

# Database Toolbox

For Use with MATLAB®

- Computation
- Visualization
- Programming

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### *Database Toolbox User's Guide*

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# Getting Started

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- What Is the Database Toolbox? (p. 1-2) Overview of how databases connect to MATLAB<sup>®</sup>, toolbox functions, the Visual Query Builder, major features of the toolbox, and the expected background for users of this product.
- System Requirements (p. 1-6) Supported platforms, MATLAB versions, databases, drivers, SQL commands, data types, and related products.
- Setting Up a Data Source (p. 1-11) Before connecting to a database, set up the data source for ODBC drivers or for JDBC drivers.
- Starting the Database Toolbox (p. 1-19) Start using functions or the Visual Query Builder GUI, and learn how to get help for the product.

## What Is the Database Toolbox?

The Database Toolbox is one of an extensive collection of toolboxes for use with MATLAB®. The Database Toolbox enables you to move data (both importing and exporting) between MATLAB and popular relational databases.

With the Database Toolbox, you can bring data from an existing database into MATLAB, use any of the MATLAB computational and analytic tools, and store the results back in the database or in another database. You read from the database, importing the data into the MATLAB workspace.

For example, a financial analyst working on a mutual fund could import a company's financial data into MATLAB, run selected analyses, and store the results for future tracking. The analyst could then export the saved results to a database.

This section covers the following topics:

- “How Databases Connect to MATLAB” on page 1-2
- “Features of the Database Toolbox” on page 1-3
- “Expected Background for Users” on page 1-4
- “Using the Visual Query Builder Versus Functions” on page 1-4

## How Databases Connect to MATLAB

The Database Toolbox connects MATLAB to a database using MATLAB functions. Data is retrieved from the database and stored in the MATLAB workspace. At that point, you use the extensive set of MATLAB tools to work with the data. You can include Database Toolbox functions in MATLAB M-files. To export the data from MATLAB to a database, you use MATLAB functions.

The Visual Query Builder (VQB), which comes with the Database Toolbox, is an easy-to-use graphical user interface (GUI) for exchanging data with your database. With the VQB tool, you build queries to retrieve data by selecting information from lists rather than by entering MATLAB functions. The VQB imports the data into the MATLAB workspace so you then can process the data using the MATLAB suite of functions. With the VQB, you can display the retrieved information in relational tables, reports, and charts. You can also use the VQB to insert data from MATLAB into new rows in a database.

## Features of the Database Toolbox

The Database Toolbox has the following features:

- Different databases can be used in a single session—Import data from one database, perform calculations, and export the modified or unmodified data to another database. Multiple databases can be open during a session.
- Data types are automatically preserved in MATLAB—No data massaging or manipulation is required. The data is stored in MATLAB as cell arrays or structures, which support mixed data types, or as numeric matrices, per your specification. Export numeric, cell array, or structure data.
- Retrieval of large data sets or partial data sets—Import large data sets from a database in a single fetch or in discrete amounts using multiple fetches.
- Retrieval of BINARY or OTHER JDBC data types—You can import Java objects such as bitmap images.
- Retrieval of database metadata—You do not need to know table names, field names, and properties of the database structure to access the database, but can retrieve that information using Database Toolbox metadata functions.
- Dynamic importing of data from within MATLAB—Modify your SQL queries in MATLAB statements to retrieve the data you need.
- Single environment for faster data analysis—Access both database data and MATLAB functions at the MATLAB command prompt.
- Multiple cursors supported for a single database connection—Once you establish a connection with a database, the connection can support the use of multiple cursors. You can execute several queries on the same connection.
- Export query results using the Report Generator—If the Report Generator product is installed locally, you can create custom reports from the Visual Query Builder.
- Database connections remain open until explicitly closed—Once you establish the connection to a database, it remains open during the entire MATLAB session until you explicitly close it. This improves database access and reduces the number of functions necessary to import and export data.
- Visual Query Builder—If you are unfamiliar with SQL, you can exchange information with databases via this easy-to-use graphical interface (GUI).

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**Note** Perform database administrative tasks, such as creating tables, using your database system application. The Database Toolbox is not intended to be used as a tool for database administration.

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## Expected Background for Users

This documentation assumes that you have a working understanding of MATLAB.

If you are not familiar with the Structured Query Language (SQL) and database applications, use the Visual Query Builder (VQB) tool. For information on using the VQB, see Chapter 2, “Visual Query Builder.”

If you are familiar with SQL and the database applications you use, you can use the VQB to build SQL queries easily and import results into MATLAB. You can also use the VQB to insert records from MATLAB to new rows in a database. To write MATLAB applications that access databases, to use a command line rather than a GUI, or to perform actions you cannot do with the Visual Query Builder, use the Database Toolbox functions. For information on how to use the functions, see Chapter 3, “Using Functions in the Database Toolbox” and Chapter 4, “Function Reference.”

## Using the Visual Query Builder Versus Functions

These guidelines describe the main differences between the Visual Query Builder and the Database Toolbox functions.

### When to Use the Visual Query Builder

Use the Visual Query Builder to:

- Retrieve data from relational databases for use in MATLAB when you are not familiar with the Structured Query Language (SQL).
- Insert data from MATLAB into new records in a database when you are not familiar with SQL.
- Easily build SQL queries and exchange data between databases and MATLAB using a GUI.

The VQB automatically generates and displays the SQL statement or MATLAB statement for the queries it runs. You can directly edit the statements in the VQB. You can also copy and paste the statements you generate using the VQB into MATLAB code that uses Database Toolbox functions.

### **When to Use Database Toolbox Functions**

You can use the Database Toolbox functions to do everything the VQB does and more. Database Toolbox functions offer these additional features:

- Replace data in databases from MATLAB.
- Write MATLAB applications that access databases.
- Perform other functions not available with the Visual Query Builder, for example, accessing database metadata.

## System Requirements

The Database Toolbox works with the systems and applications described here:

- “Platforms” on page 1-6
- “MATLAB and Related Products” on page 1-6
- “Databases” on page 1-7
- “Drivers” on page 1-8
- “Structured Query Language (SQL)” on page 1-9
- “Data Types” on page 1-9
- “Related Products” on page 1-10

### Platforms

The Database Toolbox runs on all of the platforms that support MATLAB, but you cannot run MATLAB with the `-nojvm` startup option.

### MATLAB and Related Products

The Database Toolbox requires MATLAB. To use the Visual Query Builder feature for creating customized reports in the Report Generator, you need the MathWorks Report Generator product. Without that product you can use the VQB’s similar **Display -> Report** feature.

## Databases

Your system must have access to an installed database. The Database Toolbox supports the import and export of data from any ODBC/JDBC-compliant database management system, including the following:

- IBM DB2
- Informix
- Ingres
- Microsoft Access
- Microsoft Excel
- Microsoft SQL Server
- MySQL
- Oracle
- Postgre
- Sybase SQL Server
- Sybase SQL Anywhere

RDBMS for VAX/VMS systems is not supported.

If you are upgrading from an earlier version of a database, such as Microsoft SQL Server Version 6.5, to a newer version, there is nothing special you need to do for the Database Toolbox. Just be sure to configure the data sources for the new version of the database application as you did for the original version.

### Data Retrieval Restrictions

**Spaces in Table and Column Names.** Microsoft Access supports the use of spaces in table and column names, but most other databases do not. When using functions to retrieve data from tables and fields whose names contain spaces, use delimiters around the table and field names when building the query. For Access, enclose the table or field name in quotation marks, for example `order id`. Other databases use different delimiters, for example brackets, `[ ]`, instead of quotation marks. In the Visual Query Builder, table and field names that include spaces appear in quotation marks.

**Quotation Marks in Table and Column Names.** Do not include quotation marks in table and column names. The Database Toolbox does not support data retrieval from table and column names that contain quotation marks.

**Reserved Words in Column Names.** Be sure not to name columns using the database's reserved words, such as DATE in Microsoft Access, or you will not be able to import or export the data using the Database Toolbox. You will get an error message in the Command Window, for example, reporting a syntax error from Microsoft Access.

## Drivers

For Windows platforms, the Database Toolbox supports Open Database Connectivity (ODBC) drivers used with the supported databases. For UNIX and Windows platforms, the Database Toolbox supports Java Database Connectivity (JDBC) drivers. If you use JDBC drivers on a Windows platform, you cannot use the Visual Query Builder.

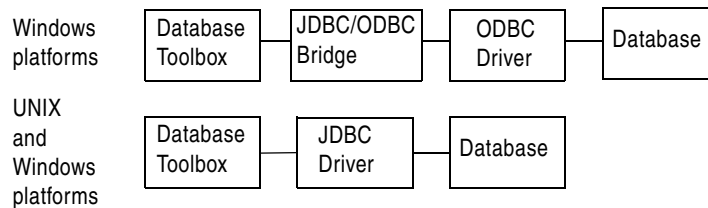
The driver for your database must be installed in order to use the Database Toolbox. Most users (or their database administrators) install the driver when they install the database. Consult your database documentation if you need instructions to install a database driver. If your database does not ship with JDBC drivers, you can download drivers from the Sun JDBC web site, <http://industry.java.sun.com/products/jdbc/drivers>.

### About Drivers for the Database Toolbox

An ODBC driver is a standard PC interface that enables communication between database management systems and SQL-based applications. A JDBC driver is a standard interface that enables communication between Java-based applications and database management systems.

The Database Toolbox is a Java-based application. To connect the Database Toolbox to a database's ODBC driver, the toolbox uses a JDBC/ODBC bridge, which is supplied and automatically installed as part of the toolbox.

The following illustrates the use of drivers with the Database Toolbox.





## Structured Query Language (SQL)

The Database Toolbox supports American National Standards Institute (ANSI) standard SQL commands.

### Data Types

You can import the following data types into MATLAB and export them back to your database:

- BOOLEAN
- CHAR
- DATE
- DECIMAL
- DOUBLE
- FLOAT
- INTEGER
- LONGCHAR (This is called the Memo data type in Microsoft Access.)
- NUMERIC
- REAL
- SMALLINT
- TIME
- TIMESTAMP
- TINYINT
- VARCHAR

If you try to *export* MATLAB data types not on this list, you see a syntax error from the database.

### BINARY and OTHER Java SQL Data Types

You can import BINARY (referred to as BLOB for Binary Large Objects) and OTHER JDBC objects. To use these data types in MATLAB, you need to understand the content, and you might need to massage it, such as stripping off headers created by the ODBC/JDBC drivers so a specific binary format can be used in MATLAB. For an example using the Visual Query Builder, see “Retrieving BINARY and OTHER Java Data” on page 2-55. For an example using functions, see “Retrieving BINARY or OTHER Java SQL Data Types” on page 3-22. In some cases, retrieving OTHER data types does not result in any data.

## **Related Products**

The MathWorks provides several products that are especially relevant to the kinds of tasks you can perform with the Database Toolbox. See more information about these products on the MathWorks Web site, at <http://www.mathworks.com/products/database/related.jsp>.

## Setting Up a Data Source

Before you can connect from the Database Toolbox to a database, you need to set up a *data source*. A data source consists of data that you want the toolbox to access, and information about how to find the data, such as driver, directory, server, or network names. You assign a name to each data source.

- 1 If you have Microsoft Access installed and want to use the examples in this documentation, first get the databases and prepare them:
  - a Get “dbtoolboxdemo Database” on page 1-11.
  - b Get “SampleDB Database” on page 1-12.
- 2 Set up the data source—the instructions depend on your configuration:
  - For MATLAB Windows platforms whose database resides on that PC or on another system to which the PC is networked via ODBC drivers, see “Setting Up a Data Source for ODBC Drivers” on page 1-13.
  - For MATLAB platforms that connect to a database via a JDBC driver, see “Setting Up a Data Source for JDBC Drivers” on page 1-17.

## Getting and Preparing Databases for Examples

If you want to use the examples in this documentation, get the databases and prepare them.

### dbtoolboxdemo Database

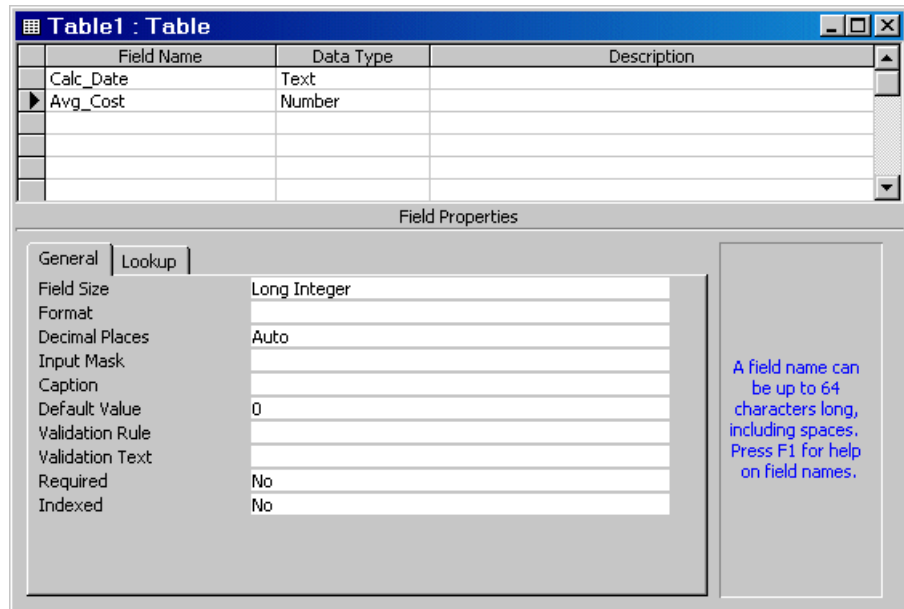
The dbtoolboxdemo data source uses the tutorial database provided with the Database Toolbox, `$matlabroot\toolbox\database\dbdemos\tutorial.mdb`. Before you can set up this data source, you must perform the following actions:

- 1 Using operating system features or the MATLAB `copyfile` function, copy `tutorial.mdb` to a different directory, one for which you have write access, and rename it to `tutorial_copy.mdb`.
- 2 Using operating system features or the MATLAB `fileattrib` function, ensure you have write access to the `tutorial_copy.mdb`.
- 3 Open `tutorial_copy.mdb` in Access. You might have to convert it to your version of Access. Save the converted version as `tutorial.mdb`.

## SampleDB Database

The SampleDB data source uses the Microsoft Access sample database called Nwind.

- 1 If you do not already have the sample database on your system, you can download it from the Microsoft Web site downloads page. The version referred to in this documentation is part of the Access 2000 downloads and is the Northwind Traders sample database, Nwind.exe. Run the file to create the Nwind.mdb database.
- 2 Rename the file to Nwind\_orig.mdb.
- 3 Using operating system features or the MATLAB fileattrib function, ensure you have write access to Nwind\_orig.mdb.
- 4 Open Nwind\_orig.mdb in Access. You might have to convert it to your version of Access. Save the converted version as Nwind.mdb.
- 5 Using Access, create a table into which you will export MATLAB results:
  - a Open the Nwind database in Microsoft Access.
  - b Create a new table that has two columns, Calc\_Date and Avg\_Cost.
  - c For the Calc\_Date field, use the default **Data Type**, which is Text, and for the Avg\_Cost field, set the **Data Type** to Number.



- d Save the table as Avg\_Freight\_Cost and close it. Access warns you that there is no primary key, but you do not need one. If you do designate a primary key, you can run the example as written only once because Access prevents you from inserting the same record twice.

If you need more information about how to create a table in Access, see Microsoft Access help.

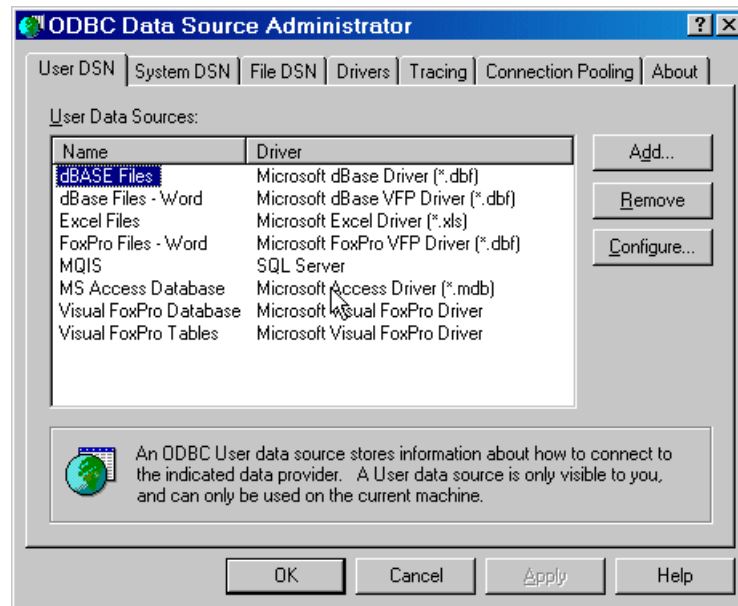
## Setting Up a Data Source for ODBC Drivers

Follow this procedure to set up a data source for a PC running Windows whose database resides on that PC or on another system to which the PC is networked via ODBC drivers. This procedure uses as an example, the Microsoft ODBC driver Version 4.00 and the U.S. English version of Microsoft Access 2000 for Windows 2000. If you have a different configuration, you may have to modify the instructions.

To set up the data source:

- 1 Close the database in the database program. For the examples, if Microsoft Access is open, be sure to close the databases tutorial1.mdb and Nwind.mdb.
- 2 From the Windows **Start** menu, select **Programs -> Administrative Tools -> Data Sources (ODBC)**.

The **ODBC Data Source Administrator** dialog box appears, listing any existing data sources.



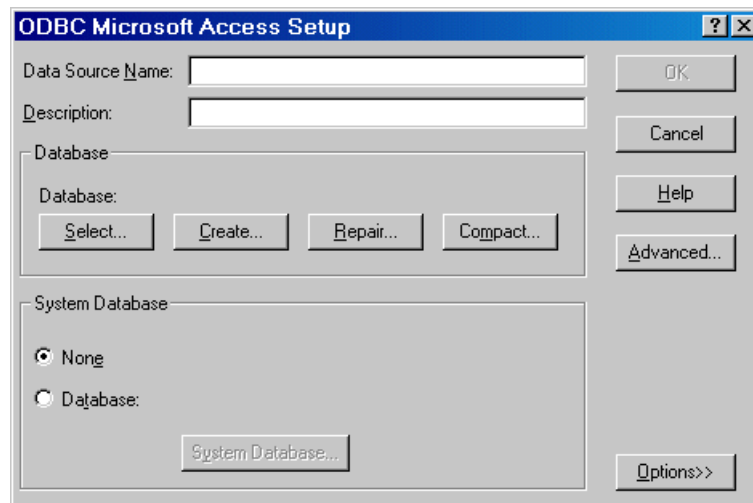
- 3 Select the **User DSN** tab.

A list of existing user data sources appears.

- 4 Click **Add**. A list of installed ODBC drivers appears in the **Create New Data Source** dialog box.

- 5 Select the ODBC driver that the local data source you are creating will use and click **Finish**.
  - For the examples in this book, select **Microsoft Access Driver (\*.mdb)**.
  - Otherwise, select the driver for your database.

The **ODBC Setup** dialog box appears for the driver you selected. Note that the dialog box for your driver might be different from the following.



- 6 Provide a **Data Source Name** and **Description**.

