplier count as a Java decimal data type.

Display the value in `results`.

```
results{1}
```

```
ans =

6.0000
```

There are six suppliers in New York.

Close the database connection `conn`.

```
close(conn)
```

Call a Stored Procedure with Multiple Input and Output Arguments

Define a stored procedure named `productsWithinUnitCost` that returns the product number and description for products that have a unit cost in a specified range by executing this code. This procedure has two input arguments `minUnitCost` and `maxUnitCost`. This procedure has two output arguments `productno` and `productdesc`. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE productsWithinUnitCost
    (@minUnitCost INT,
    @maxUnitCost INT,
    @productno INT OUTPUT,
    @productdesc VARCHAR(50) OUTPUT)
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

 SELECT @productno = productNumber, @productdesc = productDescription
```

```
 FROM productTable
    WHERE unitCost > @minUnitCost AND unitCost < @maxUnitCost
END


GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see “Connecting to Database” on page 2-142. Then, call the stored procedure using:

- Database connection `conn`
- Stored procedure `productsWithinUnitCost`
- Input arguments `inputargs` to specify a unit cost between 19 and 21
- Output Java data types `outputtypes` to specify numeric and string data types for product number and description

```
inputargs = {19,21};
outputtypes = {java.sql.Types.NUMERIC,java.sql.Types.VARCHAR};

results = runstoredprocedure(conn,'productsWithinUnitCost',...
                              inputargs,outputtypes)
```

```
results =

    [1x1 java.math.BigDecimal]
    'Snacks'
```

`results` returns a cell array that contains the product number as a Java decimal data type and the product description as a string.

Display the product number in `results`.

```
results{1}
```

```
ans =

15
```

The product with product number 15 has a unit cost between 19 and 21.

Display the product description in `results`.

```
results{2}
```

```
ans =

Snacks
```

The product with product number 15 has the product description `Snacks`.

Here, the narrow unit cost range returns only one product. If the unit cost range is wider, then more than one product might satisfy this condition. To return a data set with numerous products, use `exec` and `fetch` to call this stored procedure. Otherwise, `runstoredprocedure` returns only the last row in the data set.

Close the database connection `conn`.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

spname — Stored procedure name
character vector

Stored procedure name, specified as a character vector that contains the name of the stored procedure that is defined and instantiated in your database.

Data Types: `char`

inputargs — Input arguments
cell array

Input arguments, specified as a cell array of one or more values for each input argument of the stored procedure. Input arguments can be only basic data types such as double, character vector, logical, and so on.

Data Types: `cell`

outputtypes — Output types
cell array

Output types, specified as a cell array of one or more Java data types for the output arguments of the stored procedure. Some JDBC drivers do not support all `java.sql.Types`. Consult your JDBC driver documentation to find the supported types. Match them to the data types found in your stored procedure.

Example: `{java.sql.Types.NUMERIC}`

Data Types: `cell`

Output Arguments

`results` — Stored procedure results
logical | cell array

Stored procedure results, returned as a logical or cell array.

`runstoredprocedure` returns a logical `1` when calling the stored procedure returns a data set. Otherwise, `runstoredprocedure` returns a logical `0`. If the stored procedure returns a data set, use `exec` and `fetch` to call the stored procedure and retrieve the data set. For details, see “Call Stored Procedure That Returns Data” on page 5-24.

`runstoredprocedure` returns a cell array when you specify one or more output Java data types for the output arguments of the stored procedure. Use cell array indexing to retrieve the output argument values.

See Also

`close` | `database` | `exec` | `fetch`

Topics

“Call Stored Procedure That Returns Data” on page 5-24
“Connecting to Database” on page 2-142

External Websites

SQL Tutorial

Introduced in R2006b

select

Execute SQL `SELECT` statement and import data into MATLAB

Syntax

```
data = select(conn,selectquery)
data = select(conn,selectquery,Name,Value)
[data,metadata] = select( ___ )
```

Description

`data = select(conn,selectquery)` returns imported data from the database connection `conn` for the specified SQL `SELECT` statement `selectquery`.

`data = select(conn,selectquery,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'MaxRows',10` sets the maximum number of rows to return to 10 rows.

`[data,metadata] = select( ___ )` returns information about the imported data using any of the input argument combinations in the previous syntaxes. Use this information to change missing values in the imported data and view data types for each variable.

Examples

Import and Access Data Immediately

Import data from a database in one step using the `select` function. You can access data and perform immediate data analysis.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
```

```
    Gender VARCHAR(10),
    Age TINYINT,
    Location VARCHAR(300),
    Height SMALLINT,
    Weight SMALLINT,
    Smoker BIT,
    Systolic FLOAT,
    Diastolic NUMERIC,
    SelfAssessedHealthStatus VARCHAR(20))
```

This example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import all data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function. `data` is a table that contains the imported data.

```
selectquery = 'SELECT * FROM Patients';

data = select(conn,selectquery)
```

```
data =

  10×10 table

    LastName      Gender     Age              Location               Height    Weight
   __________    ________    ___    _____________________________    ______    ______

   'Smith'       'Male'      38     'Country General Hospital'       -32768       176
   'Johnson'     'Male'      43     'VA Hospital'                        69       163
   'Williams'    'Female'    38     ''                                   64       131
   'Jones'       'Female'     0     'VA Hospital'                        67       133
   'Broen'       'Female'    49     'Country General Hospital'           64       119
   'Davis'       'Female'    46     'St Mary's Medical Center'           68       142
   'Miller'      'Female'    33     'VA Hospital'                        64       142
   'Wilson'      'Male'      40     'VA Hospital'                    -32768       180
   'Moore'       'Male'      28     'St Mary's Medical Center'           68    -32768
   'Taylor'      'Female'    31     'Country General Hospital'           68       132
```

Determine the number of male patients by immediately accessing the data. Use the `count` function to find occurrences in the gender data of the character vector that represents a male. Determine the total number of occurrences.

```
males = count(data.Gender,'Male');
sum(males)
```

```
ans =

     4
```

Close the database connection.

```
close(conn)
```

Limit Number of Rows in Imported Data

Import a limited number of rows from a database in one step using the `select` function. Database Toolbox™ imports the data using MATLAB® numeric data types that correspond to data types in the database table. After importing data, you can access data and perform immediate data analysis.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
      Gender VARCHAR(10),
      Age TINYINT,
      Location VARCHAR(300),
      Height SMALLINT,
      Weight SMALLINT,
      Smoker BIT,
      Systolic FLOAT,
      Diastolic NUMERIC,
      SelfAssessedHealthStatus VARCHAR(20))
```

Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function. Limit the number of imported rows using the name-value pair argument `'MaxRows'`.

`data` is a table. The MATLAB® data types in the table correspond to the data types in the database. Here, `Age` has data type `uint8` that corresponds to `TINYINT` in the table definition.

`metadata` is a table that contains additional information about each variable in `data`.

- `VariableType` -- MATLAB® data type
- `MissingValue` -- `NULL` value representation
- `MissingRows` -- Vector of row indices that contain a missing value

```
selectquery = 'SELECT * FROM Patients';

[data,metadata] = select(conn,selectquery,'MaxRows',5)
```

```
data =

  5×10 table

     LastName      Gender     Age              Location              Height    Weight
    __________    ________    ___    ___________________________    ______    ______

    'Smith'       'Male'      38     'Country General Hospital'    -32768    176
    'Johnson'     'Male'      43     'VA Hospital'                     69    163
    'Williams'    'Female'    38     ''                                64    131
    'Jones'       'Female'     0     'VA Hospital'                     67    133
    'Broen'       'Female'    49     'Country General Hospital'        64    119


metadata =

  10×3 table
```

```
                                VariableType    MissingValue    MissingRows 
                                ____________    ____________    ____________

    LastName                    'char'          ''              [0×1 double]
    Gender                      'char'          ''              [0×1 double]
    Age                         'uint8'         [     0]        [         4]
    Location                    'char'          ''              [0×1 double]
    Height                      'int16'         [-32768]        [         1]
    Weight                      'int16'         [-32768]        [0×1 double]
    Smoker                      'logical'       [     0]        [0×1 double]
    Systolic                    'single'        [   NaN]        [         2]
    Diastolic                   'double'        [   NaN]        [0×1 double]
    SelfAssessedHealthStatus    'char'          ''              [0×1 double]
```

Determine the number of male patients by immediately accessing the data. Use the `count` function to find occurrences in the gender data of the character vector that represents a male. Determine the total number of occurrences.

```
males = count(data.Gender,'Male');
sum(males)
```

```
ans =

     2
```

Close the database connection.

```
close(conn)
```

View Information About Imported Data

Import data from a database in one step using the `select` function. Database Toolbox™ imports the data using MATLAB® numeric data types that correspond to data types in the database table. You can view data type information in the imported data. You can also access data and perform immediate data analysis.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
      Gender VARCHAR(10),
      Age TINYINT,
      Location VARCHAR(300),
      Height SMALLINT,
      Weight SMALLINT,
      Smoker BIT,
      Systolic FLOAT,
      Diastolic NUMERIC,
      SelfAssessedHealthStatus VARCHAR(20))
```

Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import all data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function.

`data` is a table. The MATLAB® data types in the table correspond to the data types in the database. Here, `Age` has the MATLAB® data type `uint8` that corresponds to `TINYINT` in the table definition.

`metadata` is a table that contains additional information about each variable in `data`.

- `VariableType` -- MATLAB® data type
- `MissingValue` -- Null value representation
- `MissingRows` -- Vector of row indices that contain a missing value

```
selectquery = 'SELECT * FROM Patients';
```

```
[data,metadata] = select(conn,selectquery)
```

```
data =

  10×10 table

     LastName       Gender      Age                Location                Height     Weight
```

```
    __________    ________    ___    __________________________    ______    ______

    'Smith'       'Male'      38     'Country General Hospital'    -32768       176
    'Johnson'     'Male'      43     'VA Hospital'                     69       163
    'Williams'    'Female'    38     ''                                64       131
    'Jones'       'Female'     0     'VA Hospital'                     67       133
    'Broen'       'Female'    49     'Country General Hospital'        64       119
    'Davis'       'Female'    46     'St Mary's Medical Center'        68       142
    'Miller'      'Female'    33     'VA Hospital'                     64       142
    'Wilson'      'Male'      40     'VA Hospital'                 -32768       180
    'Moore'       'Male'      28     'St Mary's Medical Center'        68    -32768
    'Taylor'      'Female'    31     'Country General Hospital'        68       132


metadata =

  10×3 table

                                VariableType    MissingValue    MissingRows 
                                ____________    ____________    ____________

    LastName                    'char'          ''              [0×1 double]
    Gender                      'char'          ''              [0×1 double]
    Age                         'uint8'         [     0]        [         4]
    Location                    'char'          ''              [0×1 double]
    Height                      'int16'         [-32768]        [2×1 double]
    Weight                      'int16'         [-32768]        [         9]
    Smoker                      'logical'       [     0]        [0×1 double]
    Systolic                    'single'        [   NaN]        [2×1 double]
    Diastolic                   'double'        [   NaN]        [         6]
    SelfAssessedHealthStatus    'char'          ''              [0×1 double]
```

View data types of each variable in the table.

```
metadata.VariableType
```

```
ans =

  10×1 cell array

    'char'
    'char'
    'uint8'
```

```
    'char'
    'int16'
    'int16'
    'logical'
    'single'
    'double'
    'char'
```

Determine the number of male patients by immediately accessing the data. Use the `count` function to find occurrences in the gender data of the character vector that represents a male. Determine the total number of occurrences.

```
males = count(data.Gender,'Male');
sum(males)
```

```
ans =

     4
```

Close the database connection.

```
close(conn)
```

Change Missing Values in Imported Data Using for Loop

Import data from a database in one step using the `select` function. During import, the `select` function sets default values for missing data in each row. Use the information about the imported data to change the default values.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
      Gender VARCHAR(10),
      Age TINYINT,
      Location VARCHAR(300),
      Height SMALLINT,
      Weight SMALLINT,
```

```
    Smoker BIT,
    Systolic FLOAT,
    Diastolic NUMERIC,
    SelfAssessedHealthStatus VARCHAR(20))
```

Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import all data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function.

`data` is a table that contains the imported data.

`metadata` is a table that contains additional information about each variable in `data`.

- `VariableType` -- MATLAB® data type
- `MissingValue` -- `NULL` value representation
- `MissingRows` -- Vector of row indices that indicate the location of missing values

```
selectquery = 'SELECT * FROM Patients';

[data,metadata] = select(conn,selectquery)
```

```
data = 

  10×10 table array

     LastName      Gender     Age              Location               Height    Weight
    __________    ________    ___    ___________________________    ______    ______

    'Smith'       'Male'      38     'Country General Hospital'     -32768     176
    'Johnson'     'Male'      43     'VA Hospital'                      69     163
    'Williams'    'Female'    38     ''                                 64     131
    'Jones'       'Female'     0     'VA Hospital'                      67     133
    'Broen'       'Female'    49     'Country General Hospital'         64     119
    'Davis'       'Female'    46     'St Mary's Medical Center'         68     142
    'Miller'      'Female'    33     'VA Hospital'                      64     142
```

```
    'Wilson'      'Male'      40     'VA Hospital'                     -32768        180
    'Moore'       'Male'      28     'St Mary's Medical Center'            68     -32768
    'Taylor'      'Female'    31     'Country General Hospital'            68        132
```

```
metadata = 

  10×3 table array

                                VariableType    MissingValue    MissingRows 
                                ____________    ____________    ____________

    LastName                    'char'          ''              [0×1 double]
    Gender                      'char'          ''              [0×1 double]
    Age                         'uint8'         [     0]        [         4]
    Location                    'char'          ''              [0×1 double]
    Height                      'int16'         [-32768]        [2×1 double]
    Weight                      'int16'         [-32768]        [         9]
    Smoker                      'logical'       [     0]        [0×1 double]
    Systolic                    'single'        [   NaN]        [2×1 double]
    Diastolic                   'double'        [   NaN]        [         6]
    SelfAssessedHealthStatus    'char'          ''              [0×1 double]
```

Retrieve indices that indicate the location of missing values in the `Height` variable using the `metadata` output argument.

```
values = metadata.MissingRows{'Height'}
```

```
values = 

     1
     8
```

Change the default value for missing data from `-32768` to `0` using a for loop. Access the imported data using the indices.

```
for i = 1:length(values)
    data.Height(values(i)) = 0;
end
```

View the imported data.

```
data.Height
```

```
ans =

  10×1 int16 column vector

    0
   69
   64
   67
   64
   68
   64
    0
   68
   68
```

Missing values appear as `0`.

Close the database connection.

```
close(conn)
```

Change Missing Values in Imported Data Using Vector Indexing

Import data from a database in one step using the `select` function. During import, the `select` function sets default values for missing data in each row. Use the information about the imported data to change default values by indexing into the vector.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
      Gender VARCHAR(10),
      Age TINYINT,
      Location VARCHAR(300),
      Height SMALLINT,
      Weight SMALLINT,
      Smoker BIT,
```

```
    Systolic FLOAT,
    Diastolic NUMERIC,
    SelfAssessedHealthStatus VARCHAR(20))
```

Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import all data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function.

`data` is a table that contains the imported data.

`metadata` is a table that contains additional information about each variable in `data`.

- `VariableType` -- MATLAB® data type
- `MissingValue` -- `NULL` value representation
- `MissingRows` -- Vector of row indices that indicate the location of missing values

```
selectquery = 'SELECT * FROM Patients';

[data,metadata] = select(conn,selectquery)
```

```
data =

  10×10 table array

    LastName      Gender      Age              Location              Height    Weight
   __________    ________    ___    ___________________________    ______    ______

   'Smith'       'Male'      38     'Country General Hospital'     -32768       176
   'Johnson'     'Male'      43     'VA Hospital'                      69       163
   'Williams'    'Female'    38     ''                                 64       131
   'Jones'       'Female'     0     'VA Hospital'                      67       133
   'Broen'       'Female'    49     'Country General Hospital'         64       119
   'Davis'       'Female'    46     'St Mary's Medical Center'         68       142
   'Miller'      'Female'    33     'VA Hospital'                      64       142
   'Wilson'      'Male'      40     'VA Hospital'                  -32768       180
```

```
    'Moore'       'Male'      28     'St Mary's Medical Center'        68    -32768
    'Taylor'      'Female'    31     'Country General Hospital'        68       132


metadata = 

  10×3 table array

                                VariableType    MissingValue    MissingRows 
                                ____________    ____________    ____________

    LastName                    'char'          ''              [0×1 double]
    Gender                      'char'          ''              [0×1 double]
    Age                         'uint8'         [     0]        [         4]
    Location                    'char'          ''              [0×1 double]
    Height                      'int16'         [-32768]        [2×1 double]
    Weight                      'int16'         [-32768]        [         9]
    Smoker                      'logical'       [     0]        [0×1 double]
    Systolic                    'single'        [   NaN]        [2×1 double]
    Diastolic                   'double'        [   NaN]        [         6]
    SelfAssessedHealthStatus    'char'          ''              [0×1 double]
```

Retrieve indices that indicate the location of missing values in the `Height` variable using the `metadata` output argument.

```
values = metadata(5,3)
valuesindex = values.MissingRows{1}
```

```
values = 

  table

              MissingRows 
              ____________

    Height    [2×1 double]


valuesindex =

     1
     8
```

Change the default value for missing data from `-32768` to `0` using vector indexing.

```
data.Height(valuesindex) = 0;
```

View the imported data.

```
data.Height
```

```
ans =

  10×1 int16 column vector

    0
   69
   64
   67
   64
   68
   64
    0
   68
   68
```

Missing values appear as `0`.

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

selectquery — SQL SELECT statement
character vector | string

SQL SELECT statement, specified as a character vector or string. The select function only executes SQL SELECT statements. To execute other SQL statements, use the exec function.

Example: 'SELECT * FROM inventoryTable'

Data Types: char | string

Name-Value Pair Arguments

Specify optional comma-separated pairs of Name,Value arguments. Name is the argument name and Value is the corresponding value. Name must appear inside quotes. You can specify several name and value pair arguments in any order as Name1,Value1,...,NameN,ValueN.

Example: 'MaxRows',100,'QueryTimeOut',5 returns 100 rows of data and waits 5 seconds to execute the SQL SELECT statement.

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of 'MaxRows' and a positive numeric scalar. By default, the select function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: 'MaxRows',10

Data Types: double

QueryTimeOut — SQL query timeout
positive numeric scalar

SQL query timeout, specified as the comma-separated pair consisting of 'QueryTimeOut' and a positive numeric scalar. By default, the select function ignores the timeout value. Use this name-value pair argument to specify the number of seconds to wait for executing the SQL query selectquery.

Example: 'QueryTimeOut',15

Output Arguments

data — Imported data
table

Imported data, returned as a table. The rows of the table correspond to the rows of data returned from the executed SQL query `selectquery`. The variable names of the table specify the columns in the SQL query.

The `select` function returns date or time data as character vectors in the table. This function returns text as character vectors or a cell array of character vectors. Strings are not supported in the table.

If no data to import exists, then `data` is an empty table.

metadata — Information about imported data
table

Information about imported data, returned as a table. The row names of `metadata` are variable names in `data`. This function stores each variable name in the `metadata` table as a cell array. `metadata` has these variable names:

- `VariableType` — Data types of each variable in `data`
- `MissingValue` — Representation of missing value for each variable in `data`
- `MissingRows` — Vector of row indices that indicate locations of missing values for each variable in `data`

This table shows how MATLAB represents `NULL` values in the database by default after data import.

Database Data Type	Default NULL Value
SIGNED TINYINT	-128
UNSIGNED TINYINT	0
SIGNED SMALLINT	-32768
UNSIGNED SMALLINT	0
SIGNED INT	-2147483648
UNSIGNED INT	0

Database Data Type	Default NULL Value
SIGNED BIGINT	-9223372036854775808
UNSIGNED BIGINT	0
REAL	NaN
FLOAT	NaN
DOUBLE	NaN
DECIMAL	NaN
NUMERIC	NaN
Boolean	false
Date, time, or text	''

To change the NULL value representation in the imported data, replace the default value by looping through the imported data or using vector indexing.

Limitations

- You cannot customize missing values in the output argument data using the select function. Index into the imported data using the metadata output argument instead.
- The output argument data does not support cell and struct data types. The select function only supports table.

Alternative Functionality

Use the exec and fetch functions for full functionality when importing data. For differences between the select function and this alternative, see “Data Import Using Database Explorer App or Command Line” on page 2-145.

See Also

close | count | database | exec | fetch

Topics

“Data Import Using Database Explorer App or Command Line” on page 2-145

"Data Import Memory Management" on page 5-28
"Import Data from Database Table Using sqlread Function" on page 5-52

External Websites

SQL Tutorial

Introduced in R2017a

set

Package: database.odbc

(Not recommended) Set properties for database cursor

Note The `set` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see "Compatibility Considerations".

Syntax

```
set(object,'property',value)
set(object)
```

Description

`set(object,'property',value)` sets the value of *`property`* to `value` for the specified `cursor`.

`set(object)` displays all properties for `object`.

`cursor` Objects

Valid values for the *`property`* and `value` arguments for a `cursor` object are as follows.

Property	Value	Description
'RowLimit'	positive integer	Set the `RowLimit` for `fetch`. Specify this property instead of passing `RowLimit` as an argument to the `fetch` function. When you define `RowLimit` for `fetch` by using `set`, then `fetch` behaves differently depending on what type of database you are using.

Examples

Example 1 — Set RowLimit for cursor Object

Establish a JDBC connection to a data source. Run fetch to retrieve data from the table EMP, and then set the row limit to 5.

```
conn = database('orcl','scott','tiger',...
    'oracle.jdbc.driver.OracleDriver',...
    'jdbc:oracle:thin:@144.212.123.24:1822:');
curs = exec(conn,'SELECT * FROM EMP');
set(curs,'RowLimit',5)
curs = fetch(curs)
curs =

  cursor with properties:

     Attributes: []
           Data: {5x8 cell}
 DatabaseObject: [1x1 database]
       RowLimit: 5
       SQLQuery: 'SELECT * FROM EMP'
        Message: []
           Type: 'Database Cursor Object'
      ResultSet: [1x1 oracle.jdbc.driver.OracleResultSet]
         Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]
      Statement: [1x1 oracle.jdbc.driver.OracleStatement]
          Fetch: [1x1 com.mathworks.toolbox.database.fetchTheData]
```

The RowLimit property of curs is 5 and the Data property is 5x8 cell, indicating that fetch returned five rows of data.

In this example, RowLimit limits the maximum number of rows you can retrieve. Therefore, rerunning the fetch function returns no data.

Compatibility Considerations

set function is not recommended

Not recommended starting in R2018b

The set function is not recommended. Use the fetch function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the set function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object, set object properties, and import data. For example:

```
curs = exec(conn,sqlquery);
set(curs,'RowLimit',5)
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the `set` function.

See Also

`commit` | `database` | `fetch` | `rollback` | `update`

Topics

"Roll Back Data After Updating Record" on page 5-14

Introduced before R2006a

setdbprefs

Set preferences for retrieval format, errors, NULLs, and more

Syntax

```
setdbprefs
v = setdbprefs
setdbprefs(preference)
```

```
setdbprefs(preference,value)
setdbprefs(s)
```

Description

`setdbprefs` returns current values for database preferences.

`v = setdbprefs` returns current values to the structure `v`.

`setdbprefs(preference)` returns the current value for the specified `preference`.

`setdbprefs(preference,value)` sets the specified `preference` to `value`. After you set database preferences, they are retained across MATLAB sessions.

`setdbprefs(s)` sets preferences specified in the structure `s` to values that you specify.

Examples

Display Current Values

Display all database preferences and their current values.

```
setdbprefs
```

```
ans =
```

```
  struct with fields:

    DataReturnFormat: 'table'
       ErrorHandling: 'store'
      NullNumberRead: 'NaN'
     NullNumberWrite: 'NaN'
      NullStringRead: 'null'
     NullStringWrite: 'null'
```

Display the current value for the specified database preference.

```
setdbprefs('ErrorHandling')
```

```
ans =

    'report'
```

Change Preference Setting

Set a database preference to a different value. Change the display of errors in MATLAB by modifying the database error handling preference.

Specify the `store` format for the `ErrorHandling` preference.

```
setdbprefs('ErrorHandling','store')
```

When you execute the `database` function, Database Toolbox stores any generated errors in the `Message` property of the returned `connection` object.

Establish the connection `conn` to a MySQL database with the user name `username` and an invalid password.

```
conn = database('MySQL','username','invalid');
```

Access the error message in the `Message` property of the `connection` object.

```
conn.Message
```

```
ans =

    'ODBC Driver Error: [MySQL][ODBC 5.3(a) Driver]Access denied for user 'username'@'s
```

Specify the `report` format for the `ErrorHandling` preference.

```
setdbprefs('ErrorHandling','report')
```

Connect to the database using the invalid password again. With the `ErrorHandling` preference set to `report`, the error generated by running the `database` function appears immediately in the Command Window.

```
conn = database('MySQL','username','invalid')
```

```
Error using database (line 156)
ODBC Driver Error: [MySQL][ODBC 5.3(a) Driver]Access denied for user
'username'@'servername' (using password: YES)
```

Assign Values to Structure

Assign values for specific preferences in a structure so you can change multiple database preferences simultaneously.

Assign values for preferences to fields in the structure `s`.

```
s.ErrorHandling = 'report';
s.NullStringRead = 'null';
s
```

```
s = 

  struct with fields:

       ErrorHandling: 'report'
      NullStringRead: 'null'
```

Set preferences using the values in `s`.

```
setdbprefs(s)
```

Run `setdbprefs` to check your database preference settings.

```
setdbprefs
```

```
ans = 

  struct with fields:

    DataReturnFormat: 'table'
```

```
       ErrorHandling: 'report'
      NullNumberRead: 'NaN'
     NullNumberWrite: 'NaN'
      NullStringRead: 'null'
     NullStringWrite: 'null'
```

Return Values to Structure

Assign values for all database preferences to `s`.

```
s = setdbprefs
```

```
s = 

  struct with fields:

    DataReturnFormat: 'table'
       ErrorHandling: 'report'
      NullNumberRead: 'NaN'
     NullNumberWrite: 'NaN'
      NullStringRead: 'null'
     NullStringWrite: 'null'
```

Save Preferences

Save your database preferences to the MAT-file to use them in future MATLAB sessions.

Assign the preferences to the variable `ImportData` and save them to a MAT-file `ImportDataPrefs` in your current folder.

```
ImportData = setdbprefs;
save ImportDataPrefs.mat ImportData
```

Load the data and restore the preferences.

```
load ImportDataPrefs.mat
setdbprefs(ImportData)
```

Input Arguments

preference — Database preference
character vector | cell array

Database preference, specified as a character vector or cell array. To set multiple database preferences, enter the preference values in a cell array of character vectors. Then, match the order with the corresponding values in the `value` argument.

You can specify database preferences for error handling and importing `NULL` strings from a database into MATLAB.

- `'ErrorHandling'` — Specify how to handle errors when importing data. Set this parameter before you execute the `database` function. To specify displaying errors in the Command Window, enter `setdbprefs('ErrorHandling','report')`. Otherwise, you can access the error message in the `Message` property of the `connection` object.
- `NULL` data — Specify how to import `NULL` strings into the MATLAB workspace. To import `NULL` strings as the character vector `'null'`, enter `setdbprefs('NullStringRead','null')`. Set this parameter before running `fetch`.

Example: `'ErrorHandling'`

Example: `{'ErrorHandling';'NullStringRead'}`

Data Types: `char`

value — Database preference value
character vector | cell array

Database preference value, specified as a character vector or cell array. To set multiple database preferences, enter the preference values in a cell array of character vectors. Then, match the order with the corresponding preferences in the `preference` argument.

Example: `'NaN'`

Example: `{'numeric';'NaN'}`

Data Types: `char`

s — Database preferences
structure

Database preferences, specified as a structure that includes all the preferences you specify.

Data Types: `struct`

Output Arguments

v — Database preferences
structure

Database preferences, returned as a structure containing database preference settings and values.

Alternative Functionality

For a visual way to set database preferences, click **Preferences** in the **Environment** section of the MATLAB toolstrip, and then click **Database Toolbox**. Enter values for each database preference.

Compatibility Considerations

`'DataReturnFormat'` database preference values will be removed

Not recommended starting in R2018b

These values for the `'DataReturnFormat'` database preference of the `setdbprefs` function will be removed in a future release:

- `'numeric'`
- `'cellarray'`
- `'structure'`

Use the `'DataReturnFormat'` name-value pair argument of the `fetch` function instead. Some differences between these function syntaxes require updates to your code.

In prior releases, you specified returning imported data as a structure by setting the `'DataReturnFormat'` database preference to the value `'structure'`.

```
setdbprefs('DataReturnFormat','structure')
results = fetch(conn,sqlquery);
```

Now you can set the same value by using the `'DataReturnFormat'` name-value pair argument of the `fetch` function.

```
results = fetch(conn,sqlquery,'DataReturnFormat','structure');
```

`'ErrorHandling'` database preference value will be removed

Not recommended starting in R2018b

The `'store'` value for the `'ErrorHandling'` database preference of the `setdbprefs` function will be removed in a future release. Use the `'report'` value instead to display errors in the Command Window.

NULL data database preference values will be removed

Not recommended starting in R2018b

The database preferences of the `setdbprefs` function for handling `NULL` data values will be removed in a future release. Some differences in functionality require updates to your code.

This table shows database preference settings that will be removed and the functionality you can use instead. When exporting data, use the `data` input argument of the `sqlwrite` function to specify missing data.

Removed Functionality	Recommended Replacement
`setdbprefs('NullNumberWrite','`*`NaN`*`')`	`data` input argument of `sqlwrite`
`setdbprefs('NullStringWrite','`*`null`*`')`	`data` input argument of `sqlwrite`

Removed Functionality	Recommended Replacement
`setdbprefs('NullNumberRead','0')`	Default value `NaN` for numeric `NULL` values

See Also

`clear` | `close` | `database` | `fetch` | `getdatasources`

Topics

"Working with Database Toolbox Preferences" on page 2-152

Introduced before R2006a

splitsqlquery

Package: database.odbc

Split SQL query using paging

Syntax

```
querybasket = splitsqlquery(conn,sqlquery)
querybasket = splitsqlquery(conn,sqlquery,'SplitSize',splitsize)
```

Description

`querybasket = splitsqlquery(conn,sqlquery)` splits a SQL query into a basket of multiple SQL queries. By default, each SQL query in the basket returns 100,000 rows in a batch. The resulting number of SQL queries in the basket depends on the size of the original SQL query results.

`querybasket = splitsqlquery(conn,sqlquery,'SplitSize',splitsize)` specifies a custom batch size for the number of rows returned by each SQL query in the basket.

Examples

Access Large Data from SQL Query Using Database Toolbox™

Determine the minimum arrival delay using a large set of flight data stored in a database. Here, access the database in a serial MATLAB® environment.

Using the `splitsqlquery` function, you can split the original SQL query into multiple SQL page queries. Then, you can access large data in chunks using the `fetch` function.

To run this example, ensure that the current folder contains the JDBC driver file `sqljdbc4.jar`. To find this file, see “Microsoft SQL Server JDBC for Windows” on page 2-32.

Add the JDBC driver file to the Java® class path.

```
javaaddpath 'sqljdbc4.jar';
```

Connect to the Microsoft® SQL Server® database using the database name `toy_store`, database server `dbtb04`, port number `54317`, and Windows® authentication.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Define the SQL query. Here, select all columns from the `airlinesmall` table, which contains 123,523 rows and 29 columns.

```
sqlquery = 'SELECT * FROM airlinesmall';
```

Split the original SQL query into multiple page queries and display them.

```
querybasket = splitsqlquery(conn,sqlquery)
```

```
querybasket = 

  2×1 string array

    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 0 ROWS FETCH NE
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 100000 ROWS FET
```

The query basket contains the page queries in a string array. The `splitsqlquery` function splits these queries using the default number of rows (100,000).

Define the `airlinesdata` variable.

```
airlinesdata = [];
```

Define the minimum arrival delay `minArrDelay` variable.

```
minArrDelay = [];
```

Use a `for` loop to execute the SQL page queries in `querybasket` and import the data in chunks. Execute SQL page queries in the query basket and import large data using the `fetch` function. Find the local minimum arrival delay for a chunk. Store the local minimum arrival delay for each chunk.

```
for i = 1: length(querybasket)
```

```
    local_airlinesdata = fetch(conn,querybasket(i));

    local_minArrDelay = min(local_airlinesdata.ArrDelay);

    minArrDelay = [minArrDelay; local_minArrDelay];

end
```

Find the minimum arrival delay from all the stored delays.

```
minArrDelay = min(minArrDelay)
```

```
minArrDelay =

   -64
```

Close the database connection.

```
close(conn)
```

Access Large Data from SQL Query Using Database Toolbox™ and Parallel Computing Toolbox™

Determine the minimum arrival delay using a large set of flight data stored in a database. Here, access the database using a parallel pool.

Using the `splitsqlquery` function, you can split the original SQL query into multiple SQL page queries. Then, you can access large data in chunks by executing each SQL page query on a separate worker.

The definition of large data can vary. Performance for importing large data depends on the SQL query, amount of data, machine specifications, and type of data analysis. To manage the performance, use the `splitsize` input argument of the `splitsqlquery` function.

To run this example, ensure that the current folder contains the JDBC driver file `sqljdbc4.jar`. To find this file, see “Microsoft SQL Server JDBC for Windows” on page 2-32.

If you have a MATLAB® Distributed Computing Server™ license, then you can replace the name of the cluster in the `parpool` function with the cluster profile of your choice.

Add the JDBC driver file to the Java® class path.

```
javaaddpath 'sqljdbc4.jar';
```

Connect to the Microsoft® SQL Server® database using the database name `toy_store`, database server `dbtb04`, port number `54317`, and Windows® authentication.

```
conn = database('toy_store','','','Vendor','Microsoft SQL Server', ...
    'Server','dbtb04','PortNumber',54317,'AuthType','Windows');
```

Define the SQL query. Here, select all columns from the `airlinesmall` table, which contains 123,523 rows and 29 columns.

```
sqlquery = 'SELECT * FROM airlinesmall';
```

Split the original SQL query into multiple page queries and display them. Use a split size of 10,000 rows.

```
splitsize = 10000;
querybasket = splitsqlquery(conn,sqlquery,'SplitSize',splitsize)
```

```
querybasket = 

  13×1 string array

    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 0 ROWS FETCH NE
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 10000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 20000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 30000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 40000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 50000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 60000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 70000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 80000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 90000 ROWS FETC
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 100000 ROWS FET
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 110000 ROWS FET
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 120000 ROWS FET
```

The query basket contains the page queries in a string array. Each SQL query in the basket, except the last one, returns 10,000 rows.

Close the database connection.

```
close(conn)
```

Start parallel pool using the local profile.

```
p = parpool('local');
```

```
Starting parallel pool (parpool) using the 'local' profile ...
connected to 6 workers.
```

Attach the required JDBC driver file `sqljdbc4.jar`.

```
addAttachedFiles(p,{'sqljdbc4.jar'});
```

Define the `airlinesdata` variable.

```
airlinesdata = [];
```

Define the minimum arrival delay `minArrDelay` variable.

```
minArrDelay = [];
```

Add the JDBC driver file to the Java® class path, and build the connection once for each worker.

```
parfevalOnAll(@javaaddpath,0,'sqljdbc4.jar');
c = parallel.pool.Constant( ...
    @() database('toy_store','','','Vendor','Microsoft SQL Server', ...
        'Server','dbtb04','PortNumber',54317,'AuthType', ...
        'Windows'),@close);
```

Use the `parfor` function to parallelize data access using the query basket.

For each worker:

- Retrieve the database connection object.
- Execute the SQL page query from the query basket and import data locally.
- Find the local minimum arrival delay.
- Store the local minimum arrival delay.

```
parfor i = 1: length(querybasket)
    conn = c.Value;
    local_airlinesdata = fetch(conn,querybasket(i));
    local_minArrDelay = min(local_airlinesdata.ArrDelay);
    minArrDelay = [minArrDelay; local_minArrDelay];
end
```

Find the minimum arrival delay using the stored delays from each worker.

```
minArrDelay = min(minArrDelay)

minArrDelay =

   -64
```

Close the parallel pool.

```
p.delete;
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar.

For information about the SQL query language, see the SQL Tutorial.

Example: `SELECT * FROM invoice` selects all columns and rows from the `invoice` table.

Data Types: `char` | `string`

`splitsize` — SQL query split size
`100000` (default) | numeric scalar

SQL query split size, specified as a numeric scalar. Specify this number to split a SQL query into a custom number of rows for each batch.

If the total number of rows returned from the original SQL query is less than 100,000 (the default), then the `splitsqlquery` function returns the original SQL query. Use this input argument to specify a smaller number of rows in a batch.

Data Types: `double`

Output Arguments

`querybasket` — SQL query basket
string array

SQL query basket, returned as a string array. Each SQL query in the basket is returned as a string scalar in the string array.

You can execute each SQL query in the basket using the `fetch` function. Or, you can run a parallel pool and assign each SQL query to a worker for execution.

Limitations

- The `splitsqlquery` function supports these databases only:
  - Microsoft SQL Server 2012 and later
  - Oracle
  - MySQL
  - PostgreSQL
  - SQLite
  - Amazon Redshift®
  - Amazon Aurora®

   - Google® Cloud SQL that runs an instance of MySQL or PostgreSQL
   - MariaDB®

  If the `connection` object uses an unsupported database, the `splitsqlquery` function displays a warning and returns the original SQL query.
- The `splitsqlquery` function does not support the MATLAB interface to SQLite.

See Also

`addAttachedFiles` | `close` | `database` | `fetch` | `javaaddpath` | `parallel.pool.Constant` | `parfevalOnAll` | `parpool`

Topics

"Analyze Large Data in Database Using Tall Arrays"

External Websites

SQL Tutorial

Introduced in R2017b

sqlite

SQLite connection

Description

The `sqlite` function creates an `sqlite` object. You can use this object to connect to an SQLite database file using the MATLAB interface to SQLite. The MATLAB interface to SQLite enables you to work with SQLite database files without installing and administering a database or driver. For details, see “Working with MATLAB Interface to SQLite” on page 2-6.

Creation

Syntax

```
conn = sqlite(dbfile)
conn = sqlite(dbfile,mode)
```

Description

`conn = sqlite(dbfile)` connects to an existing SQLite database file.

`conn = sqlite(dbfile,mode)` connects to an existing database file or creates and connects to a new database file, depending on the mode type.

Input Arguments

`dbfile` — SQLite database file
character vector | string scalar

SQLite database file, specified as a character vector or string scalar. You can use the database file to store data and import and export it to MATLAB.

Data Types: `char` | `string`

mode — SQLite database file mode
'connect' (default) | 'readonly' | 'create'

SQLite database file mode, specified as one of these values.

Value	Description
'connect'	Connect to an existing SQLite database file.
'readonly'	Create a read-only connection to an existing SQLite database file.
'create'	Create and connect to a new SQLite database file.

The file mode determines whether you connect to an existing SQLite database file or create a new one. For existing database files, the file mode determines whether the database connection is read-only and sets the IsReadOnly property.

Properties

Database — SQLite database file name
character vector

This property is read-only.

SQLite database file name, specified as a character vector that contains the full path to the SQLite database file.

The `dbfile` input argument sets this property.

Example: 'C:\tutorial.db'

Data Types: char

IsOpen — Database connection indicator
0 (default) | 1

This property is read-only.

Database connection indicator, specified as a logical `0` when the database connection is closed or invalid, or a logical `1` when the database connection is open.

Data Types: `logical`

`IsReadOnly` — Read-only database file indicator
`0` (default) | `1`

This property is read-only.

Read-only database file indicator, specified as a logical `0` when the SQLite database file can be modified, or a logical `1` when the database file is read-only.

Data Types: `logical`

Object Functions

insert	Add MATLAB data to SQLite database table
exec	Execute SQL statement using SQLite connection
fetch	Import data into MATLAB workspace using SQLite connection
close	Close SQLite connection

Examples

Create SQLite Connection to Existing Database File

Create an SQLite connection to the MATLAB® interface to SQLite using the existing database file `tutorial.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,'tutorial.db');

conn = sqlite(dbfile)

conn = 
  sqlite with properties:

      Database: 'C:\TEMP\Bdoc18b_943130_7372\ib632619\21\tp0395eaee\database-ex96650978
        IsOpen: 1
    IsReadOnly: 0
```

`conn` is an `sqlite` object with these properties:

- `Database` — SQLite database file name.
- `IsOpen` — SQLite connection is open.
- `IsReadOnly` — SQLite connection is writable.