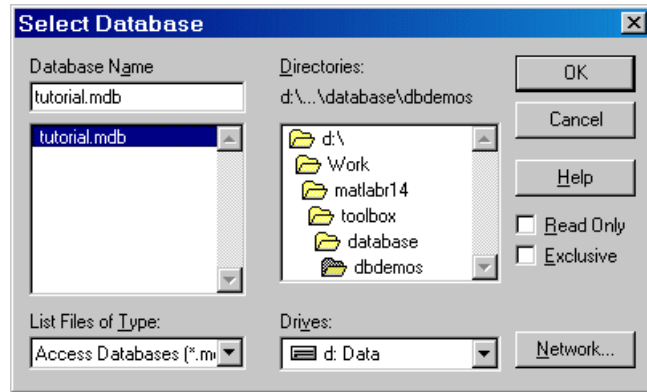
For the first sample data source, type dbtoolboxdemo as the data source name.

For some databases, the **ODBC Setup** dialog box requires you to provide additional information.

- 7 Select the database that this data source will use. Note that for some drivers, you skip this step.

- a In the **ODBC Setup** dialog box, click **Select**.

The **Select Database** dialog box appears.



- b Find and select the database you want to use. For the dbtoolboxdemo data source, select tutorial.mdb in \$matlabroot\toolbox\database\dbdemos.

If your database resides on another system to which your PC is connected, you must first click **Network** in the **Select Database** dialog box. The **Map Network Drive** dialog box appears. Find and select the directory containing the database you want to use, and then click **Finish**. The **Map Network Drive** dialog box closes.

- c Click **OK** to close the **Select Database** dialog box.

- 8 In the **ODBC Setup** dialog box, click **OK**.

- 9 Repeat steps 4 through 8 to set up the data source for the other example database, Nwind.

- In step 6, type SampleDB as the data source name.
- In step 7, select Nwind.mdb.

- 10 Click **OK** to close the **ODBC Data Source Administrator** dialog box, which now contains the dbtoolboxdemo and SampleDB data sources.



## Setting Up a Data Source for JDBC Drivers

To set up a data source for use with a Windows or UNIX system using JDBC drivers, include a pointer to the JDBC driver location in the MATLAB file `$matlabroot/toolbox/local/classpath.txt` and restart MATLAB.

For example, if you have an Oracle database system that includes the JDBC drivers in the `classes111.zip` file, perform the following steps:

- 1 Create a directory `$matlabroot/dbtools`.
- 2 Put the `classes111.zip` file into `dbtools`.
- 3 Add the `classes111.zip` file to the `classpath.txt` file, by including this line in `classpath.txt`

```
$matlabroot/dbtools/classes111.zip
```

- 4 Restart MATLAB.

The filename that contains the JDBC drivers is different for each database system. The file is available from your database provider. See the database reference page for examples of JDBC drivers and URLs.

For some databases, you first need to unzip the file containing the JDBC drivers, and then put the extracted file into `dbtools` and add it to `classpath.txt`. You can use the MATLAB `unzip` function to unzip the file.

For My SQL with JDBC drivers, add the JAR file reference to `$MATLAB/toolbox/local/classpath.txt`. This is an example:

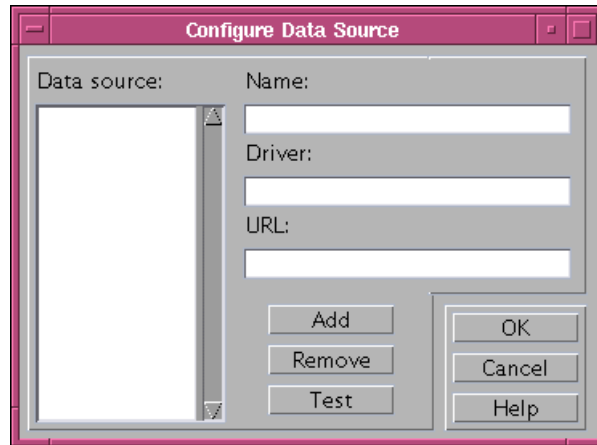
```
mysql/mysql-connector-java-3.0.9-stable/  
mysql-connector-java-3.0.9-stable-bin.jar
```

### Setup for Using Visual Query Builder on UNIX Platforms

If you want to use the Visual Query Builder on UNIX platforms, perform these steps to set up the JDBC data source. (You cannot use the Visual Query Builder on a Windows platform with a JDBC driver.)

- 1 Start MATLAB if it is not already running.

- 2 Access the **Configure Data Source** dialog box by typing `confds`



Any existing data sources are listed under **Data source**.

- 3 Complete the **Name**, **Driver**, and **URL** fields. For some data sources, the **Name** must exactly match the name of the **Data source**. For example:

**Name:** `orcl`

**Driver:** `oracle.jdbc.driver.OracleDriver`

**URL:** `jdbc:oracle:thin:@144.212.123.24:1822:`

- 4 Click **Add** to add the data source.
- 5 Click **Test** to establish a test connection to the data source. You are prompted to supply a username and password if the database requires it.
- 6 Click **OK** to save changes and close the **Configure Data Source** dialog box.

To remove a data source, select it from the **Data source** list in the **Configure Data Source** dialog box, click **Remove**, and click **OK**.

See the database reference page for examples of JDBC drivers and URLs.

## Starting the Database Toolbox

Use the Database Toolbox functions the way you would use any MATLAB function in the Command Window. For more information, see Chapter 3, “Using Functions in the Database Toolbox.”

To start the Visual Query Builder GUI, type `querybuilder`. For more information about the tool, see Chapter 2, “Visual Query Builder.”

### Online Help

- Help for the Database Toolbox is available online via the Help browser.
- Use the `doc` function for information about a specific function.
- In the Visual Query Builder, use the **Help** menu, or use the **Help** buttons in dialog boxes for detailed information about features in the dialog boxes.

For a printable version of the documentation, use the PDF version on the MathWorks Web site.



# Visual Query Builder

---

The Visual Query Builder is a graphical user interface (GUI) for exchanging data between a database and MATLAB.

|   |  |
|---|--|
| Getting Started with the Visual Query Builder GUI (p. 2-2)                                | Follow the list of steps to use the Visual Query Builder (VQB) for importing and exporting data. Know when to use the VQB tool and when to use toolbox functions.    |
| Creating and Running a Query to Import Data (p. 2-7)                                      | Build and run a query to import data.  |
| Saving, Editing, Clearing Variables for, and Specifying Preferences for Queries (p. 2-13) | Save a query for later use, edit a query, clear variables in the <b>Data</b> area, and set preferences for data retrieval format, NULLs, and errors.                 |
| Viewing Query Results (p. 2-19)   | View results as a relational display, a chart, in a table report, and in a customized report.  |
| Fine-Tuning Queries Using Advanced Query Options (p. 2-32)                                | Retrieve unique occurrences, retrieve data meeting specified criteria, order the results, use subqueries to retrieve values from multiple tables, and other options. |
| Retrieving BINARY and OTHER Java Data (p. 2-55)   | Retrieve Java object data, such as binary images.  |
| Exporting Data Using the VQB (p. 2-57)  | Export data from MATLAB into new rows in a database.   |
| BOOLEAN (MATLAB logical) Data (p. 2-62)   | Import and export BOOLEAN (MATLAB logical) data.   |
| Using VQB Queries in Database Toolbox Functions (p. 2-66)                                 | After running queries using the VQB, copy information from the VQB and paste it into Database Toolbox functions in the MATLAB Command Window.                        |

## Getting Started with the Visual Query Builder GUI

The Visual Query Builder (VQB) is an easy-to-use graphical user interface (GUI) for exchanging data with your database. With the VQB, you build queries to retrieve data by selecting information from lists rather than by entering MATLAB functions. The VQB retrieves the data from a database and puts it in a MATLAB cell array, structure, or numeric matrix so you can process the data using the MATLAB suite of functions. With the VQB, you can display information retrieved as cell arrays in relational tables, reports, and charts. You can also use the VQB to export data from MATLAB into new rows in your database. Review these key topics when you start using the VQB.

- “Before You Start” on page 2-3
- “Starting the Visual Query Builder” on page 2-3
- “Steps for Retrieving Data with the VQB” on page 2-4
- “Steps for Exporting Data with the VQB” on page 2-5
- “Help and Demos for the Visual Query Builder” on page 2-6
- “Quitting the Visual Query Builder” on page 2-6

You can use Database Toolbox functions instead of the VQB. See “Using the Visual Query Builder Versus Functions” on page 1-4 for more information.

## Before You Start

Before using the Visual Query Builder, set up a data source. This document uses simple examples to demonstrate many of the Visual Query Builder features. These examples use the `dbtoolboxdemo` data source (tutorial database) for Microsoft Access. Instructions for setting up this or any data source are in “Setting Up a Data Source” on page 1-11. If you don’t have Microsoft Access, you should still be able to follow the examples because they are not complex. If your version of Microsoft Access is different from the one used for the examples, you might get different results. If your results differ, check your version of Access, and compare the table and column names in your databases to those used in the examples.

If you use JDBC drivers on a Windows platform, you cannot use the Visual Query Builder.

## Starting the Visual Query Builder

To start the Visual Query Builder interface, type

```
querybuilder
```

at the MATLAB prompt. The Visual Query Builder opens. When you start the VQB, all fields except the **Data source** are blank. You can also start the interface using the **Start** menu in the MATLAB desktop.

## Steps for Retrieving Data with the VQB

This is a summary of the steps you take to retrieve data using the VQB. Details appear in subsequent topics.

To start the Visual Query Builder, type `querybuilder` at the MATLAB prompt.

\* Required step

1\* Specify **Select**.    2\* Select data source.    3\* Select tables.    4\* Select fields to retrieve.

11 View query results in table, chart, and report formats.

7 Set preferences for data retrieval.

12 Save, load, and run queries.

5 Refine query.

6 View SQL statement.

8\* Assign variable for results.

9\* Run query.

10 Double-click to view query results in MATLAB Array Editor.

| Workspace variable | Size | Memory (bytes) |
|--------------------|------|----------------|
| A                  | 7x2  | 952            |



## Steps for Exporting Data with the VQB

This is a summary of the steps you take to export data using the VQB. Details appear in “Exporting Data Using the VQB” on page 2-57.

To start the Visual Query Builder, type `querybuilder` at the MATLAB prompt.

\* Required step

1\* Specify Insert.    2\* Select data source.    3\* Select tables.    4\* Select fields to export to.

8 Save, load, and run queries and set preferences for exporting NULLs.

6 View MATLAB statement.

5\* Specify variable containing data to export.

7\* Run query.

The screenshot shows the Visual Query Builder GUI with the following configuration:

- Data operation:**  Insert
- Data source:** SampleDB
- Tables:** Avg\_Freight\_Cost, Categories, Customers
- Fields:** Calc\_Date, Avg\_Cost
- Advanced query options:**  All
- MATLAB command:** `Insert(conn,'Avg_Freight_Cost','Calc_Date','Avg_Cost'),dataout)`
- MATLAB workspace variable:** dataout
- Execute:** Button
- Data:**

| Workspace variable | Size | Memory (bytes) |
|--------------------|------|----------------|
| dataout            | 1x2  | 156            |

## Help and Demos for the Visual Query Builder

### Getting Help in the VQB

While using the Visual Query Builder, get online help by

- Selecting **Visual Query Builder Help** from the **Help** menu.
- Clicking **Help** in any Visual Query Builder dialog box. Detailed instructions for that dialog box appear in the Help browser.

For more information about getting help, see “Using the Help Browser” in the MATLAB documentation.

### Running a Visual Query Builder Demo

You can run a demo of the Visual Query Builder, which illustrates its main features. In the **Visual Query Builder** dialog box, select **Demos** from the **Help** menu. Follow the instructions in the Command Window, which prompt you to press **Enter** to move through the demo.

The demo runs on Windows platforms only. It uses the dbtoolboxdemo data source (tutorial database). Instructions for setting up this data source are in “Setting Up a Data Source” on page 1-11.

### Quitting the Visual Query Builder

To quit using the Visual Query Builder, select **Exit** from the **Query** menu, or click the close box.

## Creating and Running a Query to Import Data

### Building and Executing a Query

Build and run a query to import data from your database into MATLAB. Then save the query for use again later.

**Before You Start.** Before using the VQB, set up a data source—see “Setting Up a Data Source” on page 1-11. The examples here use the `dbtoolboxdemo` data source.

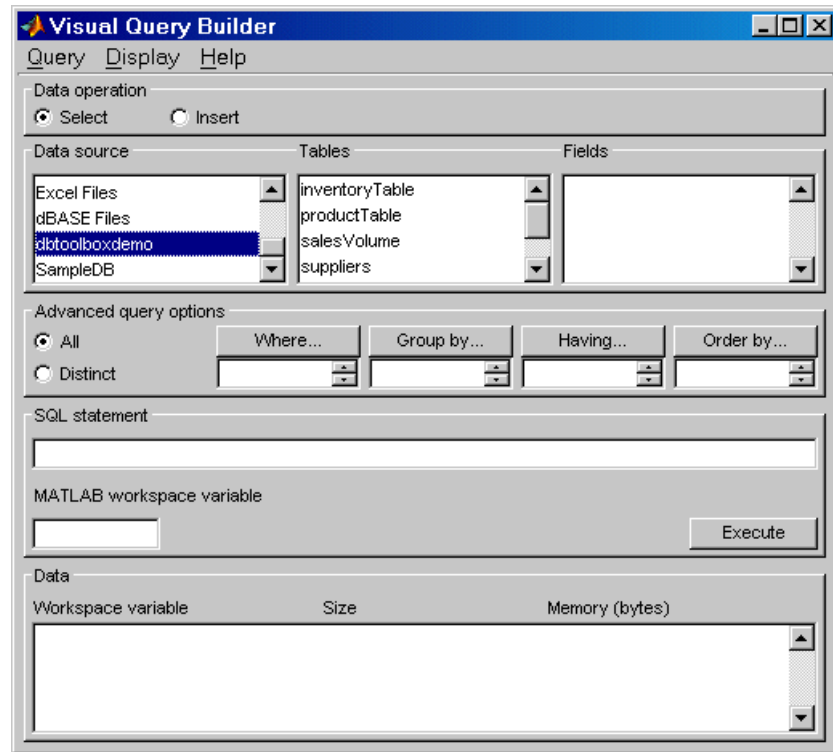
**To Start.** To open the VQB, in the Command Window, type

```
querybuilder
```

In the VQB, perform these steps to create and run a query to retrieve data:

- 1** In the **Data operation** field, choose **Select**, meaning you want to select data from a database.
- 2** From the **Data source** list box, select the data source from which you want to import data. For this example, select `dbtoolboxdemo`, which is the data source for the tutorial database.

After selecting a data source, the set of **Tables** in that data source appears.



- 3 From the **Tables** list box, select the table that contains the data you want to import. For this example, select salesVolume. Table names that include spaces appear in quotation marks. For Microsoft Excel, the **Tables** are Excel sheets.

After you select a table, the set of **Fields** (column names) in that table appears.

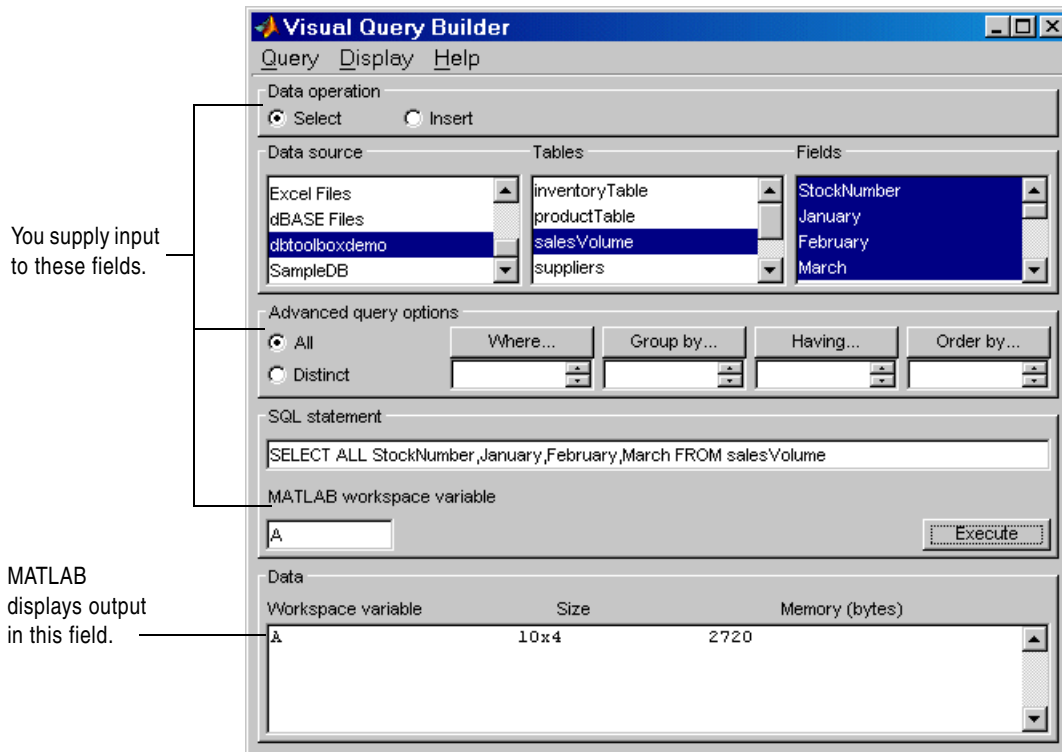
- 4 From the **Fields** list box, select the fields containing the data you want to import. To select more than one field, hold down the **Ctrl** key or **Shift** key while selecting. For this example, select the fields StockNumber, January, February, and March. Field names that include spaces appear in quotation marks. To deselect an entry, use **Ctrl**+click.

As you select items from the **Fields** list, the query appears in the **SQL statement** field.

- 5 In the **MATLAB workspace variable** field, assign a name for the data returned by the query. For this example, use A.
- 6 Click **Execute** to run the query and retrieve the data.

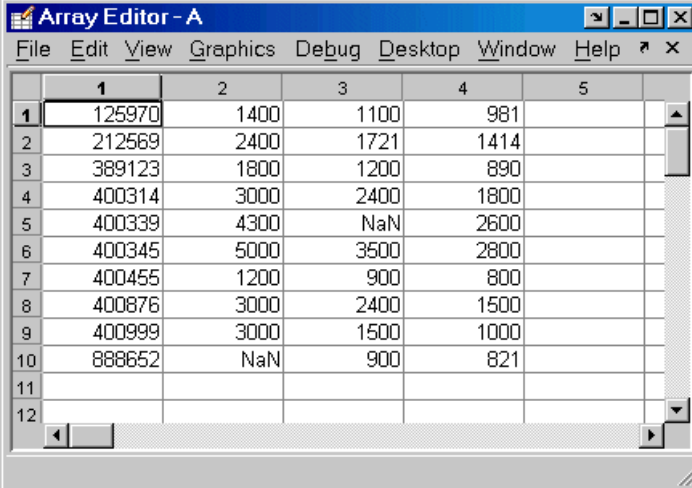
The query runs, retrieves data, and stores it in MATLAB, which in this example is a cell array assigned to the variable A. In the **Data** area, information about the query result appears.

If any of the data to be retrieved is a Java **BINARY** or **OTHER** type, for example, a bitmap image, the retrieval might be time intensive. For more information about retrieving this type of data, see “Retrieving **BINARY** and **OTHER** Java Data” on page 2-55.