To import data from the database file, you can use the `fetch` function.

Close the SQLite connection.

```
close(conn)
```

Create SQLite Connection Using New Database File

Create an SQLite connection to the MATLAB® interface to SQLite using a new database file named `mysqlite.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,'mysqlite.db');
```

```
conn = sqlite(dbfile,'create')
```

```
conn = 
  sqlite with properties:

      Database: 'C:\TEMP\Bdoc18b_943130_7372\ib632619\21\tp0395eaee\database-ex6195242
        IsOpen: 1
    IsReadOnly: 0
```

`conn` is an `sqlite` object with these properties:

- `Database` — SQLite database file name.
- `IsOpen` — SQLite connection is open.
- `IsReadOnly` — SQLite connection is writable.

To insert data into the database file, you can create a table using the `exec` function, and then insert data using the `insert` function.

Close the SQLite connection.

```
close(conn)
```

Create Read-Only SQLite Connection

Create a read-only SQLite connection to the MATLAB® interface to SQLite using the existing database file `tutorial.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,'tutorial.db');

conn = sqlite(dbfile,'readonly')
```

```
conn = 
  sqlite with properties:

      Database: 'C:\TEMP\Bdoc18b_943130_7372\ib632619\21\tp0395eaee\database-ex41829813
        IsOpen: 1
    IsReadOnly: 1
```

`conn` is an `sqlite` object with these properties:

- `Database` — SQLite database file name.
- `IsOpen` — SQLite connection is open.
- `IsReadOnly` — SQLite connection is read-only.

To import data from the database file, you can use the `fetch` function.

Close the SQLite connection.

```
close(conn)
```

Alternative Functionality

Instead of the `sqlite` object, the `connection` object enables you to connect to various relational databases using ODBC and JDBC drivers that you install and administer. You can create the `connection` object by using the `database` function.

The `sqlite` object provides limited Database Toolbox functionality. For full functionality, create a database connection to the SQLite database file using the JDBC driver. To use the

JDBC driver, close the SQLite connection and create a database connection using the URL string. For details, see these links depending on your platform:

- “SQLite JDBC for Windows” on page 2-77
- “SQLite JDBC for macOS” on page 2-127
- “SQLite JDBC for Linux” on page 2-133

See Also

Topics

“Access Relational Database Data in MATLAB” on page 2-3
“Working with MATLAB Interface to SQLite” on page 2-6
“Import Data Using MATLAB® Interface to SQLite” on page 5-35
“Configuring Driver and Data Source” on page 2-15

Introduced in R2016a

close

Close SQLite connection

Syntax

`close(conn)`

Description

`close(conn)` closes the SQLite connection by using the MATLAB interface to SQLite.

Note The SQLite connection object remains open until you close it using the `close` function. Always close this object when you finish using it.

Examples

Close SQLite Connection Object

Create an SQLite connection using the MATLAB® interface to SQLite and the existing database file `tutorial.db`, which is in the current folder.

```
dbfile = fullfile(pwd,'tutorial.db');
```

```
conn = sqlite(dbfile);
```

To import data from the database file, use the `fetch` function.

Close the SQLite connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

See Also

`fetch` | `sqlite`

Topics

“Import Data Using MATLAB® Interface to SQLite” on page 5-35
“Working with MATLAB Interface to SQLite” on page 2-6

Introduced in R2016a

fetch

Import data into MATLAB workspace using SQLite connection

Syntax

```
results = fetch(conn,sqlquery)
results = fetch(conn,sqlquery,rowlimit)
```

Description

`results = fetch(conn,sqlquery)` returns all rows of data from an SQLite database file immediately after executing the SQL statement `sqlquery` by using the SQLite connection `conn` of the MATLAB interface to SQLite.

`results = fetch(conn,sqlquery,rowlimit)` limits the number of rows for the data import.

Examples

Import Data from Database Table in SQLite Database File

Use the MATLAB® interface to SQLite to import all rows of data into MATLAB® from a database table in an SQLite database file. Then, determine the highest unit cost among products in the table.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. `conn` is an `sqlite` object.

```
dbfile = 'tutorial.db';
conn = sqlite(dbfile);
```

Import all the data from `productTable`. The `results` output argument contains the imported data as a cell array.

```
sqlquery = 'SELECT * FROM productTable';
results = fetch(conn,sqlquery)
```

```
results = 15x5 cell array
    {[ 9]}    {[125970]}    {[1003]}    {[13]}    {'Victorian Doll' }
    {[ 8]}    {[212569]}    {[1001]}    {[ 5]}    {'Train Set'      }
    {[ 7]}    {[389123]}    {[1007]}    {[16]}    {'Engine Kit'     }
    {[ 2]}    {[400314]}    {[1002]}    {[ 9]}    {'Painting Set'   }
    {[ 4]}    {[400339]}    {[1008]}    {[21]}    {'Space Cruiser'  }
    {[ 1]}    {[400345]}    {[1001]}    {[14]}    {'Building Blocks'}
    {[ 5]}    {[400455]}    {[1005]}    {[ 3]}    {'Tin Soldier'    }
    {[ 6]}    {[400876]}    {[1004]}    {[ 8]}    {'Sail Boat'      }
    {[ 3]}    {[400999]}    {[1009]}    {[17]}    {'Slinky'         }
    {[10]}    {[888652]}    {[1006]}    {[24]}    {'Teddy Bear'     }
    {[11]}    {[408143]}    {[1004]}    {[11]}    {'Convertible'    }
    {[12]}    {[210456]}    {[1010]}    {[22]}    {'Hugsy'          }
    {[13]}    {[470816]}    {[1012]}    {[16]}    {'Pancakes'       }
    {[14]}    {[510099]}    {[1011]}    {[19]}    {'Shawl'          }
    {[15]}    {[899752]}    {[1011]}    {[20]}    {'Snacks'         }
```

Determine the highest unit cost of the products. Find the number of products by using the `size` function. Access unit cost data by looping through the fourth column of the cell array. `data` is a vector that contains numeric unit costs. Find the maximum unit cost.

```
rows = size(results);
for i = 1:rows
    data(i) = results{i,4};
end
max(data)
```

```
ans = int64
    24
```

Close the SQLite connection.

```
close(conn)
```

Import Data Using Row Limit

Use the MATLAB® interface to SQLite to import a limited number of rows into MATLAB® from a database table in an SQLite database file. Then, determine the highest unit cost among products in the table.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. `conn` is an `sqlite` object.

```
dbfile = 'tutorial.db';

conn = sqlite(dbfile);
```

Import five rows of data from `productTable` by using the `rowlimit` argument. `results` contains five rows of imported data as a cell array.

```
sqlquery = 'SELECT * FROM productTable';
rowlimit = 5;
results = fetch(conn,sqlquery,rowlimit)
```

```
results = 5x5 cell array
    {[9]}    {[125970]}    {[1003]}    {[13]}    {'Victorian Doll'}
    {[8]}    {[212569]}    {[1001]}    {[ 5]}    {'Train Set'     }
    {[7]}    {[389123]}    {[1007]}    {[16]}    {'Engine Kit'    }
    {[2]}    {[400314]}    {[1002]}    {[ 9]}    {'Painting Set'  }
    {[4]}    {[400339]}    {[1008]}    {[21]}    {'Space Cruiser' }
```

Determine the highest unit cost for the limited number of products. Access unit cost data by looping through the fourth column of the cell array. `data` is a vector that contains numeric unit costs. Find the maximum unit cost.

```
for i = 1:rowlimit
    data(i) = results{i,4};
end
max(data)
```

```
ans = int64
    21
```

Close the SQLite connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

`sqlquery` — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use `fetch` function. For procedures that return output arguments, use `runstoredprocedure`.

For information about the SQL query language, see the SQL Tutorial.

Data Types: `char` | `string`

`rowlimit` — Row limit
numeric scalar

Row limit, specified as a positive numeric scalar that indicates the maximum number of rows of data to import from the database.

If `rowlimit` is `0`, `fetch` returns all the rows of data.

Data Types: `double`

Output Arguments

`results` — Result data
cell array

Result data, returned as a cell array. The result data contains all rows of data from the executed SQL statement.

The cell array contains only one of these data types: `double`, `int64`, or `char`. If `NULL`s exist in the result data, `fetch` returns an error. To avoid these limitations, connect to the SQLite database file using the JDBC driver. For details, see “Configuring Driver and Data Source” on page 2-15.

See Also
`close` | `exec` | `insert` | `sqlite`

Topics
"Import Data Using MATLAB® Interface to SQLite" on page 5-35
"Working with MATLAB Interface to SQLite" on page 2-6

External Websites
SQL Tutorial

Introduced in R2016a

tableprivileges

(To be removed) Return database table privileges

Note The `tableprivileges` function will be removed in a future release with no replacement.

Syntax

```
tp = tableprivileges(dbmeta,'cata')
tp = tableprivileges(dbmeta,'cata','sch')
tp = tableprivileges(dbmeta,'cata','sch','tab')
```

Description

`tp = tableprivileges(dbmeta,'cata')` returns a list of table privileges for all tables in the catalog `cata` for the database whose database metadata object is `dbmeta` resulting from a `connection` object.

`tp = tableprivileges(dbmeta,'cata','sch')` returns a list of table privileges for all tables in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta` resulting from a `connection` object.

`tp = tableprivileges(dbmeta,'cata','sch','tab')` returns a list of privileges for the table `tab`, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta` resulting from a `connection` object.

Examples

Get table privileges for the `builds` table in the schema `geck` for the catalog `msdb`, for the database metadata object `dbmeta`.

```
tp = tableprivileges(dbmeta,'msdb','geck', 'builds')
tp =
```

```
      'DELETE'    'INSERT'    'REFERENCES'...
         'SELECT'    'UPDATE'
```

See Also
dmd | get | sqlfind | tables

Topics
“Retrieve Database Metadata” on page 5-58

Introduced before R2006a

tables

Package: database.odbc

(To be removed) Return database table names

Note The `tables` function will be removed in a future release. Use the `sqlfind` function and access the properties of the `connection` object instead. For details, see “Compatibility Considerations”.

Syntax

```
t = tables(conn,catalog)
t = tables(conn,catalog,schema)

t = tables(dbmeta,catalog)
t = tables(dbmeta,catalog,schema)
```

Description

`t = tables(conn,catalog)` returns a list of all table names and table types for all schemas in the specified catalog named `catalog`.

Note The syntax `tables(conn)` has been removed. Use syntaxes with at least two input arguments instead.

`t = tables(conn,catalog,schema)` returns a list of all table names and table types in the specified catalog named `catalog` and schema named `schema`.

`t = tables(dbmeta,catalog)` returns a list of all table names and table types in the specified catalog named `catalog` using the database metadata object `dbmeta`.

`t = tables(dbmeta,catalog,schema)` returns a list of all table names and table types in the specified catalog named `catalog` and schema named `schema`.

Examples

Retrieve Table List for Catalog Using Database Connection

Create the database connection `conn` using the native ODBC interface to a Microsoft SQL Server database. This code assumes that you are connecting to a data source named `MS SQL Server` with the user name `username` and password `pwd`.

```
conn = database('MS SQL Server','username','pwd');
```

Retrieve the list of all table names and table types in the catalog by using `conn`. This code assumes that the database contains the catalog `toy_store`.

```
catalog = 'toy_store';

t = tables(conn,catalog)
```

```
t =

   'productTable'                                'TABLE'
   'salesVolume'                                 'TABLE'
   'COLUMNS'                                     'VIEW'
   ...
```

`t` returns a cell array with the table names in the first column and the table types in the second column.

Close the database connection `conn`.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

dbmeta — Database metadata
database metadata object

Database metadata, specified as a database metadata object created using `dmd`. To use this object, create a database connection using the `database` function first.

Note Support for the database metadata object will be removed in a future release. Use the `sqlfind` function and access the properties of the `connection` object instead.

`catalog` — Database catalog name
character vector | string scalar

Database catalog name, specified as a character vector or string scalar.

Data Types: `char` | `string`

`schema` — Database schema name
character vector | string scalar

Database schema name, specified as a character vector or string scalar.

Data Types: `char` | `string`

Output Arguments

`t` — Table information
cell array

Table information, returned as a cell array with two columns. The first column contains the table names. The second column contains the table types.

Compatibility Considerations

`tables` function will be removed

Not recommended starting in R2018b

The `tables` function will be removed in a future release. Use the `sqlfind` function or access the properties of the `connection` object instead. Some differences between the workflows require updates to your code.

In prior releases, you retrieved information about database tables by using the `tables` function. For example:

```
conn = database(datasource,username,password);
t = tables(conn,catalog,schema);
```

Now the `sqlfind` function returns information about the table types in a database.

```
conn = database(datasource,username,password);
data = sqlfind(conn,pattern);
```

Also, you can access the database properties and catalog and schema information by using the `connection` object. For example:

```
conn = database(datasource,username,password);
catalogs = conn.Catalogs;
schemas = conn.Schemas;
```

See Also

`close` | `database` | `sqlfind`

Topics

"Retrieve Database Metadata" on page 5-58
"Import Data from Database Table Using sqlread Function" on page 5-52
"Insert Data into Database Table" on page 5-55
"Connecting to Database" on page 2-142

Introduced in R2010a

update

Package: database.odbc

Replace data in database table with MATLAB data

Syntax

`update(conn,tablename,colnames,data,whereclause)`

Description

`update(conn,tablename,colnames,data,whereclause)` exports the MATLAB variable `data` in its current format into the database table `tablename` using the database connection `conn`. You can use the SQL `WHERE` statement to specify which existing records in the database to replace.

Examples

Update Existing Record Using Cell Array

Connect to a Microsoft Access database and store the data that you are updating in a cell array. Then, update one column of data in the database table. Close the database connection.

Create the database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable`, which contains these columns:

- `productnumber`

- quantity
- price
- inventorydate

Import all the data from `inventorytable` as a cell array by using `conn`, and display the first three rows of imported data.

```
sqlquery = 'SELECT * FROM inventorytable';
results = fetch(conn,sqlquery,'DataReturnFormat','cellarray');
results(1:3,:)
```

```
ans =

  3×4 cell array

    {[1]}    {[1700]}    {[15]}    {'2014-09-23 09:3…'}
    {[2]}    {[1200]}    {[ 9]}    {'2014-07-08 22:5…'}
    {[3]}    {[ 356]}    {[17]}    {'2014-05-14 07:1…'}
```

Define a cell array containing the name of the column that you are updating.

```
colnames = {'quantity'};
```

Define a cell array containing the new data, `2000`.

```
data = {2000};
```

Update the column `quantity` in `inventorytable` for the product with `productnumber` equal to `1`.

```
tablename = 'inventorytable';
whereclause = 'WHERE productnumber = 1';

update(conn,tablename,colnames,data,whereclause)
```

Import the data again and view the updated contents in `inventorytable`.

```
results = fetch(conn,sqlquery,'DataReturnFormat','cellarray');
results(1:3,:)
```

```
ans =

  3×4 cell array

    {[1]}    {[2000]}    {[15]}    {'2014-09-23 09:3…'}
```

```
    {[2]}    {[1200]}    {[ 9]}    {'2014-07-08 22:5…'}
    {[3]}    {[ 356]}    {[17]}    {'2014-05-14 07:1…'}
```

In the inventorytable data, the product with the product number equal to 1 has an updated quantity of 2000 units.

Close the database connection.

```
close(conn)
```

Update Existing Record Using Table

Connect to a Microsoft Access database and store the data that you are updating as a table. Then, update multiple columns of data in the database table. Close the database connection.

Create the database connection conn to the Microsoft Access database. This code assumes that you are connecting to a data source named dbdemo with a blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table inventorytable, which contains these columns:

- productnumber
- quantity
- price
- inventorydate

Import all the data from inventorytable by using conn, and display a few rows of the imported data.

```
sqlquery = 'SELECT * FROM inventorytable';
results = fetch(conn,sqlquery);
head(results)
```

```
ans =

  8×4 table

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _________________________
```

```
        1             1700       20      '2014-09-23 09:38:34.000'
        2             1200        9      '2014-07-08 22:50:45.000'
        3              356       17      '2014-05-14 07:14:28.000'
        4             2580       21      '2013-06-08 14:24:33.000'
        5             9000        3      '2012-09-14 15:00:25.000'
        6             4540        8      '2013-12-25 19:45:00.000'
        7             6034       16      '2014-08-06 08:38:00.000'
        8             8350        5      '2011-06-18 11:45:35.000'
```

Define a cell array containing the names of the columns that you are updating in `inventorytable`.

```
colnames = {'price','inventorydate'};
```

Define a table that contains the new data. Update the price to $15 and set the inventory timestamp to `'2014-12-01 08:50:15.000'`.

```
data = table(15,{'2014-12-01 08:50:15.000'}, ...
    'VariableNames',{'price','inventorydate'});
```

Update the columns `price` and `inventorydate` in the table `inventorytable` for the product number equal to `1`.

```
tablename = 'inventorytable';
whereclause = 'WHERE productnumber = 1';

update(conn,tablename,colnames,data,whereclause)
```

Import the data again and view the updated contents in `inventorytable`.

```
results = fetch(conn,sqlquery);
head(results)
```

```
ans =

  8×4 table

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _________________________

          1            1700       15      '2014-12-01 08:50:15.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
```

```
    5           9000       3      '2012-09-14 15:00:25.000'
    6           4540       8      '2013-12-25 19:45:00.000'
    7           6034      16      '2014-08-06 08:38:00.000'
    8           8350       5      '2011-06-18 11:45:35.000'
```

The product with the product number equal to `1` has an updated price of $15 and timestamp of `'2014-12-01 08:50:15.000'`.

Close the database connection.

```
close(conn)
```

Update Multiple Records with Multiple Conditions

Connect to a Microsoft Access database and store the data that you are updating in a cell array. Then, update multiple records of data in the table by using multiple `WHERE` clauses. Close the database connection.

Create the database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable`, which contains these columns:

- `productnumber`
- `quantity`
- `price`
- `inventorydate`

Import all the data from `inventorytable` by using `conn`, and display the first few rows of imported data.

```
sqlquery = 'SELECT * FROM inventorytable';
results = fetch(conn,sqlquery);
head(results)
```

```
ans =

  8×4 table
```

```
    productnumber    quantity    price          inventorydate        
    _____________    ________    _____    ___________________________

          1            1700       20      '2014-12-01 08:50:15.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
          5            9000        3      '2012-09-14 15:00:25.000'
          6            4540        8      '2013-12-25 19:45:00.000'
          7            6034       16      '2014-08-06 08:38:00.000'
          8            8350        5      '2011-06-18 11:45:35.000'
```

Define a cell array containing the name of the column that you are updating.

```
colnames = {'quantity'};
```

Define a cell array containing the new data. Update the quantities for two products.

```
A = 10000;    % new quantity for product number 5
B = 5000;     % new quantity for product number 8

data = {A;B}; % cell array with the new quantities
```

Update the column `quantity` in `inventorytable` for the products with product numbers equal to `5` and `8`. Create a cell array `whereclause` that contains two `WHERE` clauses, one for each product.

```
tablename = 'inventorytable';
whereclause = {'WHERE productnumber = 5';'WHERE productnumber = 8'};

update(conn,tablename,colnames,data,whereclause)
```

Import the data again and view the updated contents in `inventorytable`.

```
results = fetch(conn,sqlquery);
head(results)

ans =

  8×4 table

    productnumber    quantity    price          inventorydate        
    _____________    ________    _____    ___________________________

          1            1700       20      '2014-12-01 08:50:15.000'
```

```
2           1200        9      '2014-07-08 22:50:45.000'
3            356       17      '2014-05-14 07:14:28.000'
4           2580       21      '2013-06-08 14:24:33.000'
5          10000        3      '2012-09-14 15:00:25.000'
6           4540        8      '2013-12-25 19:45:00.000'
7           6034       16      '2014-08-06 08:38:00.000'
8           5000        5      '2011-06-18 11:45:35.000'
```

The product with the product number equal to `5` has an updated quantity of `10000` units. The product with the product number equal to `8` has an updated quantity of `5000` units.

Close the database connection.

```
close(conn)
```

Update Multiple Columns with Multiple Conditions

Connect to a Microsoft Access database and store the data that you are updating in a cell array. Then, update multiple columns of data in the table by using multiple `WHERE` clauses. Close the database connection.

Create the database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable`, which contains these columns:

- `productnumber`
- `quantity`
- `price`
- `inventorydate`

Import all the data from `inventorytable` by using `conn`, and display the first few rows of imported data.

```
sqlquery = 'SELECT * FROM inventorytable';
results = fetch(conn,sqlquery);
head(results)
```

```
ans =
```

```
  8×4 table

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _________________________

          1            1700       20      '2014-12-01 08:50:15.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
          5            9000        3      '2012-09-14 15:00:25.000'
          6            4540        8      '2013-12-25 19:45:00.000'
          7            6034       16      '2014-08-06 08:38:00.000'
          8            8350        5      '2011-06-18 11:45:35.000'
```

Define a cell array containing the names of the columns that you are updating.

```
colnames = {'quantity','price'};
```

Define a cell array containing the new data. Update the quantities and prices for two products.

```
% new quantities and prices for product numbers 5 and 8
% are separated by a semicolon in the cell array
data = {10000,5.5;9000,10};
```

Update the columns `quantity` and `price` in `inventorytable` for the products with product numbers equal to `5` and `8`. Create a cell array `whereclause` that contains two `WHERE` clauses, one for each product.

```
tablename = 'inventorytable';
whereclause = {'WHERE productnumber = 5';'WHERE productnumber = 8'};

update(conn,tablename,colnames,data,whereclause)
```

Import the data again and view the updated contents in `inventorytable`.

```
results = fetch(conn,sqlquery);
head(results)
```

```
ans =

  8×4 table

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _________________________
```

```
    1             1700       20      '2014-12-01 08:50:15.000'
    2             1200        9      '2014-07-08 22:50:45.000'
    3              356       17      '2014-05-14 07:14:28.000'
    4             2580       21      '2013-06-08 14:24:33.000'
    5            10000        6      '2012-09-14 15:00:25.000'
    6             4540        8      '2013-12-25 19:45:00.000'
    7             6034       16      '2014-08-06 08:38:00.000'
    8             9000       10      '2011-06-18 11:45:35.000'
```

The product with the product number equal to `5` has an updated quantity of `10000` units and price equal to `6`, rounded to the nearest number. The product with the product number equal to `8` has an updated quantity of `9000` units and price equal to `10`.

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

tablename — Database table name
character vector | string scalar

Database table name, specified as a character vector or string scalar denoting the name of a table in the database.

Example: `'employees'`

Data Types: `char` | `string`

colnames — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table `tablename`.

Example: `{'col1','col2','col3'}`

Data Types: `cell` | `string`

`data` — Update data
cell array | numeric matrix | table | structure | dataset

Update data, specified as a cell array, numeric matrix, table, structure, or dataset array.

If you are connecting to a database using a JDBC driver, convert the update data to a supported format before running `update`. If `data` contains MATLAB dates, times, or timestamps, use this formatting:

- Dates must be character vectors of the form `yyyy-mm-dd`.
- Times must be character vectors of the form `HH:MM:SS`.
- Timestamps must be character vectors of the form `yyyy-mm-dd HH:MM:SS.FFF`.

The database preference settings `NullNumberWrite` and `NullStringWrite` do not apply to this function. If `data` contains `null` entries and `NaN`s, convert these entries to an empty value `''`.

- If `data` is a structure, then field names in the structure must match `colnames`.
- If `data` is a table or a dataset array, then the variable names in the table or dataset array must match `colnames`.

`whereclause` — SQL `WHERE` clause
character vector | cell array of character vectors | string scalar | string array

SQL `WHERE` clause, specified as a character vector or string scalar for one condition or a cell array of character vectors or string array for multiple conditions.

Example: `'WHERE producttable.productnumber = 1'`

Data Types: `char` | `cell` | `string`

Tips

- The value of the `AutoCommit` property in the `connection` object determines whether `update` automatically commits the data to the database.
  - To view the `AutoCommit` value, access it using the `connection` object; for example, `conn.AutoCommit`.

  - To set the `AutoCommit` value, use the corresponding name-value pair argument in the `database` function.
  - To commit the data to the database, use the `commit` function or issue an SQL `COMMIT` statement using the `exec` function.
  - To roll back the data, use `rollback` or issue an SQL `ROLLBACK` statement using the `exec` function.
- You can use `datainsert` to add new rows instead of replacing existing data.
- To update multiple records, the number of SQL `WHERE` clauses in `whereclause` must match the number of records in `data`.
- If the order of records in your database is not constant, then you can use values of column names to identify records.
- If this error message appears when your database table is open in edit mode:

  ```
  [Vendor][ODBC Product Driver] The database engine could
  not lock table 'TableName' because it is already in use
  by another person or process.
  ```

  Then, close the table and rerun the `update` function.
- Running the same update operation again can cause this error message to appear.

  ```
  ??? Error using ==> database.update
  Error:Commit/Rollback Problems
  ```

See Also

`close` | `commit` | `database` | `datainsert` | `get` | `rollback` | `set`

Topics

"Replace Existing Data in Database" on page 5-17
"Roll Back Data After Updating Record" on page 5-14
"Import Data from Database Table Using sqlread Function" on page 5-52
"Data Type Support" on page 1-3

External Websites

SQL Tutorial

Introduced before R2006a

width

Package: database.odbc

(Not recommended) Return field size of column in fetched data set

---

Note The `width` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see “Compatibility Considerations”.

Syntax

```
colsize = width(curs,colnum)
```

Description

`colsize = width(curs,colnum)` returns the field size of the specified column number `colnum` in the fetched data set `curs`.

Examples

Retrieve the width of the first column of the fetched data set `curs`.

```
colsize = width(curs,1)

colsize =

    11
```

The field size of column one is 11 characters (bytes).

To create fetched data sets using an ODBC connection, you can use the native ODBC interface. For details, see `database`.

Compatibility Considerations

`width` function is not recommended

Not recommended starting in R2018b

The `width` function is not recommended. Use the `fetch` function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the `width` function at this time.

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object, import data, and determine the field size of a specified column number. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
colsize = width(curs,1);
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the `width` function.

See Also

`attr` | `cols` | `columnnames` | `fetch` | `get`

Introduced before R2006a

sqlfind

Package: database.odbc

Find information about all table types in database

Syntax

```
data = sqlfind(conn,pattern)
data = sqlfind(conn,pattern,Name,Value)
```

Description

`data = sqlfind(conn,pattern)` returns information about all the "Table Types" on page 9-332 in a database where the specified character pattern appears in the name of a table type. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM information_schema.tables`.

`data = sqlfind(conn,pattern,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Catalog','cat'` finds all table types in the `'cat'` catalog.

Examples

Find Information About Table Types in Database

Use an ODBC connection to find information about all database table types in a Microsoft® SQL Server® database.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Find information about all table types in the database.

```
data = sqlfind(conn,'');
```

Display information about the first three table types.

```
data(1:3,:)
```

```
ans =

  3×5 table

      Catalog              Schema                    Table                Columns        Typ
    ___________    ____________________    _____________________    ___________    ____

    'toy_store'    'INFORMATION_SCHEMA'    'CHECK_CONSTRAINTS'      {1×4  cell}    'VIE
    'toy_store'    'INFORMATION_SCHEMA'    'COLUMNS'                {1×23 cell}    'VIE
    'toy_store'    'INFORMATION_SCHEMA'    'COLUMN_DOMAIN_USAGE'    {1×7  cell}    'VIE
```

`data` contains these variables:

- Catalog name
- Schema name
- Table name
- Columns in the table type
- Table type

Close the database connection.

```
close(conn)
```

Find Information About Table

Use an ODBC connection to find information about a database table in a Microsoft® SQL Server® database.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Find information about any tables that contain the pattern `product` in the table name. The `sqlfind` function returns information about the table `productTable`.

```
pattern = 'product';
data = sqlfind(conn,pattern)
```

```
data =

  1×5 table

      Catalog       Schema         Table            Columns        Type
    ____________    ______    _______________    ___________    _______

    'toy_store'     'dbo'     'productTable'     {1×5 cell}     'TABLE'
```

`data` contains these variables:

- Catalog name
- Schema name
- Table name
- Columns in the database table
- Table type

Display the column names in `productTable`.

```
data.Columns{:}
```

```
ans =

  1×5 cell array

  Columns 1 through 4

    {'productNumber'}    {'stockNumber'}    {'supplierNumber'}    {'unitCost'}

  Column 5

    {'productDescript…'}
```

Close the database connection.

```
close(conn)
```

Find Information About Table Types in Catalog and Schema

Use an ODBC connection to find information about all database table types in a Microsoft® SQL Server® database. Specify the database catalog and schema to search.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Find information about all table types in the `toy_store` database catalog and the `dbo` database schema. Use the `'Catalog'` name-value pair argument to specify the catalog. Use the `'Schema'` name-value pair argument to specify the schema.

`data` is a table that contains information about all the table types in the specified catalog and schema.

```
data = sqlfind(conn,'','Catalog','toy_store','Schema','dbo');
```

Display the first eight table types.

```
head(data)
```

```
ans =

  8×5 table

      Catalog        Schema            Table                Columns         Type
    ___________      ______      __________________      __________      _______

    'toy_store'      'dbo'       'DS17111713025590'      {1×5 cell}      'TABLE'
    'toy_store'      'dbo'       'DS17111713025699'      {1×4 cell}      'TABLE'
    'toy_store'      'dbo'       'DS22121715025751'      {1×5 cell}      'TABLE'
    'toy_store'      'dbo'       'DS22121715025879'      {1×4 cell}      'TABLE'
    'toy_store'      'dbo'       'DS22121715052820'      {1×5 cell}      'TABLE'
    'toy_store'      'dbo'       'DS22121715052941'      {1×4 cell}      'TABLE'
    'toy_store'      'dbo'       'DS26121710493780'      {1×5 cell}      'TABLE'
    'toy_store'      'dbo'       'DS26121710493818'      {1×4 cell}      'TABLE'
```

`data` contains these variables:

- Catalog name
- Schema name

- Table name
- Columns in the database table
- Table type

Display the column names in the fourth table type.

```
data.Columns{4}
```

```
ans =

  1×4 cell array

    {'productNumber'}    {'Quantity'}    {'Price'}    {'inventoryDate'}
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
connection object

Database connection, specified as a `connection` object created with the `database` function.

pattern — Pattern
character vector | string scalar

Pattern, specified as a character vector or string scalar. The `sqlfind` function searches for this text in the names of the tables types in a database.

Example: `"inventory"`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes.

You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `data = sqlfind(conn,pattern,'Catalog','toy_store','Schema','dbo')` returns information about table types, stored in the specified catalog and schema, that match the name of the table type with the specified pattern.

`Catalog` — Database catalog name
character vector | string scalar

Database catalog name, specified as the comma-separated pair consisting of `'Catalog'` and a character vector or string scalar. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have numerous catalogs.

Example: `'Catalog','toy_store'`

Data Types: `char` | `string`

`Schema` — Database schema name
character vector | string scalar

Database schema name, specified as the comma-separated pair consisting of `'Schema'` and a character vector or string scalar. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `'Schema','dbo'`

Data Types: `char` | `string`

Output Arguments

`data` — Table type information
table

Table type information, returned as a table that contains information for table types, where the table type name partially or fully matches the text in `pattern`. The returned table has these variables.

Variable	Description	Variable Data Type
`Catalog`	Catalog name where the database table type is stored	Cell array of character vectors
`Schema`	Schema name where the database table type is stored	
`Table`	Database table name	
`Columns`	Column names in the database table type	
`Type`	Database table type	

Definitions

Table Types

Table types are a subset of database objects, which store or reference data.

The `sqlfind` function recognizes these table types in a database:

- Table
- View
- System table
- System view
- Synonym
- Global temporary table

- Local temporary table

See Also
`close` | `database` | `sqlinnerjoin` | `sqlread`

Topics
"Retrieve Database Metadata" on page 5-58
"Import Data from Database Table Using sqlread Function" on page 5-52

Introduced in R2018a

sqlinnerjoin

Package: database.odbc

Inner join between two database tables

Syntax

```
data = sqlinnerjoin(conn,lefttable,righttable)
data = sqlinnerjoin(conn,lefttable,righttable,Name,Value)
```

Description

`data = sqlinnerjoin(conn,lefttable,righttable)` returns a table resulting from an inner join between the left and right database tables. This function matches rows using all shared columns, or keys, in both database tables. The inner join retains only the rows that match between the two tables. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM lefttable,righttable INNER JOIN lefttable.key = righttable.key`.

`data = sqlinnerjoin(conn,lefttable,righttable,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Keys','productNumber'` specifies using the `productNumber` column as a key for joining the two database tables.

Examples

Join Two Database Tables

Use an ODBC connection to import product data from an inner join between two Microsoft® SQL Server® database tables into MATLAB®.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message


ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables.

`data` is a table that contains the matched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable);
```

Display the first three rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)


ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Close the database connection.

```
close(conn)
```

Join Two Database Tables in Catalog and Schema

Use an ODBC connection to import product data from an inner join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the database catalog and schema where the tables are stored.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. Specify the `toy_store` catalog and the `dbo` schema for both the left and right tables. Use the `'LeftCatalog'` and `'LeftSchema'` name-value pair arguments for the left table, and the `'RightCatalog'` and `'RightSchema'` name-value pair arguments for the right table.

`data` is a table that contains the matched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable,'LeftCatalog','toy_store', ...
    'LeftSchema','dbo','RightCatalog','toy_store','RightSchema','dbo');
```

Display the first three rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Close the database connection.

```
close(conn)
```

Specify Key for Joining Two Database Tables

Use an ODBC connection to import joined product data from two Microsoft® SQL Server® database tables into MATLAB®. Specify the key to use for joining the tables.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =
```

```
[]
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. Specify the key, or shared column, between the tables using the `'Keys'` name-value pair argument.

`data` is a table that contains the matched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable,'Keys','supplierNumber');
```

Display the first three rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Close the database connection.

```
close(conn)
```

Join Data Using Left and Right Keys

Use an ODBC connection to import employee data from an inner join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the left and right keys for the join.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `employees` and `departments`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `employees` and `departments`, to find the managers for particular departments. The `employees` table is the left table of the join, and the `departments` table is the right table of the join. Here, the column names of the keys are different. Specify the `MANAGER_ID` key in the left table using the `'LeftKeys'` name-value pair argument. Specify the `DEPT_MANAGER_ID` key in the right table using the `'RightKeys'` name-value pair argument.

`data` is a table that contains the matched rows from the two tables.

```
lefttable = 'employees';
righttable = 'departments';
data = sqlinnerjoin(conn,lefttable,righttable,'LeftKeys','MANAGER_ID', ...
    'RightKeys','DEPT_MANAGER_ID');
```

Display the first three rows of joined data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×15 table

    EMPLOYEE_ID    FIRST_NAME    LAST_NAME      EMAIL        PHONE_NUMBER          HI
    ___________    __________    _________    __________    ______________    _________
```

```
101         'Neena'      'Kochhar'    'NKOCHHAR'     '515.123.4568'    '2005-09
102         'Lex'        'De Haan'    'LDEHAAN'      '515.123.4569'    '2001-01
104         'Bruce'      'Ernst'      'BERNST'       '590.423.4568'    '2007-05
```

Close the database connection.

```
close(conn)
```

Limit Number of Rows in Joined Data

Use an ODBC connection to import joined product data from two Microsoft® SQL Server® database tables into MATLAB®. Specify the number of rows to return.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. Specify the number of rows to return using the `'MaxRows'` name-value pair argument.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable,'MaxRows',3)
```

```
data =
```

```
  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          8          2.1257e+05          1001             5       'Train Set'
```

`data` is a table that contains three of the matched rows from the two tables. The columns from the right table appear to the right of the columns from the left table.