If an error dialog box appears, the query is invalid. For example, you cannot perform a query on table and field names that contain quotation marks.

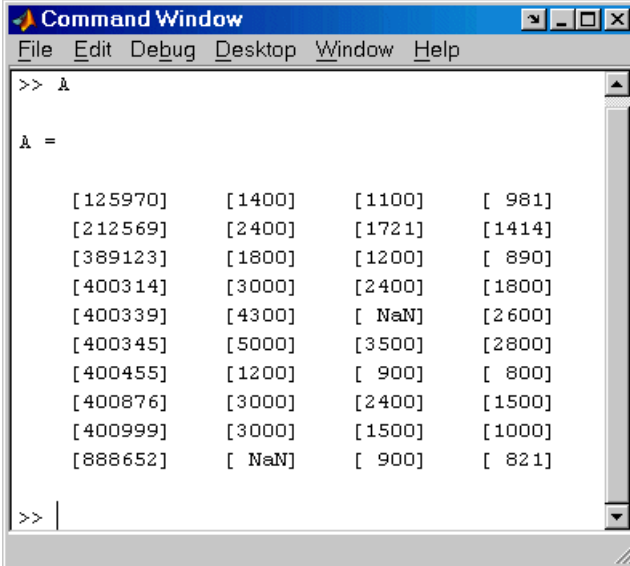
- 7 Double-click A in the **Data** area. The contents of A are displayed in the **Array Editor**, where you can view and edit the data. See the MATLAB Array Editor documentation for details about using it.



The screenshot shows the MATLAB Array Editor window titled "Array Editor - A". The window has a menu bar with "File", "Edit", "View", "Graphics", "Debug", "Desktop", "Window", and "Help". The main area displays a table with 12 rows and 5 columns. The columns are labeled 1 through 5, and the rows are labeled 1 through 12. The data is as follows:

|    | 1      | 2    | 3    | 4    | 5 |
|----|--------|------|------|------|---|
| 1  | 125970 | 1400 | 1100 | 981  |   |
| 2  | 212569 | 2400 | 1721 | 1414 |   |
| 3  | 389123 | 1800 | 1200 | 890  |   |
| 4  | 400314 | 3000 | 2400 | 1800 |   |
| 5  | 400339 | 4300 | NaN  | 2600 |   |
| 6  | 400345 | 5000 | 3500 | 2800 |   |
| 7  | 400455 | 1200 | 900  | 800  |   |
| 8  | 400876 | 3000 | 2400 | 1500 |   |
| 9  | 400999 | 3000 | 1500 | 1000 |   |
| 10 | 888652 | NaN  | 900  | 821  |   |
| 11 |        |      |      |      |   |
| 12 |        |      |      |      |   |

Another way to see the contents of A is to type A in the Command Window.



```
>> A

A =

[125970] [1400] [1100] [ 981]
[212569] [2400] [1721] [1414]
[389123] [1800] [1200] [ 890]
[400314] [3000] [2400] [1800]
[400339] [4300] [ NaN] [2600]
[400345] [5000] [3500] [2800]
[400455] [1200] [ 900] [ 800]
[400876] [3000] [2400] [1500]
[400999] [3000] [1500] [1000]
[888652] [ NaN] [ 900] [ 821]

>> |
```

As an example of how to read the results, sales for item 400876 are 3000 in January, 2400 in February, and 1500 in March.

Note that if the data contains the Java OTHER data type, some fields in A might be empty. This happens when Java cannot pass the data through the JDBC/ODBC bridge.



## Saving, Editing, Clearing Variables for, and Specifying Preferences for Queries

Topics covered in this section are

- “Saving a Query” on page 2-13
- “Editing a Query” on page 2-14
- “Clearing Variables in the Data Area” on page 2-14
- “Specifying Preferences for NULLS, Data Format, and Error Handling” on page 2-15

### Saving a Query

After building a query in the VQB, you can save it for later use. To save a query:

- 1 Select **Save** from the **Query** menu.

The **Save SQL Statement** dialog box appears.

- 2 Complete the **File name** field and click **Save**. For the example you ran in “Building and Executing a Query” on page 2-7, save the query using `basic` as the filename. Do not include spaces in the filename.

The query is saved with a `.qry` extension.

For a **Select** query (retrieves data), the MATLAB workspace variable name you assigned for the query results and the query preferences are *not* saved as part of the query. This protects you from inadvertently overwriting an existing variable in the MATLAB workspace when you run a saved query. For an **Insert** query (exports data), the MATLAB workspace variable name whose data you exported *is* saved as part of the query, although preferences are not saved.

### Using a Saved Query

To use a saved query:

- 1 Select **Load** from the **Query** menu.

The **Load SQL Statement** dialog box appears.

- 2 Select the name of the query you want to load and click **Open**. For the example, select `basic.qry`.

The VQB fields reflect the values for the saved query.

- 3 To run a **Select** query (imports data), assign a variable in the **MATLAB workspace variable** field and click **Execute**.

For an **Insert** query (exports data), the saved query might have included a workspace variable, which is shown as part of the **MATLAB command** field. Type that variable name or type a new name in the **MATLAB workspace variable** field. Press **Return** or **Enter** to see the updated **MATLAB command**. Click **Execute** to run the query.

### Editing a Query

In the VQB, you can edit a query you created or opened by changing selections you made, and then executing the query again. To deselect an entry, use **Ctrl+click**.

You can also directly edit the entry in the **SQL statement** or **MATLAB command** field. After editing, you can save the query for later use.

### Clearing Variables in the Data Area

Variables in the **Data** area include those you assigned for query results, as well as any variables you assigned in the Command Window. The variables do not appear in the **Data** area until you execute a query. They remain in the **Data** area until you clear them in the Command Window using the `clear` function, and then execute a query.

## Specifying Preferences for NULLS, Data Format, and Error Handling

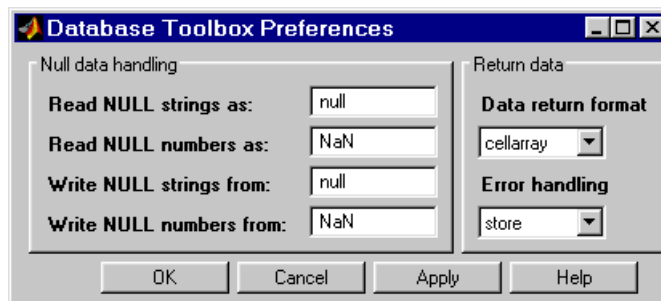
Using preferences, you can specify

- How the query builder represents NULL data
- Format of data retrieved
- Method for error notification

To set preferences

- 1 Select **Preferences** from the **Query** menu.

The **Database Toolbox Preferences** dialog box appears, showing the current settings.



- 2 Change the current preference settings to the new values and click **OK**. For this example, make the following changes.

| Preference                  | Description  | New Value            |
|-----------------------------|--|----------------------|
| <b>Read NULL numbers as</b> | <p>How NULL numbers in a database are represented when imported into MATLAB.</p> <p>For the new value, 0, the NULL data in the example results will appear as 0's. Previously, they appeared as NaN values.</p>  | 0                    |
| <b>Data return format</b>   | <p>Format for data imported into MATLAB. Select a value based on the type of data you are importing, memory considerations, and your preferred method of working with retrieved data.</p> <p>Cell arrays and structures support mixed data types, but require more memory and are processed more slowly than numeric matrices. Use the <code>numeric</code> format if the data you are retrieving consists only of numeric data or if the nonnumeric data is not relevant. With the <code>numeric</code> format, any nonnumeric data is converted to the representation specified in the <b>Read NULL numbers as</b> preference, for example, NaN. When <b>Read NULL numbers as</b> is <code>numeric</code>, the Data return format must also be <code>numeric</code>. For information about cell arrays, see “Working with Cell Arrays in MATLAB” on page 3-38. For information about working with strings, see “Characters and Strings” in the MATLAB Programming documentation.</p> <p>Because results in the example are all numeric, we can change from <code>cellarray</code> to <code>numeric</code> to reduce memory required.</p> | <code>numeric</code> |
| <b>Error handling</b>       | <p>Behavior for handling errors when importing data. In the Visual Query Builder, setting the value to <code>store</code> or <code>empty</code> means any errors are reported in a dialog box rather than in the Command Window.</p> <p>Set the value to <code>report</code>, which means that any errors from running the query will display immediately in the Command Window.</p>   | <code>report</code>  |

For more information about these preferences, see the property descriptions on the reference page for `setdbprefs`, which is the equivalent function for setting preferences.

- 3 Enter a workspace variable, `A`, and click **Execute** to run the query again.

Information about the retrieved data appears in the **Data** area. Note that the **Memory** size of `A` is 320 bytes, compared to 2720 bytes when we ran the query using the previous settings for preferences. This is because we changed the **Data return format** to `numeric`, where previously it was set to `cellarray`. The `numeric` format requires far less memory than the `cellarray` format. However, the `cellarray` (or `structure`) format is required if you want to retrieve data that is not all numeric, such as strings. If you use the `numeric` format to retrieve data that contains strings, the strings are returned as `NULL` values, represented by the preference you specified for **Read NULL numbers as**.

- 4 To see the results, type `A` in the Command Window.

```
>> A
```

```
A =
```

|        |      |      |      |
|--------|------|------|------|
| 125970 | 1400 | 1100 | 981  |
| 212569 | 2400 | 1721 | 1414 |
| 389123 | 1800 | 1200 | 890  |
| 400314 | 3000 | 2400 | 1800 |
| 400339 | 4300 | 0    | 2600 |
| 400345 | 5000 | 3500 | 2800 |
| 400455 | 1200 | 900  | 800  |
| 400876 | 3000 | 2400 | 1500 |
| 400999 | 3000 | 1500 | 1000 |
| 888652 | 0    | 900  | 821  |

Results are not in brackets because data is a numeric matrix rather than a cell array. `NULL` values are now represented by `0`'s instead of `NaN`s.

### **Saving Preferences**

Preferences apply to the current MATLAB session. They are not saved with a query. The default preferences apply when you start a new session, or after clearing all variables (for example, `clear all`). It is a good practice to verify the preference settings before you run a query.

Another way to set preferences is by using the `setdbprefs` function. To use the same preferences whenever you run MATLAB, include the `setdbprefs` function in your startup file.

## Viewing Query Results

After running a query in the Visual Query Builder, you can view the retrieved data by

- Typing the variable name in the MATLAB Command Window to view it there, or
- Double-clicking the variable in the VQB **Data** area to view the data in the Array Editor

The VQB **Display** menu provides additional options for viewing data:

- “Relational Display of Data” on page 2-20
- “Chart Display of Results” on page 2-23; for example, a pie chart
- “Report Display of Results in a Table” on page 2-26
- “Customized Display of Results in the Report Generator” on page 2-28

Use the saved query from the earlier example, `basic.qry`.

- 1** Select **Query -> Preferences** and set **Read NULL numbers as** to 0.
- 2** Select **Query -> Load**.
- 3** In the **Load SQL Statement** dialog box, select the **File name**, `basic.qry`, and click **Open**.
- 4** In the VQB, type a value for the **MATLAB workspace variable**, for example, `A`, and then click **Execute**.

## Relational Display of Data

- 1 After executing a query, select **Data** from the **Display** menu.

The query results appear in a figure window.

| StockNumber | January | February | March |
|-------------|---------|----------|-------|
| 125970      | 0       | 0        | 800   |
| 212569      | 1200    | 900      | 821   |
| 389123      |         |          | 890   |
| 400314      | 1400    | 1100     | 981   |
| 400339      | 1800    | 1200     | 1000  |
| 400345      | 2400    | 1500     | 1414  |
| 400455      | 3000    | 1721     | 1500  |
| 400876      | 4300    |          | 1800  |
| 400999      |         | 2400     | 2600  |
| 888652      | 5000    | 3500     | 2800  |

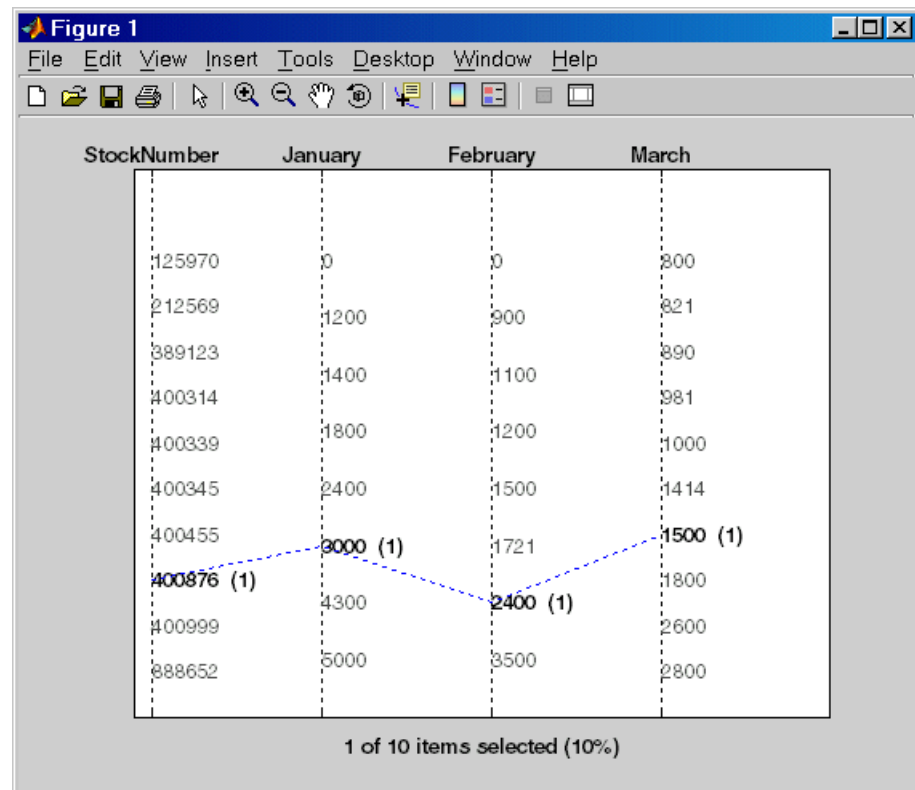
Click on a text object

The display shows only the *unique* values for each field, so you do *not* read each row as a single record. For the basic .qry example, there are 10 entries in the StockNumber field, 8 entries in the January and February fields, and 10 entries in the March field, corresponding to the number of unique values in those fields.

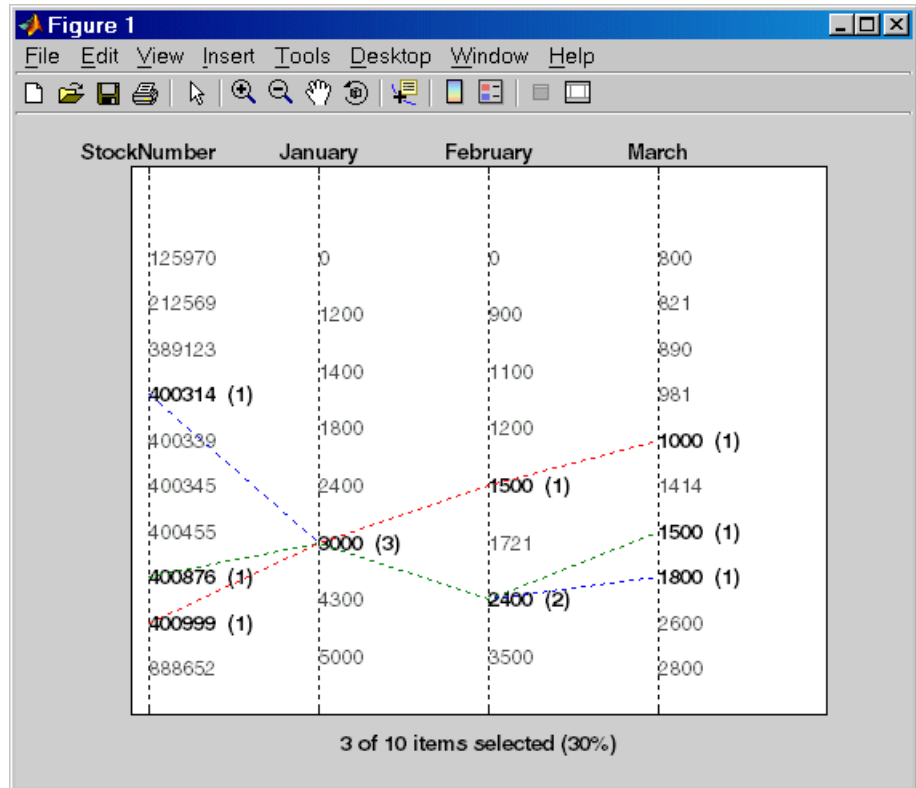


- 2 Click a value in the display, for example StockNumber 400876, to see the associated values.

The data associated with the selected value is shown in bold and connected via a dotted line. For example, sales for item 400876 are 3000 in January, 2400 in February, and 1500 in March.



As another example, click 3000 in the January field. It shows three different items with sales of 3000 units in January: 400314, 400876, and 400999.

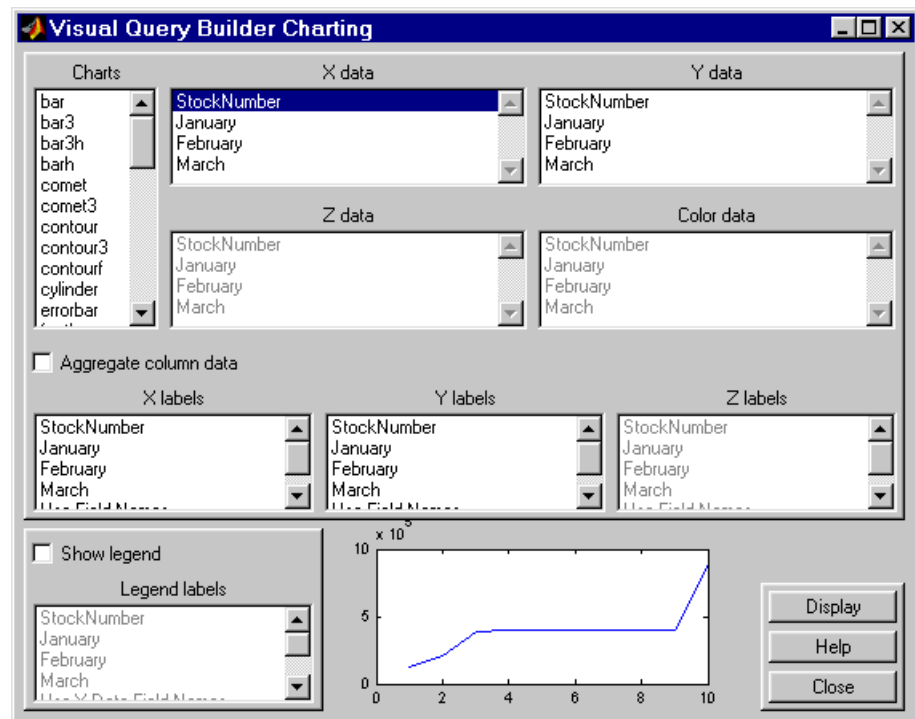


- 3 Because the display is presented in a MATLAB figure window, you can use some MATLAB figure features. For example, you can print the figure and annotate it. To print it, select **File -> Print**. You can use other print features, such as, **File -> Page Setup** and **File -> Print Preview**. For more information, use the figure window **Help** menu.
- 4 If the query results include many entries, the display might not effectively show all of them. You can stretch the window to make it larger, modify the query so there are fewer results, or display the results in a table (see “Report Display of Results in a Table” on page 2-26).