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

`lefttable` — Left table
character vector | string scalar

Left table, specified as a character vector or string scalar. Specify the name of the database table on the left side of the join.

Example: `'inventoryTable'`

Data Types: `char` | `string`

`righttable` — Right table
character vector | string scalar

Right table, specified as a character vector or string scalar. Specify the name of the database table on the right side of the join.

Example: `'productTable'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `data = sqlinnerjoin(conn,lefttable,righttable,'LeftCatalog','toy_store','LeftSchema','dbo','RightCatalog','toy_shop','RightSchema','toys','MaxRows',5)` performs an inner join between left and right tables by specifying the catalog and schema for both tables and returns five matched rows.

`LeftCatalog` — Left catalog
character vector | string scalar

Left catalog, specified as the comma-separated pair consisting of `'LeftCatalog'` and a character vector or string scalar. Specify the database catalog name where the left table of the join is stored.

Example: `'LeftCatalog','toy_store'`

Data Types: `char` | `string`

`RightCatalog` — Right catalog
character vector | string scalar

Right catalog, specified as the comma-separated pair consisting of `'RightCatalog'` and a character vector or string scalar. Specify the database catalog name where the right table of the join is stored.

Example: `'RightCatalog','toy_store'`

Data Types: `char` | `string`

`LeftSchema` — Left schema
character vector | string scalar

Left schema, specified as the comma-separated pair consisting of `'LeftSchema'` and a character vector or string scalar. Specify the database schema name where the left table of the join is stored.

Example: `'LeftSchema','dbo'`

Data Types: `char` | `string`

`RightSchema` — Right schema
character vector | string scalar

Right schema, specified as the comma-separated pair consisting of `'RightSchema'` and a character vector or string scalar. Specify the database schema name where the right table of the join is stored.

Example: `'RightSchema','dbo'`

Data Types: `char` | `string`

`Keys` — Keys
character vector | string scalar | cell array of character vectors | string array

Keys, specified as the comma-separated pair consisting of `'Keys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. Use this name-value pair argument to identify the shared keys between the two tables to join.

You cannot use this name-value pair argument with the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.

Example: `'Keys','MANAGER_ID'`

Data Types: `char` | `string` | `cell`

`LeftKeys` — Left keys
character vector | string scalar | cell array of character vectors | string array

Left keys, specified as the comma-separated pair consisting of `'LeftKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the left table for the join to the right table.

Use this name-value pair argument with the `'RightKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlinnerjoin` function pairs the values of the keys based on their order.

Example: `'LeftKeys',["productNumber" "Price"]`

Data Types: char | string | cell

RightKeys — Right keys
character vector | string scalar | cell array of character vectors | string array

Right keys, specified as the comma-separated pair consisting of 'RightKeys' and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the right table for the join to the left table.

Use this name-value pair argument with the 'LeftKeys' name-value pair argument. Both arguments must specify the same number of keys. The sqlinnerjoin function pairs the values of the keys based on their order.

Example: 'RightKeys',["productNumber" "Price"]

Data Types: char | string | cell

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of 'MaxRows' and a positive numeric scalar. By default, the sqlinnerjoin function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: 'MaxRows',10

Data Types: double

Output Arguments

data — Joined data
table

Joined data, returned as a table that contains the matched rows from the join of the left and right tables. data also contains a variable for each column in the left and right tables.

For columns that have numeric data types in the database table, the variable data types in data are double by default. For columns that have text, date, time, or timestamp data types in the database table, the variable data types are cell arrays of character vectors by default.

If the column names are shared between the joined database tables and have the same case, then the `sqlinnerjoin` function adds a unique suffix to the corresponding variable names in `data`.

See Also

`close` | `database` | `sqlfind` | `sqlouterjoin` | `sqlread`

Topics

"Join Tables Using Command Line" on page 5-51
"Importing Data Common Errors" on page 3-4

Introduced in R2018a

sqlouterjoin

Package: database.odbc

Outer join between two database tables

Syntax

```
data = sqlouterjoin(conn,lefttable,righttable)
data = sqlouterjoin(conn,lefttable,righttable,Name,Value)
```

Description

`data = sqlouterjoin(conn,lefttable,righttable)` returns a table resulting from an outer join between the left and right database tables. This function matches rows using all shared columns, or keys, in both database tables. The outer join retains the matched and unmatched rows between the two tables. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM lefttable,righttable OUTER JOIN lefttable.key = righttable.key`.

`data = sqlouterjoin(conn,lefttable,righttable,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Keys','productNumber'` specifies using the `productNumber` column as a key for joining the two database tables.

Examples

Join Two Database Tables

Use an ODBC connection to import product data from an outer join between two Microsoft® SQL Server® database tables into MATLAB®.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables.

`data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable);
```

Display the first three rows of joined data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Close the database connection.

```
close(conn)
```

Join Two Database Tables in Catalog and Schema

Use an ODBC connection to import product data from an outer join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the database catalog and schema where the tables are stored.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables. Specify the `toy_store` catalog and the `dbo` schema for both the left and right tables. Use the `'LeftCatalog'` and `'LeftSchema'` name-value pair arguments for the left table, and the `'RightCatalog'` and `'RightSchema'` name-value pair arguments for the right table.

`data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable,'LeftCatalog','toy_store', ...
    'LeftSchema','dbo','RightCatalog','toy_store','RightSchema','dbo');
```

Display the first three rows of joined data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Close the database connection.

```
close(conn)
```

Specify Key for Joining Two Database Tables

Use an ODBC connection to import joined product data from two Microsoft® SQL Server® database tables into MATLAB®. Specify the key to use for joining the tables.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =
```

```
[]
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. Specify the key, or shared column, between the tables using the `'Keys'` name-value pair argument.

`data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable,'Keys','supplierNumber');
```

Display the first three rows of joined data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Close the database connection.

```
close(conn)
```

Join Data Using Left and Right Keys

Use an ODBC connection to import employee data from an outer join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the left and right keys for the join.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `employees` and `departments`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `employees` and `departments`, to find the managers for particular departments. The `employees` table is the left table of the join, and the `departments` table is the right table of the join. Here, the column names of the keys are different. Specify the `MANAGER_ID` key in the left table using the `'LeftKeys'` name-value pair argument. Specify the `DEPT_MANAGER_ID` key in the right table using the `'RightKeys'` name-value pair argument.

`data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = 'employees';
righttable = 'departments';
data = sqlouterjoin(conn,lefttable,righttable,'LeftKeys','MANAGER_ID', ...
    'RightKeys','DEPT_MANAGER_ID');
```

Display the last three unmatched rows of joined data. Display the last five variables of the joined data.

```
tail(data(:,end-4:end),3)
```

```
ans =

  3×5 table

    DEPARTMENT_ID    DEPARTMENT_ID_1    DEPARTMENT_NAME    DEPT_MANAGER_ID    LOCATIO
    _____________    _______________    _______________    _______________    _______
```

```
        NaN                  230           'IT Helpdesk'              NaN              1700
        NaN                   40           'Human Resources'          203              2400
        NaN                   10           'Administration'           200              1700
```

Close the database connection.

```
close(conn)
```

Create Right Join Using Left and Right Keys

Use an ODBC connection to import joined employee data from two Microsoft® SQL Server® database tables into MATLAB®. Create a right join and specify the left and right keys for the join.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `employees` and `departments`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `employees` and `departments`, to find the managers for particular departments. The `employees` table is the left table of the join, and the `departments` table is the right table of the join. Here, the column names of the keys are different. Specify the `MANAGER_ID` key in the left table using the `'LeftKeys'` name-value pair argument. Specify the `DEPT_MANAGER_ID` key in the right table using the `'RightKeys'` name-value pair argument. Create a right join using the `'Type'` name-value pair argument.

```
lefttable = 'employees';
righttable = 'departments';
data = sqlouterjoin(conn,lefttable,righttable,'LeftKeys','MANAGER_ID', ...
    'RightKeys','DEPT_MANAGER_ID','Type','right');
```

`data` is a table that contains the matched rows from the two tables and the unmatched rows from the right table only.

Display the last three unmatched rows of joined data. Display the last five variables of the joined data.

```
tail(data(:,end-4:end),3)
```

```
ans =

  3×5 table

    DEPARTMENT_ID    DEPARTMENT_ID_1    DEPARTMENT_NAME    DEPT_MANAGER_ID    LOCATION_
    _____________    _______________    _______________    _______________    _________

         NaN              250           'Retail Sales'           NaN             1700
         NaN              260           'Recruiting'             NaN             1700
         NaN              270           'Payroll'                NaN             1700
```

Close the database connection.

```
close(conn)
```

Limit Number of Rows in Joined Data

Use an ODBC connection to import joined product data from two Microsoft® SQL Server® database tables into MATLAB®. Specify the number of rows to return.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the Message property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, productTable and suppliers. The productTable table is the left table of the join, and the suppliers table is the right table of the join. The sqlouterjoin function automatically detects the shared column between the tables. Specify the number of rows to return using the 'MaxRows' name-value pair argument.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable,'MaxRows',3)
```

```
data =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          7          3.8912e+05          1007            16        'Engine Kit'
          8          2.1257e+05          1001             5        'Train Set'
          9          1.2597e+05          1003            13        'Victorian Doll'
```

data is a table that contains three of the matched and unmatched rows from the two tables. The columns from the right table appear to the right of the columns from the left table.

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
connection object

Database connection, specified as a `connection` object created with the `database` function.

`lefttable` — Left table
character vector | string scalar

Left table, specified as a character vector or string scalar. Specify the name of the database table on the left side of the join.

Example: `'inventoryTable'`

Data Types: `char` | `string`

`righttable` — Right table
character vector | string scalar

Right table, specified as a character vector or string scalar. Specify the name of the database table on the right side of the join.

Example: `'productTable'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `data = sqlouterjoin(conn,lefttable,righttable,'Type','left','MaxRows',5)` performs an outer left join between left and right tables and returns five rows of the joined data.

`LeftCatalog` — Left catalog
character vector | string scalar

Left catalog, specified as the comma-separated pair consisting of `'LeftCatalog'` and a character vector or string scalar. Specify the database catalog name where the left table of the join is stored.

Example: `'LeftCatalog','toy_store'`

Data Types: `char` | `string`

`RightCatalog` — Right catalog
character vector | string scalar

Right catalog, specified as the comma-separated pair consisting of `'RightCatalog'` and a character vector or string scalar. Specify the database catalog name where the right table of the join is stored.

Example: `'RightCatalog','toy_store'`

Data Types: `char` | `string`

`LeftSchema` — Left schema
character vector | string scalar

Left schema, specified as the comma-separated pair consisting of `'LeftSchema'` and a character vector or string scalar. Specify the database schema name where the left table of the join is stored.

Example: `'LeftSchema','dbo'`

Data Types: `char` | `string`

`RightSchema` — Right schema
character vector | string scalar

Right schema, specified as the comma-separated pair consisting of `'RightSchema'` and a character vector or string scalar. Specify the database schema name where the right table of the join is stored.

Example: `'RightSchema','dbo'`

Data Types: `char` | `string`

`Keys` — Keys
character vector | string scalar | cell array of character vectors | string array

Keys, specified as the comma-separated pair consisting of `'Keys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. Use this name-value pair argument to identify the shared keys between the two tables to join.

You cannot use this name-value pair argument with the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.

Example: `'Keys','MANAGER_ID'`

Data Types: `char` | `string` | `cell`

`LeftKeys` — Left keys
character vector | string scalar | cell array of character vectors | string array

Left keys, specified as the comma-separated pair consisting of `'LeftKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the left table for the join to the right table.

Use this name-value pair argument with the `'RightKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlouterjoin` function pairs the values of the keys based on their order.

Example: `'LeftKeys',["productNumber" "Price"]`

Data Types: `char` | `string` | `cell`

`RightKeys` — Right keys
character vector | string scalar | cell array of character vectors | string array

Right keys, specified as the comma-separated pair consisting of `'RightKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the right table for the join to the left table.

Use this name-value pair argument with the `'LeftKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlouterjoin` function pairs the values of the keys based on their order.

Example: `'RightKeys',["productNumber" "Price"]`

Data Types: `char` | `string` | `cell`

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `sqlouterjoin` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

`Type` — Outer join type
`'full'` (default) | `'left'` | `'right'`

Outer join type, specified as the comma-separated pair consisting of `'Type'` and one of these values:

- `'full'` — A full join retrieves records that have matching values in the selected column of both tables, and unmatched records from both the left and right tables.
- `'left'` — A left join retrieves records that have matching values in the selected column of both tables, and unmatched records from the left table only.
- `'right'` — A right join retrieves records that have matching values in the selected column of both tables, and unmatched records from the right table only.

You can specify these values as a character vector or string scalar.

Not all databases support all join types. For an unsupported database, you must use the `sqlread` function to import data from both tables into MATLAB. Then, use the `sqlouterjoin` function to join tables in the MATLAB workspace.

Example: `'Type','left'`

Output Arguments

`data` — Joined data
table

Joined data, returned as a table that contains rows matched by keys in the left and right database tables and the retained unmatched rows. `data` also contains a variable for each column in the left and right tables.

By default, the variable data types are `double` for columns that have `numeric` data types in the database table. For any text, `date`, `time`, or `timestamp` data types in the database table, the variable data type is a cell array of character vectors by default.

If the column names are shared between the joined database tables and have the same case, then the `outerjoin` function adds a unique suffix to the corresponding variable names in `data`.

The variables in `data` that correspond to columns in the left table contain `NULL` values when no matched rows exist in the right database table. Similarly, the variables that correspond to columns in the right table contain `NULL` values when no matched rows exist in the left database table.

See Also

`close` | `database` | `sqlfind` | `sqlinnerjoin` | `sqlread`

Topics

"Join Tables Using Command Line" on page 5-51
"Importing Data Common Errors" on page 3-4

Introduced in R2018a

sqlread

Package: database.odbc

Import data into MATLAB from database table

Syntax

```
data = sqlread(conn,tablename)
data = sqlread(conn,tablename,opts)
data = sqlread( ___ ,Name,Value)
```

Description

`data = sqlread(conn,tablename)` returns a table by importing data into MATLAB from a database table. Executing this function is the equivalent of writing a `SELECT * FROM tablename` SQL statement in ANSI SQL.

`data = sqlread(conn,tablename,opts)` customizes options for importing data from a database table using the `SQLImportOptions` object.

`data = sqlread( ___ ,Name,Value)` specifies additional options using one or more name-value pair arguments and any of the previous input argument combinations. For example, `'Catalog','cat'` imports data from a database table stored in the `'cat'` catalog.

Examples

Import Data from Database Table

Use an ODBC connection to import product data from a database table into MATLAB® using a Microsoft® SQL Server® database. Then, perform a simple data analysis.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import data from the database table `productTable`. The `sqlread` function returns a MATLAB® table that contains the product data.

```
tablename = 'productTable';
data = sqlread(conn,tablename);
```

Display the first few products.

```
head(data,3)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        'Victorian Doll'
          8          2.1257e+05          1001             5        'Train Set'
          7          3.8912e+05          1007            16        'Engine Kit'
```

Close the database connection.

```
close(conn)
```

Import Data from Database Table Using Import Options

Customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                 (1) |      (2) |      (3) |         (4) |      (5) |      (6) |
       Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smo
       Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'dou
```

```
  FillValue:         '' |       '' |    [NaN] |         '' |    [NaN] |    [NaN] |    [

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker` variables using the `setoptions` function. Because the `Gender`, `Location`, and `SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `logical`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'Smoker','Type','logical');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                        (1) |           (2) |       (3) |                          (4)
       Name:      'Gender' |    'Location' |  'Smoker' | 'SelfAssessedHealthStatus'
       Type: 'categorical' | 'categorical' | 'logical' |              'categorical'
  FillValue:   <undefined> |   <undefined> |         0 |                <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts);
tail(data)
```

```
ans=8×10 table
     LastName      Gender    Age            Location             Height    Weight    Sm
    ___________    ______    ___    _________________________    ______    ______    __

    'Foster'       Female    30     St. Mary's Medical Center      70       124      fa
    'Gonzales'     Male      48     County General Hospital        71       174      fa
    'Bryant'       Female    48     County General Hospital        66       134      fa
    'Alexander'    Male      25     County General Hospital        69       171      tr
    'Russell'      Male      44     VA Hospital                    69       188      tr
```

```
'Griffin'      Male      49     County General Hospital       70       186      fa
'Diaz'         Male      45     County General Hospital       68       172      tr
'Hayes'        Male      48     County General Hospital       66       177      fa
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    LastName: 100×1 cell array of character vectors

    Gender: 100×1 categorical

        Values:

            Female       53
            Male         47

    Age: 100×1 double

        Values:

            Min        25
            Median     39
            Max        50

    Location: 100×1 categorical

        Values:

            County General Hospital          39
            St. Mary s Medical Center        24
            VA Hospital                      37

    Height: 100×1 double

        Values:

            Min          60
            Median       67
            Max          72
```

```
    Weight: 100×1 double

        Values:

            Min           111
            Median      142.5
            Max           202

    Smoker: 100×1 logical

        Values:

            True        34
            False       66

    Systolic: 100×1 double

        Values:

            Min           109
            Median        122
            Max           138

    Diastolic: 100×1 double

        Values:

            Min             68
            Median        81.5
            Max             99

    SelfAssessedHealthStatus: 100×1 categorical

        Values:

            Excellent                 34
            Fair                      15
            Good                      40
            Poor                      11
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Import Data from Database Table in Specific Schema

Use an ODBC connection to import product data from a database table into MATLAB® using a Microsoft® SQL Server® database. Specify the schema where the database table is stored. Then, sort and filter the rows in the imported data and perform a simple data analysis.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import data from the table `productTable`. Specify the database schema `dbo`. The `data` table contains the product data.

```
tablename = 'productTable';
data = sqlread(conn,tablename,'Schema','dbo');
```

Display the first few products.

```
data(1:3,:)
```

```
ans =
```

```
  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        'Victorian Doll'
          8          2.1257e+05          1001             5        'Train Set'
          7          3.8912e+05          1007            16        'Engine Kit'
```

Display the first few product descriptions.

```
data.productDescription(1:3)
```

```
ans =

  3×1 cell array

    {'Victorian Doll'}
    {'Train Set'     }
    {'Engine Kit'    }
```

Sort the rows in `data` by the product description column in alphabetical order.

```
column = 'productDescription';
data = sortrows(data,column);
```

Display the first few product descriptions after sorting.

```
data.productDescription(1:3)
```

```
ans =

  3×1 cell array

    {'Building Blocks'}
    {'Convertible'    }
    {'Engine Kit'     }
```

Close the database connection.

```
close(conn)
```

Import Specific Number of Rows from Database Table

Use an ODBC connection to import product data from a database table into MATLAB® using a Microsoft® SQL Server® database. Specify the maximum number of rows to import from the database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import data from the table `productTable`. Import only three rows of data from the database table. The `data` table contains the product data.

```
tablename = 'productTable';
data = sqlread(conn,tablename,'MaxRows',3)
```

```
data =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        'Victorian Doll'
          8          2.1257e+05          1001             5        'Train Set'
```

```
         7          3.8912e+05          1007              16          'Engine Kit'
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

`tablename` — Database table name
character vector | string scalar

Database table name, specified as a character vector or string scalar denoting the name of a table in the database.

Example: `'employees'`

Data Types: `char` | `string`

`opts` — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `data = sqlread(conn,'inventoryTable','Catalog','toy_store','Schema','dbo','MaxRows',5)` imports five rows of data from the database table `inventoryTable` stored in the `toy_store` catalog and the `dbo` schema.

`Catalog` — Database catalog name
character vector | string scalar

Database catalog name, specified as the comma-separated pair consisting of `'Catalog'` and a character vector or string scalar. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have numerous catalogs.

Example: `'Catalog','toy_store'`

Data Types: `char` | `string`

`Schema` — Database schema name
character vector | string scalar

Database schema name, specified as the comma-separated pair consisting of `'Schema'` and a character vector or string scalar. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `'Schema','dbo'`

Data Types: `char` | `string`

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `sqlread` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

Output Arguments

`data` — Imported data
table

Imported data, returned as a table. The rows of the table correspond to the rows in the database table `tablename`. The variables in the table correspond to each column in the database table. For columns that have `numeric` data types in the database table, the variable data types in `data` are `double` by default. For columns that have text, `date`, `time`, or `timestamp` data types in the database table, the variable data types are cell arrays of character vectors by default.

If the database table contains no data to import, then `data` is an empty table.

See Also

`close` | `database` | `databaseImportOptions` | `execute` | `fetch` | `getoptions` | `reset` | `select` | `setoptions` | `sqlfind` | `sqlinnerjoin` | `sqlouterjoin`

Topics

"Import Data from Database Table Using sqlread Function" on page 5-52
"Customize Options for Importing Data from Database into MATLAB" on page 5-61
"Data Import Memory Management" on page 5-28
"Importing Data Common Errors" on page 3-4

Introduced in R2018a

sqlwrite

Package: database.odbc

Insert MATLAB data into database table

Syntax

```
sqlwrite(conn,tablename,data)
sqlwrite(conn,tablename,data,Name,Value)
```

Description

`sqlwrite(conn,tablename,data)` inserts data from a MATLAB table into a database table. If the table exists in the database, this function appends the data in the MATLAB table as rows in the existing database table. If the table does not exist in the database, this function creates a table with the specified table name and then inserts the data as rows in the new table. This syntax is the equivalent of executing SQL statements that contain the `CREATE TABLE` and `INSERT INTO` ANSI SQL syntaxes.

`sqlwrite(conn,tablename,data,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Catalog','toy_store'` inserts data into a database table that is located in the database catalog named `toy_store`.

Examples

Append Data into Existing Table

Use an ODBC connection to append product data from a MATLAB® table into an existing table in a Microsoft® SQL Server® database.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

To view the existing database table `productTable` before appending data, import its contents into MATLAB and display the last few rows.

```
tablename = 'productTable';
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17           'Pancakes'
         14           5.101e+05          1011            19           'Shawl'
         15          8.9975e+05          1011            20           'Snacks'
```

Create a MATLAB table that contains the data for one product.

```
data = table(30,500000,1000,25,"Rubik's Cube", ...
    'VariableNames',{'productNumber' 'stockNumber' ...
    'supplierNumber' 'unitCost' 'productDescription'});
```

Append the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans =

  4×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17          'Pancakes'
         14           5.101e+05          1011            19          'Shawl'
         15          8.9975e+05          1011            20          'Snacks'
         30               5e+05          1000            25          'Rubik's Cube'
```

Close the database connection.

```
close(conn)
```

Insert Data into New Table

Use an ODBC connection to insert product data from MATLAB® into a new table in a Microsoft® SQL Server® database.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',{'productNumber' ...
    'stockNumber' 'supplierNumber' 'unitCost' 'productDescription'});
```

Insert the product data into a new database table `toyTable`.

```
tablename = 'toyTable';
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows =

  2×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30             5e+05            1000            25         'Rubik's Cube'
         40             6e+05            2000            30         'Doll House'
```

Close the database connection.

```
close(conn)
```

Specify Column Types When Inserting Data into New Table

Use an ODBC connection to insert product data from MATLAB® into a new table in a Microsoft® SQL Server® database. Specify the data types of the columns in the new database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',{'productNumber' ...
    'stockNumber' 'supplierNumber' 'unitCost' 'productDescription'});
```

Insert the product data into a new database table `toyTable`. Use the `'ColumnType'` name-value pair argument and a string array to specify the data types of all the columns in the database table.

```
tablename = 'toyTable';
coltypes = ["numeric" "numeric" "numeric" "numeric" "varchar(255)"];
sqlwrite(conn,tablename,data,'ColumnType',coltypes)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows =

  2×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30             5e+05            1000            25         'Rubik's Cube'
         40             6e+05            2000            30         'Doll House'
```

Close the database connection.

```
close(conn)
```

Insert Cell Array into Table

Use an ODBC connection to insert product data from MATLAB® into a new table in a Microsoft® SQL Server® database. Insert data stored as a cell array into the new database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a cell array that contains data for two products.

```
c = {30,500000,1000,25,"Rubik's Cube";40,600000,2000,30,"Doll House"};
```

Convert the cell array to a MATLAB table by specifying the column names.

```
colnames = {'productNumber' 'stockNumber' 'supplierNumber' 'unitCost' ...
    'productDescription'};
data = cell2table(c,'VariableNames',colnames);
```

Insert the product data into a new database table `toyTable`.

```
tablename = 'toyTable';
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows =

  2×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30             5e+05            1000            25         'Rubik's Cube'
         40             6e+05            2000            30         'Doll House'
```

Close the database connection.

```
close(conn)
```

Insert Structure into Table

Use an ODBC connection to insert product data from MATLAB® into a new table in a Microsoft® SQL Server® database. Insert data stored as a structure into the new database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a structure array that contains data for two products.

```
s(1).productNumber = 30;
s(1).stockNumber = 500000;
s(1).supplierNumber = 1000;
s(1).unitCost = 25;
s(1).productDescription = "Rubik's Cube";

s(2).productNumber = 40;
s(2).stockNumber = 600000;
s(2).supplierNumber = 2000;
s(2).unitCost = 30;
s(2).productDescription = "Doll House";
```

Convert the structure to a MATLAB table.

```
data = struct2table(s);
```

Insert the product data into a new database table `toyTable`.

```
tablename = 'toyTable';
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows =

  2×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30             5e+05            1000            25          'Rubik's Cube'
         40             6e+05            2000            30          'Doll House'
```

Close the database connection.

```
close(conn)
```

Insert Numeric Array into Table

Use an ODBC connection to insert sales volume data from MATLAB® into an existing table in a Microsoft® SQL Server® database. Insert data stored as a numeric array into the existing database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the `salesVolume` table.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a numeric array that contains monthly sales volume data for a specific stock number. Specify the column names for the existing database table `salesVolume`.

```
n = [100000 1000 0 2000 500 3000 450 600 700 750 1450 0 0];
colnames = {'StockNumber' 'January' 'February' 'March' 'April' 'May' ...
    'June' 'July' 'August' 'September' 'October' 'November' 'December'};
```

Convert the numeric array to a MATLAB table.

```
data = array2table(n,'VariableNames',colnames);
```

Insert the sales volume data into the database table `salesVolume`.

```
tablename = 'salesVolume';
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the last three rows. The results contain a new row for the inserted sales volume data.

```
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×13 table

    StockNumber    January    February    March    April    May     June    July    Aug
    ___________    _______    ________    _____    _____    ____    ____    ____    ___

     5.101e+05        235        1800      1040      900     750    700     400     35
    8.9975e+05        123        1700       823      701     689    621     545     42
         1e+05       1000           0      2000      500    3000    450     600     70
```

Close the database connection.

```
close(conn)
```

Insert Date Number into Table

Use an ODBC connection to insert inventory data from MATLAB® into an existing table in a Microsoft® SQL Server® database. Insert a date stored as a date number into the existing database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `inventoryTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a numeric array that contains inventory data for a specific product, including the date number `731011`. Specify the column names for the existing database table `inventoryTable`.

```
n = [25 1000 50 731011];
colnames = {'productNumber' 'Quantity' 'Price' 'inventoryDate'};
```

Convert the numeric array to a MATLAB table.

```
data = array2table(n,'VariableNames',colnames);
```

Convert the date value in the inventory data to a `datetime` array. The `sqlwrite` function does not accept date numbers as a valid data type for insertion.

```
n = data.inventoryDate;
data.inventoryDate = datetime(n,'ConvertFrom','datenum');
```

Import the contents of the database table `inventoryTable` into MATLAB and display the last few rows.

```
tablename = 'inventoryTable';
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×4 table

    productNumber    Quantity    Price          inventoryDate
    _____________    ________    _____    _________________________

         11             567       11      '2012-09-11 00:30:24.000'
         12            1278       22      '2010-10-29 18:17:47.000'
         13            1700       17      '2009-05-24 10:58:59.000'
```

Insert the inventory data into the database table `inventoryTable`. Specify the schema where the table is stored by using the `'Schema'` name-value pair argument.

```
sqlwrite(conn,tablename,data,'Schema','dbo')
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted inventory data.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans =

  4×4 table

    productNumber    Quantity    Price          inventoryDate
    _____________    ________    _____    _________________________

         11             567        11     '2012-09-11 00:30:24.000'
         12            1278        22     '2010-10-29 18:17:47.000'
         13            1700        17     '2009-05-24 10:58:59.000'
         25            1000        50     '2001-06-09 00:00:00.000'
```

Close the database connection.

```
close(conn)
```

Insert NULL Number into Table

Use an ODBC connection to insert sales volume data from MATLAB® into an existing table in a Microsoft® SQL Server® database. Insert `NULL` numbers into the existing database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `salesVolume`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =
```

```
    []
```

Create a numeric array that contains monthly sales volume data for a specific stock number, and includes a `NULL` number. The value `Inf` indicates a `NULL` value. Specify the column names for the existing database table `salesVolume`.

```
n = [100000 Inf 0 2000 500 3000 450 600 700 750 1450 0 0];
colnames = {'StockNumber' 'January' 'February' 'March' 'April' 'May' ...
    'June' 'July' 'August' 'September' 'October' 'November' 'December'};
```

Convert the numeric array to a MATLAB table.

```
data = array2table(n,'VariableNames',colnames);
```

Convert the `Inf` value in the `January` variable to `NaN`. The `sqlwrite` function does not accept `Inf` values as valid missing data for insertion.

```
data.January = NaN;
```

Import the contents of the database table `salesVolume` into MATLAB and display the last few rows.

```
tablename = 'salesVolume';
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×13 table

    StockNumber    January    February    March    April    May    June    July    Aug
    ___________    _______    ________    _____    _____    ____   ____    ____    ___

    4.7082e+05      3100        9400      1540     1500     1350   1190    900     86
     5.101e+05       235        1800      1040      900      750    700    400     35
    8.9975e+05       123        1700       823      701      689    621    545     42
```

Insert the sales volume data into the database table `salesVolume`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted sales volume data.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans =

  4×13 table

    StockNumber    January    February    March    April    May     June    July    Aug
    ___________    _______    ________    _____    _____    ____    ____    ____    ___

    4.7082e+05      3100        9400      1540     1500     1350    1190    900     86
     5.101e+05       235        1800      1040      900      750     700    400     35
    8.9975e+05       123        1700       823      701      689     621    545     42
         1e+05       NaN           0      2000      500     3000     450    600     70
```

Close the database connection.

```
close(conn)
```

Insert NULL String into Table

Use an ODBC connection to insert product data from MATLAB® into an existing table in a Microsoft® SQL Server® database. Insert a `NULL` string into the existing database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a MATLAB table that contains data for one product and includes a `NULL` value in the `productDescription` variable.

```
data = table([30],[500000],[1000],[25], ...
    ["null"],'VariableNames',{'productNumber' ...
    'stockNumber' 'supplierNumber' 'unitCost' 'productDescription'});
```

Convert the `null` value in the `productDescription` variable to `""`. The `sqlwrite` function does not accept `null` values as valid missing data for insertion.

```
data.productDescription(1) = "";
```

Import the contents of the existing database table `productTable` into MATLAB and display the last few rows.

```
tablename = 'productTable';
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17           'Pancakes'
         14           5.101e+05          1011            19           'Shawl'
         15          8.9975e+05          1011            20           'Snacks'
```

Insert the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans =
```

```
  4×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17           'Pancakes'
         14           5.101e+05          1011            19           'Shawl'
         15          8.9975e+05          1011            20           'Snacks'
         30               5e+05          1000            25           ''
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
connection object

Database connection, specified as a `connection` object created with the `database` function.

tablename — Database table name
character vector | string scalar

Database table name, specified as a character vector or string scalar denoting the name of a table in the database.

Example: `'employees'`

Data Types: `char` | `string`

data — Data to insert
table

Data to insert into a database table, specified as a table.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of numeric arrays

- Cell array of character vectors
- String array
- Datetime array
- Logical array
- Cell array of logical arrays

The numeric array can contain these data types:

- `int8`
- `uint8`
- `int16`
- `uint16`
- `int32`
- `uint32`
- `int64`
- `uint64`
- `single`
- `double`

For date and time data, supported formats are:

- Date — `'yyyy-MM-dd'`
- Time — `'HH:mm:ss'`
- Timestamp — `'yyyy-MM-dd HH:mm:ss'`

If the date and time data is specified in an invalid format, then the `sqlwrite` function automatically converts the data to a supported format.

If the cell array of character vectors or string array is specified in an invalid format, then the `sqlwrite` function enables the database driver to check the format. If the format is unexpected, then the database driver throws an error.

You can insert data in an existing database table or a new database table. The data types of variables in `data` vary depending on whether the database table exists. For valid data types, see “Data Types for Existing Table” on page 9-0 and “Data Types for New Table” on page 9-0 .

Note The `sqlwrite` function supports only the `table` data type for the `data` input argument. To insert data stored in a structure, cell array, or numeric matrix, convert the data to a `table` by using the `struct2table`, `cell2table`, and `array2table` functions, respectively.

The `sqlwrite` function does not support the database preferences `NullNumberWrite` and `NullStringWrite`. To insert missing data, see “Accepted Missing Data” on page 9-0.

Caution The Microsoft Access ODBC driver demonstrates unexpected behavior during large inserts. When you insert a large amount of data with Microsoft Access, insert the data in batches. For example, if you want to insert 100,000 rows of data, insert 10,000 rows at a time.

Example: `table([10;20],{'M';'F'})`

Data Types for Existing Table

The variable names of the MATLAB table must match the column names in the database table. The `sqlwrite` function is case-sensitive.

When you insert data into a database table, use the data types shown in the following table to ensure that the data has the correct data type. This table matches the valid data types of the MATLAB table variable to the data types of the database column. For example, when you insert data into a database column that has the `BOOLEAN` data type, ensure that the corresponding variable in the MATLAB table is a logical array or cell array of logical arrays.

Data Type of MATLAB Table Variable	Data Type of Existing Database Column
Numeric array or cell array of numeric arrays	`NUMERIC`
• Cell array of character vectors • String array • Datetime array	`DATE`, `TIME`, or `DATETIME`
Logical array or cell array of logical arrays	`BIT` or `BOOLEAN`

Data Type of MATLAB Table Variable	Data Type of Existing Database Column
Cell array of character vectors or string array	• `CHAR` • `VARCHAR` • `TEXT` • `NTEXT` • Other text data type

Data Types for New Table

The specified table name for the new database table must be unique across all tables in the database.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of character vectors
- String array
- Datetime array
- Logical array

The `sqlwrite` function ignores any invalid variable types and inserts only the valid variables from MATLAB as columns in a new database table.

The `sqlwrite` function converts the data type of the variable into the default data type of the column in the database table. The following table matches the valid data types of the MATLAB table variable to the default data types of the database column.

Data Type of MATLAB Table Variable	Default Data Type of Database Column
Numeric array or cell array of numeric arrays	`NUMERIC`
Datetime array	`TIMESTAMP`
Logical array	`NUMERIC`

Data Type of MATLAB Table Variable	Default Data Type of Database Column
String array	`VARCHAR` **Note** The size of this column equals the sum of the maximum length of a string in the string array and 100.
Cell array of character vectors	`VARCHAR` **Note** The size of this column equals the sum of the maximum length of a character vector in the cell array and 100.

To specify database-specific column data types instead of the defaults, use the `'ColumnType'` name-value pair argument. For example, you can specify `'ColumnType',"bigint"` to create a `BIGINT` column in the new database table.

Also, using the `'ColumnType'` name-value pair argument, you can specify other data types that are not in the default list. For example, to insert images, specify `'ColumnType',"image"`.

Accepted Missing Data

The accepted missing data for inserting data into a database depends on the data type of the MATLAB table variable and the data type of the column in the database. The following table matches the data type of the MATLAB table variable to the data type of the database column and specifies the accepted missing data to use in each case.

Data Type of MATLAB Table Variable	Data Type of Database Column	Accepted Missing Data
`datetime` array	`Date`, `Time`, or `Timestamp`	`NaT`
`double` or `single` array	• `Numeric` • `Double` • `Float` • `Decimal` • `Real`	`NaN`

Data Type of MATLAB Table Variable	Data Type of Database Column	Accepted Missing Data
cell array of `double` or `single` arrays	• `Numeric` • `Double` • `Float` • `Decimal` • `Real`	`NaN`, `[]`, or `''`
cell array of character vectors	`Date`, `Time`, or `Timestamp`	`'NaT'` or `''`
cell array of character vectors	`Char`, `Varchar`, or other text data type	`''`
string array	`Date`, `Time`, or `Timestamp`	`""`, `"NaT"`, or `missing`
string array	`Char`, `Varchar`, or other text data type	`missing`

Data Types: `table`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `sqlwrite(conn,"tablename",data,'ColumnType',["numeric" "timestamp" "image"])` inserts data into a new database table named `tablename` by specifying data types for all columns in the new database table.

Catalog — Database catalog name

character vector | string scalar

Database catalog name, specified as the comma-separated pair consisting of `'Catalog'` and a character vector or string scalar. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have numerous catalogs.

Example: `'Catalog','toy_store'`

Data Types: `char` | `string`

`Schema` — Database schema name
character vector | string scalar

Database schema name, specified as the comma-separated pair consisting of `'Schema'` and a character vector or string scalar. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `'Schema','dbo'`

Data Types: `char` | `string`

`ColumnType` — Database column types
character vector | string scalar | cell array of character vectors | string array

Database column types, specified as a character vector, string scalar, cell array of character vectors, or string array. Use this name-value pair argument to define custom data types for the columns in a database table. Specify a column type for each column in the table.

Example: `'ColumnType',["numeric" "varchar(400)"]`

Data Types: `char` | `string` | `cell`

See Also

`array2table` | `cell2table` | `close` | `database` | `sqlread` | `struct2table`

Topics

"Insert Data into Database Table" on page 5-55
"Append Data to Existing Database Table Using Insert Functionality" on page 5-47
"Insert Data into New Database Table Using Insert Functionality" on page 5-49
"Writing Data Common Errors" on page 3-2

Introduced in R2018a

SQLImportOptions

Define import options for database data

Description

After you create an `SQLImportOptions` object, you can customize the import options for importing data from a database into MATLAB. Import options include defining the data types and fill values for missing data.