## Chart Display of Results

- 1 After executing a query, select **Chart** from the **Display** menu.

The **Charting** dialog box appears.



- 2 Select the type of chart you want to display from the **Charts** list box (plot is the default). For example, select pie to display a pie chart.

The preview of the chart at the bottom of the dialog box shows the result of your selection. For this example, the pie chart replaces the plot line, with each stock item appearing in a different color.

- 3 Select the data you want to display in the chart from the **X data**, **Y data**, and **Z data** list boxes. For the pie chart example, select March from the **X data** list box to display a pie chart of March data.

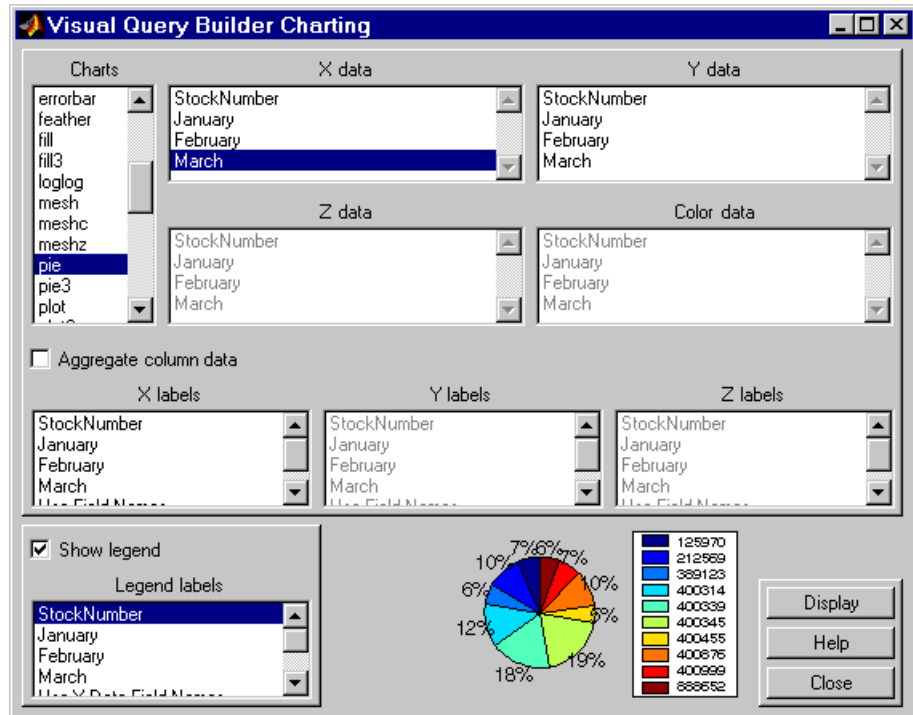
The preview of the chart at the bottom of the dialog box reflects the selection you made. For this example, the pie chart shows percentages for March data.

- 4 To display a legend, which maps the colors to the stock numbers, select the **Show legend** check box.

The **Legend labels** become available for you to select from.

- 5 Select StockNumber from the **Legend labels** list box.

A legend appears in the preview of the chart. You can drag and move the legend in the preview.

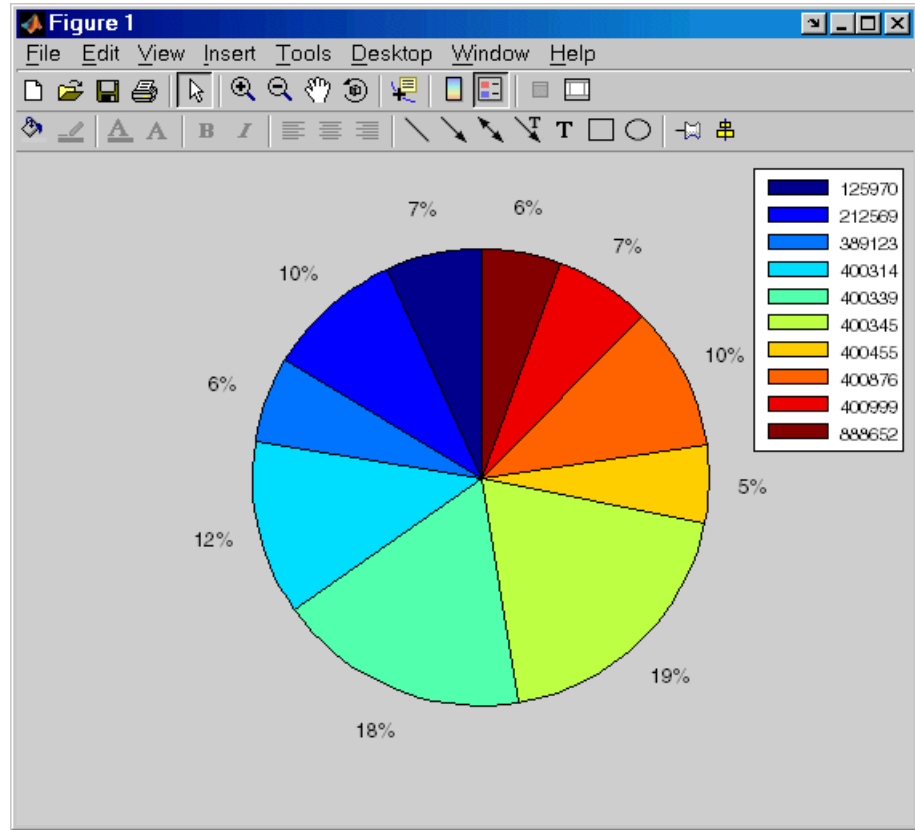


## 6 Click **Display**.

The pie chart appears in a figure window. Because the display is presented in a MATLAB figure window, you can use some MATLAB figure features such as printing or annotating the figure. To print the figure, select **File -> Print**. You can also use **File -> Page Setup** and **File -> Print Preview**.

For example:

- Resize the window by dragging any corner or edge.
- Drag the legend to another position.
- Annotate the chart using the **Insert** menu and the annotation buttons in the Plot Edit toolbar. For more information, use the figure window's **Help** menu.



7 Click **Close** to close the **Charting** dialog box.

There are many different ways to present the query results using the chart feature. For more information, click **Help** in the **Charting** dialog box.

## Report Display of Results in a Table

The report display presents the results in your system's default Web browser:

- 1 Because some browser configurations do not launch automatically, you might need to start your Web browser before using this feature.

- 2** After executing a query, select **Report** from the **Display** menu.

The query results appear as a table in your system Web browser.

**Table 1. Database Toolbox Default Report**

| StockNumber | January | February | March |
|-------------|---------|----------|-------|
| 125970      | 1400    | 1100     | 981   |
| 212569      | 2400    | 1721     | 1414  |
| 389123      | 1800    | 1200     | 890   |
| 400314      | 3000    | 2400     | 1800  |
| 400339      | 4300    | 0        | 2600  |
| 400345      | 5000    | 3500     | 2800  |
| 400455      | 1200    | 900      | 800   |
| 400876      | 3000    | 2400     | 1500  |
| 400999      | 3000    | 1500     | 1000  |
| 888652      | 0       | 900      | 821   |

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Each row represents a record from the database. For example, sales for item 400876 are 3000 in January, 2400 in February, and 1500 in March.

- 3** Use your Web browser to save the report as an HTML page if you want to view it later. To print the report, use the print features in your Web browser.

### Customized Display of Results in the Report Generator

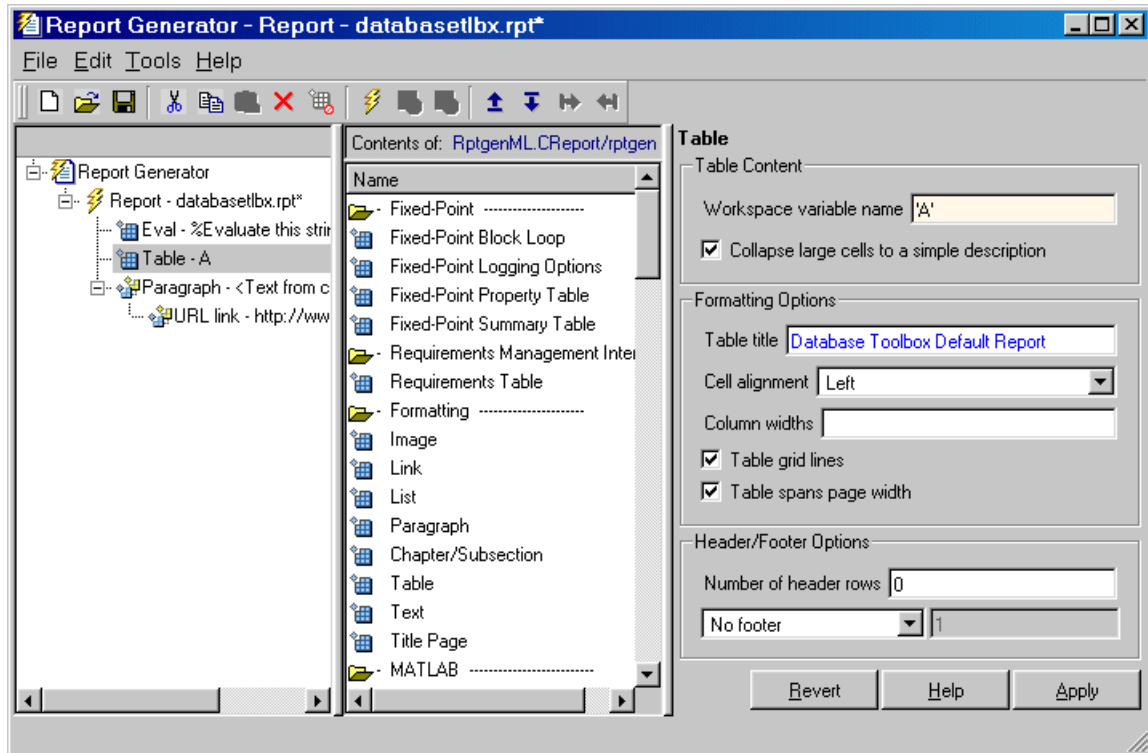
If the MATLAB Report Generator is installed, you can customize the display of results using that product.

- 1 Because some browser configurations do not launch automatically, you might need to start your Web browser before using this feature.
- 2 After executing a query, select **Report Generator** from the **Display** menu.

The **Report Generator** interface opens.

- 3 In the contents listing, select `databaset1bx.rpt` (in `$matlabroot/toolbox/database/vqb`). This is a sample report template. You can create and use your own reports.
- 4 Modify the report format—click **Open Report**.
  - a In the left column, under **Report Generator** -> **Report** `databaset1bx.rpt`, select **Table - ans**.
  - b In the right column, under **Table Content**, for **Workspace Variable Name**, replace the default, 'ans' with the **Workspace variable name** you had assigned to the query result in the Visual Query Builder, for example, 'A'.
  - c In the right column, under **Header/Footer Options**, set the **Number of header rows** to 0.
  - d Click **Apply**.

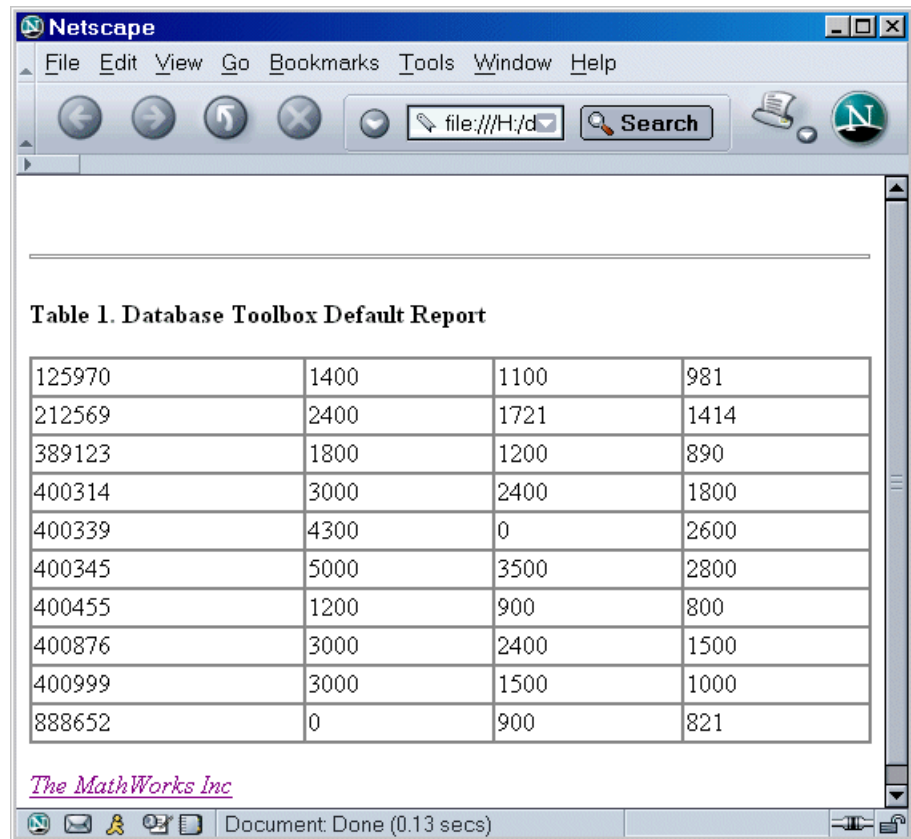




Click the **Help** button in the dialog box for more information about this and other features of the Report Generator.

- 5 To run and view the report, select **File -> Generate Report**.

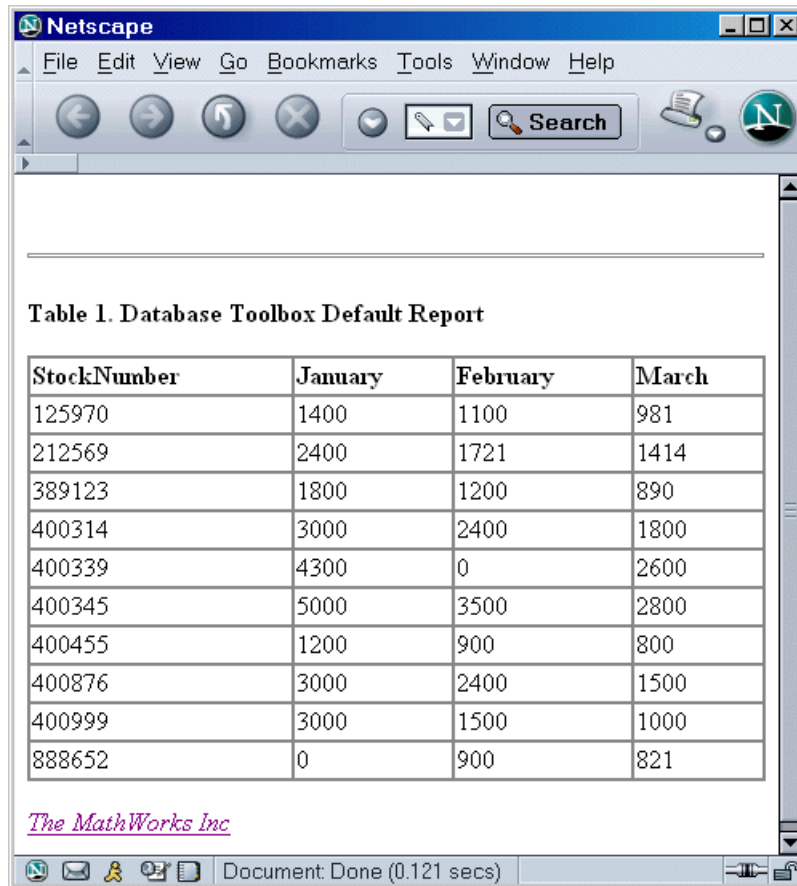
The report appears in your system's default Web browser.



- 6 Note that the names of the **Fields** from the Visual Query Builder do not automatically appear as column headers in the report, as they did for the feature described in “Report Display of Results in a Table” on page 2-26. You can modify the workspace variable, for example, *A*, to include the field names so that they will appear in the report. For example, in the Command Window, redefine *A* using

```
A = [{'Stock Number', 'January', 'February', 'March'};A]
```

In the Report Generator, change the **Header/Footer Options, Number of header rows** to 1 (refer back to step 4-c for details). The output report now shows the field names as headings.



The screenshot shows a Netscape browser window with a menu bar (File, Edit, View, Go, Bookmarks, Tools, Window, Help) and a toolbar with navigation buttons and a search box. The main content area displays a table titled "Table 1. Database Toolbox Default Report". The table has four columns: StockNumber, January, February, and March. Below the table, the text "The MathWorks Inc" is displayed in a purple font. The status bar at the bottom shows "Document: Done (0.121 secs)".

| StockNumber | January | February | March |
|-------------|---------|----------|-------|
| 125970      | 1400    | 1100     | 981   |
| 212569      | 2400    | 1721     | 1414  |
| 389123      | 1800    | 1200     | 890   |
| 400314      | 3000    | 2400     | 1800  |
| 400339      | 4300    | 0        | 2600  |
| 400345      | 5000    | 3500     | 2800  |
| 400455      | 1200    | 900      | 800   |
| 400876      | 3000    | 2400     | 1500  |
| 400999      | 3000    | 1500     | 1000  |
| 888652      | 0       | 900      | 821   |

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Each row represents a record from the database. For example, sales for item 400876 are 3000 in January, 2400 in February, and 1500 in March.

## Fine-Tuning Queries Using Advanced Query Options

Use advanced query options when retrieving data with the Visual Query Builder for these tasks:

- “Retrieving Unique Occurrences” on page 2-32
- “Retrieving Information That Meets Specified Criteria” on page 2-34
- “Presenting Results in Specified Order” on page 2-42
- “Creating Subqueries for Values from Multiple Tables” on page 2-46
- “Creating Queries for Results from Multiple Tables” on page 2-51
- “Other Features in Advanced Query Options” on page 2-54

For more information about advanced query options, select **Help** in any of the dialog boxes for the options.

### Retrieving Unique Occurrences

In the Visual Query Builder **Advanced query options**, select **Distinct** to limit results to only unique occurrences. Select **All** to retrieve all occurrences. For example:

- 1** Set **Preferences**; for this example, set **Data return format** to cellarray and **Read NULL numbers as** to NaN.
- 2** For the **Data operation**, choose **Select**.
- 3** From **Data source**, select a data source; for this example, dbtoolboxdemo.
- 4** From **Tables**, select a table; for this example, SalesVolume.
- 5** From **Fields**, select the fields; for this example, January.
- 6** Run the query to retrieve all occurrences.
  - a** In **Advanced query options**, select **All**.
  - b** Assign a **MATLAB workspace variable**; for this example, All.
  - c** Click **Execute**.