Creation

Create an `SQLImportOptions` object with the `databaseImportOptions` function.

Properties

`VariableNames` — Variable names
cell array of character vectors

Variable names, specified as a cell array of character vectors. Each character vector in the cell array indicates the name of an imported database column from an SQL query or database table.

For a table or SQL query with only one database column, the cell array contains only one character vector.

The default variable names are the names of the columns in an SQL query or database table.

Example: `{'productNumber','stockNumber'}`

Data Types: `cell`

`VariableTypes` — Variable types
cell array of character vectors

Variable types, specified as a cell array of character vectors. Each character vector in the cell array indicates the data type of an imported database column from an SQL query or database table. Each character vector must be a valid MATLAB data type.

For a table or SQL query with only one database column, the cell array contains only one character vector.

When you create the `SQLImportOptions` object, the `databaseImportOptions` function automatically detects the data type based on the data type of a database column. This table maps the data type of a database column to the detected MATLAB data type.

Database Data Type	MATLAB Detected Data Type
`TEXT`	`char`
`DATE`, `TIME`, `DATETIME`, or `TIMESTAMP`	`char`
`NUMERIC`	`double`
`BOOLEAN` or `BIT`	`logical`

To update the `VariableTypes` property, use the `setoptions` function.

Example: `{'int64','int32'}`

Data Types: `cell`

SelectedVariableNames — Subset of variables to import
character vector | cell array of character vectors | numeric array

Subset of variables to import, specified as a character vector, cell array of character vectors, or numeric array that contains indices. Use the `SelectedVariableNames` property to determine the database columns to import into the MATLAB workspace.

The values in the `SelectedVariableNames` property must be equal to the values in the `VariableNames` property or a subset of these values. By default, the `SelectedVariableNames` property contains all variable names specified in the `VariableNames` property. When the `SelectedVariableNames` property specifies all variable names, the `sqlread`, `fetch`, and import functions of the `DatabaseDatastore` object import all database columns.

Example: `{'productNumber','stockNumber'}`

Example: `[1,2,3]`

Data Types: `double` | `char` | `cell`

`FillValues` — Fill value for missing data
cell array

Fill value for missing data, specified as a cell array that contains one or more values. Each value can be one of these data types:

- All integer classes
- `single`
- `double`
- `char`
- `string` scalar
- `logical`
- `datetime` array
- `categorical` array
- `missing`

When you create the `SQLImportOptions` object, the `databaseImportOptions` function automatically detects the fill value for missing data based on the data type of the database column. This table maps the data type of a database column to the detected MATLAB fill value.

Database Data Type	MATLAB Detected Fill Value
`TEXT`	`''`
`DATE`, `TIME`, `DATETIME`, or `TIMESTAMP`	`''`
`NUMERIC`	`NaN`
`BOOLEAN` or `BIT`	`false`

To update the `FillValues` property, use the `setoptions` function.

Example: `{'',NaN}`

Data Types: `cell`

`VariableOptions` — Type-specific variable import options
array of variable import options objects

Type-specific variable import options, returned as an array of variable import options objects. The array contains an object corresponding to each variable specified in the `VariableNames` property. Each object in the array contains properties that support the importing of data with a specific data type.

To query the current (or detected) options for a variable, use the `getoptions` function.

To set and customize options for a variable, use the `setoptions` function.

Example: `opts.VariableOptions` returns a collection of `SQLVariableImportOptions` objects, one corresponding to each variable in the data.

Object Functions

getoptions	Retrieve import options for database data
reset	Reset to default import options for database data
setoptions	Customize import options for database data

Examples

Import Data from Database Table Using Import Options

Customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |      (2) |      (3) |        (4) |      (5) |      (6) |
       Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smo
       Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'dou
  FillValue:         '' |       '' |    [NaN] |         '' |    [NaN] |    [NaN] |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker` variables using the `setoptions` function. Because the `Gender`, `Location`, and `SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `logical`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'Smoker','Type','logical');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
```

```
                    (1) |           (2) |       (3) |                          (4)
       Name:       'Gender' |    'Location' |  'Smoker' | 'SelfAssessedHealthStatus'
       Type: 'categorical' | 'categorical' | 'logical' |              'categorical'
  FillValue:   <undefined> |   <undefined> |         0 |                <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts);
tail(data)
```

```
ans=8×10 table
     LastName      Gender    Age            Location            Height    Weight    Sm
    ___________    ______    ___    _________________________    ______    ______    __

    'Foster'       Female    30     St. Mary's Medical Center      70       124      fa
    'Gonzales'     Male      48     County General Hospital        71       174      fa
    'Bryant'       Female    48     County General Hospital        66       134      fa
    'Alexander'    Male      25     County General Hospital        69       171      tr
    'Russell'      Male      44     VA Hospital                    69       188      tr
    'Griffin'      Male      49     County General Hospital        70       186      fa
    'Diaz'         Male      45     County General Hospital        68       172      tr
    'Hayes'        Male      48     County General Hospital        66       177      fa
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    LastName: 100×1 cell array of character vectors

    Gender: 100×1 categorical

        Values:

            Female       53
            Male         47

    Age: 100×1 double
```

```
    Values:

        Min        25
        Median     39
        Max        50

Location: 100×1 categorical

    Values:

        County General Hospital          39
        St. Mary s Medical Center        24
        VA Hospital                      37

Height: 100×1 double

    Values:

        Min          60
        Median       67
        Max          72

Weight: 100×1 double

    Values:

        Min          111
        Median     142.5
        Max          202

Smoker: 100×1 logical

    Values:

        True        34
        False       66

Systolic: 100×1 double

    Values:

        Min          109
        Median       122
```

```
        Max          138

    Diastolic: 100×1 double

        Values:

            Min            68
            Median       81.5
            Max            99

    SelfAssessedHealthStatus: 100×1 categorical

        Values:

            Excellent            34
            Fair                 15
            Good                 40
            Poor                 11
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`close` | `database` | `databaseDatastore` | `execute` | `fetch` | `sqlread` | `sqlwrite`

Topics

“Customize Options for Importing Data from Database into MATLAB” on page 5-61
“Importing Data Common Errors” on page 3-4

External Websites

SQL Tutorial

Introduced in R2018b

databaseImportOptions

Package: database.options

Define import options for database data

Syntax

```
opts = databaseImportOptions(conn,source)
opts = databaseImportOptions(conn,source,Name,Value)
```

Description

`opts = databaseImportOptions(conn,source)` creates an `SQLImportOptions` object using the database connection and a source, which is a database table name or SQL query.

`opts = databaseImportOptions(conn,source,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'Catalog','toy_store'` retrieves data from the `toy_store` database catalog.

Examples

Import Data from Database Table Using Import Options

Customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts =
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                     (1) |      (2) |      (3) |        (4) |      (5) |      (6) |
       Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smo
       Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'dou
  FillValue:         '' |       '' |    [NaN] |         '' |    [NaN] |    [NaN] |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker` variables using the `setoptions` function. Because the `Gender`, `Location`, and `SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `logical`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
```

```
opts = setoptions(opts,'Smoker','Type','logical');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                       (1) |            (2) |        (3) |                          (4)
        Name:     'Gender' |     'Location' |   'Smoker' | 'SelfAssessedHealthStatus'
        Type: 'categorical' | 'categorical' | 'logical' |               'categorical'
   FillValue:   <undefined> |   <undefined> |          0 |                 <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts);
tail(data)
```

```
ans=8×10 table
     LastName      Gender    Age              Location             Height    Weight    Sm
    ___________    ______    ___    _________________________    ______    ______    __

    'Foster'       Female    30     St. Mary's Medical Center      70        124     fa
    'Gonzales'     Male      48     County General Hospital        71        174     fa
    'Bryant'       Female    48     County General Hospital        66        134     fa
    'Alexander'    Male      25     County General Hospital        69        171     tr
    'Russell'      Male      44     VA Hospital                    69        188     tr
    'Griffin'      Male      49     County General Hospital        70        186     fa
    'Diaz'         Male      45     County General Hospital        68        172     tr
    'Hayes'        Male      48     County General Hospital        66        177     fa
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    LastName: 100×1 cell array of character vectors
```

```
Gender: 100×1 categorical

    Values:

        Female       53
        Male         47

Age: 100×1 double

    Values:

        Min         25
        Median      39
        Max         50

Location: 100×1 categorical

    Values:

        County General Hospital           39
        St. Mary s Medical Center         24
        VA Hospital                       37

Height: 100×1 double

    Values:

        Min           60
        Median        67
        Max           72

Weight: 100×1 double

    Values:

        Min           111
        Median      142.5
        Max           202

Smoker: 100×1 logical

    Values:
```

```
        True        34
        False       66

Systolic: 100×1 double

    Values:

        Min          109
        Median       122
        Max          138

Diastolic: 100×1 double

    Values:

        Min            68
        Median       81.5
        Max            99

SelfAssessedHealthStatus: 100×1 categorical

    Values:

        Excellent              34
        Fair                   15
        Good                   40
        Poor                   11
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query Using Import Options

Customize import options when importing data from the results of an SQL query on a database. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different columns in the SQL query. Import data using the `fetch` function.

This example uses the `employees_database.mat` file, which contains the columns `first_name`, `hire_date`, and `DEPARTMENT_NAME`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load employee information into the MATLAB® workspace.

```
employeedata = load('employees_database.mat');
```

Create the `employees` and `departments` database tables using the employee information.

```
emps = employeedata.employees;
depts = employeedata.departments;

sqlwrite(conn,'employees',emps)
sqlwrite(conn,'departments',depts)
```

Create an `SQLImportOptions` object using an SQL query and the `databaseImportOptions` function. This query retrieves all information for employees who are sales managers or programmers.

```
sqlquery = ['SELECT * from employees e join departments d ' ...
    'on (e.department_id = d.department_id) where job_id ' ...
    'in (''IT_PROG'',''SA_MAN'')'];
opts = databaseImportOptions(conn,sqlquery)
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:
```

```
   Variable Options:
                    (1) |          (2) |         (3) |     (4) |            (5) | 
       Name: 'employee_id' | 'first_name' | 'last_name' | 'email' | 'phone_number' | 'h
       Type:      'double' |       'char' |      'char' |  'char' |         'char' | 
  FillValue:         [NaN] |           '' |          '' |      '' |             '' | 

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `hire_date`, `DEPARTMENT_NAME`, and `first_name` variables using the `setoptions` function. Then, display the updated import options. Because `hire_date` stores date and time data, change the data type of this variable to `datetime`. Because `DEPARTMENT_NAME` designates a finite set of repeating values, change the data type of this variable to `categorical`. Also, change the name of this variable to lowercase. Because `first_name` stores text data, change the data type of this variable to `string`.

```
opts = setoptions(opts,'hire_date','Type','datetime');
opts = setoptions(opts,'DEPARTMENT_NAME','Name','department_name', ...
    'Type','categorical');
opts = setoptions(opts,'first_name','Type','string');

vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:

   Variable Options:
                    (1) |          (2) |         (3) |     (4) |            (5) | 
       Name: 'employee_id' | 'first_name' | 'last_name' | 'email' | 'phone_number' | 'h
       Type:      'double' |     'string' |      'char' |  'char' |         'char' | 
  FillValue:           NaN |    <missing> |          '' |      '' |             '' | 

    To access sub-properties of each variable, use getoptions
```

Select the three modified variables using the `SelectVariableNames` property.

```
opts.SelectedVariableNames = {'first_name','hire_date','department_name'};
```

Import and display the results of the SQL query using the `fetch` function.

```
employees_data = fetch(conn,sqlquery,opts)
```

```
employees_data=10×3 table
    first_name          hire_date          department_name
    ___________    ____________________    _______________

    "Alexander"    03-Jan-2006 00:00:00         IT
    "Bruce"        21-May-2007 00:00:00         IT
    "David"        25-Jun-2005 00:00:00         IT
    "Valli"        05-Feb-2006 00:00:00         IT
    "Diana"        07-Feb-2007 00:00:00         IT
    "John"         01-Oct-2004 00:00:00         Sales
    "Karen"        05-Jan-2005 00:00:00         Sales
    "Alberto"      10-Mar-2005 00:00:00         Sales
    "Gerald"       15-Oct-2007 00:00:00         Sales
    "Eleni"        29-Jan-2008 00:00:00         Sales
```

Delete the `employees` and `departments` database tables using the `execute` function.

```
execute(conn,'DROP TABLE employees')
execute(conn,'DROP TABLE departments')
```

Close the database connection.

```
close(conn)
```

Import Data from Database Table Using Import Options with Specified Catalog and Schema

Customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Specify the location of the database table by using the database catalog and schema. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table in the `toy_store` database catalog and `dbo` database schema using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients, ...
    'Catalog','toy_store','Schema','dbo')
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function. Specify the `toy_store` database catalog and `dbo` database schema for the location of the database table.

```
opts = databaseImportOptions(conn,tablename, ...
    'Catalog','toy_store','Schema','dbo');
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                 (1) |      (2) |      (3) |        (4) |      (5) |      (6) |
       Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smo
       Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'dou
  FillValue:         '' |       '' |    [NaN] |         '' |    [NaN] |    [NaN] |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker` variables using the `setoptions` function. Because the `Gender`, `Location`, and `SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `logical`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'Smoker','Type','logical');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                          (1) |            (2) |       (3) |                          (4)
        Name:      'Gender' |    'Location' |  'Smoker' | 'SelfAssessedHealthStatus'
        Type: 'categorical' | 'categorical' | 'logical' |                'categorical'
   FillValue:   <undefined> |   <undefined> |         0 |                  <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts,'Catalog','toy_store','Schema','dbo');
tail(data)
```

```
ans=8×10 table
     LastName      Gender    Age              Location              Height    Weight    Sm
    ___________    ______    ___    _________________________    ______    ______    __

    'Foster'       Female    30     St. Mary's Medical Center      70        124      fa
    'Gonzales'     Male      48     County General Hospital        71        174      fa
    'Bryant'       Female    48     County General Hospital        66        134      fa
    'Alexander'    Male      25     County General Hospital        69        171      tr
    'Russell'      Male      44     VA Hospital                    69        188      tr
    'Griffin'      Male      49     County General Hospital        70        186      fa
    'Diaz'         Male      45     County General Hospital        68        172      tr
    'Hayes'        Male      48     County General Hospital        66        177      fa
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:
```

```
LastName: 100×1 cell array of character vectors

Gender: 100×1 categorical

    Values:

        Female       53
        Male         47

Age: 100×1 double

    Values:

        Min        25
        Median     39
        Max        50

Location: 100×1 categorical

    Values:

        County General Hospital          39
        St. Mary s Medical Center        24
        VA Hospital                      37

Height: 100×1 double

    Values:

        Min          60
        Median       67
        Max          72

Weight: 100×1 double

    Values:

        Min          111
        Median     142.5
        Max          202

Smoker: 100×1 logical

    Values:
```

```
        True        34
        False       66

Systolic: 100×1 double

    Values:

        Min          109
        Median       122
        Max          138

Diastolic: 100×1 double

    Values:

        Min            68
        Median       81.5
        Max            99

SelfAssessedHealthStatus: 100×1 categorical

    Values:

        Excellent               34
        Fair                    15
        Good                    40
        Poor                    11
```

Delete the `patients` database table from the `toy_store` database catalog and the `dbo` database schema by using the `execute` function.

```
sqlquery = ['DROP TABLE toy_store.dbo.' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

`source` — Source
character vector | string scalar

Source, specified as a character vector or string scalar. Use the `source` input argument to specify the name of a database table or an SQL query for importing data from a database.

Example: `'inventorytable'`

Example: `'SELECT * FROM inventorytable'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `opts = databaseImportOptions(conn,'inventorytable','Catalog','toy_store','Schema','dbo')` defines import options for importing data from the `inventorytable` database table located in the `toy_store` catalog and `dbo` schema.

`Catalog` — Database catalog name
character vector | string scalar

Database catalog name, specified as the comma-separated pair consisting of `'Catalog'` and a character vector or string scalar. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have numerous catalogs.

Use the `'Catalog'` name-value pair argument only when `source` is a database table.

Example: `'Catalog','toy_store'`

Data Types: `char` | `string`

`Schema` — Database schema name
character vector | string scalar

Database schema name, specified as the comma-separated pair consisting of `'Schema'` and a character vector or string scalar. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Use the `'Schema'` name-value pair argument only when `source` is a database table.

Example: `'Schema','dbo'`

Data Types: `char` | `string`

Output Arguments

`opts` — Database import options
`SQLImportOptions` object

Database import options, returned as an `SQLImportOptions` object.

See Also

`close` | `database` | `execute` | `fetch` | `getoptions` | `reset` | `setoptions` | `sqlread` | `sqlwrite`

Topics

"Customize Options for Importing Data from Database into MATLAB" on page 5-61
"Importing Data Common Errors" on page 3-4

External Websites

SQL Tutorial

Introduced in R2018b

getoptions

Package: database.options

Retrieve import options for database data

Syntax

```
varOpts = getoptions(opts)
varOpts = getoptions(opts,varnames)
varOpts = getoptions(opts,index)
```

Description

`varOpts = getoptions(opts)` returns the import options for all variables in the `SQLImportOptions` object.

`varOpts = getoptions(opts,varnames)` returns the import options for the specified variable names.

`varOpts = getoptions(opts,index)` returns the import options for the variables specified by a numeric index.

Examples

Retrieve Default Import Options for Database Table

Control the import options by creating an `SQLImportOptions` object. Then, retrieve the default import options from a database table.

This example uses the `patients.xls` spreadsheet, which contains patient information. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve and display the default import options for the `patients` database table.

```
varOpts = getoptions(opts)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                  (1) |       (2) |      (3) |        (4) |      (5) |      (6) |
       Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smo
       Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'dou
  FillValue:         '' |       '' |    [NaN] |         '' |    [NaN] |    [NaN] |     

    To access sub-properties of each variable, use getoptions
```

To modify the variable import options, see the `setoptions` function.

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Retrieve Default Import Options for Database Columns Using Variable Names

Control the import options by creating an `SQLImportOptions` object. Then, retrieve the default import options for several columns from a database table. Specify the columns to retrieve by using the database column names.

This example uses the `patients.xls` spreadsheet, which contains the columns `LastName`, `Age`, and `Location`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Specify the names of the database columns in the `patients` database table.

```
varnames = {'LastName','Age','Location'};
```

Retrieve and display the default import options for the specified database columns.

```
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
    1x3 SQLVariableImportOptions array with properties:

   Variable Options:
```

```
                   (1) |      (2) |        (3)
      Name: 'LastName' |    'Age' | 'Location'
      Type:     'char' | 'double' |     'char'
 FillValue:         '' |    [NaN] |         ''

    To access sub-properties of each variable, use getoptions
```

To modify the variable import options, see the `setoptions` function.

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Retrieve Default Import Options for Database Columns Using Numeric Index

Control the import options by creating an `SQLImportOptions` object. Then, retrieve the default import options for several columns from a database table. Specify the columns to retrieve by using a numeric index.

This example uses the `patients.xls` spreadsheet, which contains the columns `LastName`, `Gender`, and `Age`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Specify the first three database columns by using a numeric index.

```
index = [1,2,3];
```

Retrieve and display the default import options for the specified database columns.

```
varOpts = getoptions(opts,index)
```

```
varOpts = 
    1x3 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |      (2) |      (3)
       Name: 'LastName' | 'Gender' |    'Age'
       Type:     'char' |   'char' | 'double'
  FillValue:         '' |       '' |    [NaN]

    To access sub-properties of each variable, use getoptions
```

To modify the variable import options, see the `setoptions` function.

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

opts — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

`varnames` — Variable names
character vector | cell array of character vectors | string scalar | string array | numeric vector

Variable names, specified as a character vector, cell array of character vectors, string scalar, string array, or numeric vector. The `varnames` input argument indicates the variables in the `VariableNames` property of the `SQLImportOptions` object to use for importing data.

Example: `'productname'`

Data Types: `double` | `char` | `string` | `cell`

`index` — Index
numeric vector

Index, specified as a numeric vector that identifies the variables in the `VariableNames` property of the `SQLImportOptions` object to use for importing data.

Example: `[1,2,3]`

Data Types: `double`

Output Arguments

`varOpts` — Type-dependent options for selected variables
array of variable import options objects

Type-dependent options for selected variables, returned as an array of variable import options objects. The array contains an object corresponding to each variable in the `opts` input argument or in the selected variables specified by the `varnames` or `index` input argument. The data type of each object in the array depends on the data type of the corresponding variable.

For `categorical` and `datetime` data types, each variable import options object contains additional properties that correspond to the data type.

To modify the properties of the individual objects, use the `setoptions` function.

See Also

`close` | `database` | `databaseImportOptions` | `execute` | `reset` | `setoptions` | `sqlread` | `sqlwrite`

Topics

"Customize Options for Importing Data from Database into MATLAB" on page 5-61
"Importing Data Common Errors" on page 3-4

External Websites

SQL Tutorial

Introduced in R2018b

reset

Package: database.options

Reset to default import options for database data

Syntax

```
opts = reset(opts)
```

Description

`opts = reset(opts)` resets the import options for importing data from a database back to the original state. The function returns the `SQLImportOptions` object. The `VariableNames`, `VariableTypes`, and `FillValues` properties of the `SQLImportOptions` object revert to the default values.

Examples

Reset Options When Importing Data

Reset import options when importing numeric data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for a numeric database column. Import data using the `sqlread` function. Then, reset the import options back to the original state.

This example uses the `patients.xls` file, which contains the column `Weight`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the import options for the `Weight` variable. This variable has the `double` data type.

```
varnames = 'Weight';
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
  SQLVariableImportOptions with properties:

  Variable Properties :
              Name: 'Weight'
              Type: 'double'
         FillValue: NaN
```

Customize the import options for the `Weight` column in the `patients` database table. Because this column contains numeric data, change the data type to `int64`.

```
opts = setoptions(opts,varnames,'Type','int64');
```

Import the numeric data in the specified column and display a summary of the imported variable. The summary shows that the variable has the `int64` data type.

```
opts.SelectedVariableNames = varnames;
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    Weight: 100×1 int64
```

```
        Values:

            Min          111
            Median       143
            Max          202
```

Reset the import options back to their original state, and retrieve the import options for the `Weight` variable. This variable has the `double` data type again.

```
opts = reset(opts);
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
  SQLVariableImportOptions with properties:

  Variable Properties :
              Name: 'Weight'
              Type: 'double'
         FillValue: NaN
```

Import the numeric data again using the default import options, and display a summary of the imported variable.

```
opts.SelectedVariableNames = varnames;
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    Weight: 100×1 double

        Values:

            Min           111
            Median      142.5
            Max           202
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

opts — Database import options
SQLImportOptions object

Database import options, specified as an SQLImportOptions object.

See Also

close | database | databaseImportOptions | execute | getoptions | setoptions | sqlwrite

Topics

“Customize Options for Importing Data from Database into MATLAB” on page 5-61
“Importing Data Common Errors” on page 3-4

External Websites

SQL Tutorial

Introduced in R2018b

setoptions

Package: database.options

Customize import options for database data

Syntax

`opts = setoptions(opts,varnames, Option1,OptionValue1,...,OptionN,OptionValueN)`
`opts = setoptions(opts,index, Option1,OptionValue1,...,OptionN,OptionValueN)`

Description

`opts = setoptions(opts,varnames, Option1,OptionValue1,...,OptionN,OptionValueN)` customizes the import options for importing data from a database into MATLAB. The function returns the `SQLImportOptions` object. To import data, you use the `SQLImportOptions` object, the specified variable names, and the import options with their corresponding values.

`opts = setoptions(opts,index, Option1,OptionValue1,...,OptionN,OptionValueN)` customizes the import options for the variables specified by a numeric index.

Examples

Customize Options When Importing Numeric Data

Customize import options when importing numeric data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for a numeric database column. Import data using the `sqlread` function.

This example uses the `patients.xls` spreadsheet, which contains the column `Weight`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Customize the import options for the `Weight` column in the `patients` database table. Because this column is numeric, change the data type to `int64`.

```
varnames = 'Weight';
opts = setoptions(opts,varnames,'Type','int64');
```

Import the numeric data in the specified column and display a summary of the imported variable. The summary shows that the variable has the `int64` data type.

```
opts.SelectedVariableNames = {'Weight'};
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    Weight: 100×1 int64

        Values:

            Min         111
```

```
        Median      143
        Max         202
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options When Importing Text Data

Customize import options when importing text data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for a text database column. Import data using the `sqlread` function.

This example uses the `patients.xls` spreadsheet, which contains the first column `LastName`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `LastName` variable.

```
varnames = 'LastName';
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
  SQLVariableImportOptions with properties:

  Variable Properties :
              Name: 'LastName'
              Type: 'char'
         FillValue: ''
```

Set the import options for the data type of the `LastName` variable to `string`. Specify the `LastName` variable by using a numeric index that finds the variable within the `SelectedVariables` property of the `SQLImportOptions` object. Also, set the import options to replace missing data in the `LastName` variable with the `NoName` fill value.

```
index = 1;
opts = setoptions(opts,index,'Type','string', ...
    'FillValue','NoName');
```

Import the text data in the selected variable and display the first eight rows. The imported data shows that the variable has the `string` data type.

```
opts.SelectedVariableNames = 'LastName';
T = sqlread(conn,tablename,opts);
head(T)
```

```
ans=8×1 table
     LastName 
    __________

    "Smith"   
    "Johnson" 
    "Williams"
    "Jones"   
    "Brown"   
    "Davis"   
    "Miller"  
    "Wilson"  
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options When Importing Date and Time Data

Customize import options when importing date and time data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database columns that contain date and time data. Import data using the `sqlread` function.

This example uses the `outages.csv` file, which contains the columns `OutageTime` and `RestorationTime`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load outage information into the MATLAB® workspace.

```
outages = readtable('outages.csv');
```

Create the `outages` database table using the outage information.

```
tablename = 'outages';
sqlwrite(conn,tablename,outages)
```

Retrieve the data using the `sqlread` function and display the first eight rows. The second row of the `RestorationTime` variable contains missing data.

```
data = sqlread(conn,tablename);
head(data)
```

```
ans=8×6 table
      Region              OutageTime            Loss     Customers        Restoratio
    ___________    _________________________    _____    __________    _______________
```

```
    'SouthWest'    '2002-02-01 12:18:00.000'    458.98    1.8202e+06    '2002-02-07 16
    'SouthEast'    '2003-01-23 00:49:00.000'    530.14    2.1204e+05    ''
    'SouthEast'    '2003-02-07 21:15:00.000'     289.4    1.4294e+05    '2003-02-17 08
    'West'         '2004-04-06 05:44:00.000'    434.81    3.4037e+05    '2004-04-06 06
    'MidWest'      '2002-03-16 06:18:00.000'    186.44    2.1275e+05    '2002-03-18 23
    'West'         '2003-06-18 02:49:00.000'         0             0    '2003-06-18 10
    'West'         '2004-06-20 14:39:00.000'    231.29           NaN    '2004-06-20 19
    'West'         '2002-06-06 19:28:00.000'    311.86           NaN    '2002-06-07 00
```

Create an `SQLImportOptions` object using the `outages` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `OutageTime` and `RestorationTime` variables.

```
varnames = {'OutageTime','RestorationTime'};
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
    1x2 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |                 (2)
       Name: 'OutageTime' | 'RestorationTime'
       Type:       'char' |            'char'
  FillValue:           '' |                ''

    To access sub-properties of each variable, use getoptions
```

Set the import options for the data type of the specified variables to `datetime`. Also, set the import options to replace missing data in the specified variables with the current date and time.

```
opts = setoptions(opts,varnames,'Type','datetime', ...
    'FillValue',datetime('now'));
```

Import the date and time data in the selected variables and display the first eight rows. The imported data shows that the variables have the `datetime` data type. The missing value in the second row of the `RestorationTime` variable is filled with the current date and time.

```
opts.SelectedVariableNames = varnames;
T = sqlread(conn,tablename,opts);
head(T)
```

```
ans=8×2 table
          OutageTime             RestorationTime
    ____________________    ____________________

    01-Feb-2002 12:18:00    07-Feb-2002 16:50:00
    23-Jan-2003 00:49:00    19-Jun-2018 15:30:14
    07-Feb-2003 21:15:00    17-Feb-2003 08:14:00
    06-Apr-2004 05:44:00    06-Apr-2004 06:10:00
    16-Mar-2002 06:18:00    18-Mar-2002 23:23:00
    18-Jun-2003 02:49:00    18-Jun-2003 10:54:00
    20-Jun-2004 14:39:00    20-Jun-2004 19:16:00
    06-Jun-2002 19:28:00    07-Jun-2002 00:51:00
```

Delete the `outages` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options When Importing Categorical Array Data

Customize import options when importing categorical array data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database columns that contain categorical array data. Import data using the `sqlread` function.

This example uses the `outages.csv` file, which contains the columns `Region` and `Cause`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load outage information into the MATLAB® workspace.

```
outages = readtable('outages.csv');
```

Create the `outages` database table using the outage information.

```
tablename = 'outages';
sqlwrite(conn,tablename,outages)
```

Create an `SQLImportOptions` object using the `outages` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `Region` and `Cause` variables.

```
varnames = {'Region','Cause'};
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
    1x2 SQLVariableImportOptions array with properties:

   Variable Options:
                  (1) |     (2)
       Name: 'Region' | 'Cause'
       Type:   'char' |  'char'
  FillValue:       '' |      ''

    To access sub-properties of each variable, use getoptions
```

Set the import options for the data type of the specified variables to `categorical`. Also, set the import options to replace missing data in the specified variables with the fill value `unknown`.

```
opts = setoptions(opts,varnames,'Type','categorical', ...
    'FillValue','unknown');
```

Import the categorical array data in the selected variables and display a summary of the data. The imported data shows that the variables have the `categorical` data type. The missing values of both variables are filled with the value `unknown`.

```
opts.SelectedVariableNames = varnames;
T = sqlread(conn,tablename,opts);
summary(T)
```

```
Variables:

    Region: 1468×1 categorical

        Values:

            MidWest        142
            NorthEast      557
            SouthEast      389
            SouthWest       26
            West           354
            unknown          0

    Cause: 1468×1 categorical

        Values:

            attack                 294
            earthquake               2
            energy emergency       188
            equipment fault        156
            fire                    25
            severe storm           338
            thunder storm          201
            unknown                 24
            wind                    95
            winter storm           145
```

Delete the `outages` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options When Importing Logical Data

Customize import options when importing logical data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database columns that contain logical data. Import data using the `sqlread` function.

This example uses the `airlinesmall_subset.xls` spreadsheet, which contains the column `Cancelled`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load flight information in the MATLAB® workspace.

```
flights = readtable('airlinesmall_subset.xlsx');
```

Create the `flights` database table using the flight information.

```
tablename = 'flights';
sqlwrite(conn,tablename,flights)
```

Create an `SQLImportOptions` object using the `flights` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,'flights');
```

Retrieve the default import options for the `Cancelled` variable.

```
varnames = 'Cancelled';
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
  SQLVariableImportOptions with properties:

  Variable Properties :
              Name: 'Cancelled'
              Type: 'double'
         FillValue: NaN
```

Set the import options for the data type of the specified variable to `logical`. Also, set the import options to replace missing data in the specified variable with the fill value `true`.

```
opts = setoptions(opts,varnames,'Type','logical', ...
    'FillValue',true);
```

Import the logical data in the selected variable and display a summary of the data. The imported data shows that the variable has the `logical` data type.

```
opts.SelectedVariableNames = varnames;
T = sqlread(conn,tablename,opts);
summary(T)
```

```
Variables:

    Cancelled: 1338×1 logical

        Values:

            True          29
            False       1309
```

Delete the `flights` database table using the `execute` function.

```
sqlquery = 'DROP TABLE flights';
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

opts — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

varnames — Variable names
character vector | cell array of character vectors | string scalar | string array | numeric vector

Variable names, specified as a character vector, cell array of character vectors, string scalar, string array, or numeric vector. The `varnames` input argument indicates the variables in the `VariableNames` property of the `SQLImportOptions` object to use for importing data.

Example: `'productname'`

Data Types: `double` | `char` | `string` | `cell`

`index` — Index
numeric vector

Index, specified as a numeric vector that identifies the variables in the `VariableNames` property of the `SQLImportOptions` object to use for importing data.

Example: `[1,2,3]`

Data Types: `double`

`Option1,OptionValue1,...,OptionN,OptionValueN` — Import options
name-value pair arguments

Import options, specified as one or more name-value pair arguments. `Option` is a character vector or string scalar that specifies the name of an import option. `OptionValue` specifies the value of the import option.

Example: `'FillValue',true,'Type','logical'` sets the data type of the specified variable as `logical` and sets the fill value for missing data in the specified variable as `true`.

Example: `'Name',"Location"` changes the name of the specified variable to `Location`.

All Variables

You can set import options to change the value of missing data, the name of a variable, or the data type of a variable. These import options apply to all variables specified by either the `varnames` or `index` input argument.

Import Option Name	Description	Import Option Values
`'FillValue'`	Missing data value	Value must be a scalar for a single variable or a cell array for multiple variables. Valid data types are: • All integer classes • `single` • `double` • `logical` • `char` • `string` • `datetime` • `missing` The data type depends on the variable type in the database.
`'Name'`	Variable name	Value must be a character vector or string scalar for a single variable or a cell array of character vectors or string array for multiple variables.
`'Type'`	Data type	Value must be a character vector or string scalar for a single variable or a cell array of character vectors or string array for multiple variables.

The following table describes the valid import option values for the `'Type'` import option. The first column shows the data types in the `VariableTypes` property of the `SQLImportOptions` object. The second column shows the valid data types to specify in the character vector. To use the valid data type value, enclose it in quotes (for example, `'single'`).

<table>
<tr><th>Variable Data Type</th><th>Valid Data Type Values for 'Type' Import Option</th></tr>
<tr><td>Any integer class
<code>single</code>
<code>double</code></td><td>Any integer class
<code>single</code>
<code>double</code>
<code>logical</code>
<code>categorical</code>
The undefined floating-point numbers <code>NaN</code>, <code>–Inf</code>, and <code>+Inf</code> are valid only for the <code>single</code> and <code>double</code> data types. When you change the data type of a floating-point number to an integer, the function that imports the data from the database converts the undefined floating-point number. For example, when you change the data type to <code>'int8'</code>:
<code>NaN</code> values change to <code>0</code>.
<code>–Inf</code> values change to <code>intmin('int8')</code>.
<code>+Inf</code> values change to <code>intmax('int8')</code>.
For details, see <code>intmin</code> and <code>intmax</code>.

The same conversion applies to all integer classes.</td></tr>
<tr><td><code>logical</code></td><td>All integer classes
<code>single</code>
<code>double</code>
<code>logical</code>
<code>categorical</code></td></tr>
</table>

Variable Data Type	Valid Data Type Values for 'Type' Import Option
char or string	• char • string • datetime • categorical You can change the VariableTypes property to datetime only if the column in the database table has the DATETIME data type.
datetime	• char • string • datetime
categorical	• All integer classes • single • double • char • string • logical • categorical

Variables with datetime Data Type

You can set import options to change the value of variables with the datetime data type. These import options apply to variables with the datetime data type specified by either the varnames or index input argument.

Import Option Name	Description	Import Option Values	Default Import Option Value
'DatetimeFormat'	Display format of dates and times	For valid values, see the description of the Format property in the datetime function.	'default'

Import Option Name	Description	Import Option Values	Default Import Option Value
'DatetimeLocale'	Locale to use for interpreting dates	For valid values, see the description of the 'Locale' name-value pair argument in the datetime function.	'en-US'
'TimeZone'	Time zone	For valid values, see the description of the TimeZone property in the datetime function.	''
'InputFormat'	Format of the input text representing dates and times	For valid values, see the description of the infmt input argument in the datetime function.	'yyyy-MM-dd HH:mm:ss.SSSSSSSSS'

Variable with categorical Data Type

You can set import options to change the value of variables with the categorical data type. These import options apply to variables with the categorical data type specified by either the varnames or index input argument.

Import Option Name	Description	Import Option Values	Default Import Option Value
'Categories'	Expected categories	For valid values, see the description of the catnames input argument in the categorical function.	{}

Import Option Name	Description	Import Option Values	Default Import Option Value
`'Protected'`	Category protection indicator	For valid values, see the description of the `'Protected'` name-value pair argument in the `categorical` function.	`false`
`'Ordinal'`	Mathematical ordering indicator	For valid values, see the description of the `'Ordinal'` name-value pair argument in the `categorical` function.	`false`

Data Types: `char` | `string`

See Also

`close` | `database` | `databaseImportOptions` | `execute` | `getoptions` | `reset` | `sqlread` | `sqlwrite`

Topics

"Customize Options for Importing Data from Database into MATLAB" on page 5-61
"Importing Data Common Errors" on page 3-4

External Websites

SQL Tutorial

Introduced in R2018b

Neo4jConnect

Neo4j database connection

Description

Create a Neo4j database connection using the MATLAB interface to Neo4j. Explore the graph database or perform graph analytics using the MATLAB directed graph.

With a `Neo4jConnect` object, you can perform these tasks:

- Explore the graph database for nodes and relationships.
- Search the graph database for nodes, relationships, or a subgraph.
- Execute a Cypher query.

Creation

Create a `Neo4jConnect` object using `neo4j`.

Properties

URL — Neo4j database connection URL
character vector

This property is read-only.

Neo4j database connection URL that contains the server, port number, and web location of the Neo4j database, specified as a character vector.

Example: `http://localhost:7474/db/data` where `localhost` is the server, `7474` is the port number, `/db/data` is the web location of the database

Data Types: `char`

UserName — User name
character vector

This property is read-only.

User name for accessing the Neo4j database, specified as a character vector.

Data Types: `char`

`Message` — Error message
character vector

This property is read-only.

Error message, specified as a character vector. If this property is empty, the database connection is successful.

Data Types: `char`

Object Functions

Traverse the Graph

nodeLabels	All node labels in Neo4j database
relationTypes	All relationship types in Neo4j database
propertyKeys	All property keys in Neo4j database
searchNodeByID	Search for Neo4j database nodes by node identifier
searchNode	Search Neo4j database nodes by label or by property key and value
searchRelation	Search relationships for Neo4j database node
searchRelationByID	Search Neo4j relationship by relationship identifier
searchGraph	Search for subgraph or entire graph in Neo4j database

Update the Graph

createNode	Create nodes in Neo4j database
createRelation	Create relationships between nodes in Neo4j database
deleteNode	Delete nodes from Neo4j database
deleteRelation	Delete relationships from Neo4j database
updateNode	Update node labels and properties in Neo4j database
updateRelation	Update relationship properties in Neo4j database

Store Directed Graph

storeDigraph	Store directed graph in Neo4j database

Execute Cypher Query

executeCypher Execute Cypher query on Neo4j database

Examples

Connect to Neo4j® Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password)
```

```
neo4jconn = 

  Neo4jConnect with properties:

         URL: 'http://localhost:7474/db/data/'
    UserName: 'neo4j'
     Message: []
```

`neo4j` returns a `Neo4jConnect` object with these properties:

- `URL` -- The Neo4j® database web location
- `UserName` -- The user name used to connect to the database
- `Message` -- Any database connection error messages

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful Neo4j® database connection.