- 7 Run the query to retrieve only unique occurrences.
  - a In **Advanced query options**, select **Distinct**.
  - b Assign a **MATLAB workspace variable**, for this example, **Distinct**.
  - c Click **Execute**.
- 8 In the **Data** area, the **Workspace variable - Size** shows 10x1 for All and 8x1 for Distinct.
- 9 In the Command Window, type All, Distinct to display the query results.

```
>> All, Distinct
```

```
All =
```

```
[1400]  
[2400]  
[1800]  
[3000]  
[4300]  
[5000]  
[1200]  
[3000]  
[3000]  
[ NaN]
```

```
Distinct =
```

```
[ NaN]  
[1200]  
[1400]  
[1800]  
[2400]  
[3000]  
[4300]  
[5000]
```

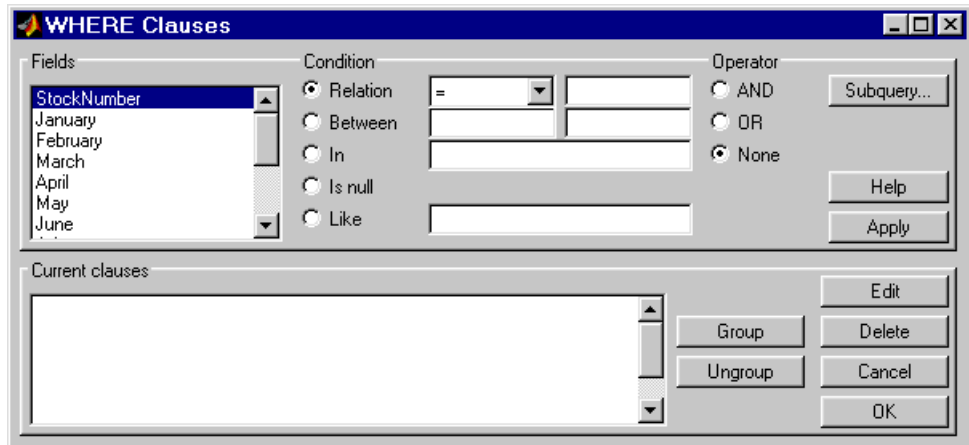
The value 3000, appears three times in All, but appears only once in Distinct.

## Retrieving Information That Meets Specified Criteria

Use the **Where** field in **Advanced query options** to retrieve only the information that meets the criteria you specify. This example uses the basic.qry query that was created and saved as explained in “Creating and Running a Query to Import Data” on page 2-7. It limits the results to those stock numbers greater than 400000 and less than 500000:

- 1 Load basic.qry. For instructions, see “Using a Saved Query” on page 2-13.
- 2 Set **Preferences**; for this example, set **Data return format** to cellarray and **Read NULL numbers as** to NaN.
- 3 In **Advanced query options**, click **Where**.

The **Where Clauses** dialog box appears.

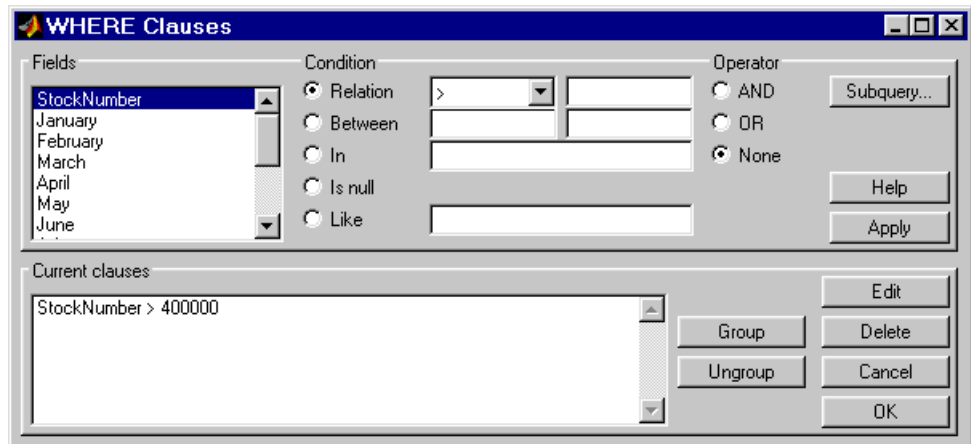


- 4 From **Fields**, select the fields whose values you want to restrict. For example, select StockNumber.

- 5 Use **Condition** to specify the criteria. For example, specify that the StockNumber be greater than 400000.
  - a Select **Relation**.
  - b From the drop-down list to the right of **Relation**, select >.
  - c In the field to the right of the drop-down list, type 400000.

The screenshot shows the 'WHERE Clauses' dialog box. The 'Fields' list on the left includes 'StockNumber', 'January', 'February', 'March', 'April', 'May', and 'June'. The 'Condition' section has 'Relation' selected, with a dropdown menu showing '>' and a text box containing '400000'. The 'Operator' section has 'None' selected. The 'Current clauses' area is empty. Buttons for 'Subquery...', 'Help', 'Apply', 'Edit', 'Group', 'Ungroup', 'Delete', 'Cancel', and 'OK' are visible.

- d Click **Apply**.  
The clause appears in the **Current clauses** area.



- 6 You can add another condition. First you edit the current clause to add the AND operator to it, and then you provide the new condition.
  - a Select StockNumber > 400000 from **Current clauses**.
  - b Click **Edit** (or double-click the StockNumber entry in **Current clauses**). The **Condition** reflects the StockNumber clause.
  - c For **Operator**, select **AND**.
  - d Click **Apply**.  
The **Current clauses** updates to show  
StockNumber > 400000 AND
- 7 Add the new condition. For example, specify that StockNumber must also be less than 500000.
  - a From **Fields**, select StockNumber.
  - b Select **Relation** from **Condition**.
  - c From the drop-down list to the right of **Relation**, select <.
  - d In the field to the right of the drop-down list, type 500000.



**e Click Apply.**

The **Current clauses** area now shows

```
StockNumber > 400000 AND
StockNumber < 500000
```

**8 Click OK.**

The **Where Clauses** dialog box closes. The **Where** field and the **SQL statement** in the **Visual Query Builder** dialog box reflect the where clause you specified.

**9 Assign a MATLAB workspace variable; for example, A.****10 Click Execute.**

The results are a 6-by-4 matrix.

**11 To view the results, type A in the Command Window. Compare these to the results for all stock numbers, which is a 10-by-4 matrix (see step 7 in “Building and Executing a Query”).**

```
>> A
A =
    [400314]    [3000]    [2400]    [1800]
    [400339]    [4300]    [ NaN]    [2600]
    [400345]    [5000]    [3500]    [2800]
    [400455]    [1200]    [ 900]    [ 800]
    [400876]    [3000]    [2400]    [1500]
    [400999]    [3000]    [1500]    [1000]

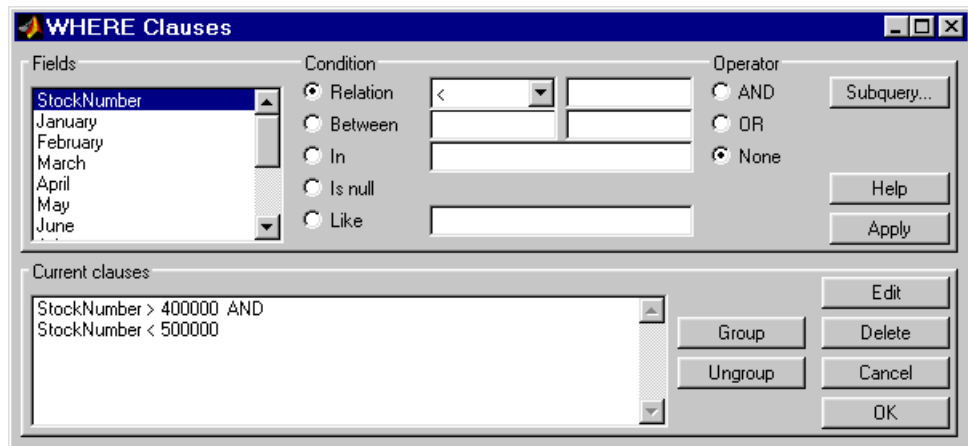
>>
```

**12 Select Save from the Query menu and name this query basic\_where.qry for use with subsequent examples.****Grouping Criteria**

In the **Where Clauses** dialog box, you can group together constraints so that the group of constraints is evaluated as a whole in the query. For the example, `basic_where.qry`, where `StockNumber` is greater than 400000 and less than 50000, modify the query to group constraints. The new query will retrieve

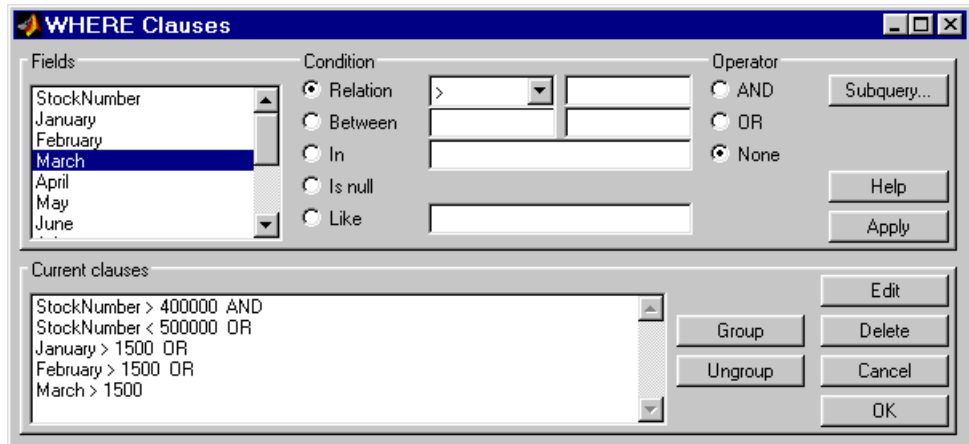
results where sales in any of the 3 months is greater than 1500 units, as long as sales for each of the 3 months is greater than 1000 units.

Click **Where** in the Visual Query Builder. The **Where Clauses** dialog box appears as follows, to retrieve data where the StockNumber is greater than 400000 and less than 500000.



- 1** Add the criteria to retrieve data where sales in any of the 3 months is greater than 1500 units.
  - a** In **Current clauses**, select StockNumber < 500000, and then click **Edit**.
  - b** For **Operator**, select OR, and then click **Apply**.
  - c** In **Fields**, select January. For **Relation**, select > and type 1500 in the field for it. For **Operator**, select OR, and then click **Apply**.
  - d** In **Fields**, select February. For **Relation**, select > and type 1500 in the field for it. For **Operator**, select OR, and then click **Apply**.
  - e** In **Fields**, select March. For **Relation**, select > and type 1500 in the field for it. Then click **Apply**.

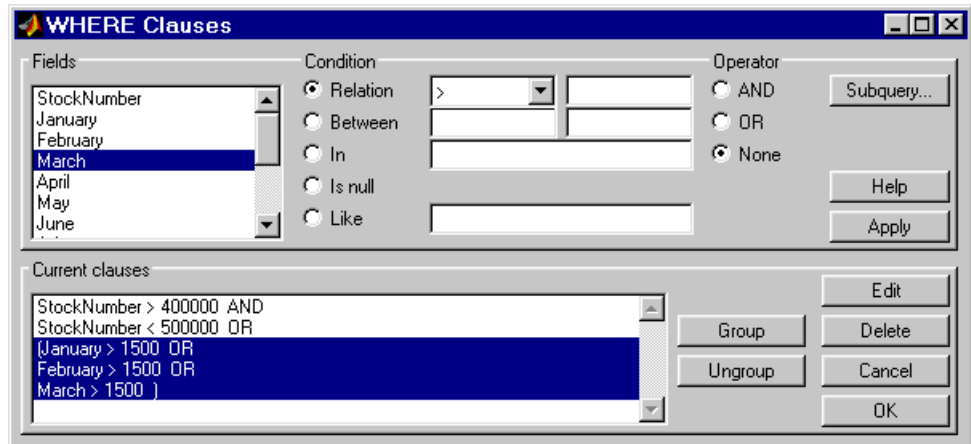
The **Where Clauses** dialog box appears as follows.



**2** Group the criteria requiring any of the months to be greater than 1500 units.

- a** In **Current clauses**, select the statement `January >1500 OR`.
- b** **Shift**+click to also select `February > 1500 OR`.
- c** **Shift**+click to also select `March > 1500`.
- d** Click **Group**.

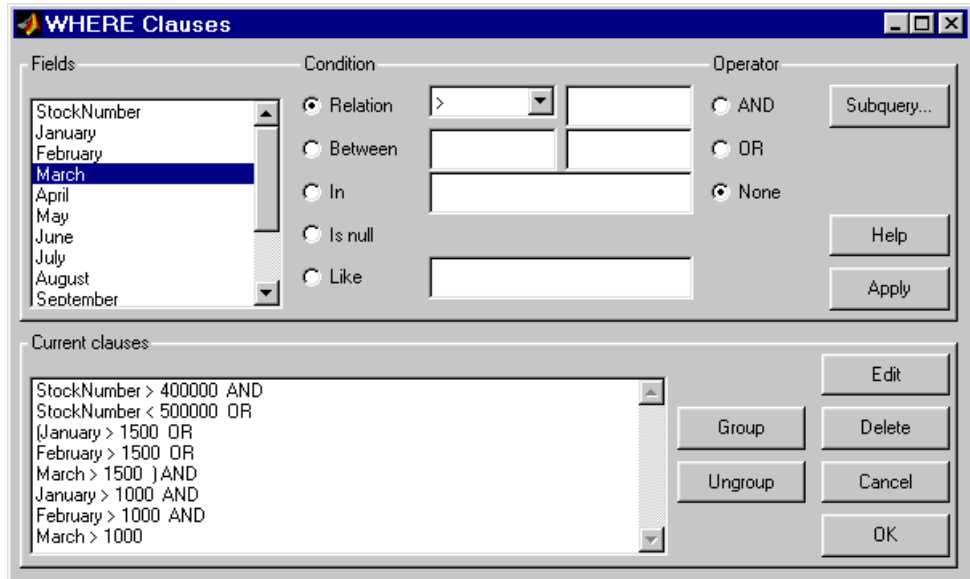
An opening parenthesis is added before `January`, and a closing parenthesis is added after `March > 1500`, signifying that these statements are evaluated as a whole.



- 3 Add the criteria to retrieve data where sales in each of the 3 months is greater than 1000 units:
  - a In **Current clauses**, select the statement `March > 1500 )`, and then click **Edit**.
  - b For **Operator**, select **AND**, and then click **Apply**.
  - c In **Fields**, select **January**. For **Relation**, select **>** and type 1000 in the field for it. For **Operator**, select **AND**, and then click **Apply**.
  - d In **Fields**, select **February**. For **Relation**, select **>** and type 1000 in the field for it. For **Operator**, select **AND**, and then click **Apply**.

- e In **Fields**, select March. For **Relation**, select > and type 1000 in the field for it. Then click **Apply**.

The **Where clauses** dialog box appears as follows.



- f Click **OK**.

The **Where Clauses** dialog box closes. The **SQL statement** in the **Visual Query Builder** dialog box reflects the modified where clause. Because the clause is long, you have to use the right arrow key in the field to see all of the contents.

- 4 Assign a **MATLAB workspace variable**, for example, AA.
- 5 Click **Execute**.

The results are a 7-by-4 matrix.

- 6 To view the results, type AA in the Command Window.

```
AA =  
  
[212569] [2400] [1721] [1414]  
[400314] [3000] [2400] [1800]  
[400339] [4300] [ NaN] [2600]  
[400345] [5000] [3500] [2800]  
[400455] [1200] [ 900] [ 800]  
[400876] [3000] [2400] [1500]  
[400999] [3000] [1500] [1000]  
  
>>
```

**Removing Grouping.** To remove grouping criteria in the **Where Clauses** dialog box, in **Current clauses**, select all of the statements in the group, and then click **Ungroup**. The parentheses are removed from the statements.

For the above example, to remove the grouping, select

```
(January > 1000 AND
```

and then **Shift**+click to also select

```
February > 1000 AND  
March > 1000)
```

Then click **Ungroup**. The three statements are no longer grouped.

## Presenting Results in Specified Order

By default, the order of the rows in the query results depends on their order in the database, which is effectively random. Use the **Order by** field in **Advanced query options** to specify the order in which results appear. This example uses the `basic_where.qry` query, which was created and saved in the example presented in “Retrieving Information That Meets Specified Criteria” on page 2-34.

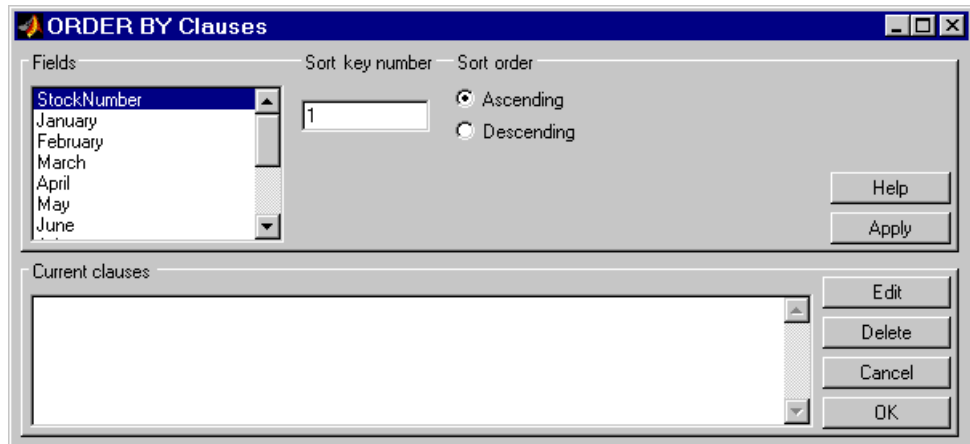
This example sorts the results of `basic_where.qry`, so that January is the primary sort field, February the secondary, and March the last. Results for January and February are ascending, and results for March are descending:

- 1 Load `basic_where.qry`. For instructions, see “Using a Saved Query” on page 2-13.

**2** Set **Preferences**. For this example, set **Data return format** to cellarray and **Read NULL numbers** as to NaN.

**3** In **Advanced query options**, click **Order by**.

The **Order By Clauses** dialog box appears.



**4** For the **Fields** whose results you want to specify the order of, specify the **Sort key number** and **Sort order**. For example, specify January as the primary sort field, with results displayed in ascending order.

- a** From **Fields**, select January.
- b** For **Sort key number**, type 1.
- c** For **Sort order**, select **Ascending**.
- d** Click **Apply**.

The **Current clauses** area now shows  
January ASC

- 5 Specify February as the second sort field, with results displayed in ascending order.
  - a From **Fields**, select February.
  - b For **Sort key number**, type 2.
  - c For **Sort order**, select **Ascending**.
  - d Click **Apply**.

The **Current clauses** area now shows

```
January ASC  
February ASC
```
- 6 Specify March as the third sort field, with results displayed in descending order.
  - a From **Fields**, select March.
  - b For **Sort key number**, type 3.
  - c For **Sort order**, select **Descending**.
  - d Click **Apply**.

The **Current clauses** area now shows

```
January ASC  
February ASC  
March DESC
```
- 7 Click **OK**.

The **Order By Clauses** dialog box closes. The **Order by** field and the **SQL statement** in the **Visual Query Builder** reflect the order by clause you specified.
- 8 Assign a **MATLAB workspace variable**, for example, B.
- 9 Click **Execute**.
- 10 To view the results, type B in the Command Window. Compare these to the unordered query results, shown as A.