Retrieve all node labels using the Neo4j® database connection `neo4jconn`.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels =

  1×1 cell array

    {'Person'}
```

The cell array `nlabels` contains a character vector for the one node label in the Neo4j® database.

See Also

Topics

"Determine Dependencies of Services in Network"
"Find Shortest Path Between People in Social Neighborhood"
"Find Friends of Friends in Social Neighborhood"
"Explore Graph Database Structure" on page 7-2
"Working with MATLAB Interface to Neo4j" on page 7-9
"Searching Graph Database Using MATLAB Interface to Neo4j" on page 7-12

Introduced in R2016b

Neo4jNode

Neo4j database node

Description

After creating a Neo4j database connection using the MATLAB interface to Neo4j, explore nodes in the database. With a `Neo4jNode` object, you can explore the node degree and relationship types of the nodes in the database.

Creation

Create a `Neo4jNode` object using the `createNode`, `searchNodeByID`, and `searchNode` functions.

Properties

`NodeID` — Node identifier
double

This property is read-only.

Node identifier for the unique node in the Neo4j database, specified as a double.

Data Types: `double`

`NodeData` — Node data
structure

This property is read-only.

Node data consisting of property keys and values for the unique node in the Neo4j database, specified as a structure.

Data Types: `struct`

`NodeLabels` — Node labels
character vector | cell array of character vectors

This property is read-only.

Node labels of the unique Neo4j database node, specified as a character vector for one label or as a cell array of character vectors for multiple labels.

Data Types: `char` | `cell`

Object Functions

nodeDegree	In-degree and out-degree for each associated relationship type for Neo4j database node
nodeRelationTypes	Associated relationship types for Neo4j database node

Examples

Search Neo4j® Database by Node Identifier

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Search the database for the node with the node identifier 2 by using the Neo4j database connection `neo4jconn`.

```
nodeid = 2;

nodeinfo = searchNodeByID(neo4jconn,nodeid)
```

```
nodeinfo = 

  Neo4jNode with properties:

        NodeID: 2
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

`nodeinfo` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Access the property keys and values of the node using the property `NodeData`.

```
nodeinfo.NodeData
```

```
ans = 

  struct with fields:

    name: 'User2'
```

See Also

Topics

“Explore Graph Database Structure” on page 7-2
“Working with MATLAB Interface to Neo4j” on page 7-9
“Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12

Introduced in R2016b

Neo4jRelation

Neo4j database relationship

Description

The `Neo4jRelation` object represents a single relationship in a Neo4j database. Use this object to find information about the relationship between two nodes in a Neo4j database.

Creation

Create a `Neo4jRelation` object using the `createRelation`, `searchRelation`, and `searchRelationByID` functions.

Properties

`RelationID` — Relationship identifier
numeric scalar

This property is read-only.

Relationship identifier, specified as a numeric scalar. The Neo4j database assigns this number automatically.

Example: `3`

Data Types: `double`

`RelationData` — Relationship data
structure

This property is read-only.

Relationship data consisting of property keys and values for the unique relationship in the Neo4j database, specified as a structure. If the relationship has no properties, then this structure contains no fields.

Data Types: `struct`

`StartNodeID` — Start node identifier
numeric scalar

This property is read-only.

Start node identifier, specified as a numeric scalar. This number specifies the start node of the Neo4j database relationship.

Example: `3`

Data Types: `double`

`RelationType` — Relationship type
character vector

This property is read-only.

Relationship type, specified as a character vector. This character vector specifies the type of the Neo4j database relationship.

Example: `'knows'`

Data Types: `char`

`EndNodeID` — End node identifier
numeric scalar

This property is read-only.

End node identifier, specified as a numeric scalar. This number specifies the end node of the Neo4j database relationship.

Example: `7`

Data Types: `double`

Examples

Search Neo4j Database by Relationship Identifier

Search for information about a `Neo4jRelation` object in a Neo4j® database and display the information.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the database for the relationship with the identifier `3` by using the Neo4j database connection.

```
relationid = 3;

relinfo = searchRelationByID(neo4jconn,relationid)
```

```
relinfo = 

  Neo4jRelation with properties:

      RelationID: 3
    RelationData: [1×1 struct]
```

```
     StartNodeID: 1
    RelationType: 'knows'
       EndNodeID: 3
```

`relinfo` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Access the property keys and values of the relationship using the property `RelationData`. Here, the relationship does not contain properties, so the structure has no fields.

```
relinfo.RelationData
```

```
ans =

  struct with no fields.
```

See Also

Topics

“Explore Graph Database Structure” on page 7-2
“Working with MATLAB Interface to Neo4j” on page 7-9

Introduced in R2018a

neo4j

Connect to Neo4j database

The `neo4j` function creates connections to a Neo4j database. For relational database connections, see “Connecting to Database” on page 2-142.

Syntax

`neo4jconn = neo4j(url,username,password)`

Description

`neo4jconn = neo4j(url,username,password)` creates a `Neo4jConnect` object using the URL, user name, and password for the Neo4j database. To retrieve graph data from the Neo4j database, use this object.

Examples

Connect to Neo4j® Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password)
```

```
neo4jconn = 

  Neo4jConnect with properties:

         URL: 'http://localhost:7474/db/data/'
```

```
    UserName: 'neo4j'
     Message: []
```

`neo4j` returns a `Neo4jConnect` object with these properties:

- `URL` -- The Neo4j® database web location
- `UserName` -- The user name used to connect to the database
- `Message` -- Any database connection error messages

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful Neo4j® database connection.

Retrieve all node labels using the Neo4j® database connection `neo4jconn`.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels =

  1×1 cell array

    {'Person'}
```

The cell array `nlabels` contains a character vector for the one node label in the Neo4j® database.

Input Arguments

`url` — Neo4j database connection URL
character vector | string scalar

Neo4j database connection URL that contains the server, port number, and web location of the Neo4j database, specified as a character vector or string scalar.

Example: `http://localhost:7474/db/data` where `localhost` is the server, `7474` is the port number, `/db/data` is the web location of the database

Data Types: `char` | `string`

`username` — User name
character vector | string scalar

User name for accessing the Neo4j database, specified as a character vector or string scalar. If no database authentication is required, specify an empty character vector.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password for accessing the Neo4j database, specified as a character vector or string scalar. If no database authentication is required, specify an empty character vector or string scalar.

Data Types: `char` | `string`

Output Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, returned as a `Neo4jConnect` object.

See Also

`neo4j` | `nodeLabels` | `propertyKeys` | `relationTypes`

Topics

"Determine Dependencies of Services in Network"
"Find Shortest Path Between People in Social Neighborhood"
"Find Friends of Friends in Social Neighborhood"
"Explore Graph Database Structure" on page 7-2

“Working with MATLAB Interface to Neo4j” on page 7-9
“Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12
“MATLAB Interface to Neo4j Error Messages” on page 7-28

Introduced in R2016b

nodeLabels

Package: database.neo4j

All node labels in Neo4j database

Syntax

`nlabels = nodeLabels(neo4jconn)`

Description

`nlabels = nodeLabels(neo4jconn)` returns all node labels in the Neo4j database using the Neo4j database connection `neo4jconn`. You can retrieve the entire graph or search for a subgraph using the node labels. To search the graph database for relationship types instead, see `relationTypes`.

Examples

Retrieve Node Labels in Neo4j® Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =
```

```
    []
```

The blank `Message` property indicates a successful connection.

Retrieve all node labels using the Neo4j® database connection `neo4jconn`.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels =

  cell

    'Person'
```

The cell array `nlabels` contains a character vector for the one node label in the Neo4j® database.

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

Output Arguments

`nlabels` — Node labels
cell array of character vectors

Node labels in the Neo4j database, returned as a cell array of character vectors. Each character vector denotes a node label.

See Also

`neo4j` | `propertyKeys` | `relationTypes`

Topics

“Explore Graph Database Structure” on page 7-2
“Working with MATLAB Interface to Neo4j” on page 7-9
“Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12
“MATLAB Interface to Neo4j Error Messages” on page 7-28

Introduced in R2016b

relationTypes

Package: database.neo4j

All relationship types in Neo4j database

Syntax

`rtypes = relationTypes(neo4jconn)`

Description

`rtypes = relationTypes(neo4jconn)` returns all relationship types in the Neo4j database using the Neo4j database connection `neo4jconn`. You can retrieve the entire graph or search for a subgraph using the relationship types. To search the graph database for node labels instead, see `nodeLabels`.

Examples

Retrieve Relationship Types in Neo4j® Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =
```

```
    []
```

The blank Message property indicates a successful connection.

Retrieve all relationship types using the Neo4j® database connection neo4jconn.

```
rtypes = relationTypes(neo4jconn)
```

```
rtypes =

  cell

    'knows'
```

The cell array rtypes contains a character vector for the one relationship type in the Neo4j® database.

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a Neo4jConnect object created with the function neo4j.

Output Arguments

rtypes — Relationship types
cell array of character vectors

Relationship types in the Neo4j database, returned as a cell array of character vectors. Each character vector denotes a relationship type.

See Also

neo4j | nodeLabels | propertyKeys

Topics

"Explore Graph Database Structure" on page 7-2
"Working with MATLAB Interface to Neo4j" on page 7-9
"Searching Graph Database Using MATLAB Interface to Neo4j" on page 7-12
"MATLAB Interface to Neo4j Error Messages" on page 7-28

Introduced in R2016b

propertyKeys

Package: database.neo4j

All property keys in Neo4j database

Syntax

`propkeys = propertyKeys(neo4jconn)`

Description

`propkeys = propertyKeys(neo4jconn)` returns all property keys in the Neo4j database using the Neo4j database connection `neo4jconn`.

Examples

Retrieve Property Keys in Neo4j® Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =
```

```
    []
```

The blank `Message` property indicates a successful connection.

Retrieve all property keys using the Neo4j® database connection `neo4jconn`.

```
propkeys = propertyKeys(neo4jconn)
```

```
propkeys =

  2×1 cell array

    'name'
    'property'
```

The cell array `propkeys` contains a character vector for the one property key in the Neo4j® database.

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

Output Arguments

`propkeys` — Property keys
cell array of character vectors

Property keys in the Neo4j database, returned as a cell array of character vectors. Each character vector denotes a property key.

See Also

`neo4j` | `nodeLabels` | `relationTypes`

Topics

“Explore Graph Database Structure” on page 7-2
“Working with MATLAB Interface to Neo4j” on page 7-9
“MATLAB Interface to Neo4j Error Messages” on page 7-28

Introduced in R2016b

searchNodeByID

Package: database.neo4j

Search for Neo4j database nodes by node identifier

Syntax

`nodeinfo = searchNodeByID(neo4jconn,nodeid)`

Description

`nodeinfo = searchNodeByID(neo4jconn,nodeid)` creates the `Neo4jNode` object using the Neo4j database connection `neo4jconn` and the node identifier `nodeid`.

Examples

Search Neo4j® Database by Node Identifier

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =
```

```
    []
```

The blank Message property indicates a successful connection.

Search the database for the node with the node identifier 2 by using the Neo4j database connection neo4jconn.

```
nodeid = 2;

nodeinfo = searchNodeByID(neo4jconn,nodeid)
```

```
nodeinfo = 

  Neo4jNode with properties:

        NodeID: 2
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

nodeinfo is a Neo4jNode object with these properties:

- Node identifier
- Node data
- Node labels

Access the property keys and values of the node using the property NodeData.

```
nodeinfo.NodeData
```

```
ans = 

  struct with fields:
```

```
    name: 'User2'
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a Neo4jConnect object created with the function neo4j.

nodeid — Node identifier
numeric scalar | numeric vector

Node identifier of a Neo4j database node, specified as a numeric scalar for one node in the Neo4j database, or a numeric vector for multiple nodes. If a node identifier is unknown, search for nodes using searchNode and search for relationships using searchRelation.

Data Types: double

Output Arguments

nodeinfo — Node information
Neo4jNode object

Node information for one node in the Neo4j database, returned as a Neo4jNode object. You can use this node as the origin node for searching the Neo4j database.

See Also

neo4j | nodeDegree | nodeRelationTypes

Topics

"Explore Graph Database Structure" on page 7-2
"Working with MATLAB Interface to Neo4j" on page 7-9
"Searching Graph Database Using MATLAB Interface to Neo4j" on page 7-12

Introduced in R2016b

searchNode

Package: database.neo4j

Search Neo4j database nodes by label or by property key and value

Syntax

```
nodeinfo = searchNode(neo4jconn,nlabel)
nodeinfo = searchNode(neo4jconn,nlabel,Name,Value)
```

Description

`nodeinfo = searchNode(neo4jconn,nlabel)` returns node information for nodes with a specific node label using the Neo4j database connection `neo4jconn`.

`nodeinfo = searchNode(neo4jconn,nlabel,Name,Value)` narrows the search for nodes with additional options specified by the `Name,Value` pair arguments.

Examples

Search Nodes by Node Label

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Search the database for nodes that have node label `Person` using the Neo4j® database connection `neo4jconn`.

```
nlabel = 'Person';

nodeinfo = searchNode(neo4jconn,nlabel)
```

```
nodeinfo =

         NodeLabels      NodeData                  NodeObject
         __________    ____________    __________________________________

    0    'Person'      [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    1    'Person'      [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    2    'Person'      [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    3    'Person'      [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    4    'Person'      [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    5    'Person'      [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    6    'Person'      [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

`nodeinfo` is a table that contains information for each database node:

- Each row name is a node identifier.
- Variable `NodeLabels` is the node label.
- Variable `NodeData` is the node information.
- Variable `NodeObject` is the `Neo4jNode` object.

Access the node information for the first node in the table.

```
node = nodeinfo.NodeData(1);
node{1}
```

```
ans =
```

```
  struct with fields:

    name: 'User1'
```

The structure contains one property key and value.

Access the node information using the row name as an index.

```
nodeinfo.NodeData{'0'}
```

```
ans = 

  struct with fields:

    name: 'User1'
```

The structure contains one property key and value.

Find the node degree for the first database node in the table. Specify outgoing relationships.

```
degree = nodeDegree(nodeinfo.NodeObject(1),'out')
```

```
degree = 

  struct with fields:

    knows: 2
```

There are two outgoing relationships from the first node in the table with relationship type `knows`.

Search Nodes by Property Key and Value

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Search the database for nodes that have node label `Person` using the Neo4j® database connection `neo4jconn`. Filter the results further by the property key and value for a specific person named `User2`.

```
nlabel = 'Person';

nodeinfo = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User2')
```

```
nodeinfo = 

  Neo4jNode with properties:

        NodeID: 2
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

`nodeinfo` is a `Neo4jNode` object that contains node information.

Access the node information.

```
nodeinfo.NodeData
```

```
ans =
```

```
  struct with fields:

    name: 'User2'
```

The structure contains a property key and value for `User2`.

Find the node degree of the outgoing relationships.

```
degree = nodeDegree(nodeinfo,'out')
```

```
degree = 

  struct with fields:

    knows: 1
```

There is one outgoing relationship type `knows` for `User2`.

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`nlabel` — Neo4j database node label
character vector | string scalar

Neo4j database node label, specified as a character vector or string scalar.

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes.

You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `nodeinfo = searchNode(neo4jconn,'Person','PropertyKey','name','PropertyValue','User2');`

`PropertyKey` — Property key
character vector | string scalar

Property key, specified as a comma-separated pair consisting of `'PropertyKey'` and a character vector or string scalar. A property key must have a corresponding property value. To specify the property value, use the name-value pair argument `'PropertyValue'`.

Example: `'PropertyKey','name'`

Data Types: `char` | `string`

`PropertyValue` — Property value
character vector | string scalar

Property value, specified as a comma-separated pair consisting of `'PropertyValue'` and a character vector or string scalar. A property value must have a corresponding property key. To specify the property key, use the name-value pair argument `'PropertyKey'`.

Example: `'PropertyValue','User1'`

Data Types: `char` | `string`

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node

- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

See Also

`neo4j` | `nodeDegree` | `nodeRelationTypes` | `searchGraph` | `searchNodeByID` | `searchRelation`

Topics

"Explore Graph Database Structure" on page 7-2
"Searching Graph Database Using MATLAB Interface to Neo4j" on page 7-12
"Working with MATLAB Interface to Neo4j" on page 7-9
"MATLAB Interface to Neo4j Error Messages" on page 7-28

Introduced in R2016b

searchRelation

Package: database.neo4j

Search relationships for Neo4j database node

Syntax

```
relinfo = searchRelation(neo4jconn,nodeinfo,direction)
relinfo = searchRelation(neo4jconn,nodeinfo,direction,Name,Value)
```

Description

`relinfo = searchRelation(neo4jconn,nodeinfo,direction)` returns relationship information for the origin node `nodeinfo` and relationship direction using a Neo4j database connection. The search starts from the origin node. To find an origin node, use `searchNode` or `searchNodeByID`.

`relinfo = searchRelation(neo4jconn,nodeinfo,direction,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'RelationTypes',{'works with'}` returns information for relationships that have the type `works with`.

Examples

Search for Incoming Relationship

Search for information about a relationship in a Neo4j® database and display the information.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Retrieve the origin node `nodeinfo` using the Neo4j® database connection and the node identifier `3`.

```
nodeid = 3;

nodeinfo = searchNodeByID(neo4jconn,nodeid);
```

Search for incoming relationships using the Neo4j® database connection and the origin node `nodeinfo`.

```
direction = 'in';

relinfo = searchRelation(neo4jconn,nodeinfo,direction)
```

```
relinfo =

  struct with fields:

       Origin: 3
        Nodes: [2×3 table]
    Relations: [1×5 table]
```

`relinfo` is a structure that contains the results of the search:

- `Origin` -- The node identifier for the specified origin node
- `Nodes` -- A table containing all start and end nodes for each matched relationship
- `Relations` -- A table containing all matched relationships

Access the table of nodes.

```
relinfo.Nodes
```

```
ans =

  2×3 table

         NodeLabels      NodeData                  NodeObject
         __________    ____________    ________________________________

    1     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

Access the table of relationships.

```
relinfo.Relations
```

```
ans =

  1×5 table

         StartNodeID    RelationType    EndNodeID    RelationData             Relatio
         ___________    ____________    _________    ____________    ____________________

    3         1           'knows'           3        [1×1 struct]    [1x1 database.neo
```

Search Relationships by Type and Distance

Search for information about relationships in a Neo4j® database and display the information. Specify the relationship type and distance to search.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only

one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Retrieve the origin node `nodeinfo` using the Neo4j® database connection and the node identifier `3`.

```
nodeid = 3;

nodeinfo = searchNodeByID(neo4jconn,nodeid);
```

Search for incoming relationships using the Neo4j® database connection and the origin node `nodeinfo`. Refine the search by filtering for the relationship type `knows` and for nodes at a distance of two or fewer.

```
direction = 'in';
reltypes = {'knows'};

relinfo = searchRelation(neo4jconn,nodeinfo,direction, ...
    'RelationTypes',reltypes,'Distance',2)
```

```
relinfo =

  struct with fields:
```

```
       Origin: 3
        Nodes: [4×3 table]
    Relations: [3×5 table]
```

`relinfo` is a structure that contains the results of the search:

- `Origin` -- The node identifier for the specified origin node
- `Nodes` -- A table containing all start and end nodes for each matched relationship
- `Relations` -- A table containing all matched relationships

Access the table of nodes.

```
relinfo.Nodes
```

```
ans =

  4×3 table

         NodeLabels      NodeData                NodeObject
         __________    ____________    ________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

Access the table of relationships.

```
relinfo.Relations
```

```
ans =

  3×5 table

         StartNodeID    RelationType    EndNodeID    RelationData            Relatio
         ___________    ____________    _________    ____________    _________________

    3         1           'knows'           3        [1×1 struct]    [1x1 database.neo4
    2         2           'knows'           1        [1×1 struct]    [1x1 database.neo4
```

```
    1         0           'knows'           1        [1×1 struct]    [1x1 database.neo4
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

nodeinfo — Origin node information
Neo4jNode object | numeric scalar

Origin node information, specified as a `Neo4jNode` object or numeric scalar that denotes a node identifier.

Data Types: `double`

direction — Relationship direction
'in' | 'out'

Relationship direction, specified as either `'in'` for an incoming relationship or `'out'` for an outgoing relationship. The relationships are associated with the specified origin node.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `relinfo = searchRelation(neo4jconn,nodeinfo,'in','RelationTypes',{'knows'},'Distance',2)` returns the relationship information for the incoming relationships, which have the relationship type `knows` and are two or fewer nodes away from the origin node.

RelationTypes — Relationship types
character vector | string scalar | cell array of character vectors | string array

Relationship types, specified as a comma-separated pair consisting of 'RelationTypes' and a character vector, string scalar, cell array of character vectors, or string array. To search for relationships using only one relationship type, use a character vector or string scalar. To search for relationships using numerous relationship types, use a cell array of character vectors or string array.

Example: 'RelationTypes',{'knows'}

Data Types: char | cell | string

Distance — Node distance
numeric scalar

Node distance, specified as a comma-separated pair consisting of 'Distance' and a positive numeric scalar. For example, if the node distance is three, searchRelation returns information for nodes that are three or fewer nodes away from the origin node nodeinfo.

Example: 'Distance',3

Data Types: double

Output Arguments

relinfo — Relationship information
structure

Relationship information in the Neo4j database that matches the search criteria from the origin node nodeinfo, returned as a structure with these fields.

Field	Description
Origin	Node identifier of the origin node nodeinfo.
Nodes	Table that contains node information for each node in the Relations table. The • NodeLabels — Character vector that denotes the node label for each match • NodeData — Structure array that contains node information such as propert • NodeObject — Neo4jNode object that represents each matched database n The row names in the table are Neo4j node identifiers of the matched database

Field	Description
Relations	Table that contains relationship information for the nodes in the Nodes table. Th • StartNodeID — Node identifier for the start node for each matched relation • RelationType — Character vector that denotes the relationship type for ea • EndNodeID — Node identifier for the end node for each matched relationshi • RelationData — Structure array that contains property keys associated wi • RelationObject — Neo4jRelation object that represents each matched The row names in the table are Neo4j relationship identifiers.

See Also

Neo4jRelation | neo4j | searchGraph | searchNode | searchNodeByID | searchRelationByID

Topics

"Explore Graph Database Structure" on page 7-2
"Searching Graph Database Using MATLAB Interface to Neo4j" on page 7-12
"Working with MATLAB Interface to Neo4j" on page 7-9
"MATLAB Interface to Neo4j Error Messages" on page 7-28

Introduced in R2016b

searchGraph

Package: database.neo4j

Search for subgraph or entire graph in Neo4j database

Syntax

```
graphinfo = searchGraph(neo4jconn,criteria)
```

Description

`graphinfo = searchGraph(neo4jconn,criteria)` returns graph information based on the search criteria using a Neo4j database connection. You can search for a subgraph or the entire graph.

Examples

Search Graph by Node Labels

Search for graph information in a Neo4j® database by using node labels and display the information.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the graph for all nodes with the label `'Person'` using the Neo4j database connection.

```
nlabel = {'Person'};
```

```
graphinfo = searchGraph(neo4jconn,nlabel)
```

```
graphinfo = 

  struct with fields:

        Nodes: [7×3 table]
    Relations: [8×5 table]
```

`graphinfo` is a structure that contains the results of the search:

- All start and end nodes that denote each matched relationship
- All matched relationships

Access the table of nodes.

```
graphinfo.Nodes
```

```
ans =

  7×3 table

         NodeLabels      NodeData                NodeObject             
         __________    ____________    _________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    4     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    5     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

```
    9     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

Access property keys for the first node.

```
graphinfo.Nodes.NodeData{1}
```

```
ans = 

  struct with fields:

    name: 'User1'
```

Access the table of relationships.

```
graphinfo.Relations
```

```
ans =

  8×5 table

         StartNodeID    RelationType    EndNodeID    RelationData                Relation
         ___________    ____________    _________    ____________    ____________________

    1         0           'knows'           1        [1×1 struct]    [1x1 database.neo4
    0         0           'knows'           2        [1×1 struct]    [1x1 database.neo4
    3         1           'knows'           3        [1×1 struct]    [1x1 database.neo4
    2         2           'knows'           1        [1×1 struct]    [1x1 database.neo4
    5         3           'knows'           4        [1×1 struct]    [1x1 database.neo4
    4         3           'knows'           5        [1×1 struct]    [1x1 database.neo4
    6         5           'knows'           4        [1×1 struct]    [1x1 database.neo4
    8         5           'knows'           9        [1×1 struct]    [1x1 database.neo4
```

Access property keys for the first relationship. The first relationship has no property keys.

```
graphinfo.Relations.RelationData{1}
```

```
ans = 

  struct with no fields.
```

Search the graph for all node labels in the database.

```
allnodes = nodeLabels(neo4jconn);

graphinfo = searchGraph(neo4jconn,allnodes);
```

Search Graph by Relationships

Search for graph information in a Neo4j® database by using the relationship type and display the information.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the graph for the relationship type `'knows'` using the Neo4j database connection.

```
reltype = {'knows'};

graphinfo = searchGraph(neo4jconn,reltype)
```

```
graphinfo = 

  struct with fields:

        Nodes: [7×3 table]
```

```
    Relations: [8×5 table]
```

`graphinfo` is a structure that contains the results of the search:

- All start and end nodes that denote each matched relationship
- All matched relationships

Access the table of nodes.

```
graphinfo.Nodes
```

```
ans =

  7×3 table

         NodeLabels      NodeData                  NodeObject
         __________    ____________    ________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    5     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    4     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    9     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

Access the table of relationships.

```
graphinfo.Relations
```

```
ans =

  8×5 table

         StartNodeID    RelationType    EndNodeID    RelationData            Relatior
         ___________    ____________    _________    ____________    __________________

    0         0           'knows'           2        [1×1 struct]    [1x1 database.neo4
    1         0           'knows'           1        [1×1 struct]    [1x1 database.neo4
    2         2           'knows'           1        [1×1 struct]    [1x1 database.neo4
    3         1           'knows'           3        [1×1 struct]    [1x1 database.neo4
```

```
    4         3           'knows'           5         [1×1 struct]    [1x1 database.neo4
    5         3           'knows'           4         [1×1 struct]    [1x1 database.neo4
    6         5           'knows'           4         [1×1 struct]    [1x1 database.neo4
    8         5           'knows'           9         [1×1 struct]    [1x1 database.neo4
```

Search the graph for all relationship types in the database.

```
allreltypes = relationTypes(neo4jconn);

graphinfo = searchGraph(neo4jconn,allreltypes);
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`criteria` — Search criteria
cell array of character vectors | string array

Search criteria, specified as a cell array of character vectors or string array. To search by nodes, specify one or more node labels as character vectors in the cell array. To search by relationships, specify one or more relationship types as character vectors in the cell array. Or, specify a string array for multiple node labels or relationship types.

Data Types: `cell` | `string`

Output Arguments

`graphinfo` — Graph information
structure

Graph information in the Neo4j database that matches the search criteria, returned as a structure with these fields.

Field	Description
Nodes	Table that contains node information for each node in the Relations table. The • NodeLabels — Character vector that denotes the node label for each match • NodeData — Structure array that contains node information such as propert • NodeObject — Neo4jNode object for each matched database node The row names in the table are Neo4j node identifiers of the matched database If criteria contains node labels, the output is automatically sorted by StartN
Relations	Table that contains relationship information for the nodes in the Nodes table. Th • StartNodeID — Node identifier for the start node for each matched relation • RelationType — Character vector that denotes the relationship type for ea • EndNodeID — Node identifier for the end node for each matched relationshi • RelationData — Structure array that contains property keys associated wi • RelationObject — Neo4jRelation object that represents each matched The row names in the table are Neo4j relationship identifiers. If criteria contains relationship types, the output is automatically sorted by R

See Also

neo4j | nodeLabels | relationTypes | searchNode | searchNodeByID | searchRelation

Topics

“Determine Dependencies of Services in Network”
“Find Shortest Path Between People in Social Neighborhood”
“Find Friends of Friends in Social Neighborhood”
“Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12
“Working with MATLAB Interface to Neo4j” on page 7-9

Introduced in R2016b

executeCypher

Package: database.neo4j

Execute Cypher query on Neo4j database

Syntax

`results = executeCypher(neo4jconn,query)`

Description

`results = executeCypher(neo4jconn,query)` returns data from the Neo4j database using the Neo4j database connection `neo4jconn` and a Cypher query. You can execute a Cypher query on the Neo4j database using the Cypher Query Language.

Examples

Execute Cypher® Query in Neo4j® Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =
```

```
    []
```

The blank `Message` property indicates a successful connection.

Create the Cypher® query that searches for the names of all nodes with the node label `Person`.

```
query = 'MATCH (node:Person) RETURN node.name';
```

Execute the query and display the results using the Neo4j® database connection `neo4jconn`.

```
results = executeCypher(neo4jconn,query)
```

```
results = 

    node_name
    _________

    'User1'
    'User3'
    'User2'
    'User4'
    'User5'
    'User6'
    'User7'
```

`results` is a table that contains the column `node_name`. This column has the names of each node in the Neo4j® database.

Input Arguments

neo4jconn — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

query — Cypher query
character vector | string scalar

Cypher query, specified as a character vector or string scalar.

Example: `'MATCH (movie: Movie {title: ''The Matrix''}) RETURN movie.title, movie.studio'`

Data Types: `char` | `string`

Output Arguments

`results` — Cypher query results
table

Cypher query results, returned as a table. The columns in the table match the RETURN statement in the Cypher query.

See Also

`neo4j` | `searchGraph` | `searchNode` | `searchNodeByID` | `searchRelation`

Topics

"Working with MATLAB Interface to Neo4j" on page 7-9
"Searching Graph Database Using MATLAB Interface to Neo4j" on page 7-12
"MATLAB Interface to Neo4j Error Messages" on page 7-28

Introduced in R2016b

nodeRelationTypes

Package: database.neo4j

Associated relationship types for Neo4j database node

Syntax

`nodereltypes = nodeRelationTypes(node,direction)`

Description

`nodereltypes = nodeRelationTypes(node,direction)` returns the relationship types for the specified `Neo4jNode` object and direction.

Examples

Search Relationship Types for Node

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =
```

```
    []
```

The blank `Message` property indicates a successful connection.

Search the database for the node with node identifier `2` using the Neo4j® database connection `neo4jconn`.

```
nodeid = 2;

node = searchNodeByID(neo4jconn,nodeid);
```

Search for all incoming relationships for the node.

```
nodereltypes = nodeRelationTypes(node,'in')
```

```
nodereltypes =

  cell

    'knows'
```

`nodereltypes` returns a list of the relationship types.

Input Arguments

node — Neo4j database node
`Neo4jNode` object

Neo4j database node, specified as a `Neo4jNode` object created using `searchNode` or `searchNodeByID`.

`direction` — Relationship direction
`'in'` | `'out'`

Relationship direction, specified as either `'in'` for an incoming relationship or `'out'` for an outgoing relationship. The relationships are associated with the specified origin node.

Output Arguments

`nodereltypes` — Relationship types
cell array of character vectors

Relationship types, returned as a cell array of character vectors. The cell array contains one character vector for one relationship or multiple character vectors for multiple relationships.

See Also

`nodeDegree` | `searchNode` | `searchNodeByID`

Topics

“Explore Graph Database Structure” on page 7-2
“Working with MATLAB Interface to Neo4j” on page 7-9
“Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12

Introduced in R2016b

nodeDegree

Package: database.neo4j

In-degree and out-degree for each associated relationship type for Neo4j database node

Syntax

```
degree = nodeDegree(node,direction)
```

Description

`degree = nodeDegree(node,direction)` returns the in- or out-degree for each relationship for the specified `Neo4jNode` object. `direction` specifies the relationship direction.

Examples

Search Node Degree for Node

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =
```

```
    []
```

The blank `Message` property indicates a successful connection.

Search the database for the node with node identifier `2` using the Neo4j® database connection `neo4jconn`.

```
nodeid = 2;

node = searchNodeByID(neo4jconn,nodeid);
```

Search for the degree of all incoming relationships for the node.

```
degree = nodeDegree(node,'in')
```

```
degree =

  struct with fields:

    knows: 1
```

`degree` returns a structure with the in-degree for each relationship type.

Input Arguments

node — Neo4j database node
`Neo4jNode` object

Neo4j database node, specified as a `Neo4jNode` object created using `searchNode` or `searchNodeByID`.

direction — Relationship direction
`'in'` | `'out'`

Relationship direction, specified as either `'in'` for an incoming relationship or `'out'` for an outgoing relationship. The relationships are associated with the specified origin node.

Output Arguments

degree — In- or out-degree
structure

In- or out-degree, returned as a structure. Each field in the structure represents either incoming or outgoing relationship types. If there are no incoming or outgoing relationship types, the structure is empty.

See Also

`nodeRelationTypes` | `searchNode` | `searchNodeByID`

Topics

“Explore Graph Database Structure” on page 7-2
“Working with MATLAB Interface to Neo4j” on page 7-9
“Searching Graph Database Using MATLAB Interface to Neo4j” on page 7-12

Introduced in R2016b

neo4jStruct2Digraph

Convert graph or relationship structure from Neo4j database to directed graph

Syntax

```
G = neo4jStruct2Digraph(s)
G = neo4jStruct2Digraph(s,'NodeNames',nodenames)
```

Description

`G = neo4jStruct2Digraph(s)` creates a directed graph from the structure `s`. With the directed graph, run graph network analytics using MATLAB. For example, to visualize the graph, see “Graph Plotting and Customization” (MATLAB).

`G = neo4jStruct2Digraph(s,'NodeNames',nodenames)` specifies names of the Neo4j database nodes in the directed graph.

Examples

Create Directed Graph Using Relationships

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =
```

```
     []
```

The blank `Message` property indicates a successful connection.

Search for incoming relationships using the Neo4j® database connection `neo4jconn` and origin node identifier `nodeid`.

```
nodeid = 1;
direction = 'in';

relinfo = searchRelation(neo4jconn,nodeid,direction);
```

Convert the relationship information into a directed graph.

```
G = neo4jStruct2Digraph(relinfo)
```

```
G = 

  digraph with properties:

    Edges: [2×3 table]
    Nodes: [3×3 table]
```

`G` is a `digraph` object that contains two tables for edges and nodes.

Access the table of edges.

```
G.Edges
```

```
ans = 

     EndNodes      RelationType    RelationData
    __________     ____________    ____________

    '0'    '1'     'knows'         [1×1 struct]
    '2'    '1'     'knows'         [1×1 struct]
```

Access the table of nodes.

```
G.Nodes
```

```
ans =

    Name    NodeLabels      NodeData
    ____    __________    ____________

    '0'     'Person'      [1×1 struct]
    '1'     'Person'      [1×1 struct]
    '2'     'Person'      [1×1 struct]
```

Find the shortest path between all nodes in `G`.

```
d = distances(G)
```

```
d =

     0     1   Inf
   Inf     0   Inf
   Inf     1     0
```

Create Directed Graph Using a Subgraph

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Search for a subgraph using the Neo4j® database connection `neo4jconn` and node label `nlabel`.

```
nlabel = {'Person'};

graphinfo = searchGraph(neo4jconn,nlabel);
```

Convert the graph information into a directed graph.

```
G = neo4jStruct2Digraph(graphinfo)


G = 

  digraph with properties:

    Edges: [8×3 table]
    Nodes: [7×3 table]
```

`G` is a `digraph` object that contains two tables for edges and nodes.

Access the table of edges.

```
G.Edges


ans =

     EndNodes      RelationType    RelationData
    __________     ____________    ____________

    '0'    '1'     'knows'         [1×1 struct]
    '0'    '2'     'knows'         [1×1 struct]
    '1'    '3'     'knows'         [1×1 struct]
    '2'    '1'     'knows'         [1×1 struct]
    '3'    '4'     'knows'         [1×1 struct]
    '3'    '5'     'knows'         [1×1 struct]
    '5'    '4'     'knows'         [1×1 struct]
    '5'    '6'     'knows'         [1×1 struct]
```

Access the table of nodes.

```
G.Nodes

ans = 

    Name    NodeLabels       NodeData   
    ____    __________    ______________

    '0'     'Person'      [1×1 struct]
    '1'     'Person'      [1×1 struct]
    '2'     'Person'      [1×1 struct]
    '3'     'Person'      [1×1 struct]
    '4'     'Person'      [1×1 struct]
    '5'     'Person'      [1×1 struct]
    '6'     'Person'      [1×1 struct]
```

Find the shortest path between all nodes in `G`.

```
d = distances(G)

d =

     0     1     1     2     3     3     4
   Inf     0   Inf     1     2     2     3
   Inf     1     0     2     3     3     4
   Inf   Inf   Inf     0     1     1     2
   Inf   Inf   Inf   Inf     0   Inf   Inf
   Inf   Inf   Inf   Inf     1     0     1
   Inf   Inf   Inf   Inf   Inf   Inf     0
```

Create Directed Graph Using Node Names

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Search for a subgraph using the Neo4j® database connection `neo4jconn` and node label `nlabel`.

```
nlabel = {'Person'};

graphinfo = searchGraph(neo4jconn,nlabel);
```

Convert the graph information into a directed graph using the node names in the subgraph. Convert node names into a cell array of character vectors `nodenames`.

```
names = [graphinfo.Nodes.NodeData{:}];
nodenames = {names(:).name};

G = neo4jStruct2Digraph(graphinfo,'NodeNames',nodenames)
```

```
G =

  digraph with properties:

    Edges: [8×3 table]
    Nodes: [7×3 table]
```

`G` is a `digraph` object that contains two tables for edges and nodes.

Access the table of edges.

```
G.Edges
```

```
ans =
```

```
        EndNodes          RelationType    RelationID
    __________________    ____________    __________

    'User1'    'User3'    'knows'         1         
    'User1'    'User2'    'knows'         0         
    'User3'    'User4'    'knows'         3         
    'User2'    'User3'    'knows'         2         
    'User4'    'User5'    'knows'         5         
    'User4'    'User6'    'knows'         4         
    'User6'    'User5'    'knows'         6         
    'User6'    'User7'    'knows'         7         
```

Access the table of nodes.

```
G.Nodes
```

```
ans = 

     Name      NodeLabels       NodeData   
    _______    __________    ____________

    'User1'    'Person'      [1×1 struct]
    'User3'    'Person'      [1×1 struct]
    'User2'    'Person'      [1×1 struct]
    'User4'    'Person'      [1×1 struct]
    'User5'    'Person'      [1×1 struct]
    'User6'    'Person'      [1×1 struct]
    'User7'    'Person'      [1×1 struct]
```

Find the shortest path between all nodes in G.

```
d = distances(G)
```

```
d =

     0     1     1     2     3     3     4
   Inf     0   Inf     1     2     2     3
   Inf     1     0     2     3     3     4
   Inf   Inf   Inf     0     1     1     2
   Inf   Inf   Inf   Inf     0   Inf   Inf
   Inf   Inf   Inf   Inf     1     0     1
```

```
   Inf   Inf   Inf   Inf   Inf   Inf     0
```

Input Arguments

s — Graph or relationship information
structure

Graph or relationship information, specified as a structure returned by `searchGraph` or `searchRelation`.

Data Types: `struct`

nodenames — Node names
cell array of character vectors | string array

Node names in a Neo4j database, specified as a cell array of character vectors or string array.

Example: `["User6","User7"]`

Data Types: `cell` | `string`

Output Arguments

G — Directed graph
`digraph` object

Directed graph, returned as a `digraph` object.

See Also

`distances` | `neo4j` | `searchGraph` | `searchNode` | `searchRelation`

Topics

"Determine Dependencies of Services in Network"
"Find Shortest Path Between People in Social Neighborhood"
"Find Friends of Friends in Social Neighborhood"
"Searching Graph Database Using MATLAB Interface to Neo4j" on page 7-12

“Working with MATLAB Interface to Neo4j” on page 7-9

Introduced in R2016b

createNode

Package: database.neo4j

Create nodes in Neo4j database

Syntax

```
nodeinfo = createNode(neo4jconn)
nodeinfo = createNode(neo4jconn,Name,Value)
```

Description

`nodeinfo = createNode(neo4jconn)` creates a single node without labels and properties by using a Neo4j database connection.

`nodeinfo = createNode(neo4jconn,Name,Value)` creates a single node or multiple nodes by specifying additional options using one or more name-value pair arguments. For example, `'Labels','Person'` creates a node with the `Person` node label.

Examples

Create Node in Neo4j Database

Create a single node in the Neo4j® database and display the contents of the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the Neo4j database using the Neo4j database connection.

```
nodeinfo = createNode(neo4jconn)
```

```
nodeinfo = 

  Neo4jNode with properties:

        NodeID: 30
      NodeData: [1×1 struct]
    NodeLabels: []
```

`nodeinfo` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

When you execute the `createNode` function without any arguments except the Neo4j database connection, the function creates a single node without labels and properties. To add labels and properties, use the `updateNode` function.

Create Node with Label in Neo4j Database

Create a single node with a node label in a Neo4j® database and access the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the Neo4j database with a node label using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label.

```
label = 'Person';
nodeinfo = createNode(neo4jconn,'Labels',label)
```

```
nodeinfo = 

  Neo4jNode with properties:

        NodeID: 31
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

`nodeinfo` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Display the node label for this node.

```
nodeinfo.NodeLabels
```

```
ans =

    'Person'
```

Create Two Nodes with Labels in Neo4j Database

Create two nodes with labels in the Neo4j® database. Access data in the nodes.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes that represent two people in the Neo4j database by using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the node labels. One node has the `Person` node label and the other node has two node labels, `Person` and `Employee`.

```
labels = {{'Person'},{'Person','Employee'}};
nodeinfo = createNode(neo4jconn,'Labels',labels)
```

```
nodeinfo =

  2×3 table
```

```
          NodeLabels      NodeData                   NodeObject
          __________    ____________    ______________________________

    32    {1×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    33    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

`nodeinfo` is a table with two rows, one for each person. The table contains these variables:

- Node labels
- Node properties
- `Neo4jNode` object

Access the `Neo4jNode` object for the first node.

```
data = nodeinfo.NodeObject(1)
```

```
data = 

  Neo4jNode with properties:

        NodeID: 32
      NodeData: [1×1 struct]
    NodeLabels: {'Person'}
```

`data` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Access the node labels of both nodes.

```
nodeinfo.NodeObject(1).NodeLabels
nodeinfo.NodeObject(2).NodeLabels
```

```
ans =

  1×1 cell array
```

```
    {'Person'}


ans =

  2×1 cell array

    {'Person'  }
    {'Employee'}
```

Create Two Nodes with Labels and Properties in Neo4j Database

Create two nodes with labels and properties in the Neo4j® database. Access the data in the nodes.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message


ans =

     []
```

Create a table with two rows that contain the names and job titles of two people.

```
props = table(["User8";"User9"],["Analyst";"Technician"], ...
    'VariableNames',{'Name','Title'});
```

Create two nodes that represent these two people in the Neo4j database by using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the node labels `Person` and `Employee`. Then, use the `'Properties'` name-value pair argument to specify the node properties using the `props` table.

```
labels = ["Person","Employee"];
nodeinfo = createNode(neo4jconn,'Labels',labels,'Properties',props)
```

```
nodeinfo =

  2×3 table

          NodeLabels      NodeData                  NodeObject
          __________    ____________    ______________________________

    8     {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    34    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

`nodeinfo` is a table with two rows, one for each person. The table contains these variables:

- Node labels
- Node properties
- `Neo4jNode` object

Access the properties of the first node. This structure contains the properties of the node as fields and values.

```
nodeinfo.NodeData{1}
```

```
ans =

  struct with fields:

    Title: 'Technician'
     Name: 'User9'
```

Access the `Neo4jNode` object for the first node.

```
data = nodeinfo.NodeObject(1)
```

```
data = 

  Neo4jNode with properties:

        NodeID: 8
      NodeData: [1×1 struct]
    NodeLabels: {2×1 cell}
```

`data` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Input Arguments

neo4jconn — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `node = createNode(neo4jconn,'Labels','Person','Properties',table(["User8"],["Analyst"],'VariableNames',{'Name','Title'}))` creates a single node with the `Person` node label and two properties, `Name` and `Title`, and their corresponding values `User8` and `Analyst`.

`Labels` — Node labels
character vector | string scalar | cell array of character vectors | string array | cell array of cell arrays | cell array of string arrays

Node labels, specified as the comma-separated pair consisting of `'Labels'` and a character vector, string scalar, cell array of character vectors, string array, cell array of cell arrays, or cell array of string arrays. To specify one node label, use a character vector or string scalar. For multiple node labels, use a cell array of character vectors or string array. To create multiple nodes with different node labels, use a cell array of cell arrays or cell array of string arrays.

Note If you do not specify any labels, then the created node has no labels by default.

Example: `'Labels','Person'`

Data Types: `char` | `string` | `cell`

`Properties` — Node properties
structure | structure array | table | cell array of structures

Node properties, specified as the comma-separated pair consisting of `'Properties'` and a structure, structure array, table, or cell array of structures.

When you specify a structure, each field and its corresponding value convert to a property and its corresponding value in the database node. Also, the `createNode` function sets the `NodeData` property of the `Neo4jNode` object to this structure.

When you specify a table that contains one row, each variable and its corresponding value convert to a property and its corresponding value in the database node. The `createNode` function converts the variables and their corresponding values to fields and their corresponding values in a structure. The function sets this structure to the `NodeData` property of the `Neo4jNode` object.

To create multiple nodes, specify a structure array or table with multiple rows.

To create multiple nodes with different properties, specify a cell array of structures.

Note If a property is missing its corresponding value, then the created node does not contain this property.

Data Types: `struct` | `table` | `cell`

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node
- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

See Also

`deleteNode` | `neo4j` | `updateNode`

Topics

"Update Friend Information in Social Neighborhood" on page 7-15
"Working with MATLAB Interface to Neo4j" on page 7-9

Introduced in R2018a

createRelation

Package: database.neo4j

Create relationships between nodes in Neo4j database

Syntax

```
relationinfo = createRelation(neo4jconn,startnode,endnode,
relationtype)
relationinfo = createRelation(neo4jconn,startnode,endnode,
relationtype,'Properties',properties)
```

Description

`relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype)` creates a single relationship or multiple relationships between the start and end nodes with specified relationship types using the Neo4j database connection.

`relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype,'Properties',properties)` specifies the properties of the new relationships.

Examples

Create Relationship Between Two Nodes in Neo4j Database

Create a single relationship between two nodes in a Neo4j® database and display the relationship.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
```

```
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message


ans =

     []
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. Specify the relationship type as `works with`.

```
relationtype = 'works with';
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype)


relationinfo = 

  Neo4jRelation with properties:

      RelationID: 31
    RelationData: [1×1 struct]
     StartNodeID: 39
    RelationType: 'works with'
       EndNodeID: 40
```

`relationinfo` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data

- Start node identifier
- Relationship type
- End node identifier

Display the relationship type.

```
relationinfo.RelationType
```

```
ans =

    'works with'
```

Create Multiple Relationships in Neo4j Database

Create two relationships between nodes in a Neo4j® database and display them.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for the node with the node label `Person` and the property key `name` set to the value `User7` by using the Neo4j database connection.

```
nlabel = 'Person';
user7 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7');
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
user8 = createNode(neo4jconn,'Labels',label);
user9 = createNode(neo4jconn,'Labels',label);
```

Create two relationships using the Neo4j database connection. Specify the relationship types as `works with` and `studies with`. The two relationships are:

- `User8` works with `User7`
- `User8` studies with `User9`

```
startnode = [user8,user8];
endnode = [user7,user9];
relationtype = {'works with','studies with'};
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype)
```

```
relationinfo =

  2×5 table

          StartNodeID     RelationType      EndNodeID    RelationData             Relat
          ___________    ______________    _________    _____________    _______________

    33        41         'studies with'       42        [1×1 struct]     [1x1 database.r
    32        41         'works with'          9        [1×1 struct]     [1x1 database.r
```

`relationinfo` is a table with these variables:

- Start node identifier
- Relationship type
- End node identifier

- Relationship properties
- `Neo4jRelation` object

Display the `Neo4jRelation` object for the first relationship.

```
relation = relationinfo.RelationObject(1)
```

```
relation = 

  Neo4jRelation with properties:

      RelationID: 33
    RelationData: [1×1 struct]
     StartNodeID: 41
    RelationType: 'studies with'
       EndNodeID: 42
```

`relation` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Create Relationship with Properties in Neo4j Database

Create a single relationship with properties between two nodes in a Neo4j® database and display the properties.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. These nodes represent two colleagues that started working together on a project named `Database` on September 1, 2017. Specify the relationship type as `works with`. Specify the project name and start date as properties of the relationship by using the `properties` structure.

```
relationtype = 'works with';
properties.Project = 'Database';
properties.StartDate = '09/01/2017';
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype, ...
    'Properties',properties)
```

```
relationinfo = 

  Neo4jRelation with properties:

      RelationID: 34
    RelationData: [1×1 struct]
     StartNodeID: 43
    RelationType: 'works with'
       EndNodeID: 44
```

`relationinfo` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Display the properties of the relationship.

```
relationinfo.RelationData
```

```
ans = 

  struct with fields:

    StartDate: '09/01/2017'
      Project: 'Database'
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

startnode — Start node
numeric scalar | numeric vector | Neo4jNode object | Neo4jNode object array

Start node, specified as a numeric scalar, numeric vector, `Neo4jNode` object, or `Neo4jNode` object array. To specify database nodes using node identifiers, use a numeric scalar for one node or a numeric vector for multiple nodes. To specify database nodes as `Neo4jNode` objects, use this object for one node or an array of these objects for multiple nodes.

The number of start nodes must match the number of end nodes in `endnode`.

The number of start nodes equals the number of relationships that the `createRelation` function creates in the Neo4j database.

Example: 8

endnode — End node
numeric scalar | numeric vector | `Neo4jNode` object | `Neo4jNode` object array

End node, specified as a numeric scalar, numeric vector, `Neo4jNode` object, or `Neo4jNode` object array. To specify database nodes using node identifiers, use a numeric scalar for one node or a numeric vector for multiple nodes. To specify database nodes as `Neo4jNode` objects, use this object for one node or an array of these objects for multiple nodes.

The number of end nodes must match the number of start nodes in `startnode`.

The number of end nodes equals the number of relationships that the `createRelation` function creates in the Neo4j database.

Example: 9

`relationtype` — Relationship type
character vector | string scalar | cell array of character vectors | string array

Relationship type, specified as a character vector, string scalar, cell array of character vectors, or string array. To specify one relationship type, use a character vector or string scalar. To specify multiple relationship types, use a cell array of character vectors or string array.

If you specify only one relationship type, all relationships must have the same type. Otherwise, the number of relationship types in this input argument must match the number of nodes in `startnode` and `endnode`.

Example: `'knows'`

Data Types: `char` | `string` | `cell`

`properties` — Relationship properties
structure | structure array | table | cell array of structures

Relationship properties, specified as a structure, structure array, table, or cell array of structures.

When you specify a structure, each field and its corresponding value convert to a property and its corresponding value in the database relationship.

When you specify a table with one row, each variable and its corresponding value convert to a property and its corresponding value in the database relationship.

The `createRelation` function sets the `RelationObject` variable of the `relationinfo` output argument to the `Neo4jRelation` object, which contains the relationship information.

For multiple relationships, specify a structure array or table with multiple rows.

For multiple relationships with different properties, specify a cell array of structures.

Note If a property is missing its corresponding value, then the resulting relationship does not contain this property.

Data Types: `struct` | `table` | `cell`

Output Arguments

`relationinfo` — Relationship
`Neo4jRelation` object | table

Relationship, returned as a `Neo4jRelation` object or table that contains relationship information. A `Neo4jRelation` object represents a single relationship. A table represents multiple relationships and contains these variables:

- `StartNodeID` — Node identifier for the start node for each matched relationship
- `RelationType` — Character vector that denotes the relationship type for each matched relationship
- `EndNodeID` — Node identifier for the end node for each matched relationship
- `RelationData` — Structure array that contains property keys associated with each matched relationship
- `RelationObject` — `Neo4jRelation` object for each matched relationship

The row names in the table are Neo4j relationship identifiers.

See Also

`deleteRelation` | `neo4j` | `updateRelation`

Topics

“Update Friend Information in Social Neighborhood” on page 7-15
“Working with MATLAB Interface to Neo4j” on page 7-9

Introduced in R2018a

deleteNode

Package: database.neo4j

Delete nodes from Neo4j database

Syntax

```
deleteNode(neo4jconn,node)
deleteNode(neo4jconn,node,'DeleteRelations','true')
```

Description

`deleteNode(neo4jconn,node)` deletes a single node or multiple nodes using the Neo4j database connection. If a specified node has an associated relationship, this syntax throws an error.

`deleteNode(neo4jconn,node,'DeleteRelations','true')` deletes nodes and their associated relationships without throwing an error.

Examples

Delete Node in Neo4j Database

Create a single node in a Neo4j® database and delete the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the Neo4j database using the Neo4j database connection.

```
node = createNode(neo4jconn)
```

```
node = 

  Neo4jNode with properties:

        NodeID: 35
      NodeData: [1×1 struct]
    NodeLabels: []
```

`node` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Delete the node using the Neo4j database connection.

```
deleteNode(neo4jconn,node)
```

Delete Node and Its Relationship

Create a single relationship between two nodes in a Neo4j® database. Then, delete one of the nodes and the relationship.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between two nodes using the Neo4j database connection. Specify the relationship type as `works with`.

```
relationtype = 'works with';
relation = createRelation(neo4jconn,startnode,endnode,relationtype)
```

```
relation = 

  Neo4jRelation with properties:

      RelationID: 23
    RelationData: [1×1 struct]
     StartNodeID: 36
    RelationType: 'works with'
       EndNodeID: 37
```

`relation` is a `Neo4jRelation` object with these properties:

- Relationship identifier

- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Delete the first node and the associated relationship. Use this syntax to delete the node and relationship without throwing an error.

```
deleteNode(neo4jconn,startnode,'DeleteRelations',true)
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a Neo4jConnect object created with the function neo4j.

node — Node
Neo4jNode object | Neo4jNode object array | numeric scalar | numeric vector

Node in a Neo4j database, specified as a Neo4jNode object, Neo4jNode object array, numeric scalar, or numeric vector. For one node, specify a Neo4jNode object or numeric scalar. For multiple nodes, specify a Neo4jNode object array or numeric vector.

The numeric scalar or vector must contain Neo4j database node identifiers.

Example: 15

Example: [2,3,4]

See Also

createNode | neo4j | updateNode

Topics

"Update Friend Information in Social Neighborhood" on page 7-15
"Working with MATLAB Interface to Neo4j" on page 7-9

Introduced in R2018a

deleteRelation

Package: database.neo4j

Delete relationships from Neo4j database

Syntax

`deleteRelation(neo4jconn,relation)`

Description

`deleteRelation(neo4jconn,relation)` deletes a single relationship or multiple relationships using the Neo4j database connection.

Examples

Delete Relationship from Neo4j Database

Create a single relationship between two nodes in a Neo4j® database. Then, delete the relationship and the corresponding nodes.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. These nodes represent two colleagues who work together. Specify the relationship type as `works with`.

```
relationtype = 'works with';
relation = createRelation(neo4jconn,startnode,endnode,relationtype)
```

```
relation = 

  Neo4jRelation with properties:

      RelationID: 24
    RelationData: [1×1 struct]
     StartNodeID: 21
    RelationType: 'works with'
       EndNodeID: 22
```

`relation` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Delete the relationship.

```
deleteRelation(neo4jconn,relation)
```

Delete the two nodes by using a `Neo4jNode` object array.

```
nodes = [startnode,endnode];
deleteNode(neo4jconn,nodes)
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

relation — Relationship
Neo4jRelation object | Neo4jRelation object array | numeric scalar | numeric vector

Relationship in a Neo4j database, specified as a `Neo4jRelation` object, `Neo4jRelation` object array, numeric scalar, or numeric vector. For a single relationship, use a `Neo4jRelation` object or numeric scalar that contains the relationship identifier. For multiple relationships, use a `Neo4jRelation` object array or numeric vector that contains an array of relationship identifiers.

Example: 15

Example: [15,16,17]

See Also

`createRelation` | `neo4j` | `updateRelation`

Topics

“Update Friend Information in Social Neighborhood” on page 7-15
“Working with MATLAB Interface to Neo4j” on page 7-9

Introduced in R2018a

updateNode

Package: database.neo4j

Update node labels and properties in Neo4j database

Syntax

```
nodeinfo = updateNode(neo4jconn,node,'Labels',labels)
nodeinfo = updateNode(neo4jconn,node,'Properties',properties)
nodeinfo = updateNode(neo4jconn,node,'Labels',labels,'Properties',
properties)
```

Description

`nodeinfo = updateNode(neo4jconn,node,'Labels',labels)` updates existing node labels by replacing them with the specified node labels for associated nodes by using a Neo4j database connection.

`nodeinfo = updateNode(neo4jconn,node,'Properties',properties)` updates existing node properties by replacing them with the specified node properties.

`nodeinfo = updateNode(neo4jconn,node,'Labels',labels,'Properties',properties)` updates existing node labels and properties.

Examples

Update Node Labels in Neo4j Database

Create a single node in a Neo4j® database, update its node labels, and display them.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
```

```
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the Neo4j database using the Neo4j database connection.

```
node = createNode(neo4jconn)
```

```
node = 

  Neo4jNode with properties:

        NodeID: 16
      NodeData: [1×1 struct]
    NodeLabels: []
```

`node` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Update the node with the labels `Person` and `Employee`. The output argument `nodeinfo` is a `Neo4jNode` object.

```
labels = ["Person","Employee"];
nodeinfo = updateNode(neo4jconn,node,'Labels',labels);
```

Display the updated node labels.

```
nodeinfo.NodeLabels
```

```
ans =

  2×1 cell array

    {'Person'  }
    {'Employee'}
```

Update Node Properties in Neo4j Database

Create a single node in a Neo4j® database, update its properties, and display them.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the Neo4j database using the Neo4j database connection.

```
node = createNode(neo4jconn)
```

```
node =
```

```
  Neo4jNode with properties:

        NodeID: 23
      NodeData: [1×1 struct]
    NodeLabels: []
```

node is a Neo4jNode object with these properties:

- Node identifier
- Node data
- Node labels

Update the properties of the node that represents a person. Create a table with one row that contains the name and job title for this person. The nodeinfo output argument is a Neo4jNode object.

```
properties = table("User8","Analyst",'VariableNames',{'Name','Title'});
nodeinfo = updateNode(neo4jconn,node,'Properties',properties);
```

Display the node properties.

```
nodeinfo.NodeData
```

```
ans = 

  struct with fields:

    Title: 'Analyst'
     Name: 'User8'
```

Update Node Properties of Existing Node

Search for an existing node in a Neo4j® database, add a node property, and display the updated node properties.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only

one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for a single node with the node label `Person`. Then, using the Neo4j database connection, filter the results further by the property key and value for a specific person named `User7`.

```
nlabel = 'Person';
node = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7')
```

```
node = 

  Neo4jNode with properties:

        NodeID: 9
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

`node` is a `Neo4jNode` object with these properties:

- Node identifier

- Node data
- Node labels

Retrieve the existing properties of the node by using the `NodeData` property of the `Neo4jNode` object. `properties` is a structure.

```
properties = node.NodeData
```

```
properties = 

  struct with fields:

    name: 'User7'
```

Update the properties of the node. Add another node property by setting a new field in the structure to specify the job title of the person. The `nodeinfo` output argument is a `Neo4jNode` object.

```
properties.title = 'Analyst';
nodeinfo = updateNode(neo4jconn,node,'Properties',properties);
```

Display the updated node properties.

```
nodeinfo.NodeData
```

```
ans = 

  struct with fields:

     name: 'User7'
    title: 'Analyst'
```

Update Node Labels and Properties in Neo4j Database

Create a single node in a Neo4j® database, update its node labels and properties, and display them.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only

one unique property key name with values User1 through User7. Each relationship has the type knows.

Create a Neo4j database connection using the URL http://localhost:7474/db/data, user name neo4j, and password matlab.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the Message property of the Neo4j connection object neo4jconn. The blank Message property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the Neo4j database using the Neo4j database connection.

```
node = createNode(neo4jconn)
```

```
node = 

  Neo4jNode with properties:

        NodeID: 55
      NodeData: [1×1 struct]
    NodeLabels: []
```

node is a Neo4jNode object with these properties:

- Node identifier
- Node data
- Node labels

Create a table with one row that contains data about a person. Specify the name and job title of the person.

```
properties = table("User8","Analyst",'VariableNames',{'Name','Title'});
```

Update the node with the labels `Person` and `Employee` and with the node properties defined in the table. The `nodeinfo` output argument is a `Neo4jNode` object.

```
labels = ["Person","Employee"];
nodeinfo = updateNode(neo4jconn,node,'Labels',labels, ...
    'Properties',properties);
```

Display the updated node labels.

```
nodeinfo.NodeLabels
```

```
ans =

  2×1 cell array

    {'Person'  }
    {'Employee'}
```

Display the updated node properties.

```
nodeinfo.NodeData
```

```
ans =

  struct with fields:

    Title: 'Analyst'
     Name: 'User8'
```

Update Labels and Properties for Two Nodes

Create two nodes in a Neo4j® database, update their node labels and properties, and display the labels and properties for the first node.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the Neo4j database using the Neo4j database connection. These nodes represent two people.

```
user8 = createNode(neo4jconn);
user9 = createNode(neo4jconn);
```

Create a table with two rows. Each row contains data about a person. Specify the name and job title for each person.

```
properties = table(["User8";"User9"],["Analyst";"Technician"], ...
    'VariableNames',{'Name','Title'});
```

Update the nodes with the labels `Person` and `Employee` and with the node properties defined in the table.

```
labels = ["Person","Employee"];
nodeinfo = updateNode(neo4jconn,[user8;user9],'Labels',labels, ...
    'Properties',properties)
```

```
nodeinfo =
```

```
  2×3 table

          NodeLabels      NodeData                NodeObject           
          __________    ____________    ______________________________

    56    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    57    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

`nodeinfo` is a table that contains these variables:

- Node labels
- Node properties
- `Neo4jNode` objects

Display the node labels for the first node.

```
nodeinfo.NodeLabels{1}
```

```
ans =

  2×1 cell array

    {'Person'  }
    {'Employee'}
```

Display the node properties for the first node.

```
nodeinfo.NodeData{1}
```

```
ans = 

  struct with fields:

    Title: 'Analyst'
```

```
Name: 'User8'
```

Input Arguments

neo4jconn — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

node — Node
`Neo4jNode` object | `Neo4jNode` object array | numeric scalar | numeric vector

Node in a Neo4j database, specified as a `Neo4jNode` object, `Neo4jNode` object array, numeric scalar, or numeric vector. For one node, specify a `Neo4jNode` object or numeric scalar. For multiple nodes, specify a `Neo4jNode` object array or numeric vector.

The numeric scalar or vector must contain Neo4j database node identifiers.

Example: `15`

Example: `[2,3,4]`

`labels` — Node labels
character vector | cell array of character vectors | string scalar | string array | cell array of cell arrays | cell array of string arrays

Node labels, specified as a character vector, cell array of character vectors, string scalar, string array, cell array of cell arrays, or cell array of string arrays. To specify one node label, use a character vector or string scalar. For multiple node labels, use a cell array of character vectors or string array. To update multiple nodes with different node labels, use a cell array of cell arrays or cell array of string arrays.

Example: `'Person'`

Data Types: `char` | `string` | `cell`

`properties` — Node properties
structure | structure array | table | cell array of structures

Node properties, specified as a structure, structure array, table, or cell array of structures.

When you specify a structure, each field and its corresponding value convert to a property and its corresponding value in the database node. The `updateNode` function sets the `NodeData` property of the `Neo4jNode` object to this structure.

When you specify a table that contains one row, each variable and its corresponding value convert to a property and its corresponding value in the database node. The `updateNode` function converts the variables and their corresponding values to fields and their corresponding values in a structure. The function sets this structure to the `NodeData` property of the `Neo4jNode` object.

To update multiple nodes, specify a structure array or table with multiple rows.

To update multiple nodes with different properties, specify a cell array of structures.

Note If a property is missing its corresponding value, then the updated node does not contain this property.

Data Types: `struct` | `table` | `cell`

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node
- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

See Also

`createNode` | `deleteNode` | `neo4j`

Topics

"Update Friend Information in Social Neighborhood" on page 7-15
"Working with MATLAB Interface to Neo4j" on page 7-9

Introduced in R2018a

updateRelation

Package: database.neo4j

Update relationship properties in Neo4j database

Syntax

`relationinfo = updateRelation(neo4jconn,relation,properties)`

Description

`relationinfo = updateRelation(neo4jconn,relation,properties)` updates the properties of a single relationship or multiple relationships using a Neo4j database connection.

Examples

Update Relationship Between Two Nodes in Neo4j Database

Create a single relationship between two nodes in a Neo4j® database, update the properties of the relationship, and display the properties.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the 'Labels' name-value pair argument to specify the Person node label for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. Specify the relationship type as works with. The relationship relationinfo is a Neo4jRelation object.

```
relationtype = 'works with';
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype);
```

Update the relationship to include two more properties. The nodes represent two colleagues who started working together on a project named Database on September 1, 2017. Specify the project name and start date as properties of the relationship by using the properties structure.

```
properties.Project = 'Database';
properties.StartDate = '09/01/2017';
relationinfo = updateRelation(neo4jconn,relationinfo,properties)
```

```
relationinfo = 

  Neo4jRelation with properties:

      RelationID: 25
    RelationData: [1×1 struct]
     StartNodeID: 26
    RelationType: 'works with'
       EndNodeID: 27
```

relationinfo is a Neo4jRelation object that contains these properties:

- Relationship identifier

- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Display the updated relationship properties.

```
relationinfo.RelationData
```

```
ans = 

  struct with fields:

    StartDate: '09/01/2017'
      Project: 'Database'
```

Update Multiple Relationships in Neo4j Database

Create two relationships between nodes in a Neo4j® database, update the properties of the relationships, and display the properties.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for the node with the node label `Person` and the property key `name` set to the value `User7` by using the Neo4j database connection.

```
nlabel = 'Person';
user7 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7');
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
user8 = createNode(neo4jconn,'Labels',label);
user9 = createNode(neo4jconn,'Labels',label);
```

Create two relationships using the Neo4j database connection. Specify the relationship types as `works with` and `studies with`. The two relationships are:

- `User8` works with `User7`
- `User8` studies with `User9`

The relationship `relationinfo` is a table that contains the relationship and node information.

```
startnode = [user8,user8];
endnode = [user7,user9];
relationtype = {'works with','studies with'};
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype);
```

Create a table that defines the properties. Here, `User8` works with `User7` in the workplace, and `User8` studies with `User9` in the library. Also, `User8` started working with `User7` on January 2, 2017, and `User8` started studying with `User9` on March 6, 2017.

```
properties = table(["Workplace";"Library"],["01/02/2017";"03/06/2017"], ...
    'VariableNames',{'Location','Date'});
```

Update both relationships with these properties.

```
relations = relationinfo.RelationObject;
relationinfo = updateRelation(neo4jconn,relations,properties)
```

```
relationinfo =

  2×5 table

          StartNodeID     RelationType     EndNodeID    RelationData          Relat
          ___________    _______________    _________    ____________    ______________

    30        28         'studies with'        38        [1×1 struct]    [1x1 database.r
    29        28         'works with'           9        [1×1 struct]    [1x1 database.r
```

`relationinfo` is a table with these variables:

- Start node identifier
- Relationship type
- End node identifier
- Relationship properties
- `Neo4jRelation` object

Display the updated properties of the relationships.

```
relationinfo.RelationData{1}
relationinfo.RelationData{2}
```

```
ans =

  struct with fields:

        Date: '01/02/2017'
    Location: 'Workplace'


ans =

  struct with fields:

        Date: '03/06/2017'
```

```
Location: 'Library'
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`relation` — Relationship
`Neo4jRelation` object | `Neo4jRelation` object array | numeric scalar | numeric vector

Relationship in a Neo4j database, specified as a `Neo4jRelation` object, `Neo4jRelation` object array, numeric scalar, or numeric vector. For a single relationship, use a `Neo4jRelation` object or numeric scalar that contains the relationship identifier. For multiple relationships, use a `Neo4jRelation` object array or numeric vector that contains an array of relationship identifiers.

Example: `15`

Example: `[15,16,17]`

`properties` — Relationship properties
structure | structure array | table | cell array of structures

Relationship properties, specified as a structure, structure array, table, or cell array of structures.

When you specify a structure, each field and its corresponding value convert to a property and its corresponding value in the database relationship.

When you specify a table with one row, each variable and its corresponding value convert to a property and its corresponding value in the database relationship.

The `updateRelation` function sets the `RelationObject` variable of the `relationinfo` output argument to the `Neo4jRelation` object, which contains the relationship information.

For multiple relationships, specify a structure array or table with multiple rows.

For multiple relationships with different properties, specify a cell array of structures.

Note If a property is missing its corresponding value, then the resulting relationship does not contain this property.

Data Types: `struct` | `table` | `cell`

Output Arguments

`relationinfo` — Relationship
`Neo4jRelation` object | table

Relationship, returned as a `Neo4jRelation` object or table that contains relationship information. A `Neo4jRelation` object represents a single relationship. A table represents multiple relationships and contains these variables:

- `StartNodeID` — Node identifier for the start node for each matched relationship
- `RelationType` — Character vector that denotes the relationship type for each matched relationship
- `EndNodeID` — Node identifier for the end node for each matched relationship
- `RelationData` — Structure array that contains property keys associated with each matched relationship
- `RelationObject` — `Neo4jRelation` object for each matched relationship

The row names in the table are Neo4j relationship identifiers.

See Also

`createRelation` | `deleteRelation` | `neo4j`

Topics

"Update Friend Information in Social Neighborhood" on page 7-15
"Working with MATLAB Interface to Neo4j" on page 7-9

Introduced in R2018a

searchRelationByID

Package: database.neo4j

Search Neo4j relationship by relationship identifier

Syntax

`relationinfo = searchRelationByID(neo4jconn,relationid)`

Description

`relationinfo = searchRelationByID(neo4jconn,relationid)` returns the Neo4j relationship specified by the relationship identifier using the Neo4j database connection.

Examples

Search for Relationships in Neo4j Database

Search for a single relationship or multiple relationships by using relationship identifiers in the Neo4j database.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
```

```
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for the relationship with the identifier `8` by using the Neo4j database connection.

```
relationid = 8;
relationinfo = searchRelationByID(neo4jconn,relationid)
```

```
relationinfo = 

  Neo4jRelation with properties:

      RelationID: 8
    RelationData: [1×1 struct]
     StartNodeID: 5
    RelationType: 'knows'
       EndNodeID: 9
```

`relationinfo` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Display the relationship type.

```
relationinfo.RelationType
```

```
ans =
```

```
    'knows'
```

Search for multiple relationships with the identifiers 4, 5, and 6 by using the Neo4j database connection.

```
relationid = [4,5,6];
relationinfo = searchRelationByID(neo4jconn,relationid)
```

```
relationinfo =

  3×5 table

         StartNodeID    RelationType    EndNodeID    RelationData              Relatio
         ___________    ____________    _________    ____________    __________________

    5         3           'knows'           4        [1×1 struct]    [1x1 database.neo4
    4         3           'knows'           5        [1×1 struct]    [1x1 database.neo4
    6         5           'knows'           4        [1×1 struct]    [1x1 database.neo4
```

`relationinfo` is a table with these variables:

- Start node identifier
- Relationship type
- End node identifier
- Relationship properties
- `Neo4jRelation` object

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`relationid` — Relationship identifier
numeric scalar | numeric vector

Relationship identifier, specified as a numeric scalar for a single relationship or numeric vector for multiple relationships.

Example: [15,16]

Data Types: double

Output Arguments

relationinfo — Relationship
Neo4jRelation object | table

Relationship, returned as a Neo4jRelation object or table that contains relationship information. A Neo4jRelation object represents a single relationship. A table represents multiple relationships and contains these variables:

- StartNodeID — Node identifier for the start node for each matched relationship
- RelationType — Character vector that denotes the relationship type for each matched relationship
- EndNodeID — Node identifier for the end node for each matched relationship
- RelationData — Structure array that contains property keys associated with each matched relationship
- RelationObject — Neo4jRelation object for each matched relationship

The row names in the table are Neo4j relationship identifiers.

See Also

neo4j | searchNodeByID | searchRelation

Topics

“Explore Graph Database Structure” on page 7-2
“Working with MATLAB Interface to Neo4j” on page 7-9

Introduced in R2018a

storeDigraph

Package: database.neo4j

Store directed graph in Neo4j database

Syntax

```
graphinfo = storeDigraph(neo4jconn,G)
graphinfo = storeDigraph(neo4jconn,G,Name,Value)
```

Description

`graphinfo = storeDigraph(neo4jconn,G)` converts a directed graph to a Neo4j graph and stores it in the Neo4j database using a Neo4j database connection. The variables in the node and edge tables of the `digraph` object (except the `EndNodes` variable) become the properties of the nodes and relationships in the Neo4j graph.

`graphinfo = storeDigraph(neo4jconn,G,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'GlobalNodeLabel','Person'` stores all nodes in the directed graph by using the `Person` node label.

Examples

Store Directed Graph in Neo4j Database

Create a `digraph` object and store its contents in a Neo4j® database. Display the contents of the resulting Neo4j graph.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a `digraph` object with three nodes, which represents a new Neo4j graph. These nodes represent three additional people: `User8`, `User9`, and `User10`.

```
G = digraph([1 1 3],[2 3 2],[1 2 3],{'User8','User9','User10'});
```

Store the data in the `digraph` object as a Neo4j graph in the Neo4j database.

```
graphinfo = storeDigraph(neo4jconn,G)
```

```
graphinfo = 

  struct with fields:

        Nodes: [3×3 table]
    Relations: [3×5 table]
```

`graphinfo` is a structure that contains node and relationship information. By default, the `storeDigraph` function stores the directed graph without node labels. Also, the function stores the relationships with the default relationship type `Edge` in the resulting Neo4j graph.

Display information about the Neo4j graph nodes.

```
graphinfo.Nodes
```

```
ans =

  3×3 table

          NodeLabels      NodeData                  NodeObject
          __________    ____________    ______________________________

    45        []        [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    46        []        [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    47        []        [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

`Nodes` is a table that contains these variables:

- Node labels
- Node properties
- `Neo4jNode` objects

Display information about the Neo4j graph relationships.

```
graphinfo.Relations
```

```
ans =

  3×5 table

          StartNodeID    RelationType    EndNodeID    RelationData            Relatio
          ___________    ____________    _________    ____________    ________________

    35        45            'Edge'           46       [1×1 struct]    [1x1 database.neo
    17        45            'Edge'           47       [1×1 struct]    [1x1 database.neo
    18        47            'Edge'           46       [1×1 struct]    [1x1 database.neo
```

`Relations` is a table that contains these variables:

- Start node identifiers
- Relationship types
- End node identifiers

- Relationship properties
- `Neo4jRelation` objects

Store Directed Graph with Global Node Labels and Relationship Types

Create a `digraph` object and store its contents in a Neo4j® database. Specify a node label to apply to all nodes in the resulting Neo4j graph. Specify a relationship type to apply to all relationships in the resulting Neo4j graph. Display the contents of the graph.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a `digraph` object with three nodes, which represents a new Neo4j graph. These nodes represent three additional people: `User8`, `User9`, and `User10`.