A =

|          |        |        |        |
|----------|--------|--------|--------|
| [400314] | [3000] | [2400] | [1800] |
| [400339] | [4300] | [ NaN] | [2600] |
| [400345] | [5000] | [3500] | [2800] |
| [400455] | [1200] | [ 900] | [ 800] |
| [400876] | [3000] | [2400] | [1500] |
| [400999] | [3000] | [1500] | [1000] |

B =

|          |        |        |        |
|----------|--------|--------|--------|
| [400455] | [1200] | [ 900] | [ 800] |
| [400999] | [3000] | [1500] | [1000] |
| [400314] | [3000] | [2400] | [1800] |
| [400876] | [3000] | [2400] | [1500] |
| [400339] | [4300] | [ NaN] | [2600] |
| [400345] | [5000] | [3500] | [2800] |

For B, results are first sorted by January sales, in ascending order. The lowest value for January sales, 1200 (for item number 400455) appears first and the highest value, 5000 (for item number for 400345) appears last.

For items 400999, 400314, and 400876, January sales were equal at 3000. Therefore, the second sort key, February sales, applies. February sales appear in ascending order—1500, 2400, and 2400 respectively.

For items 400314 and 400876, February sales were 2400, so the third sort key, March sales, applies. March sales appear in descending order—1800 and 1500 respectively.

## Creating Subqueries for Values from Multiple Tables

Use the **Where** feature in **Advanced query options** to specify a subquery, which further limits a query by using values found in other tables. This is referred to as nested SQL. With the VQB, you can include only one subquery; use Database Toolbox functions to use multiple subqueries.

This example uses `basic.qry` (see “Creating and Running a Query to Import Data” on page 2-7). It retrieves sales volumes for the product whose description is Building Blocks. The table used for `basic.qry`, `salesVolume`, has sales volumes and a stock number field, but not a product description field. Another table, `productTable`, has the product description and stock number, but not the sales volumes. Therefore, the query needs to look at `productTable` to get the stock number for the product whose description is Building Blocks, and then has to look at the `salesVolume` table to get the sales volume values for that stock number:

- 1 Load `basic.qry`. For instructions, see “Using a Saved Query” on page 2-13.

This creates a query that retrieves the values for January, February, and March sales for all stock numbers.

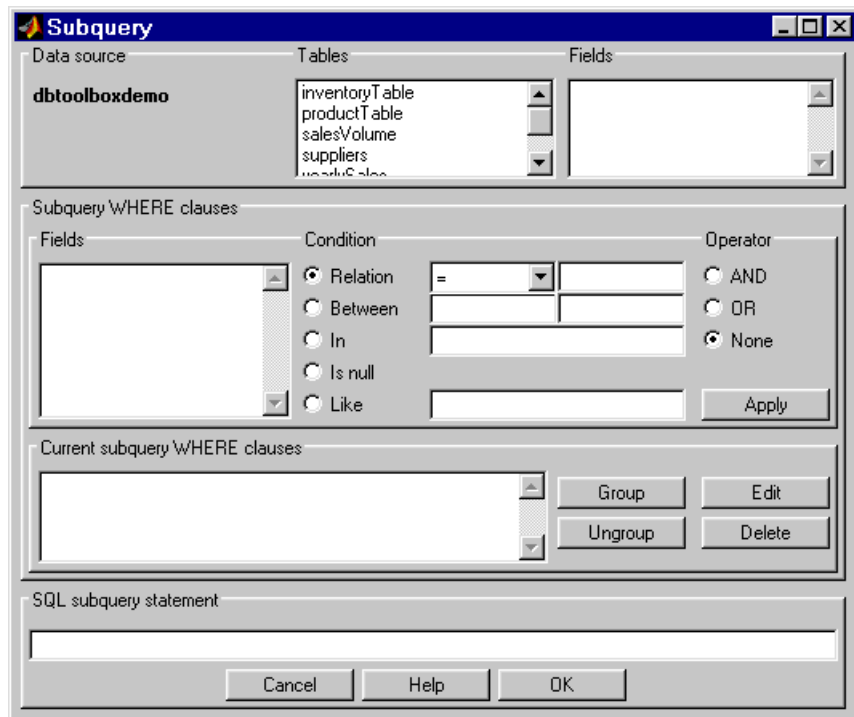
- 2 Set **Preferences**. For this example, set **Data return format** to `cellarray` and **Read NULL numbers as** to `NaN`.

- 3 In **Advanced query options**, click **Where**.

The **Where Clauses** dialog box appears.

- 4 Click **Subquery**.

The **Subquery** dialog box appears.



- 5** From **Tables**, select the table that contains the values you want to associate. In this example, select `productTable`, which contains the association between the stock number and the product description.

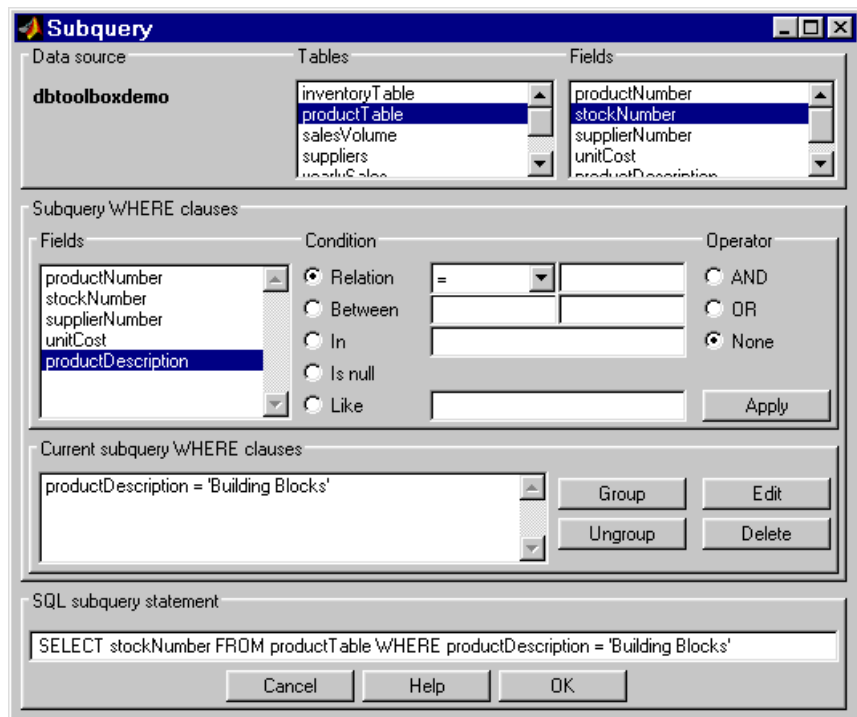
The fields in that table appear.

- 6** From **Fields**, select the field that is common to this table and the table from which you are retrieving results (the table you selected in the **Visual Query Builder** dialog box). In this example, select `stockNumber`.

This begins creating the **SQL subquery statement** to retrieve the stock number from `productTable`.

- 7 Create the condition that limits the query. In this example, limit the query to those product descriptions that are Building Blocks.
  - a In **Subquery Where clauses**, select productDescription from **Fields**.
  - b For **Condition**, select **Relation**.
  - c From the drop-down list to the right of **Relation**, select =.
  - d In the field to the right of the drop-down list, type 'Building Blocks' (include the single quotation marks to denote it is a string).
  - e Click **Apply**.

The clause appears in the **Current subquery Where clauses** area and updates the **SQL subquery statement**.

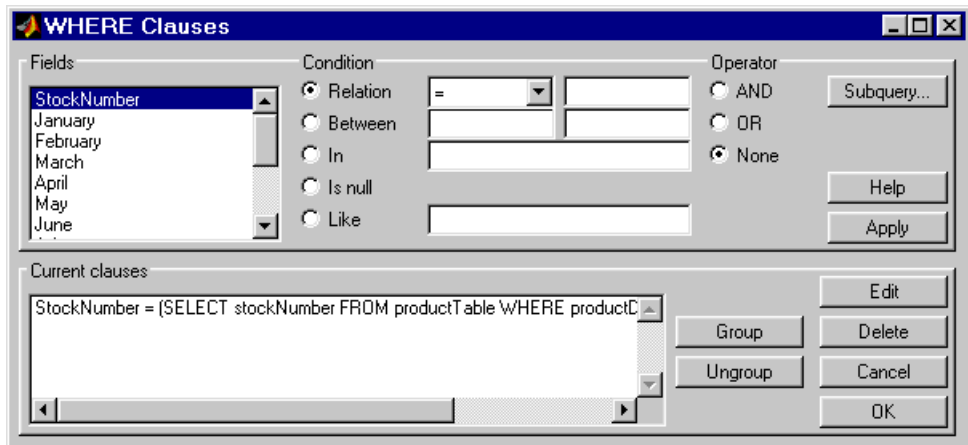


- 8** In the **Subquery** dialog box, click **OK**.

The **Subquery** dialog box closes.

- 9** In the **Where Clauses** dialog box, click **Apply**.

This updates the **Current clauses** area using the subquery criteria specified in steps 3 through 8.



- 10** In the **Where Clauses** dialog box, click **OK**.

This closes the **Where Clauses** dialog box and updates the **SQL statement** in the **Visual Query Builder** dialog box.

- 11** In the **Visual Query Builder** dialog box, assign a **MATLAB workspace variable**, for example, **C**.

- 12** Click **Execute**.

The results are a 1-by-4 matrix.

**13** Type C at the prompt in the Command Window to see the results.

```
C =  
  
    [400345]    [5000]    [3500]    [2800]  
  
>>
```

**14** The results are for item 400345, which has the product description Building Blocks, although that is not evident from the results. To verify that the product description is actually Building Blocks, run this simple query.

- a** Select dbtoolboxdemo as the **Data source**. This clears the VQB selections made during a previous query.
- b** Select productTable from **Tables**.
- c** Select stockNumber and productDescription from **Fields**.
- d** Assign a **MATLAB workspace variable**, for example, P.
- e** Click **Execute**.
- f** Type P at the prompt in the Command Window to view the results.

```
P =  
  
    [125970]    'Victorian Doll'  
    [212569]    'Train Set'  
    [389123]    'Engine Kit'  
    [400314]    'Painting Set'  
    [400339]    'Space Cruiser'  
    [400345]    'Building Blocks'  
    [400455]    'Tin Soldier'  
    [400876]    'Sail Boat'  
    [400999]    'Slinky'  
    [888652]    'Teddy Bear'
```

The results show that item 400345 has the product description Building Blocks. “Creating Queries for Results from Multiple Tables” on page 2-51 creates a query that includes the product description in the results.

## Creating Queries for Results from Multiple Tables

You can select multiple tables to create a query whose results include values from both tables. This is called a *join* operation in SQL.

This example retrieves sales volumes by product description. The example is very similar to the example in “Creating Subqueries for Values from Multiple Tables” on page 2-46. The difference is that this example creates a query that uses both tables in order to include the product description rather than the stock number in the results.

The salesVolume table has sales volumes and a stock number field, but not a product description field. Another table, productTable, has the product description and the stock number, but not sales volumes. Therefore, the query needs to retrieve data from both tables and equate the stock number from productTable with the stock number from the salesVolume table:

- 1 Set **Preferences**. For this example, set **Data return format** to cellarray and **Read NULL numbers as** to NaN.
- 2 For **Data operation**, choose **Select**.
- 3 Select the **Data source**, for this example, dbtoolboxdemo. This clears the VQB selections made during a previous query.

The tables in that data source appear in **Tables**.

- 4 From **Tables**, select the tables from which you want to retrieve data. For example, **Ctrl+click** productTable and salesVolume to select both tables.

The fields (columns) in those tables appear in **Fields**. Note that the field names now include the table names. For example, productTable.stockNumber is the field name for the stock number in the product table, and salesVolume.StockNumber is the field name for the stock number in the sales volume table.

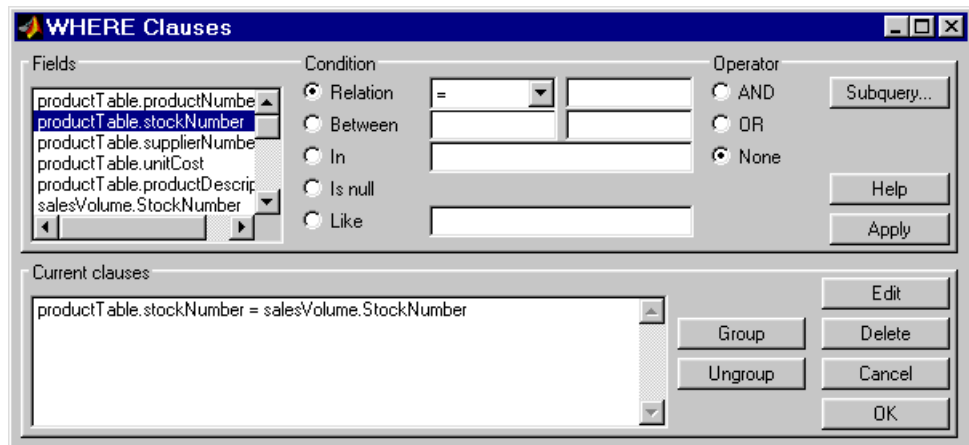
- 5 From **Fields**, select these fields to be included in the results. For example, **Ctrl+click** on productTable.productDescription, salesVolume.January, salesVolume.February, and salesVolume.March.

- 6** In **Advanced query options**, click **Where** to make the necessary associations between fields in different tables. For example, the where clause equates the `productTable.stockNumber` with the `salesVolume.StockNumber` so that the product description is associated with sales volumes in the results.

The **Where Clauses** dialog box appears.

- 7** In the **Where Clauses** dialog box:
- a** Select `productTable.stockNumber` from **Fields**.
  - b** For **Condition**, select **Relation**.
  - c** From the drop-down list to the right of **Relation**, select `=`.
  - d** In the field to the right of the drop-down list, type `salesVolume.StockNumber`.
  - e** Click **Apply**.

The clause appears in the **Current clauses** area.



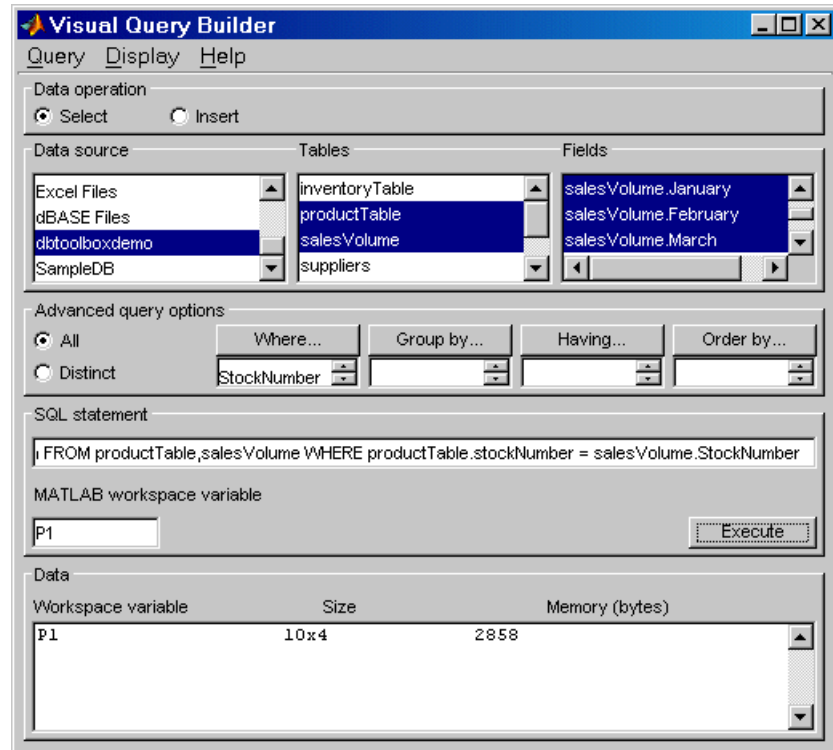
- f** Click **OK**.

The **Where Clauses** dialog box closes. The **Where** field and **SQL statement** in the **Visual Query Builder** dialog box reflect the where clause.



- 8 Assign a **MATLAB workspace variable**, for example, P1.
- 9 Click **Execute** to run the query.

The results are a 10-by-4 matrix.



**10** Type P1 at the prompt in the Command Window to see the results.

P1 =

|                   |        |        |        |
|-------------------|--------|--------|--------|
| 'Victorian Doll'  | [1400] | [1100] | [ 981] |
| 'Train Set'       | [2400] | [1721] | [1414] |
| 'Engine Kit'      | [1800] | [1200] | [ 890] |
| 'Painting Set'    | [3000] | [2400] | [1800] |
| 'Space Cruiser'   | [4300] | [ NaN] | [2600] |
| 'Building Blocks' | [5000] | [3500] | [2800] |
| 'Tin Soldier'     | [1200] | [ 900] | [ 800] |
| 'Sail Boat'       | [3000] | [2400] | [1500] |
| 'Slinky'          | [3000] | [1500] | [1000] |
| 'Teddy Bear'      | [ NaN] | [ 900] | [ 821] |

## Other Features in Advanced Query Options

For more information about advanced query options, select the option and then click **Help** in the resulting dialog box. For example, click **Group by** in **Advanced query options**, and then click **Help** in the **Group by Clauses** dialog box.

## Retrieving BINARY and OTHER Java Data

The Database Toolbox supports the data types listed in “Data Types” on page 1-9 with no data manipulation required. You can also import BINARY and OTHER Java SQL objects, such as bitmap images. The process for importing BINARY and OTHER Java objects differs from the standard VQB import process in these ways:

- MATLAB cannot directly process these Java data types when returned. You need to understand the object contents to use the data. You might need to massage the data, such as stripping off leading entries added by your driver during data retrieval.
- For the OTHER data type, the returned data is sometimes empty because Java does not always successfully pass it through the JDBC/ODBC bridge.

### Retrieving Images in Data

This example uses the SampleDB data source and a sample file for parsing image data, `$matlabroot/toolbox/database/vqb/parsebinary.m`. For more information about the data source, see “Setting Up a Data Source” on page 1-11.

- 1 In the VQB dialog box, select
  - a **Select for Data Operation.**
  - b SampleDB from **Data source.**
  - c Employees from **Tables.**
  - d EmployeeID and Photo from **Fields.**The Photo field contains bitmap images.
- 2 Select **Query -> Preferences** and specify the **Data return format** as cellarray or structure.
- 3 Assign A as the **MATLAB workspace variable** and click **Execute.**

- 4 Type A to view the contents.

MATLAB displays

```
A =  
 [1] [21626x1 B[]]  
 [2] [21626x1 B[]]  
 [3] [21722x1 B[]]  
 [4] [21626x1 B[]]  
 [5] [21626x1 B[]]  
 [6] [21626x1 B[]]  
 [7] [21626x1 B[]]  
 [8] [21626x1 B[]]  
 [9] [21626x1 B[]]
```

The data in column 2 of the imported data, [21626x1 B[]], indicates that the data type is BINARY.

- 5 Assign the first element in the image data to the variable photo. Type  
`photo = A{1,2};`
- 6 Run the sample program parsebinary, which will display photo as a bitmap image.

```
parsebinary(photo, 'BMP');
```

The bitmap image displays in a figure window.

The parsebinary M-file writes the retrieved data to a file, strips ODBC header information, and displays a bitmap image. For more details, type `help parsebinary` or view the parsebinary M-file in the MATLAB Editor by typing `open parsebinary`.

This is just one example of retrieving a BINARY object. Your application might require different manipulations to process the data in MATLAB.

## Exporting Data Using the VQB

Build and run a query to export data from MATLAB into new rows in a database. Then save the query for use again later.

You cannot use the VQB to replace existing data in a database with data from MATLAB. Instead, use the update function. Use Database Toolbox functions instead of the VQB if you require commit and rollback features when exporting data.