```
G = digraph([1 1 3],[2 3 2],[1 2 3],{'User8','User9','User10'});
```

Store the data in the `digraph` object as a Neo4j graph in the Neo4j database. Specify the node label `Person` for each node in the resulting Neo4j graph by using the

'GlobalNodeLabel' name-value pair argument. Specify the relationship type knows for each relationship in the graph by using the 'GlobalRelationType' name-value pair argument.

```
graphinfo = storeDigraph(neo4jconn,G,'GlobalNodeLabel','Person', ...
    'GlobalRelationType','knows')
```

```
graphinfo = 

  struct with fields:

        Nodes: [3×3 table]
    Relations: [3×5 table]
```

Display information about the Neo4j graph nodes.

```
graphinfo.Nodes
```

```
ans =

  3×3 table

          NodeLabels      NodeData                 NodeObject               
          __________    ____________    ________________________________

    48     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    49     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    50     'Person'     [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

Nodes is a table that contains these variables:

- Node labels
- Node properties
- Neo4jNode objects

Display information about the Neo4j graph relationships.

```
graphinfo.Relations
```

```
ans =
```

```
  3×5 table

          StartNodeID    RelationType    EndNodeID    RelationData          Relatio
          ___________    ____________    _________    ____________    _______________

    37        48            'knows'         50        [1×1 struct]    [1x1 database.neo
    36        48            'knows'         49        [1×1 struct]    [1x1 database.neo
    19        50            'knows'         49        [1×1 struct]    [1x1 database.neo
```

`Relations` is a table that contains these variables:

- Start node identifiers
- Relationship types
- End node identifiers
- Relationship properties
- `Neo4jRelation` objects

Store Directed Graph with Node Labels and Relationship Types

Create a `digraph` object by specifying nodes and edges. Then, store the directed graph in a Neo4j® database by specifying node labels and relationship types. Display the contents of the resulting Neo4j graph.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with values `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message

ans =

     []
```

Create a table for nodes. Define the `names` variable, which contains the names of three additional people: `User8`, `User9`, and `User10`. Then, define the `classification` variable to classify each person as `Person`. Also, define the `titles` variable, which contains the job title of each person. The first two people are analysts and the third is a technician.

```
names = {'User8';'User9';'User10'};
classification = {'Person';'Person';'Person'};
titles = {'Analyst';'Analyst';'Technician'};
nodetable = table(names,classification,titles,'VariableNames', ...
    {'Name','Classification','Title'});
```

Create a table with two edges. One edge specifies that two people know each other. The other edge specifies that two people work with each other.

```
edge1 = [1 2];
edge2 = [3 3];
description = {'knows','works with'};
edgetable = table([edge1',edge2'],description', ...
    'VariableNames',{'EndNodes','Description'});
```

Create a `digraph` object using the node and edge tables.

```
G = digraph(edgetable,nodetable);
```

Store the data in the `digraph` object as a Neo4j graph in the Neo4j database. Specify the node labels for each node in the resulting Neo4j graph by using the `'NodeLabel'` name-value pair argument. The graph uses the `Classification` and `Title` variables of the node table for the node labels. Also, the graph uses the `Description` variable of the edge table for the relationship types.

```
labels = {'Classification';'Title'};
relation = 'Description';
graphinfo = storeDigraph(neo4jconn,G,'NodeLabel',labels, ...
    'RelationType',relation)

graphinfo =
```

```
  struct with fields:

        Nodes: [3×3 table]
    Relations: [2×5 table]
```

Display information about the Neo4j graph nodes.

```
graphinfo.Nodes
```

```
ans =

  3×3 table

           NodeLabels      NodeData                 NodeObject
           __________    ____________    ________________________________

    51    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    52    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
    53    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.Neo4jNode]
```

`Nodes` is a table that contains these variables:

- Node labels
- Node properties
- `Neo4jNode` objects

Display information about the Neo4j graph relationships.

```
graphinfo.Relations
```

```
ans =

  2×5 table

           StartNodeID    RelationType    EndNodeID    RelationData            Relatio
           ___________    ____________    _________    ____________    ________________

    26         51         'knows'            53        [1×1 struct]    [1x1 database.neo
    27         52         'works with'       53        [1×1 struct]    [1x1 database.neo
```

`Relations` is a table that contains these variables:

- Start node identifiers
- Relationship types
- End node identifiers
- Relationship properties
- `Neo4jRelation` objects

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`G` — Directed graph
`digraph` object

Directed graph, specified as a `digraph` object.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside quotes. You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `graphinfo = storeDigraph(neo4jconn,G,'GlobalNodeLabel','Person','GlobalRelationType','knows')` stores a directed graph and specifies that all nodes in the resulting graph have the `Person` node label and all relationships have the `knows` type.

Note If you do not specify `'GlobalNodeLabel'` or `'NodeLabel'`, the resulting Neo4j graph contains nodes without labels.

`GlobalNodeLabel` — Global node label
character vector | cell array of character vectors | string scalar | string array

Global node label, specified as the comma-separated pair consisting of `'GlobalNodeLabel'` and a character vector, cell array of character vectors, string scalar, or string array. To specify one node label, use a character vector or string scalar. To specify multiple node labels, use a cell array of character vectors or string array.

After you execute the `storeDigraph` function, each node in the resulting Neo4j graph contains node labels that you specify using this name-value pair argument.

Example: `"Person"`

Example: `{'Person','Employee'}`

Data Types: `char` | `string` | `cell`

`NodeLabel` — Node label
character vector | cell array of character vectors | string scalar | string array

Node label, specified as the comma-separated pair consisting of `'NodeLabel'` and a character vector, cell array of character vectors, string scalar, or string array. To specify one node label, use a character vector or string scalar. To specify multiple node labels, specify a cell array of character vectors or string array.

To specify different node labels for nodes in the resulting Neo4j graph, use this name-value pair argument. The specified node labels must match the variable names in the table of node information in the `digraph` object.

Example: `"Person"`

Example: `{'Name','Title'}`

Data Types: `char` | `string` | `cell`

`GlobalRelationType` — Global relationship type
`'Edge'` (default) | character vector | string scalar

Global relationship type, specified as the comma-separated pair consisting of `'GlobalRelationType'` and a character vector or string scalar. To specify the type of all relationships between nodes in the resulting Neo4j graph, use this name-value pair argument.

Note When specifying the type of relationship, use either the `'GlobalRelationType'` or `'RelationType'` name-value pair argument. You cannot specify both of these arguments at the same time.

Example: `"knows"`

Data Types: `char` | `string`

`RelationType` — Relationship type
`'Edge'` (default) | character vector | string scalar

Relationship type, specified as the comma-separated pair consisting of `'RelationType'` and a character vector or string scalar. To specify different types of relationships between nodes in the resulting Neo4j graph, use this name-value pair argument. The specified types must match the variable names in the table of edge information in the `digraph` object.

Note When specifying the type of relationship, use either the `'RelationType'` or `'GlobalRelationType'` name-value pair argument. You cannot specify both of these arguments at the same time.

Example: `'Description'`

Data Types: `char` | `string`

Output Arguments

`graphinfo` — Graph information
structure

Graph information in the Neo4j database, returned as a structure with these fields.

Field	Description
Nodes	Table that contains node information for each node in the Relations table. The • NodeLabels — Character vector that denotes the node label • NodeData — Structure array that contains node information such as propert • NodeObject — Neo4jNode object that represents each node The row names in the table are Neo4j node identifiers.
Relations	Table that contains relationship information for the nodes in the Nodes table. Th • StartNodeID — Node identifier for the start node of each relationship • RelationType — Character vector that denotes the type of each relationshi • EndNodeID — Node identifier for the end node of each relationship • RelationData — Structure array that contains property keys associated wi • RelationObject — Neo4jRelation object that represents each relationsh The row names in the table are Neo4j relationship identifiers.

Tips

The `storeDigraph` function stores all MATLAB objects as JSON `string` equivalents in the Neo4j graph. For example, the function stores the date `datetime('Jan/01/2017')` as `"Jan/01/2017"` in the Neo4j graph.

See Also

`createNode` | `createRelation` | `deleteNode` | `deleteRelation` | `neo4j` | `updateNode` | `updateRelation`

Topics

"Add and Query Group of Colleagues in Social Neighborhood" on page 7-20
"Working with MATLAB Interface to Neo4j" on page 7-9

Introduced in R2018a

mongo

MongoDB connection

Description

The `mongo` function creates a `mongo` object using the Database Toolbox interface for MongoDB. With the object, you can connect to MongoDB stored on one or more database servers.

First, you must install the Database Toolbox interface for MongoDB. For details, see “Database Toolbox Interface for MongoDB Installation” on page 8-19.

Using the `mongo` object, you can manage collections in the database. You can also query documents stored in a collection and import them into the MATLAB workspace. From MATLAB, you can export MATLAB tables, structures, and objects into MongoDB. For details about MongoDB, see the MongoDB Manual.

Creation

Syntax

```
conn = mongo(server,port,dbname)
conn = mongo(server,port,dbname,'UserName',username,'Password',
password)
```

Description

`conn = mongo(server,port,dbname)` creates a MongoDB connection to the database server using a database name and sets the Port property.

`conn = mongo(server,port,dbname,'UserName',username,'Password',
password)` specifies a user name and password for connecting to MongoDB.

Input Arguments

`server` — Server name
string scalar | string array

Server name, specified as a string scalar for one database server name or a string array for multiple database server names.

Example: `"localhost"`

Data Types: `string`

`dbname` — Database name
string scalar

Database name, specified as a string scalar.

Example: `"employeesdb"`

Data Types: `string`

`username` — User name
string scalar

User name, specified as a string scalar. Contact your MongoDB administrator for access credentials.

Example: `"username"`

Data Types: `string`

`password` — Password
string scalar

Password, specified as a string scalar. Contact your MongoDB administrator for access credentials.

Example: `"pwd"`

Data Types: `string`

Properties

`Database` — Database name
character vector

This property is read-only.

Database name, specified as a character vector.

The `dbname` input argument sets this property.

Example: `'databasename'`

Data Types: `char`

`UserName` — User name
character vector

This property is read-only.

User name, specified as a character vector.

The `username` input argument sets this property.

Example: `'username'`

Data Types: `char`

`Server` — Server name
cell array of character vectors

This property is read-only.

Server name, specified as a cell array of character vectors. Each character vector in the cell array specifies one database server name.

The `server` input argument sets this property.

Example: `{'server1'}`

Data Types: `cell`

`Port` — Port number
numeric scalar | numeric vector

This property is read-only.

Port number, specified as a numeric scalar for one port or a numeric vector for multiple ports.

Example: `27017`

Data Types: `double`

`CollectionNames` — Collection names
cell array of character vectors

This property is read-only.

Collection names of all collections defined in MongoDB, specified as a cell array of character vectors.

Example: `{'airlinesmall', 'employee', 'largedata' ... and 3 more}`

Data Types: `cell`

`TotalDocuments` — Count of documents in all collections
numeric scalar

This property is read-only.

Count of the documents in all collections defined in MongoDB, specified as a numeric scalar.

Data Types: `double`

Object Functions

MongoDB Connection

isopen	Determine if MongoDB connection is open
close	Close MongoDB connection

Import Document Collections into MATLAB

count	Count total number of documents in MongoDB collection
distinct	Retrieve distinct values for field in MongoDB collection
find	Retrieve documents in MongoDB collection

Export and Manage Document Collections in MongoDB

createCollection	Create MongoDB collection
dropCollection	Drop MongoDB collection
insert	Insert one or multiple documents into MongoDB collection
remove	Remove one or multiple documents from MongoDB collection
update	Update one or multiple documents in MongoDB collection

Examples

Create MongoDB Connection

Connect to MongoDB and count the total number of documents in a collection.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.

- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Determine the number of documents in the `employee` collection. There are 25 documents in the collection.

```
collection = "employee";
n = count(conn,collection)
```

```
n =

    25
```

Close the MongoDB connection.

```
close(conn)
```

Create MongoDB Connection Using User Name and Password

Connect to MongoDB and count the total number of documents in a collection. Specify a user name and password to connect to the database.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`. Specify the user name `adminuser` and password `matlab`.

```
conn = mongo("dbtb01",27017,"mongotest",'UserName',"adminuser",'Password',"matlab")
```

```
conn = 

  mongo with properties:

             Database: 'mongotest'
```

```
           UserName: 'adminuser'
             Server: {'dbtb01'}
               Port: 27017
    CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
     TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is `adminuser`.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Check the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Determine the number of documents in the `employee` collection. There are 25 documents in the collection.

```
collection = "employee";
n = count(conn,collection)
```

```
n =

    25
```

Close the MongoDB connection.

```
close(conn)
```

See Also

Topics

“Database Toolbox Interface for MongoDB Installation” on page 8-19
“Import and Analyze Data from MongoDB” on page 8-2
“Import Filtered Data from MongoDB” on page 8-5
“Import Large Data from MongoDB” on page 8-8
“Export MATLAB Data into MongoDB” on page 8-11
“Import and Export MATLAB Objects Using MongoDB” on page 8-15
“Database Toolbox Interface for MongoDB Error Messages” on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

close

Close MongoDB connection

Syntax

`close(conn)`

Description

`close(conn)` closes the MongoDB connection.

Examples

Close MongoDB Connection

Connect to MongoDB and count the total number of documents in a collection.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Determine the number of documents in the `employee` collection. There are 25 documents in the collection.

```
collection = "employee";
n = count(conn,collection)
```

```
n =

    25
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB connection
`mongo` object

MongoDB connection, specified as a `mongo` object.

See Also
`find` | `isopen` | `mongo`

Topics
"Import and Analyze Data from MongoDB" on page 8-2
"Import Filtered Data from MongoDB" on page 8-5
"Import Large Data from MongoDB" on page 8-8
"Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites
MongoDB Manual

Introduced in R2017b

isopen

Determine if MongoDB connection is open

Syntax

`i = isopen(conn)`

Description

`i = isopen(conn)` returns `1` if the MongoDB connection is open and `0` if it is closed.

Examples

Verify MongoDB Connection

Connect to MongoDB and count the total number of documents in a collection.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn =

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Determine the number of documents in the `employee` collection. There are 25 documents in the collection.

```
collection = "employee";
n = count(conn,collection)
```

```
n =

    25
```

Close the MongoDB connection.

```
close(conn)
```

Verify the MongoDB connection is closed.

```
isopen(conn)
```

```
ans =

  logical
```

```
0
```

Input Arguments

conn — MongoDB connection
`mongo` object

MongoDB connection, specified as a `mongo` object.

See Also

`close` | `find` | `mongo`

Topics

"Import and Analyze Data from MongoDB" on page 8-2
"Import Filtered Data from MongoDB" on page 8-5
"Import Large Data from MongoDB" on page 8-8
"Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

createCollection

Create MongoDB collection

Syntax

`createCollection(conn,collection)`

Description

`createCollection(conn,collection)` creates a collection in MongoDB by using the MongoDB connection.

Examples

Create Collection in MongoDB

Connect to MongoDB and create a collection.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

conn is the mongo object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Create a collection in the database using the MongoDB connection. Specify the collection name taxidata.

```
collection = "taxidata";
createCollection(conn,collection)
```

Display the collections in the database by using the CollectionNames property. The database contains the new collection taxidata.

```
conn.CollectionNames
```

```
ans =

  1×7 cell array

  Columns 1 through 5

    {'airlinesmall'}    {'employee'}    {'largedata'}    {'nyctaxi'}    {'product'}

  Columns 6 through 7

    {'restaurants'}    {'taxidata'}
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB connection
mongo object

MongoDB connection, specified as a mongo object.

collection — Collection name
string scalar

Collection name, specified as a string scalar.

Example: "taxidata"

Data Types: string

See Also

close | dropCollection | find | insert | isopen | mongo

Topics

“Import and Analyze Data from MongoDB” on page 8-2
“Import Filtered Data from MongoDB” on page 8-5
“Import Large Data from MongoDB” on page 8-8
“Database Toolbox Interface for MongoDB Error Messages” on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

dropCollection

Drop MongoDB collection

Syntax

`dropCollection(conn,collection)`

Description

`dropCollection(conn,collection)` drops an existing collection from MongoDB by using the MongoDB connection.

Examples

Drop Collection from MongoDB

Connect to MongoDB and drop a collection.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

conn is the mongo object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Display the collections in the database before dropping a collection by using the CollectionNames property.

```
conn.CollectionNames
```

```
ans =

  1×7 cell array

  Columns 1 through 5

    {'airlinesmall'}    {'employee'}    {'largedata'}    {'nyctaxi'}    {'product'}

  Columns 6 through 7

    {'restaurants'}    {'taxidata'}
```

Drop an existing collection from the database by using the MongoDB connection. Specify the collection name taxidata.

```
collection = "taxidata";
dropCollection(conn,collection)
```

Display the collections in the database again by using the `CollectionNames` property. The database no longer contains the collection `taxidata`.

```
conn.CollectionNames
```

```
ans =

  1×7 cell array

  Columns 1 through 5

    {'airlinesmall'}    {'employee'}    {'largedata'}    {'nyctaxi'}    {'product'}

  Columns 6

    {'restaurants'}
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB connection

`mongo` object

MongoDB connection, specified as a `mongo` object.

collection — Collection name

string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

See Also

`close` | `createCollection` | `find` | `isopen` | `mongo`

Topics

“Import and Analyze Data from MongoDB” on page 8-2
“Import Filtered Data from MongoDB” on page 8-5

"Import Large Data from MongoDB" on page 8-8
"Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

count

Count total number of documents in MongoDB collection

Syntax

```
n = count(conn,collection)
n = count(conn,collection,'Query',mongoquery)
```

Description

`n = count(conn,collection)` returns the total number of documents in a collection by using the MongoDB connection.

`n = count(conn,collection,'Query',mongoquery)` returns the total number of documents in an executed MongoDB query on a collection.

Examples

Count Documents in Collection

Connect to MongoDB and count the total number of documents in a collection.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
```

```
              Server: {'dbtb01'}
                Port: 27017
     CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
      TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Determine the number of documents in the `employee` collection. There are 25 documents in the collection.

```
collection = "employee";
n = count(conn,collection)
```

```
n =

    25
```

Close the MongoDB connection.

```
close(conn)
```

Count Documents in MongoDB Query

Connect to MongoDB and count the total number of documents in a MongoDB query on a collection in the database. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn =

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Create a JSON-style query as a character vector that contains a JSON-style string. This query sets the `department` field equal to the value `Sales`.

```
mongoquery = '{"department":"Sales"}';
```

Use the MongoDB query on the `employee` collection to count the total number of employees who work in the Sales department. A total of four employees work in the Sales department.

```
collection = "employee";
n = count(conn,collection,'Query',mongoquery)
```

```
n =

     4
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB connection
`mongo` object

MongoDB connection, specified as a `mongo` object.

`collection` — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

`mongoquery` — MongoDB query
string scalar | character vector

MongoDB query, specified as a string scalar or character vector. Specify a JSON-style string to query the database.

Example: `'{"department":"Sales"}'` queries the database for documents where the `department` field is equal to `Sales`.

Example: `'{salary: {$gt: 90000}}'` queries the database for documents where the value of the `salary` field is greater than `90000`.

Data Types: `char` | `string`

Output Arguments

n — Total number of documents
numeric scalar

Total number of documents in a MongoDB collection or query, returned as a numeric scalar.

See Also

`close` | `distinct` | `find` | `isopen` | `mongo`

Topics

"Import and Analyze Data from MongoDB" on page 8-2
"Import Filtered Data from MongoDB" on page 8-5
"Import Large Data from MongoDB" on page 8-8
"Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

distinct

Retrieve distinct values for field in MongoDB collection

Syntax

```
values = distinct(conn,collection,field)
values = distinct(conn,collection,field,'Query',mongoquery)
```

Description

`values = distinct(conn,collection,field)` returns distinct values for a field in a collection by using the MongoDB connection.

`values = distinct(conn,collection,field,'Query',mongoquery)` returns distinct values for a field in an executed MongoDB query on a collection.

Examples

Retrieve Distinct Values for Field in Collection

Connect to MongoDB and retrieve a distinct set of values for a field in a collection of documents. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
```

```
            UserName: ''
              Server: {'dbtb01'}
                Port: 27017
     CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
      TotalDocuments: 23485919
```

conn is the mongo object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Retrieve a distinct set of values for a field in a document collection. Here, retrieve distinct salaries for all employees. values is a cell array of doubles.

```
collection = "employee";
field = "salary";
values = distinct(conn,collection,field);
```

Display the first three salaries in the cell array.

```
values{1:3}
```

```
ans =

       60000
```

```
ans =

       50000


ans =

       55000
```

Close the MongoDB connection.

```
close(conn)
```

Retrieve Distinct Values for Field in MongoDB Query

Connect to MongoDB and retrieve a distinct set of values for a field in a MongoDB query. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.

- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Create a JSON-style query as a character vector that contains a JSON-style string. This query sets the `department` field equal to the value `Sales`.

```
mongoquery = '{"department":"Sales"}';
```

Use the MongoDB query on the `employee` collection to retrieve a distinct set of values for a field. Here, retrieve distinct salaries of all employees in the Sales department. `values` is a cell array of doubles.

```
collection = "employee";
field = "salary";
values = distinct(conn,collection,field,'Query',mongoquery)
```

```
values =

  1×3 cell array

    {[60000]}    {[64440]}    {[66000]}
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

`conn` — MongoDB connection
`mongo` object

MongoDB connection, specified as a `mongo` object.

`collection` — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

`field` — Field
string scalar

Field in a collection, specified as a string scalar.

Example: `"department"`

Data Types: `string`

`mongoquery` — MongoDB query
string scalar | character vector

MongoDB query, specified as a string scalar or character vector. Specify a JSON-style string to query the database.

Example: `'{"department":"Sales"}'` queries the database for documents where the `department` field is equal to `Sales`.

Example: `'{salary: {$gt: 90000}}'` queries the database for documents where the value of the `salary` field is greater than `90000`.

Data Types: `char` | `string`

Output Arguments

`values` — Distinct values
cell array

Distinct values of a field in a MongoDB collection or query, specified as a cell array. The cell array can contain numeric scalars for numeric data, character vectors for text data, and structures for nested documents.

See Also

`close` | `count` | `find` | `isopen` | `mongo`

Topics

"Import and Analyze Data from MongoDB" on page 8-2
"Import Filtered Data from MongoDB" on page 8-5
"Import Large Data from MongoDB" on page 8-8
"Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

find

Retrieve documents in MongoDB collection

Syntax

```
documents = find(conn,collection)
documents = find(conn,collection,Name,Value)
```

Description

`documents = find(conn,collection)` returns all documents in a collection by using the MongoDB connection.

`documents = find(conn,collection,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'Limit',10` limits the number of documents returned to 10.

Examples

Retrieve All Documents in Collection

Connect to MongoDB, retrieve all documents in a collection, and import them into MATLAB. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn =

  mongo with properties:
```

```
           Database: 'mongotest'
           UserName: ''
             Server: {'dbtb01'}
               Port: 27017
    CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
     TotalDocuments: 23485919
```

conn is the mongo object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Specify the employee collection for document retrieval. Retrieve all documents in the collection by using the MongoDB connection. documents is a structure array.

```
collection = "employee";
documents = find(conn,collection);
```

Display the first document in the collection. Each document is a structure with these fields.

Field	Description	Data Type
x_id	Unique identifier	Structure

Field	Description	Data Type
department	Department name	Character vector
employee	Employee identifier	Double
salary	Employee salary	Double

```
documents(1)
```

```
ans = 

  struct with fields:

          x_id: [1×1 struct]
    department: 'Sales'
      employee: 1
        salary: 60000
```

Close the MongoDB connection.

```
close(conn)
```

Retrieve All Documents in MongoDB Query

Connect to MongoDB, retrieve all documents in a MongoDB query on a collection in the database, and import them into MATLAB. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

conn is the mongo object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Specify the employee collection for document retrieval. Create the MongoDB query as a character vector that contains a JSON-style string. This query retrieves all employees in the Sales department.

```
collection = "employee";
mongoquery = '{"department":"Sales"}';
```

Retrieve all documents in the MongoDB query on the employee collection by using the MongoDB connection. documents is a structure array that contains a structure for each document returned by the query.

```
documents = find(conn,collection,'Query',mongoquery);
```

Close the MongoDB connection.

```
close(conn)
```

Sort Retrieved Documents in Collection

Connect to MongoDB and retrieve documents in a MongoDB query on a collection in the database. Then, sort the results by a field in the documents. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Specify the `employee` collection for document retrieval. Create the MongoDB query as a character vector that contains a JSON-style string. This query retrieves all employees in the Sales department.

```
collection = "employee";
mongoquery = '{"department":"Sales"}';
```

Create the sort query as a character vector that contains a JSON-style string. Sort the documents by the `salary` field.

```
sortquery = '{"salary":1.0}';
```

Retrieve all documents in the MongoDB query on the `employee` collection by using the MongoDB connection, and sort the documents. `documents` is a structure array that contains a structure for each document returned by the query. The documents are sorted by salary in increasing order.

```
documents = find(conn,collection,'Query',mongoquery,'Sort',sortquery);
```

Display the sorted salaries for the first two employees.

```
documents(1:2).salary
```

```
ans =

       60000


ans =

       64440
```

Close the MongoDB connection.

```
close(conn)
```

Retrieve Specific Fields in Collection

Connect to MongoDB and retrieve all documents in a collection. Specify the fields to retrieve for each document. Import the documents into MATLAB. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Specify the `employee` collection for document retrieval. Specify the fields to retrieve for each document by using a character vector that contains a JSON-style string. Here, return the `department` and `salary` fields.

```
collection = "employee";
fields = '{"department":1.0,"salary":1.0}';
```

Retrieve all documents in the collection. Use the name-value pair argument `'Projection'` to retrieve the specified fields for each document. `documents` is a structure array.

```
documents = find(conn,collection,'Projection',fields);
```

Display the first document in the results. In addition to the unique identifier for the document, the document contains only the specified fields, `department` and `salary`.

```
documents(1)
```

```
ans = 

  struct with fields:

          x_id: [1×1 struct]
    department: 'Sales'
        salary: 60000
```

Close the MongoDB connection.

```
close(conn)
```

Retrieve Specific Number of Documents Using Offset

Connect to MongoDB and retrieve a specific number of documents in a collection in the database. Return documents from a specific position in the results using an offset value. Import the documents into MATLAB. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Specify the `employee` collection for document retrieval.

```
collection = "employee";
```

Use the name-value pair argument 'Skip' to skip the first five documents in the collection. Then, use the name-value pair argument 'Limit' to return the next 10 documents in the collection. documents is structure array that contains 10 documents.

```
documents = find(conn,collection,'Skip',5,'Limit',10);
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB connection
mongo object

MongoDB connection, specified as a mongo object.

collection — Collection name
string scalar

Collection name, specified as a string scalar.

Example: "taxidata"

Data Types: string

Name-Value Pair Arguments

Specify optional comma-separated pairs of Name,Value arguments. Name is the argument name and Value is the corresponding value. Name must appear inside quotes. You can specify several name and value pair arguments in any order as Name1,Value1,...,NameN,ValueN.

Example: 'Skip',5,'Limit',10 skips the first five documents in a collection and returns the next 10 documents.

Query — MongoDB query
string scalar | character vector

MongoDB query, specified as the comma-separated pair consisting of 'Query' and a string scalar or character vector. Specify a JSON-style string to query the database.

Example: `'Query','{"department":"Sales"}'` queries the database for documents where the `department` field is equal to `Sales`.

Example: `'Query','{salary: {$gt: 90000}}'` queries the database for documents where the value of the `salary` field is greater than `90000`.

Example: `'Query','{"_id":{$oid:"593fec95b78dc311e01e9204"}}'` queries the database for the document that has the identifier `593fec95b78dc311e01e9204`.

Data Types: `char` | `string`

`Projection` — Fields
string scalar | character vector

Fields to retrieve in each document, specified as the comma-separated pair consisting of `'Projection'` and a string scalar or character vector. Specify a JSON-style string to describe the fields.

Example: `'Projection','{"department":1.0,"salary":1.0}'` returns the `department` and `salary` fields.

Data Types: `char` | `string`

`Sort` — Sort field
string scalar | character vector

Sort field for documents, specified as the comma-separated pair consisting of `'Sort'` and a string scalar or character vector. Specify a JSON-style string to describe the sort field.

Example: `'Sort','{"department":1.0}'` sorts the returned documents by the `department` field.

Data Types: `char` | `string`

`Skip` — Offset
numeric scalar

Offset from the beginning of the returned documents, specified as the comma-separated pair consisting of `'Skip'` and a numeric scalar.

Example: `'Skip',5` skips the first five returned documents.

Data Types: `double`

`Limit` — Number of documents to return
numeric scalar

Number of documents to return, specified as the comma-separated pair consisting of `'Limit'` and a numeric scalar.

Example: `'Limit',10` returns 10 documents.

Data Types: `double`

Output Arguments

`documents` — Documents
structure | structure array | cell array of structures

Documents in a MongoDB collection or query on a collection, returned as a structure, structure array, or cell array of structures.

Each JSON-style document is represented as a structure. The `find` function returns a:

- Structure for one document
- Structure array for multiple documents containing the same fields
- Cell array of structures for multiple documents containing different fields

Tips

- The `find` function estimates memory requirements when retrieving many documents using the Java heap. To avoid out-of-memory issues, the function automatically limits the number of returned documents in a single execution.

  When an issue occurs, the function throws a warning message, for example, `Warning: Available memory is less than Total memory required. Limiting the RESULTSET from 15837001 to 59248. Use Skip and Limit to retrieve resultset in batches.`

  To retrieve many documents, retrieve them in batches. For an example, see “Import Large Data from MongoDB” on page 8-8.

See Also

`close` | `insert` | `isopen` | `mongo` | `remove` | `update`

Topics

“Import and Analyze Data from MongoDB” on page 8-2
“Import Filtered Data from MongoDB” on page 8-5
“Import Large Data from MongoDB” on page 8-8
“Database Toolbox Interface for MongoDB Error Messages” on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

insert

Insert one or multiple documents into MongoDB collection

Syntax

`n = insert(conn,collection,documents)`

Description

`n = insert(conn,collection,documents)` returns the number of documents inserted into a collection using the MongoDB connection. Specify one or multiple documents to insert.

Examples

Insert One Document into Collection as Structure

Connect to MongoDB and export one document from MATLAB and insert it into a collection. Specify the document to insert as a structure. Here, the collection represents employee data.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
```

```
    CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
     TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Create one document as the `document` structure with these fields: `employee`, `department`, and `salary`.

```
document.employee = 28;
document.department = 'Sales';
document.salary = 200000;
```

Specify the `employee` collection. Insert the document into the collection by using the MongoDB connection. The `insert` function inserts one document into the collection.

```
collection = "employee";
n = insert(conn,collection,document)
```

```
n =

     1
```

Close the MongoDB connection.

```
close(conn)
```

Insert Multiple Documents into Collection as Structure Array

Connect to MongoDB and export multiple documents from MATLAB and insert them into a collection. Specify documents to insert as a structure array. Here, the collection represents employee data.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Create two documents as structures with these fields: `employee`, `department`, and `salary`. Create the `documents` structure array from these documents.

```
employee1.employee = 26;
employee1.department = 'Sales';
employee1.salary = 100000;

employee2.employee = 27;
employee2.department = 'Training';
employee2.salary = 150000;

documents = [employee1 employee2];
```

Specify the `employee` collection. Insert documents into the collection using the MongoDB connection. The `insert` function inserts two documents into the collection.

```
collection = "employee";
n = insert(conn,collection,documents)

n =

     2
```

Close the MongoDB connection.

```
close(conn)
```

Insert Multiple Documents into Collection as Table

Connect to MongoDB and export documents from MATLAB and insert them into a collection. Specify documents to insert as a table. Here, the collection represents employee data.

Create a MongoDB connection to the database mongotest. Here, the database server dbtb01 hosts this database using port number 27017.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

conn is the mongo object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Create two documents using these workspace variables:

- `employee` — Double array
- `department` — Cell array of character vectors
- `salary` — Double array

Create the `documents` table from these workspace variables.

```
employee = [26;27];
department = {'Sales';'Training'};
salary = [100000;150000];
documents = table(department,employee,salary);
```

Specify the `employee` collection. Insert documents into the collection using the MongoDB connection. The `insert` function inserts two documents into the collection.

```
collection = "employee";
n = insert(conn,collection,documents)
```

```
n =

     2
```

Close the MongoDB connection.

```
close(conn)
```

Insert Multiple Documents into Collection as Cell Array of Structures

Connect to MongoDB and export documents from MATLAB and insert them into a collection. Specify documents to insert as a cell array of structures. Here, the collection represents employee data.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:
```

```
           Database: 'mongotest'
           UserName: ''
             Server: {'dbtb01'}
               Port: 27017
    CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
     TotalDocuments: 23485919
```

conn is the mongo object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Create two documents as the structures employee1 and employee2. Create the documents cell array using these structures.

```
employee1.department = 'Sales';
employee1.employee = 26;
employee1.salary = 100000;

employee2.department = 'Training';
employee2.employee = 27;
employee2.salary = 150000;

documents = {employee1;employee2};
```

Specify the `employee` collection. Insert documents into the collection using the MongoDB connection. The `insert` function inserts two documents into the collection.

```
collection = "employee";
n = insert(conn,collection,documents)
```

```
n =

     2
```

Close the MongoDB connection.

```
close(conn)
```

Insert `Map` Object into Collection

Connect to MongoDB and export a `Map` object from MATLAB and insert it into a collection. Here, the collection represents employee data.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.

- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Construct a Map object document that contains an employee's payroll data for the first three months of the year.

```
months = {'January','February','March'};
payslips = [4500,5000,4500];
document = containers.Map(months,payslips);
```

Specify the employee collection. Insert the Map object into the collection using the MongoDB connection. The insert function inserts one document into the collection.

```
collection = "employee";
n = insert(conn,collection,document)
```

```
n =

     1
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB connection
mongo object

MongoDB connection, specified as a `mongo` object.

`collection` — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

`documents` — Documents to insert
string scalar | character vector | structure | ...

Documents to insert into a MongoDB collection, specified as one of these types:

- String scalar
- Character vector
- Structure
- Structure array
- Cell array of structures
- Table
- `Map` object
- Handle or value classes

When working with string scalars and character vectors, you specify key-value pairs as shown in these examples.

- String scalar — `"{'department':'Sales','employeename':'George Mason'}"`
- Character vector — `'{''department'':''Sales'',''employeename'':''George Mason''}'`

For handle and value classes, you can define your own class. After you instantiate a class, you can insert the resulting object into MongoDB. However, the resulting object properties must contain data types that can be converted to MATLAB data types. For example, if one of the object properties is a Java object, then you cannot insert the object into MongoDB. For details about these classes, see “Handle Classes” (MATLAB).

Output Arguments

n — Number of documents inserted
numeric scalar

Number of documents inserted into a collection in the database, returned as a numeric scalar.

See Also

`close` | `containers.Map` | `isopen` | `mongo` | `remove` | `update`

Topics

"Export MATLAB Data into MongoDB" on page 8-11
"Import and Export MATLAB Objects Using MongoDB" on page 8-15
"Import and Analyze Data from MongoDB" on page 8-2
"Import Filtered Data from MongoDB" on page 8-5
"Import Large Data from MongoDB" on page 8-8
"Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

remove

Remove one or multiple documents from MongoDB collection

Syntax

`n = remove(conn,collection,mongoquery)`

Description

`n = remove(conn,collection,mongoquery)` returns the number of documents removed from a collection using the MongoDB connection. Use a MongoDB query to specify removing one or multiple documents.

Examples

Remove Documents Using MongoDB Query

Connect to MongoDB and remove documents from a collection. Specify a MongoDB query to determine which documents to remove. Here, the collection represents employee data.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

conn is the mongo object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains six document collections. The first three collection names are airlinesmall, employee, and largedata.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Create a MongoDB query to identify documents to remove. Here, specify the employee collection. Create the MongoDB query to identify documents in the Sales department.

```
collection = "employee";
mongoquery = '{"department":"Sales"}';
```

Remove documents using the MongoDB query. The remove function removes six documents from the collection.

```
n = remove(conn,collection,mongoquery)
```

```
n =

     6
```

Close the MongoDB connection.

```
close(conn)
```

Remove All Documents from Collection

Connect to MongoDB and remove all documents from a collection.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
        CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
         TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = 

  logical
```

```
    1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Remove all documents from the `employee` collection. Use an empty MongoDB query to specify removing all documents. The `remove` function removes three documents from the collection.

```
collection = "employee";
n = remove(conn,collection,"{}")

n =

     3
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

`conn` — MongoDB connection
`mongo` object

MongoDB connection, specified as a `mongo` object.

`collection` — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

`mongoquery` — MongoDB query
string scalar | character vector

MongoDB query, specified as a string scalar or character vector. Specify a JSON-style string to query the database.

Example: `'{"department":"Sales"}'` queries the database for documents where the `department` field is equal to `Sales`.

Example: `'{salary: {$gt: 90000}}'` queries the database for documents where the value of the `salary` field is greater than `90000`.

Data Types: `char` | `string`

Output Arguments

n — Number of documents removed
numeric scalar

Number of documents removed from a collection in the database, returned as a numeric scalar.

See Also

`close` | `insert` | `isopen` | `mongo` | `update`

Topics

"Export MATLAB Data into MongoDB" on page 8-11
"Import and Export MATLAB Objects Using MongoDB" on page 8-15
"Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

update

Update one or multiple documents in MongoDB collection

Syntax

`n = update(conn,collection,findquery,updatequery)`

Description

`n = update(conn,collection,findquery,updatequery)` returns the number of documents updated in a collection using the MongoDB connection. Use MongoDB queries to find and update documents.

Examples

Update Documents in Collection

Connect to MongoDB and update documents in a collection. Find documents to update by using a MongoDB query. Specify the criteria for the update by using a MongoDB query. Here, the collection represents employee data.

Create a MongoDB connection to the database `mongotest`. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongo(server,port,dbname)
```

```
conn = 

  mongo with properties:

               Database: 'mongotest'
               UserName: ''
                 Server: {'dbtb01'}
                   Port: 27017
```

```
    CollectionNames: {'airlinesmall', 'employee', 'largedata' ... and 3 more}
     TotalDocuments: 23485919
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains six document collections. The first three collection names are `airlinesmall`, `employee`, and `largedata`.
- This database contains 23,485,919 documents.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Specify the `employee` collection. Create a MongoDB query to find employees in the Sales department. Then, create a MongoDB query to increase the value in the `salary` field by 5000.