**Before You Start.** Before using the VQB, set up a data source—see “Setting Up a Data Source” on page 1-11. The examples here use the SampleDB data source.

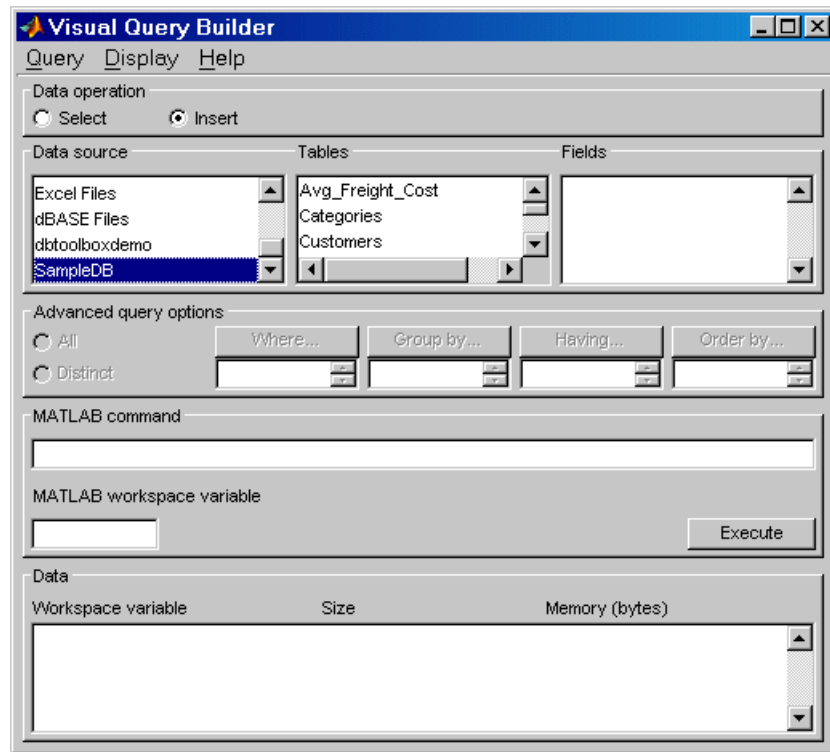
**To Start.** To open the VQB, in the Command Window, type

```
querybuilder
```

In the VQB, perform these steps to create and run a query to export data:

- 1** In the **Data operation** field, select **Insert**, meaning you want to insert data into a database.
- 2** From the **Data source** list box, select the data source into which you want to export data. For this example, select SampleDB, which is the data source for the Nwind database.

After selecting a data source, the set of **Tables** in that data source appears.



- 3 From the **Tables** list box, select the table into which you want to export data. For this example, select Avg\_Freight\_Cost. Table names that include spaces appear in quotation marks. For Microsoft Excel, the **Tables** are Excel sheets.

After you select a table, the set of **Fields** (column names) in that table appears.

- 4 From the **Fields** list box, select the fields into which you want to export data. To select more than one field, hold down the **Ctrl** key or **Shift** key while selecting. For this example, select the fields Calc\_Date and Avg\_Cost. Field names that include spaces appear in quotation marks. To deselect an entry, use **Ctrl**+click.

As you select items from the **Fields** list, the query appears in the **MATLAB Command** field.

- 5 Assign the data you want to export to a variable. For this example, type the following in the Command Window.

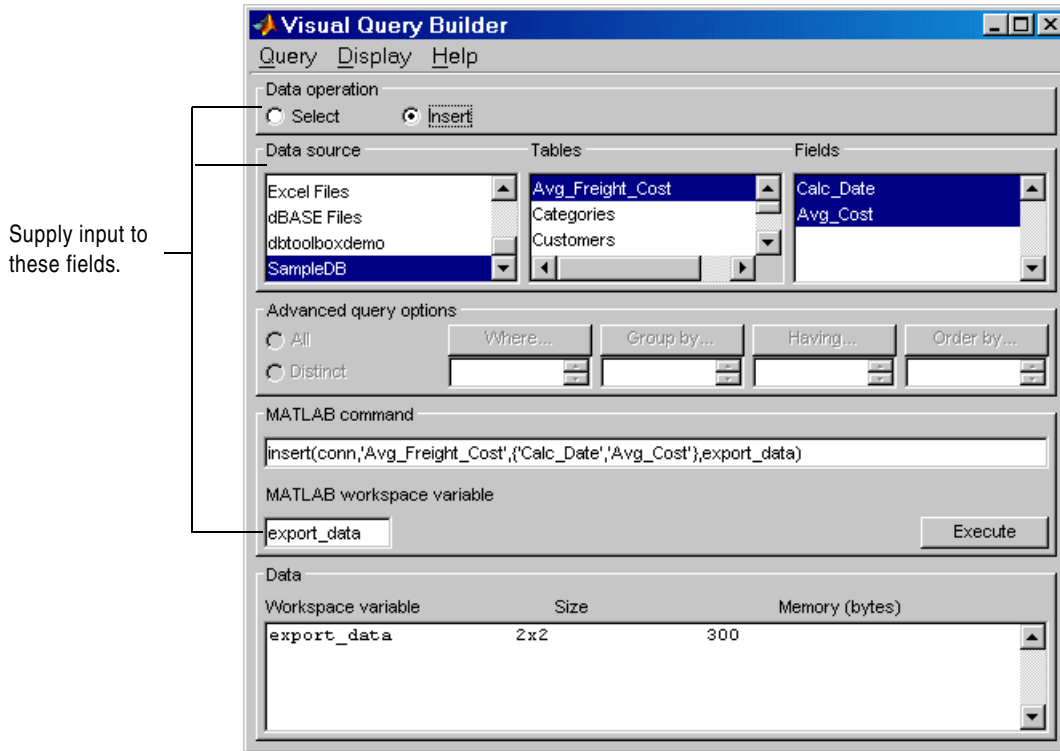
```
export_data = {'07-Aug-2003', 50.44};
```

This cell array contains a date and a numeric value.

If the data contains NULL values, specify the format they take. Select **Query -> Preferences** and specify **Write NULL numbers from** and **Write NULL strings from**. For more information about these preferences, see the property descriptions on the reference page for `setdbprefs`, which is the equivalent function for setting preferences.

- 6 In the VQB **MATLAB workspace variable** field, enter the name of the variable whose data you want to export. For this example, use `export_data`. Press **Enter** or **Return** to view the **MATLAB command** that exports the data.
- 7 Click **Execute** to run the query and export the data.


The query runs and exports the data. In the **Data** area, information about the exported data appears.



If an error dialog box appears, the query is invalid. For example, you cannot perform a query on table and field names that contain quotation marks.



- 8 In Microsoft Access, view the Avg\_Freight\_Cost table to verify the results.



The screenshot shows a Microsoft Access window titled "Avg\_Freight\_Cost : Ta...". The window displays a table with two columns: "Calc\_Date" and "Avg\_Cost". The first record shows "07-Aug-2003" and "50". The second record shows a blank date and "0". Below the table, the status bar indicates "Record: 2 of" with navigation buttons.

| Calc_Date   | Avg_Cost |
|-------------|----------|
| 07-Aug-2003 | 50       |
|             | 0        |

Note that the Avg\_Cost value was rounded to a whole number to match the properties of that field in Access.

- 9 To save this query, select **Query -> Save** and name it `export.qry`. See “Saving, Editing, Clearing Variables for, and Specifying Preferences for Queries” on page 2-13.

## BOOLEAN (MATLAB logical) Data

When you import data of the BOOLEAN type, MATLAB reads the data as a logical data type within the cell array or structure, having a value of 0 (false) or 1 (true). Similarly, you can export logical data from MATLAB to a database. This example illustrates both importing and exporting BOOLEAN data. For more information about the MATLAB logical data type, see “Logical Types” in the MATLAB Programming documentation.

- “Importing BOOLEAN Data” on page 2-62
- “Exporting BOOLEAN Data” on page 2-65

### Importing BOOLEAN Data

- 1 Set **Preferences**; for this example, set **Data return format** to cellarray.
- 2 For the **Data operation**, choose **Select**.
- 3 From **Data source**, select a data source; for this example, SampleDB.
- 4 From **Tables**, select a table; for this example, Products.
- 5 From **Fields**, select the fields; for this example, ProductName and Discontinued.
- 6 Assign the **MATLAB workspace variable**; for this example, use D.
- 7 Click **Execute** to run the query.

The VQB retrieves a 77x2 array.

- 8 Type D in the Command Window and MATLAB displays 77 records, with the first five shown here.

```
D =
    'Chai'                [0]
    'Chang'               [0]
    'Aniseed Syrup'       [0]
                        [1x28 char] [0]
                        [1x22 char] [1]
```

9 Compare this to the table in Microsoft Access.

Discontinued field is a BOOLEAN data type, where a check means true or Yes.

| Product ID | Product Name       | Supplier   | Category | Quantity      | Unit Price | Units In | Units | Reorder | Discontinued                        |
|------------|--------------------|------------|----------|---------------|------------|----------|-------|---------|-------------------------------------|
| 1          | Chai               | Exotic Liq | Bever    | 10 boxes      | \$18.00    | 39       | 0     | 10      | <input type="checkbox"/>            |
| 2          | Chang              | Exotic Liq | Bever    | 24 - 12 oz    | \$19.00    | 17       | 40    | 25      | <input type="checkbox"/>            |
| 3          | Aniseed Syrup      | Exotic Liq | Condit   | 12 - 550 ml   | \$10.00    | 13       | 70    | 25      | <input type="checkbox"/>            |
| 4          | Chef Anton's Cajun | New Orlea  | Condit   | 48 - 6 oz jar | \$22.00    | 53       | 0     | 0       | <input type="checkbox"/>            |
| 5          | Chef Anton's Gummi | New Orlea  | Condit   | 36 boxes      | \$21.35    | 0        | 0     | 0       | <input checked="" type="checkbox"/> |

Design view in Access for the **Discontinued** field shows it is a Yes/No (BOOLEAN) data type.

| Field Name   | Data Type | Description                            |
|--------------|-----------|--|
| Discontinued | Yes/No    | Yes means item is no longer available. |

Field Properties

General | Lookup

Format: Yes/No

Caption: \_\_\_\_\_

Default Value: =No

Validation Rule: \_\_\_\_\_

Validation Text: \_\_\_\_\_

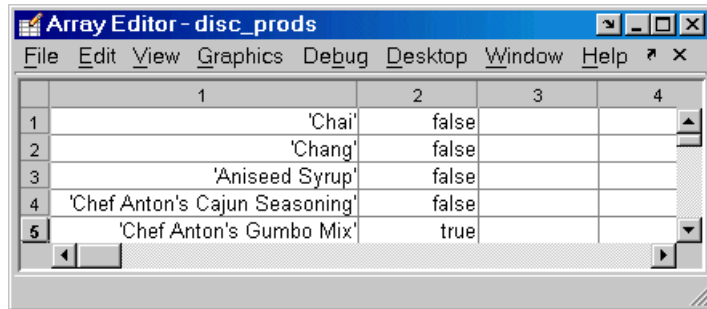
Required: No

Indexed: No

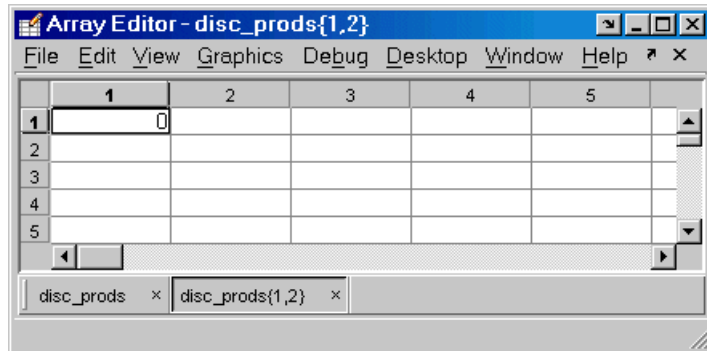
The field description is optional. It helps you describe the field and is also displayed in the status bar when you select this field on a form. Press F1 for help on descriptions.

- 10** In the VQB Data area, double-click D to view the contents in the Array Editor.

The logical data type appears as false instead of 0 in the Array Editor cell array display. Double-click the false element in the cell array to view the logical value.



- 11** In the Array Editor, the logical value for the first product, Chai, appears as false instead of 0 for the cell array. This is to distinguish it as a logical value instead of a numeric 0. In the Array Editor, double-click false. Its logical value, 0, appears in a separate window.



## Exporting BOOLEAN Data

This example adds two rows of data to the Products table in the Access Nwind database.

- 1 In the MATLAB Command Window, create the structure P, which will be exported, by typing these commands:

```
P.ProductName{1}='Chocolate Truffles';
P.Discontinued{1}=logical(0);
P.ProductName{2}='Guatemalan Coffee';
P.Discontinued{2}=logical(1);
```

- 2 For the **Data operation**, choose **Insert**.
  - 3 From **Data source**, select a data source; for this example, SampleDB.
  - 4 From **Tables**, select a table; for this example, Products.
  - 5 From **Fields**, select the fields; for this example, ProductName and Discontinued.
  - 6 Assign the **MATLAB workspace variable**; for this example, use P.
  - 7 Click **Execute** to run the query.
- The VQB inserts two new rows into the Products table.
- 8 View the table in Microsoft Access to ensure the data was correctly inserted.

The screenshot shows a Microsoft Access table named 'Products : Table'. The table has the following columns: Product, Product Name, Supplier, Category, Quantity Per Unit, Unit Price, Units, Units On Hand, Reorder Level, and Discontinued. The data is as follows:

| Product | Product Name             | Supplier    | Category | Quantity Per Unit | Unit Price | Units | Units On Hand | Reorder Level | Discontinued                        |
|---------|--------------------------|-------------|----------|-------------------|------------|-------|---------------|---------------|-------------------------------------|
| 74      | Longlife Tofu            | Tokyo Trad  | Produc   | 5 kg pkg.         | 10.00      | 4     | 20            | 5             | <input type="checkbox"/>            |
| 75      | Rhönbräu Klosterbier     | Plutzer Leb | Bevera   | 24 - 0.5 l bc     | 7.75       | 125   | 0             | 25            | <input type="checkbox"/>            |
| 76      | Lakkalikööri             | Karkki Oy   | Bevera   | 500 ml            | 18.00      | 57    | 0             | 20            | <input type="checkbox"/>            |
| 77      | Original Frankfurter grü | Plutzer Leb | Condin   | 12 boxes          | 13.00      | 32    | 0             | 15            | <input type="checkbox"/>            |
| 78      | Chocolate Truffles       |             |          |                   | 0.00       | 0     | 0             | 0             | <input type="checkbox"/>            |
| 79      | Guatemalan Coffee        |             |          |                   | 0.00       | 0     | 0             | 0             | <input checked="" type="checkbox"/> |
| *       | Number)                  |             |          |                   | 0.00       | 0     | 0             | 0             | <input type="checkbox"/>            |

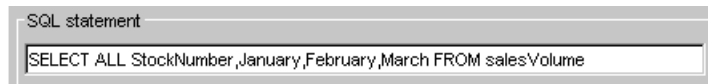
The status bar at the bottom indicates 'Record: 1 of 79'.

## Using VQB Queries in Database Toolbox Functions

Use the Visual Query Builder to easily create a query with its graphical interface. Then copy information from the SQL statement or MATLAB command field for use with Database Toolbox functions. For more information, see Chapter 3, “Using Functions in the Database Toolbox.”

### Example Using VQB SQL Statement with exec Function

In the VQB, select **Query -> Load** and choose `basic.qry`, which you created in “Saving a Query” on page 2-13. The **SQL statement** in the VQB contains the SQL query.



You can run the same query using Database Toolbox functions in the Command Window.

- 1 Connect to the database with the `database` function. This is the equivalent of selecting the **Data source** in the VQB.

```
conn = database('dbtoolboxdemo', '', '')
```

- 2 Issue an SQL query with the `exec` function. This is the equivalent of selecting the **Tables** and **Fields** in the VQB. In creating the `exec` statement, you can copy the content of the **SQL statement** from the VQB and paste it into the Command Window.

```
curs=exec(conn, 'SELECT ALL StockNumber,January,February,March  
FROM salesVolume');
```

- 3 Get the data using `fetch`.

```
curs=fetch(curs);
```

**4** View the results.

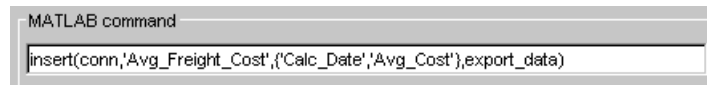
```
curs.Data
```

MATLAB displays

```
ans =
    [125970]    [1400]    [1100]    [ 981]
    [212569]    [2400]    [1721]    [1414]
    [389123]    [1800]    [1200]    [ 890]
    [400314]    [3000]    [2400]    [1800]
    [400339]    [4300]    [ NaN]    [2600]
    [400345]    [5000]    [3500]    [2800]
    [400455]    [1200]    [ 900]    [ 800]
    [400876]    [3000]    [2400]    [1500]
    [400999]    [3000]    [1500]    [1000]
    [888652]    [ NaN]    [ 900]    [ 821]
```

## Example Using VQB MATLAB Command with insert Function

In the VQB, select **Query -> Load** and choose `export.qry`, which you created in “Exporting Data Using the VQB” on page 2-57. The **MATLAB command** in the VQB contains the insert statement.



```
MATLAB command
insert(conn,'Avg_Freight_Cost',{'Calc_Date','Avg_Cost'},export_data)
```

You can run the same query using Database Toolbox functions in the Command Window.

**1** Connect to the database with the database function. This is the equivalent of selecting the **Data source** in the VQB.

```
conn = database('SampleDB', '', '')
```

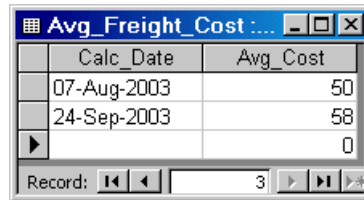
**2** Create the data to insert. Use

```
D = {'24-Sep-2003',57.51};
```

- 3 Export the data using the insert function. Copy the contents of the **MATLAB command** field from the VQB, paste it into the Command Window, change the variable name in the statement from export\_data to D, and run the statement. This is the equivalent of assigning the **MATLAB workspace variable** and executing the query in the VQB.

```
insert(conn, 'Avg_Freight_Cost', {'Calc_Date', 'Avg_Cost'}, D)
```

MATLAB exports the data to the database, which you can verify by viewing the table in Access.



The screenshot shows a table window titled 'Avg\_Freight\_Cost ...'. The table has two columns: 'Calc\_Date' and 'Avg\_Cost'. The data rows are as follows:

| Calc_Date   | Avg_Cost |
|-------------|----------|
| 07-Aug-2003 | 50       |
| 24-Sep-2003 | 58       |
|             | 0        |

At the bottom of the window, there is a 'Record:' field with navigation buttons and the number '3'.