```
collection = "employee";
findquery = '{"department":"Sales"}';
updatequery = '{$inc:{"salary":5000}}';
```

Increase the salaries for all employees in the Sales department using the MongoDB connection. The `update` function updates seven documents in the collection.

```
n = update(conn,collection,findquery,updatequery)
```

```
n =

     7
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB connection
mongo object

MongoDB connection, specified as a `mongo` object.

collection — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

findquery — MongoDB find query
string scalar | character vector

MongoDB find query, specified as a string scalar or character vector. Specify a JSON-style string to find documents in the database.

Example: `'{"department":"Sales"}'` finds all documents where the `department` field is equal to `Sales`.

Example: `'{"_id":{$oid:"593fec95b78dc311e01e9204"}}'` finds the document that has the identifier `593fec95b78dc311e01e9204`.

Data Types: `char` | `string`

updatequery — MongoDB update query
string scalar | character vector

MongoDB update query, specified as a string scalar or character vector. Use a JSON-style string to specify the criteria for the update.

Example: `'{$inc:{"salary":5000}}'` increases the values in the `salary` field by `5000`.

Data Types: `char` | `string`

Output Arguments

n — Number of documents updated
numeric scalar

Number of documents updated in a collection in the database, returned as a numeric scalar.

See Also

`close` | `insert` | `isopen` | `mongo` | `remove`

Topics

"Export MATLAB Data into MongoDB" on page 8-11
"Import and Export MATLAB Objects Using MongoDB" on page 8-15
"Database Toolbox Interface for MongoDB Error Messages" on page 8-21

External Websites

MongoDB Manual

Introduced in R2017b

cassandra

Apache Cassandra database connection

Description

The `cassandra` function creates a `cassandra` object, which represents an Apache Cassandra database connection using the Database Toolbox Interface for Apache Cassandra Database.

First, you must install the Database Toolbox Interface for Apache Cassandra Database. For details, see “Database Toolbox Interface for Apache Cassandra Database Installation” on page 6-7.

After you create a `cassandra` object, you can use the object functions to import data from the Cassandra database into MATLAB. You can also explore the database structure and execute Cassandra Query Language (CQL) queries.

For details about the Cassandra database, see the Apache Cassandra Documentation.

Creation

Syntax

```
c = cassandra(contactPoints)
c = cassandra(contactPoints,username,password)
c = cassandra( ___ ,'PortNumber',portnumber)
```

Description

`c = cassandra(contactPoints)` creates a Cassandra database connection using a host address.

`c = cassandra(contactPoints,username,password)` specifies a user name and password.

`c = cassandra( ___ ,'PortNumber',portnumber)` specifies a port number for connection to the host using the input argument combinations in any of the previous syntaxes.

Input Arguments

`contactPoints` — Host address
character vector | string scalar | cell array of character vectors | string array

Host address for one node or host addresses for multiple nodes in the Cassandra cluster, specified as a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar for one node. Or, specify a cell array of character vectors or string array for multiple nodes.

You can specify a local host or the IP address of a different machine in the Cassandra cluster.

When you specify multiple nodes, if the connection to one host fails, then the `cassandra` function connects to the other nodes in the cell array or string array until a connection succeeds. If a connection attempt fails for all specified nodes, the `cassandra` function displays an error message. If one or more nodes are not available, enter multiple nodes in the cell array or string array to increase the likelihood of a successful connection.

Example: `'localhost'`

Data Types: `cell` | `char` | `string`

`username` — User name
character vector | string scalar

User name, specified as a character vector or string scalar. If the cluster requires authentication, use the `username` input argument for the user name.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password, specified as a character vector or string scalar. If the cluster requires authentication, use the `password` input argument for the password.

Data Types: `char` | `string`

`portnumber` — Port number
`9042` (default) | numeric scalar

Port number for connection to the host, specified as a numeric scalar.

Data Types: `double`

Properties

`Cluster` — Cassandra cluster name
string scalar

Cassandra cluster name, specified as a string scalar.

Example: `"Test Cluster"`

Data Types: `string`

`HostAddresses` — Host address
string scalar | string array

Host address for one node or host addresses for multiple nodes in the Cassandra cluster, specified as a string scalar for one node or string array for multiple nodes. These addresses include the addresses specified in the `contactPoints` input argument.

Example: `"localhost/127.0.0.1"`

Data Types: `string`

`LocalDataCenter` — Local data center name
string scalar

Local data center name, specified as a string scalar. The name describes the data center that the cluster declares as local for the connection instance. The name matches the data center of the original contact point for the connection. When you set up the cluster, you define a data center for each node.

Example: `"datacenter1"`

Data Types: `string`

`Keyspaces` — Keyspaces
string scalar | string array

Keyspaces in the Cassandra database, specified as a string scalar or string array. A string scalar indicates the Cassandra database has one keyspace, and a string array indicates multiple keyspaces.

Example: `["employeedata" "system"]`

Data Types: `string`

Object Functions

Cassandra Database Connection

close	Close Apache Cassandra database connection
isopen	Determine if Apache Cassandra database connection is open

Import Cassandra Database Data into MATLAB

columninfo	Retrieve column information from Apache Cassandra database table
partitionRead	Import data from partitions of Apache Cassandra database table
tablenames	List names of database tables in Apache Cassandra database

Execute CQL Query

executecql	Execute CQL query on Apache Cassandra database

Examples

Create Cassandra Database Connection

Using a local host address, create a Cassandra® database connection and display the keyspaces in the database.

Create a Cassandra database connection using the local host address.

```
contactPoints = "localhost";
conn = cassandra(contactPoints)
```

```
conn = 
  cassandra with properties:
```

```
              Cluster: "Test Cluster"
        HostAddresses: "localhost/127.0.0.1"
      LocalDataCenter: "datacenter1"
            Keyspaces: ["employeedata", "system", "system_auth" ... and 3 more]
```

conn is a cassandra object that contains these properties:

- Cluster name
- Host address
- Local data center name
- Keyspaces

Display the keyspaces in the Cassandra database by accessing the Keyspaces property of the cassandra object.

```
conn.Keyspaces
```

```
ans = 1×6 string array
    "employeedata"    "system"    "system_auth"    "system_distributed"    "system_sche
```

Close the Cassandra database connection.

```
close(conn)
```

Create Cassandra Database Connection Using Authentication

Using a local host address and authentication, create a Cassandra® database connection and display the keyspaces in the database.

Create a Cassandra database connection using the local host address, user name, and password.

```
contactPoints = "localhost";
username = "username";
password = "password";
conn = cassandra(contactPoints,username,password)
```

```
conn =
  cassandra with properties:
```

```
               Cluster: "Test Cluster"
         HostAddresses: "localhost/127.0.0.1"
       LocalDataCenter: "datacenter1"
             Keyspaces: ["employeedata", "system", "system_auth" ... and 3 more]
```

`conn` is a `cassandra` object that contains these properties:

- Cluster name
- Host address
- Local data center name
- Keyspaces

Display the keyspaces in the Cassandra database by accessing the `Keyspaces` property of the `cassandra` object.

```
conn.Keyspaces
```

```
ans = 1×6 string array
    "employeedata"    "system"    "system_auth"    "system_distributed"    "system_sche
```

Close the Cassandra database connection.

```
close(conn)
```

Create Cassandra Database Connection Using Port Number

Using a local host address and port number, create a Cassandra® database connection and display the keyspaces in the database.

Create a Cassandra database connection using the local host address. Specify the port number `9042`.

```
contactPoints = "localhost";
portnumber = 9042;
conn = cassandra(contactPoints,'PortNumber',portnumber)
```

```
conn = 
  cassandra with properties:
```

```
            Cluster: "Test Cluster"
      HostAddresses: "localhost/127.0.0.1"
    LocalDataCenter: "datacenter1"
          Keyspaces: ["employeedata", "system", "system_auth" ... and 3 more]
```

`conn` is a `cassandra` object that contains these properties:

- Cluster name
- Host address
- Local data center name
- Keyspaces

Display the keyspaces in the Cassandra database by accessing the `Keyspaces` property of the `cassandra` object.

```
conn.Keyspaces
```

```
ans = 1×6 string array
    "employeedata"    "system"    "system_auth"    "system_distributed"    "system_sche
```

Close the Cassandra database connection.

```
close(conn)
```

See Also

Topics

"Database Toolbox Interface for Apache Cassandra Database Installation" on page 6-7
"Explore and Import Data from Cassandra Database Table" on page 6-14
"Import Data from Cassandra Database Table Using CQL" on page 6-18
"Convert CQL Data Types to MATLAB Data Types" on page 6-2
"Fill Values for Missing Data from Apache Cassandra Database" on page 6-9
"Database Toolbox Interface for Apache Cassandra Database Error Messages" on page 6-11

External Websites

Apache Cassandra
Apache Cassandra Documentation

Introduced in R2018b

close

Close Apache Cassandra database connection

Syntax

`close(conn)`

Description

`close(conn)` closes the Cassandra database connection.

Examples

Close Cassandra Database Connection

Using a Cassandra® database connection, display the keyspaces and then close the connection.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Verify that the Cassandra database connection is open.

```
val = isopen(conn)
```

```
val = logical
   1
```

The database connection is open because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Display the keyspaces in the Cassandra database.

```
conn.Keyspaces
```

```
ans = 1×6 string array
    "employeedata"    "system"    "system_auth"    "system_distributed"    "system_sche
```

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Cassandra database connection
`cassandra` object

Cassandra database connection, specified as a `cassandra` object.

See Also

`cassandra` | `columninfo` | `executecql` | `isopen` | `partitionRead` | `tablenames`

Topics

"Database Toolbox Interface for Apache Cassandra Database Installation" on page 6-7
"Explore and Import Data from Cassandra Database Table" on page 6-14
"Import Data from Cassandra Database Table Using CQL" on page 6-18
"Database Toolbox Interface for Apache Cassandra Database Error Messages" on page 6-11

External Websites

Apache Cassandra Documentation

Introduced in R2018b

isopen

Determine if Apache Cassandra database connection is open

Syntax

```
val = isopen(conn)
```

Description

`val = isopen(conn)` returns `1` if the Cassandra database connection is open and `0` if it is closed.

Examples

Verify Cassandra Connection

Using a Cassandra® database connection, verify that the connection is open. Display the keyspaces in the Cassandra database, and then close the connection.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Verify that the Cassandra database connection is open.

```
val = isopen(conn)
```

```
val = logical
   1
```

The database connection is open because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Display the keyspaces in the Cassandra database.

```
conn.Keyspaces
```

```
ans = 1×6 string array
    "employeedata"    "system"    "system_auth"    "system_distributed"    "system_sche
```

Close the Cassandra database connection.

```
close(conn)
```

Verify that the Cassandra database connection is closed.

```
val = isopen(conn)
```

```
val = logical
   0
```

Input Arguments

conn — Cassandra database connection
`cassandra` object

Cassandra database connection, specified as a `cassandra` object.

See Also

`cassandra` | `close` | `columninfo` | `executecql` | `partitionRead` | `tablenames`

Topics

"Database Toolbox Interface for Apache Cassandra Database Installation" on page 6-7
"Explore and Import Data from Cassandra Database Table" on page 6-14
"Import Data from Cassandra Database Table Using CQL" on page 6-18
"Database Toolbox Interface for Apache Cassandra Database Error Messages" on page 6-11

External Websites

Apache Cassandra Documentation

Introduced in R2018b

columninfo

Retrieve column information from Apache Cassandra database table

Syntax

```
cols = columninfo(conn,keyspace,tablename)
[cols,keyValues] = columninfo(conn,keyspace,tablename)
```

Description

`cols = columninfo(conn,keyspace,tablename)` returns column information from a specified Cassandra database table in a specified keyspace using the Cassandra database connection.

`[cols,keyValues] = columninfo(conn,keyspace,tablename)` also returns the key values for each partition in the Cassandra database table.

Examples

Return Column Information from Cassandra Database Table

Using a Cassandra® database connection, return column information for a Cassandra database table. Specify the keyspace and the name of the table. In this case, the Cassandra database has the `employeedata` keyspace, which contains the `employees_by_job` database table.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Return column information for the `employees_by_job` database table in the `employeedata` keyspace.

```
keyspace = "employeedata";
tablename = "employees_by_job";
cols = columninfo(conn,keyspace,tablename);
```

Display the first few rows of column information.

```
head(cols)
```

```
ans=8×4 table
          Name            DataType    PartitionKey    ClusteringColumn
    ________________    ________    ____________    ________________

    "job_id"            "text"         true                ""
    "hire_date"         "date"         false               "DESC"
    "employee_id"       "int"          false               "ASC"
    "commission_pct"    "double"       false               ""
    "department_id"     "int"          false               ""
    "email"             "text"         false               ""
    "first_name"        "text"         false               ""
    "last_name"         "text"         false               ""
```

`cols` is a table with these variables:

- `Name` — Cassandra database column name
- `DataType` — Cassandra Query Language (CQL) data type of the Cassandra database column
- `PartitionKey` — Partition key indicator
- `ClusteringColumn` — Clustering column indicator

Close the Cassandra database connection.

```
close(conn)
```

Return Partition Key Values from Cassandra Database Table

Using a Cassandra® database connection, return partition key values for a Cassandra database table. Specify the keyspace and name of the table. In this case, the Cassandra database has the `employeedata` keyspace, which contains the `employees_by_job` database table.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Return column information for the `employees_by_job` database table in the `employeedata` keyspace.

```
keyspace = "employeedata";
tablename = "employees_by_job";
[cols,keyValues] = columninfo(conn,keyspace,tablename);
```

`keyValues` is a table that contains a variable for each partition key. The rows are partition key values.

Display the first few partition key values of the Cassandra database table.

```
head(keyValues)
```

```
ans=8×1 table
      job_id
    __________

    "ST_CLERK"
    "SA_MAN"
    "HR_REP"
    "IT_PROG"
    "FI_MGR"
    "PR_REP"
    "PU_MAN"
    "AD_PRES"
```

`job_id` is the only partition key in the `employees_by_job` database table. Each row is a partition key value that is a unique partition in `employees_by_job`.

Use the partition key values with the `partitionRead` function to import data from a Cassandra database table.

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Cassandra database connection
cassandra object

Cassandra database connection, specified as a `cassandra` object.

keyspace — Keyspace
character vector | string scalar

Keyspace, specified as a character vector or string scalar. If you do not know the keyspace, then access the `Keyspaces` property of the `cassandra` object using dot notation to view the keyspaces in the Cassandra database.

Example: `"employeedata"`

Data Types: `char` | `string`

tablename — Cassandra database table name
character vector | string scalar

Cassandra database table name, specified as a character vector or string scalar. If you do not know the name of the table, then use the `tablenames` function to find it.

Example: `"employees_by_job"`

Data Types: `char` | `string`

Output Arguments

cols — Column information
table

Column information from a Cassandra database table, returned as a MATLAB table containing these variables.

Variable Name	Variable Description	Variable Data Type
`Name`	Cassandra database column name	`string`
`DataType`	CQL data type of the Cassandra database column	`string`

Variable Name	Variable Description	Variable Data Type
`PartitionKey`	Whether the Cassandra database table column is a partition key (`true` indicates a partition key)	`logical`
`ClusteringColumn`	Whether the Cassandra database table column is a clustering column (`"ASC"` indicates ascending order, `"DESC"` indicates descending order, and `""` indicates that the column is not a clustering column)	`string`

If the data type of a column in a Cassandra database table is a collection (for example, a `list`, `map`, and so on), then the value of the `DataType` variable contains angle brackets (<>). These angle brackets surround the data type of the items in the collection. The value for user-defined types (UDTs) contains the type name. For example, if the UDT is `person`, then the value of the `DataType` variable is `person` in the MATLAB table. For details about valid CQL data types, see CQL data types.

keyValues — Partition key values
table

Partition key values, returned as a table. The MATLAB table contains one variable for each partition key in the Cassandra database table. Each row in the MATLAB table represents a unique partition in the Cassandra database table.

You can use the partition key values with the `partitionRead` function to import data from a Cassandra database table.

For details about the MATLAB data types of the partition key values, see “Convert CQL Data Types to MATLAB Data Types” on page 6-2.

See Also

`cassandra` | `close` | `executecql` | `partitionRead` | `tablenames`

Topics

“Database Toolbox Interface for Apache Cassandra Database Installation” on page 6-7
“Explore and Import Data from Cassandra Database Table” on page 6-14
“Database Toolbox Interface for Apache Cassandra Database Error Messages” on page 6-11

External Websites

Apache Cassandra Documentation
CQL data types

Introduced in R2018b

executecql

Execute CQL query on Apache Cassandra database

Syntax

```
results = executecql(conn,query)
results = executecql(conn,query,'ConsistencyLevel',level)
```

Description

`results = executecql(conn,query)` returns the results of executing a Cassandra Query Language (CQL) query on the Cassandra database using the Cassandra database connection. The `executecql` function imports the query results into MATLAB.

`results = executecql(conn,query,'ConsistencyLevel',level)` sets a consistency level to specify how many nodes must respond for the CQL query to execute.

Examples

Execute CQL Query

Using a Cassandra® database connection, execute a CQL query to import data from a Cassandra database table into MATLAB®. In this case, the Cassandra database contains the `employees_by_job` database table with employee data in the `employeedata` keyspace.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Write a CQL query that selects all employees who are programmers or shop clerks hired before April 30, 2006, and retrieves their job identifiers, hire dates, and email addresses.

`job_id` is the partition key of the `employees_by_job` database table, and `hire_date` is a clustering column.

```
query = strcat("SELECT job_id,hire_date,email ", ...
    "FROM employeedata.employees_by_job ", ...
    "WHERE job_id IN ('IT_PROG','SH_CLERK') ", ...
    "AND hire_date < '2006-04-30';");
```

Execute the CQL query and display the first few rows of results.

```
results = executecql(conn,query);
head(results)
```

```
ans=8×3 table
      job_id       hire_date       email
    __________    ___________    __________

    "IT_PROG"     05-Feb-2006    "VPATABAL"
    "IT_PROG"     03-Jan-2006    "AHUNOLD"
    "IT_PROG"     25-Jun-2005    "DAUSTIN"
    "SH_CLERK"    24-Apr-2006    "AWALSH"
    "SH_CLERK"    23-Feb-2006    "JFLEAUR"
    "SH_CLERK"    24-Jan-2006    "WTAYLOR"
    "SH_CLERK"    13-Aug-2005    "JDILLY"
    "SH_CLERK"    14-Jun-2005    "KCHUNG"
```

`results` is a table with the `job_id`, `hire_date`, and `email` variables. The `hire_date` variable is a `datetime` array and the `job_id` and `email` variables are string arrays.

Close the Cassandra database connection.

```
close(conn)
```

Execute CQL Query Using Consistency Level

Using a Cassandra® database connection, execute a CQL query to import data from a Cassandra database table into MATLAB®. Specify a consistency level for returning query results. In this case, the Cassandra database contains the `employees_by_job` database table with employee data in the `employeedata` keyspace.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Write a CQL query that selects all employees who are programmers, and retrieves their hire dates and email addresses. `job_id` is the partition key of the `employees_by_job` database table. Limit the returned data to three rows.

```
query = strcat("SELECT hire_date,email ", ...
    "FROM employeedata.employees_by_job ", ...
    "WHERE job_id = 'IT_PROG'", ...
    "LIMIT 3;");
```

Execute the CQL query with the consistency level set to a quorum and display the results.

```
level = "QUORUM";
results = executecql(conn,query,'ConsistencyLevel',level)
```

```
results=3×2 table
     hire_date       email
    ___________    __________

    21-May-2007    "BERNST"
    07-Feb-2007    "DLORENTZ"
    05-Feb-2006    "VPATABAL"
```

Most of the replica nodes respond with returned data. `results` is a table with the `hire_date` and `email` variables. The `hire_date` variable is a `datetime` array and the `email` variable is a string array.

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Cassandra database connection
`cassandra` object

Cassandra database connection, specified as a `cassandra` object.

`query` — CQL query
character vector | string scalar

CQL query, specified as a character vector or string scalar. For details about CQL, see the CQL Reference Documentation.

Example: `"SELECT * FROM dev.maps"`

Data Types: `char` | `string`

`level` — Consistency level
`"ONE"` (default) | character vector | string scalar

Consistency level, specified as one of these values.

Consistency Level Value	Consistency Level Description
`"ALL"`	Return query results when all replica nodes respond (read operation) or commit the change (write operation).
`"EACH_QUORUM"`	Finish execution when most replica nodes in each data center commit the change (write operation only).
`"QUORUM"`	Return query results when most replica nodes respond (read operation) or commit the change (write operation).
`"LOCAL_QUORUM"`	Return query results when most replica nodes in the local data center respond (read operation) or commit the change (write operation).
`"ONE"` (default)	Return query results when one replica node responds (read operation) or commits the change (write operation).
`"TWO"`	Return query results when two replica nodes respond (read operation) or commit the change (write operation).
`"THREE"`	Return query results when three replica nodes respond (read operation) or commit the change (write operation).

Consistency Level Value	Consistency Level Description
"LOCAL_ONE"	Return query results when one replica node in the local data center responds (read operation) or commits the change (write operation).
"ANY"	Finish execution even if all replica nodes for the specified partition are not available (write operation only).
"SERIAL"	Return query results for current (and possibly uncommitted) data for replica nodes in any data center (read operation only).
"LOCAL_SERIAL"	Return query results for current (and possibly uncommitted) data for replica nodes in the local data center (read operation only).

You can specify the value of the consistency level as a character vector or string scalar.

For details about consistency levels, see Configuring data consistency.

Data Types: `char` | `string`

Output Arguments

`results` — CQL query results
table

CQL query results, returned as a table. Each Cassandra database column from the result of the CQL query is a variable in the table. The variable names match the names of the Cassandra database columns from the result of the CQL query.

The data types of the variables in the table depend on the CQL data types. For details about how CQL data types convert to MATLAB data types, see “Convert CQL Data Types to MATLAB Data Types” on page 6-2.

For read or write operations that return no data, the `executecql` function returns an empty table.

See Also

`cassandra` | `close` | `columninfo` | `partitionRead` | `tablenames`

Topics

"Database Toolbox Interface for Apache Cassandra Database Installation" on page 6-7
"Import Data from Cassandra Database Table Using CQL" on page 6-18
"Convert CQL Data Types to MATLAB Data Types" on page 6-2
"Fill Values for Missing Data from Apache Cassandra Database" on page 6-9
"Database Toolbox Interface for Apache Cassandra Database Error Messages" on page 6-11

External Websites

Apache Cassandra Documentation
CQL Reference Documentation
CQL data types
Configuring data consistency

Introduced in R2018b

partitionRead

Import data from partitions of Apache Cassandra database table

Syntax

```
results = partitionRead(conn,keyspace,tablename)
results = partitionRead(conn,keyspace,tablename,
keyValue1...keyValueN)
results = partitionRead( ___ ,'ConsistencyLevel',level)
```

Description

`results = partitionRead(conn,keyspace,tablename)` returns imported data by reading all Cassandra database columns from all partitions of a Cassandra database table. The `partitionRead` function imports data from a Cassandra database into MATLAB without using a Cassandra Query Language (CQL) query.

`results = partitionRead(conn,keyspace,tablename,keyValue1...keyValueN)` returns imported data by reading all Cassandra columns from one or more partitions specified by the partition key values.

`results = partitionRead( ___ ,'ConsistencyLevel',level)` sets a consistency level to specify how many nodes must respond when the function reads data from the Cassandra database table, using any of the previous input argument combinations.

Examples

Import Data from Cassandra Database Table

Using a Cassandra® database connection, import data from a Cassandra database table into MATLAB®. The Cassandra database contains a database table with employee data.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Import employee data into MATLAB from the `employeedata` keyspace and the `employees_by_job` database table by using the Cassandra database connection.

```
keyspace = "employeedata";
tablename = "employees_by_job";
results = partitionRead(conn,keyspace,tablename);
```

Display the first few rows of the returned employee data.

```
head(results)
```

```
ans=8×13 table
      job_id       hire_date     employee_id    commission_pct    department_id      em

    __________    ___________    ___________    ______________    _____________    ____

    "ST_CLERK"    08-Mar-2008        128             NaN               50          "SMA
    "ST_CLERK"    06-Feb-2008        136             NaN               50          "HPH
    "ST_CLERK"    12-Dec-2007        135             NaN               50          "KGE
    "ST_CLERK"    10-Apr-2007        132             NaN               50          "TJO
    "ST_CLERK"    14-Jan-2007        127             NaN               50          "JLA
    "ST_CLERK"    28-Sep-2006        126             NaN               50          "IMI
    "ST_CLERK"    26-Aug-2006        134             NaN               50          "MRO
    "ST_CLERK"    09-Jul-2006        144             NaN               50          "PVA
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier

- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close the Cassandra database connection.

```
close(conn)
```

Import Data Using Partition Key Value

Using a Cassandra® database connection, import data from a Cassandra database table into MATLAB®. Use the value of the partition key in the database table to import data. The Cassandra database contains a database table with employee data.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Import employee data into MATLAB from the `employeedata` keyspace and the `employees_by_job` database table by using the Cassandra database connection. This database table has the `job_id` partition key. Specify the `IT_PROG` value of the partition key to import all data for only those employees who are programmers.

```
keyspace = "employeedata";
tablename = "employees_by_job";
keyValue = "IT_PROG";
results = partitionRead(conn,keyspace,tablename,keyValue);
```

Display the returned employee data.

```
results
```

```
results=5×13 table
     job_id       hire_date     employee_id    commission_pct    department_id      ema

    _________    ___________    ___________    ______________    _____________    _____
```

```
    "IT_PROG"    21-May-2007       104             NaN               60          "BERN
    "IT_PROG"    07-Feb-2007       107             NaN               60          "DLOF
    "IT_PROG"    05-Feb-2006       106             NaN               60          "VPAT
    "IT_PROG"    03-Jan-2006       103             NaN               60          "AHUN
    "IT_PROG"    25-Jun-2005       105             NaN               60          "DAUS
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close the Cassandra database connection.

```
close(conn)
```

Import Data Using Multiple Partition Key Values

Using a Cassandra® database connection, import data from a Cassandra database table into MATLAB®. Use the values of two partition keys in the database table to import data. The Cassandra database contains a database table with employee data.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Import employee data into MATLAB from the `employeedata` keyspace and the `employees_by_name` database table by using the Cassandra database connection. This database table has the `first_name` and `last_name` partition keys. Specify the first and last names of two employees as values of the partition keys to import data for those two employees.

```
keyspace = "employeedata";
tablename = "employees_by_name";
keyValue1 = ["Christopher","Alexander"];
keyValue2 = ["Olsen","Hunold"];
results = partitionRead(conn,keyspace,tablename,keyValue1,keyValue2);
```

Display the returned employee data for the two employees.

```
results
```

```
results=2×13 table
     first_name       last_name      hire_date      employee_id     commission_pct     depa

    _____________     _________     ___________     ___________     ______________     ____

    "Alexander"       "Hunold"      03-Jan-2006         103              NaN
    "Christopher"     "Olsen"       30-Mar-2006         153              0.2
```

`results` is a table that contains these variables:

- `first_name` — First name
- `last_name` — Last name
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `job_id` — Job identifier
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)

- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close the Cassandra database connection.

```
close(conn)
```

Import Data Using Consistency Level

Using a Cassandra® database connection, import data from a Cassandra database table into MATLAB®. Use the value of the partition key in the database table to import data. Specify a consistency level for returning results. The Cassandra database contains a database table with employee data.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Import employee data into MATLAB from the `employeedata` keyspace and the `employees_by_job` database table by using the Cassandra database connection. This database table has the `job_id` partition key. Specify the `IT_PROG` value of the partition key to import all data for only those employees who are programmers. Also, specify the consistency level as a quorum.

```
keyspace = "employeedata";
tablename = "employees_by_job";
keyValue = "IT_PROG";
level = "QUORUM";
results = partitionRead(conn,keyspace,tablename,keyValue, ...
    'ConsistencyLevel',level);
```

Most of the replica nodes respond with the returned data.

Display the returned employee data.

```
results
```

```
results=5×13 table
     job_id       hire_date     employee_id    commission_pct    department_id      ema

    _________    ___________    ___________    ______________    _____________    _____

    "IT_PROG"    21-May-2007        104             NaN               60          "BERN
    "IT_PROG"    07-Feb-2007        107             NaN               60          "DLOR
    "IT_PROG"    05-Feb-2006        106             NaN               60          "VPAT
    "IT_PROG"    03-Jan-2006        103             NaN               60          "AHUN
    "IT_PROG"    25-Jun-2005        105             NaN               60          "DAUS
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Cassandra database connection
`cassandra` object

Cassandra database connection, specified as a `cassandra` object.

keyspace — Keyspace
character vector | string scalar

Keyspace, specified as a character vector or string scalar. If you do not know the keyspace, then access the `Keyspaces` property of the `cassandra` object using dot notation to view the keyspaces in the Cassandra database.

Example: `"employeedata"`

Data Types: `char` | `string`

tablename — Cassandra database table name
character vector | string scalar

Cassandra database table name, specified as a character vector or string scalar. If you do not know the name of the table, then use the `tablenames` function to find it.

Example: `"employees_by_job"`

Data Types: `char` | `string`

keyValue1...keyValueN — Partition key values
numeric scalar | numeric array | character vector | cell array of character vectors | ...

Partition key values, specified as one of these data types:

- numeric scalar
- numeric array
- character vector
- cell array of character vectors
- string scalar
- string array
- `logical`
- `logical` array
- `datetime` array
- `duration` array

If you do not specify the `keyValue1...keyValueN` input argument, then the `partitionRead` function imports data from all partitions of the Cassandra database table (same as the CQL query `SELECT * FROM tablename`).

To specify one or more partition key values, specify one key value for each partition key of the Cassandra database table.

If you specify a scalar value, then the CQL query equivalent is an = clause in the CQL `WHERE` clause. If you specify an array of values, then the CQL query equivalent is an `IN` clause in the CQL `WHERE` clause.

If all partition key values are scalar values, then the `partitionRead` function imports data from one partition. If some partition key values are arrays, then the `partitionRead` function imports data by searching multiple partitions that correspond to all possible key combinations.

The following table describes supported Cassandra partition keys.

Supported Cassandra Partition Key	MATLAB Valid Data Types for One Partition	MATLAB Valid Data Types for Multiple Partitions
`ascii`	character vector or string scalar	cell array of character vectors or string array
`bigint`	numeric scalar or `logical` scalar	numeric array or `logical` array
`blob`	numeric array	cell array of numeric arrays
`boolean`	numeric scalar or `logical` scalar	numeric array or `logical` array
`date`	`datetime` array, string scalar, or character vector	`datetime` array, string array, or cell array of character vectors
`decimal`	numeric scalar, `logical` scalar, or `java.math.BigDecimal` scalar	numeric array, `logical` array, or `java.math.BigDecimal` array
`double`	numeric scalar or `logical` scalar	numeric array or `logical` array
`float`	numeric scalar or `logical` scalar	numeric array or `logical` array

Supported Cassandra Partition Key	MATLAB Valid Data Types for One Partition	MATLAB Valid Data Types for Multiple Partitions
`inet`	character vector or string scalar	cell array of character vectors or string array
`int`	numeric scalar or `logical` scalar	numeric array or `logical` array
`smallint`	numeric scalar or `logical` scalar	numeric array or `logical` array
`text`	character vector or string scalar	cell array of character vectors or string array
`time`	`duration` array, string scalar, or character vector	`duration` array, string array, or cell array of character vectors
`timestamp`	`datetime` array, string scalar, or character vector	`datetime` array, string array, or cell array of character vectors
`timeuuid`	character vector or string scalar	cell array of character vectors or string array
`tinyint`	numeric scalar or `logical` scalar	numeric array or `logical` array
`uuid`	character vector or string scalar	cell array of character vectors or string array
`varchar`	character vector or string scalar	cell array of character vectors or string array
`varint`	numeric scalar, `logical` scalar, or `java.math.BigInteger`	numeric array, `logical` array, or `java.math.BigInteger` array

These Cassandra partition keys are not supported:

- `counter`
- `list`
- `map`
- `set`
- `tuple`

- user-defined types (UDTs)

Example: `["MA","CT"]`

Example: `1,2,'DataProvider1','AmbientTemp'`

Data Types: `double` | `logical` | `char` | `string` | `struct` | `cell` | `datetime` | `duration`

`level` — Consistency level
`"ONE"` (default) | character vector | string scalar

Consistency level, specified as one of these values.

Consistency Level Value	Consistency Level Description
`"ALL"`	Return query results when all replica nodes respond.
`"QUORUM"`	Return query results when most replica nodes respond.
`"LOCAL_QUORUM"`	Return query results when most replica nodes in the local data center respond.
`"ONE"` (default)	Return query results when one replica node responds.
`"TWO"`	Return query results when two replica nodes respond.
`"THREE"`	Return query results when three replica nodes respond.
`"LOCAL_ONE"`	Return query results when one replica node in the local data center responds.
`"SERIAL"`	Return query results for current (and possibly uncommitted) data for replica nodes in any data center.
`"LOCAL_SERIAL"`	Return query results for current (and possibly uncommitted) data for replica nodes in the local data center.

You can specify the value of the consistency level as a character vector or string scalar.

For details about consistency levels, see Configuring data consistency.

Data Types: `char` | `string`

Output Arguments

`results` — Imported data results
table

Imported data results, returned as a table. The table contains imported data from the partitions that correspond to the `keyValue1...keyValueN` input argument. Each Cassandra database column from the partitions becomes a variable in the table. The variable names match the names of the Cassandra database columns in the specified partitions.

The data types of the variables in the table depend on the Cassandra data types. For details about how CQL data types convert to MATLAB data types, see "Convert CQL Data Types to MATLAB Data Types" on page 6-2.

See Also

`cassandra` | `close` | `columninfo` | `executecql` | `tablenames`

Topics

"Database Toolbox Interface for Apache Cassandra Database Installation" on page 6-7
"Explore and Import Data from Cassandra Database Table" on page 6-14
"Convert CQL Data Types to MATLAB Data Types" on page 6-2
"Fill Values for Missing Data from Apache Cassandra Database" on page 6-9
"Database Toolbox Interface for Apache Cassandra Database Error Messages" on page 6-11

External Websites

Apache Cassandra Documentation
CQL Reference Documentation
CQL data types
Configuring data consistency

Introduced in R2018b

tablenames

List names of database tables in Apache Cassandra database

Syntax

```
t = tablenames(conn)
t = tablenames(conn,keyspace)
```

Description

`t = tablenames(conn)` returns a list that contains the names of Cassandra database tables and their corresponding keyspaces of the Cassandra database.

`t = tablenames(conn,keyspace)` returns a list that contains the names of Cassandra database tables in the specified keyspace of the Cassandra database.

Examples

Return Database Table Names in Cassandra Database

Using a Cassandra® database connection, return the names of all database tables in the Cassandra database.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Return the names of all database tables in the Cassandra database using the Cassandra database connection. `t` is a table that contains the names of all Cassandra database tables and their corresponding keyspaces.

```
t = tablenames(conn);
```

Display the first few rows of the returned data.

```
head(t)
```

```
ans=8×2 table
       Keyspace                    Table
    _______________     ____________________________

    "employeedata"      "employees_by_job"
    "employeedata"      "employees_by_id"
    "employeedata"      "employees_by_name"
    "system"            "built_views"
    "system"            "sstable_activity"
    "system"            "views_builds_in_progress"
    "system"            "compaction_history"
    "system"            "hints"
```

The `Keyspace` variable indicates the keyspace. The `Table` variable indicates the name of the Cassandra database table in the corresponding keyspace.

Close the Cassandra database connection.

```
close(conn)
```

Return Database Table Names in Cassandra Database Keyspace

Using a Cassandra® database connection, return the names of all database tables in a specific keyspace of the Cassandra database—in this case, the `employeedata` keyspace.

Create a Cassandra database connection using the local host address. `conn` is a `cassandra` object.

```
contactPoints = "localhost";
conn = cassandra(contactPoints);
```

Return and display all database tables in the `employeedata` keyspace of the Cassandra database by using the Cassandra database connection. `t` is a string array that contains the names of all database tables in the `employeedata` keyspace.

```
keyspace = "employeedata";
t = tablenames(conn,keyspace)
```

```
t = 3×1 string array
    "employees_by_job"
    "employees_by_id"
    "employees_by_name"
```

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Cassandra database connection
`cassandra` object

Cassandra database connection, specified as a `cassandra` object.

keyspace — Keyspace
character vector | string scalar

Keyspace, specified as a character vector or string scalar. If you do not know the keyspace, then access the `Keyspaces` property of the `cassandra` object using dot notation to view the keyspaces in the Cassandra database.

Example: `"employeedata"`

Data Types: `char` | `string`

Output Arguments

t — Database table names
string array | table

Database table names in the Cassandra database, specified as a string array or table. If you specify a keyspace in the `keyspace` input argument, the `tablenames` function returns a string array that contains all the database table names in the specified keyspace of the Cassandra database. If you do not specify a keyspace, the `tablenames` function returns a table with the `Keyspace` and `Table` variables. The `Keyspace` variable is a string array that contains all keyspaces in the Cassandra database. The `Table` variable is a string array that contains the names of all database tables in the Cassandra database for their corresponding keyspaces.

See Also

`cassandra` | `close` | `columninfo` | `executecql` | `partitionRead`

Topics

"Database Toolbox Interface for Apache Cassandra Database Installation" on page 6-7
"Explore and Import Data from Cassandra Database Table" on page 6-14
"Database Toolbox Interface for Apache Cassandra Database Error Messages" on page 6-11

External Websites

Apache Cassandra Documentation

Introduced in R2018b