# Using Functions in the Database Toolbox

---

When first using the toolbox, follow the simple examples in this section consecutively. Once you are familiar with the process, refer to the example of interest. To run these examples, you need to set up the specified data source—for instructions, see “Setting Up a Data Source” on page 1-11. If your version of Microsoft Access is different from the one used here, you might get different results. M-files containing functions used in some of these examples are in `matlab/toolbox/database/dbdemos`. For more information on the functions used in these examples, type `doc` followed by the function name, or see Chapter 4, “Function Reference.”

|  |   |
|--|---|
| Importing Data into MATLAB from a Database (p. 3-2)                | Import data from the <code>SampleDB</code> data source, including setting the format for retrieved data.            |
| Viewing Information About the Imported Data (p. 3-8)               | View information retrieved from the <code>SampleDB</code> data source, such as number of rows and column names.     |
| Exporting Data from MATLAB to a New Record in a Database (p. 3-11) | Export a new record from MATLAB and commit it to the <code>SampleDB</code> data source.                             |
| Replacing Existing Data in a Database from MATLAB (p. 3-16)        | Update an existing record in the <code>SampleDB</code> data source.   |
| Exporting Multiple New Records from MATLAB (p. 3-18)               | After importing data from the <code>dbtoolboxdemo</code> data source, export multiple records to a different table. |
| Retrieving BINARY or OTHER Java SQL Data Types (p. 3-22)           | Retrieve BINARY or OTHER Java SQL data types, such as bitmap images and MAT-files.                                  |
| Accessing Metadata (p. 3-25)                                       | Get information about the <code>dbtoolboxdemo</code> data source.   |
| Performing Driver Functions (p. 3-32)                              | Create driver objects and set and get the properties (does not require you to set up a data source).                |
| About Objects and Methods for the Database Toolbox (p. 3-35)       | Use object-oriented methods with the Database Toolbox.  |
| Working with Cell Arrays in MATLAB (p. 3-38)                       | Examples for the toolbox, if you are unfamiliar with cell arrays, used for mixed data types.                        |

## Importing Data into MATLAB from a Database

In this example, you connect to and import data from a database. Specifically, you connect to the SampleDB data source, and then import country data from the customers table in the Nwind sample database.

---

**Note** You can use the Visual Query Builder GUI instead of functions to import data from a database. See Chapter 2, “Visual Query Builder” for details.

---

In this section, you learn to use these Database Toolbox functions:

- database
- exec
- fetch
- logintimeout
- ping
- setdbprefs

If you want to see or copy the functions for this example, or if you want to run the set of functions, use the M-file

matlab\toolbox\database\dbdemos\dbimportdemo.m:

- 1 If you did not already do so, set up the data source SampleDB according to the directions in “Setting Up a Data Source” on page 1-11.
- 2 In MATLAB, set the maximum time, in seconds, you want to allow the MATLAB session to try to connect to a database. This prevents the MATLAB session from hanging up if a database connection fails.

Enter the function *before* you connect to a database.

Type

```
logintimeout(5)
```

to specify the maximum allowable connection time as 5 seconds. If you are using a JDBC connection, the function syntax is different. For more information, see `logintimeout`.

MATLAB returns

```
ans=
     5
```

When you use the `database` function in the next step to connect to the database, MATLAB tries to make the connection. If it cannot connect in 5 seconds, it stops trying.

### 3 Connect to the database by typing

```
conn = database('SampleDB', '', '')
```

In this example, you define a MATLAB variable, `conn`, to be the returned connection object. This connection stays open until you close it with the `close` function.

For the `database` function, you provide the name of the database, which is the data source `SampleDB` for this example. The other two arguments for the `database` function are `username` and `password`. For this example, they are empty strings because the `SampleDB` database does not require a `username` or `password`.

If you are using a `JDBC` connection, the `database` function syntax is different. For more information, see the [database reference page](#).

For a valid connection, MATLAB returns information about the connection object.

```
conn =
  Instance: 'SampleDB'
  UserName: ''
  Driver: []
  URL: []
  Constructor: [1x1
               com.mathworks.toolbox.database.databaseConnect]
  Message: []
  Handle: [1x1 sun.jdbc.odbc.JdbcOdbcConnection]
  Timeout: 5
  AutoCommit: 'on'
  Type: 'Database Object'
```

**4** Check the connection status by typing

```
ping(conn)
```

MATLAB returns status information about the connection, indicating that the connection was successful.

```
DatabaseProductName: 'ACCESS'  
DatabaseProductVersion: '04.00.0000'  
JDBCDriverName: 'JDBC-ODBC Bridge (odbcjt32.dll)'  
JDBCDriverVersion: '2.0001 (04.00.6200)'  
MaxDatabaseConnections: 64  
CurrentUserName: 'admin'  
DatabaseURL: 'jdbc:odbc:SampleDB'  
AutoCommitTransactions: 'True'
```

**5** Open a cursor and execute an SQL statement by typing

```
curs = exec(conn, 'select country from customers')
```

In the `exec` function, `conn` is the name of the connection object. The second argument, `select country from customers`, is a valid SQL statement that selects the country column of data from the `customers` table.

The `exec` function returns a cursor object. In this example, you assign the returned cursor object to the MATLAB variable `curs`.

```
curs =  
    Attributes: []  
    Data: 0  
    DatabaseObject: [1x1 database]  
    RowLimit: 0  
    SQLQuery: 'select country from customers'  
    Message: []  
    Type: 'Database Cursor Object'  
    ResultSet: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]  
    Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]  
    Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]  
    Fetch: 0
```

The data in the cursor object is stored in MATLAB.

If MATLAB displays an error, the query syntax might be invalid. See “Data Retrieval Restrictions” on page 1-7 for more information.

- 6 Specify the format of retrieved data by typing  
`setdbprefs('DataReturnFormat','cellarray')`

In this example, the returned data contains strings so the data format must support strings, which `cellarray` does. If the returned data contains only numerics or if the nonnumeric data is not relevant, you could instead specify the numeric format, which uses less memory.

#### 7 Import data into MATLAB by typing

```
curs = fetch(curs, 10)
```

`fetch` is the function that imports data. It has the following two arguments in this example:

- `curs`, the cursor object returned by `exec`.
- `10`, the maximum number of rows you want to be returned by `fetch`. The `RowLimit` argument is optional. If `RowLimit` is omitted, MATLAB imports all remaining rows. When importing large quantities of data, rather than importing all the rows at once, import the data using multiple fetches and include the `rowlimit` argument to improve speed and memory usage.

In this example, `fetch` reassigns the cursor object containing the rows of data returned by `fetch` to the variable `curs`. MATLAB returns information about the cursor object.

```
curs =  
    Attributes: []  
           Data: {10x1 cell}  
DatabaseObject: [1x1 database]  
      RowLimit: 0  
   SQLQuery: 'select country from customers'  
   Message: []  
           Type: 'Database Cursor Object'  
   ResultSet: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]  
           Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]  
   Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]  
           Fetch: [1x1  
                  com.mathworks.toolbox.database.fetchTheData]
```

The `curs` object contains an element, `Data`, that in turn contains the rows of data in the cell array. You can tell that `Data` contains 10 rows and 1 column.

- 8 Display the Data element in the cursor object, `curs`. Assign the data element, `curs.Data` to the variable `AA`. Type

```
AA = curs.Data
```

MATLAB returns

```
AA =  
    'Germany'  
    'Mexico'  
    'Mexico'  
    'UK'  
    'Sweden'  
    'Germany'  
    'France'  
    'Spain'  
    'France'  
    'Canada'
```

Now you can use MATLAB to perform operations on the returned data. For more information, see “Working with Cell Arrays in MATLAB” on page 3-38. For more about working with strings, see “Characters and Strings” in the MATLAB Programming documentation.

If the returned data includes Java `BINARY` or `OTHER` data types, you might have to process the data before using it. See “Retrieving `BINARY` or `OTHER` Java SQL Data Types” on page 3-22 for instructions to use this type of data.

- 9 At this point, you can go to the next example. If you want to stop working now and resume with the next example at a later time, close the cursor and the connection. Type

```
close(curs)  
close(conn)
```

## Viewing Information About the Imported Data

In this example, you view information about the data you imported and close the connection. You learn to use these Database Toolbox functions:

- `attr`
- `close`
- `cols`
- `columnnames`
- `rows`
- `width`

If you want to see or copy the functions for this example, or if you want to run the set of functions, use the M-file

`matlab\toolbox\database\dbdemos\dbinfodemo.m`:

- 1** If you are continuing directly from the previous example (“Importing Data into MATLAB from a Database” on page 3-2), skip this step. Otherwise, if the cursor and connection are not open, type the following to continue with this example.

```
conn = database('SampleDB', '', '');  
curs = exec(conn, 'select country from customers');  
setdbprefs('DataReturnFormat', 'cellarray');  
curs = fetch(curs, 10);
```

- 2** View the number of rows in the data set you imported by typing

```
numrows = rows(curs)
```

MATLAB returns

```
numrows =  
    10
```

`rows` returns the number of rows in the data set, which is 10 in this example.



- 3 View the number of columns in the data set by typing

```
numcols = cols(curs)
```

MATLAB returns

```
numcols =  
    1
```

`cols` returns the number of columns in the data set, which is one in this example.

- 4 View the column names for the columns in the data set by typing

```
colnames = columnnames(curs)
```

MATLAB returns

```
colnames =  
    'country'
```

`columnnames` returns the names of the columns in the data set. This example has only one column and, therefore, only one column name, 'country', is returned.

- 5 View the width of the column (size of field) in the data set by typing

```
colsize = width(curs, 1)
```

MATLAB returns

```
colsize =  
    15
```

`width` returns the column width for the column number you specify. Here, the width of column 1 is 15.

- 6** You can use a single function to view multiple attributes for a column by typing

```
attributes = attr(curs)
```

MATLAB returns

```
attributes =  
    fieldName: 'country'  
    typeName: 'VARCHAR'  
    typeValue: 12  
    columnWidth: 15  
    precision: []  
    scale: []  
    currency: 'false'  
    readOnly: 'false'  
    nullable: 'true'  
    Message: []
```

Note that if you had imported multiple columns, you could include a `colnum` argument to specify the number of the column for which you want the information.

- 7** Close the cursor by typing

```
close(curs)
```

Always close a cursor when you are finished with it to avoid using memory unnecessarily and to ensure there are enough available cursors for other users.

- 8** At this point, you can go to the next example. If you want to stop working now and resume with the next example at a later time, close the connection. Type

```
close(conn)
```

## Exporting Data from MATLAB to a New Record in a Database

In this example, you retrieve a set of data, perform a simple calculation on the data using MATLAB, and export the results as a new record to another table in the database. Specifically, you retrieve freight costs from an orders table, calculate the average freight cost, and put the data into a cell array to export it. Then export the data (the average freight cost and the date the calculation was made) to an empty table.

If you want to see or copy the functions for this example, or if you want to run the set of functions, use the M-file `matlab\toolbox\database\dbdemos\dbinsertdemo.m`.

---

**Note** You can use the Visual Query Builder GUI instead of functions to export data from MATLAB to new rows in a database. See Chapter 2, “Visual Query Builder” for details.

---

You learn to use these Database Toolbox functions:

- `get`
- `insert`
- `setdbprefs`

- 1 If you are continuing from the previous example (“Viewing Information About the Imported Data” on page 3-8), skip this step. Otherwise, connect to the data source, `SampleDB`. Type

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

- 2** In MATLAB, set the format for retrieved data to numeric by typing
- ```
setdbprefs('DataReturnFormat','numeric')
```

In this example, the returned data will contain only a column of numbers so the data format can be numeric, which is needed to perform calculations on the data.

- 3** Import the data on which you want to perform calculations. Specifically, import the freight column of data from the orders table. To keep the example simple, import only three rows of data. Type

```
curs = exec(conn, 'select freight from orders');  
curs = fetch(curs, 3);
```

- 4** View the data you imported by typing

```
AA = curs.Data
```

MATLAB returns

```
AA =  
    32.3800  
    11.6100  
    65.8300
```

- 5** Calculate the average freight cost. First, assign the number of rows in the array to the variable numrows. Then calculate the average, assigning the result to the variable meanA. Type

```
numrows = rows(curs);  
meanA = sum(AA(:))/numrows
```

MATLAB returns

```
meanA =  
    36.6067
```

- 6** Assign the date on which this calculation was made to the variable D by typing

```
D = '20-Jan-2002';
```

For more information about working with strings in MATLAB, see “Characters and Strings” in the MATLAB Programming documentation.

- 7** Assign the date and mean to a cell array, which you will export to the database. A cell array is required because the date information is a string. Unlike importing data, you do not specify the export format using `setdbprefs`, but instead use standard MATLAB operations to define it. Put the date in the first cell by typing

```
exdata(1,1) = {D}
```

MATLAB returns

```
exdata =  
    '20-Jan-2002'
```

Put the mean in the second cell by typing

```
exdata(1,2) = {meanA}
```

MATLAB returns

```
exdata =  
    '20-Jan-2002'    [36.6067]
```

- 8** Define the names of the columns to which you will be exporting data. In this example, the column names are those in the `Avg_Freight_Cost` table you created earlier, `Calc_Date` and `Avg_Cost`. Assign the cell array containing the column names to the variable `colnames`. Type

```
colnames = {'Calc_Date', 'Avg_Cost'};
```

- 9** Before you export data from MATLAB, determine the current status of the `AutoCommit` flag for the database. The status of the `AutoCommit` flag determines if the database data will be automatically committed or not. If the flag is off, you can undo an update.

Verify the status of the `AutoCommit` flag using the `get` function by typing

```
get(conn, 'AutoCommit')
```

MATLAB returns

```
ans =  
    on
```

The AutoCommit flag is set to on so exported data will be automatically committed. In this example, keep the AutoCommit flag on; for a Microsoft Access database, this is the only option.

- 10** Export the data into the Avg\_Freight\_Cost table. For this example, type `insert(conn, 'Avg_Freight_Cost', colnames, exdata)`

where `conn` is the connection object for the database to which you are exporting data. In this example, `conn` is `SampleDB`, which is already open. However, if you export to a different database that is not open, use the database function to connect to it before exporting the data.


`Avg_Freight_Cost` is the name of the table to which you are exporting data. In the `insert` function, you also include the `colnames` cell array and the cell array containing the data you are exporting, `exdata`, both of which you defined in the previous steps. Note that you do not define the type of data you are exporting; the data is exported in its current MATLAB format.

Running `insert` appends the data as a new record at the end of the `Avg_Freight_Cost` table.

If you get an error, it may be because the table is open in design mode in Access (edit mode for other databases). Close the table in Access and repeat the `insert` function. For example, the error might be

```
[Vendor][ODBC Product Driver] The database engine could not lock table 'TableName' because it is already in use by another person or process.
```

- 11** In Microsoft Access, view the Avg\_Freight\_Cost table to verify the results.



| Calc_Date   | Avg_Cost |
|-------------|----------|
| 20-Jan-2002 | 37       |
|             | 0        |

Record: 2

Note that the Avg\_Cost value was rounded to a whole number to match the properties of that field in Access.

- 12** Close the cursor by typing

```
close(curs)
```

Always close a cursor when you are finished with it to avoid using memory unnecessarily and to ensure there are enough available cursors for other users.

- 13** At this point, you can go to the next example. If you want to stop working now and resume with the next example at a later time, close the connection. Type

```
close(conn)
```

Do not delete or change the Avg\_Freight\_Cost table in Access because you will use it in the next example.

## Replacing Existing Data in a Database from MATLAB

In this example, you update existing data in the database with exported data from MATLAB. Specifically, you update the date you previously imported into the Avg\_Freight\_Cost table.

You learn to use these Database Toolbox functions:

- close
- update

If you want to see or copy the functions for this example, or if you want to run a similar set of functions, use the M-file

matlab\toolbox\database\dbdemos\dbupdatedemo.m:

- 1** If you are continuing directly from the previous example (“Exporting Data from MATLAB to a New Record in a Database” on page 3-11), skip this step. Otherwise, type

```
conn = database('SampleDB', '', '');  
colnames = {'Calc_Date', 'Avg_Cost'};  
D = '20-Jan-2002';  
meanA = 36.6067;  
exdata = {D, meanA}
```

MATLAB returns

```
exdata =  
    '20-Jan-2002'    [36.6067]
```

- 2** Assume that the date in the Avg\_Freight\_Cost table is incorrect and instead should be 19-Jan-2002. Type

```
D = '19-Jan-2002'
```

- 3** Assign the new date value to the cell array, newdata, which contains the data you will export. Type

```
newdata(1,1) = {D}
```

MATLAB returns

```
newdata =  
    '19-Jan-2002'
```



- 4** Identify the record to be updated in the database. To do so, define an SQL where statement and assign it to the variable `whereclause`. The record to be updated is the record that has 20-Jan-2002 for the `Calc_Date`.

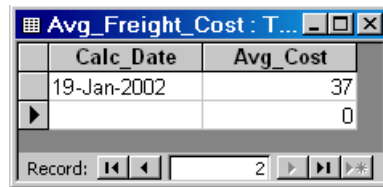
```
whereclause = 'where Calc_Date = ''20-Jan-2002'''
```

Because the date string is within a string, two single quotation marks surround the date instead of just a single quotation mark. MATLAB returns

```
whereclause =  
    where Calc_Date = '20-Jan-2002'
```

For more information about working with strings in MATLAB, see “Characters and Strings” in the MATLAB Programming documentation.

- 5** Export the data, replacing the record whose `Calc_Date` is 20-Jan-2002.
- ```
update(conn, 'Avg_Freight_Cost', colnames, newdata, whereclause)
```
- 6** In Microsoft Access, view the `Avg_Freight_Cost` table to verify the results.



| Calc_Date   | Avg_Cost |
|-------------|----------|
| 19-Jan-2002 | 37       |
|             | 0        |

- 7** Close the cursor and disconnect from the database.

```
close(curs)  
close(conn)
```

Always close a connection when you are finished with it to avoid using memory unnecessarily and to ensure there are enough available connections for other users.

## Exporting Multiple New Records from MATLAB

In this example, you import multiple records, manipulate the data in MATLAB, and then export it to a different table in the database. Specifically, you import sales figures for all products, by month, into MATLAB. Then you compute the total sales for each month. Finally, you export the monthly totals to a new table.

You learn to use these Database Toolbox functions:

- `insert`
- `setdbprefs`

If you want to see or copy the functions for this example, or if you want to run a similar set of functions, use the M-file

```
matlab\toolbox\database\dbdemos\dbinsert2demo.m:
```

- 1 If you did not already do so, set up the data source `dbtoolboxdemo` according to the directions in “Setting Up a Data Source” on page 1-11. This data source uses the tutorial database.
- 2 Check the properties of the tutorial database to be sure it is writable, that is, *not* read only.
- 3 Connect to the database by typing

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

You define the returned connection object as `conn`. You do not need a username or password to access the `dbtoolboxdemo` database.

- 4 Specify preferences for the retrieved data by using the `setdbprefs` function. Set the data return format to `numeric` and specify that any NULL value read from the database is to be converted to a 0 in MATLAB.

```
setdbprefs...  
({'NullNumberRead'; 'DataReturnFormat'}, {'0'; 'numeric'})
```

Note that when you specify `DataReturnFormat` as `numeric`, the value for `NullNumberRead` must also be numeric, such as 0. For example, it cannot be a string, such as NaN.

- 5** Import the sales figures. Specifically, import all data from the salesVolume table. Type

```
curs = exec(conn, 'select * from salesVolume');  
curs = fetch(curs);
```

- 6** To get a sense of the data you imported, view the column names in the fetched data set. Type

```
columnnames(curs)
```

MATLAB returns

```
ans =  
    'StockNumber' 'January' 'February' 'March' 'April',  
    'May' 'June' 'July' 'August' 'September' 'October',  
    'November' 'December'
```

- 7** To get a sense of what the data is, view the data for January, which is in column 2. Type

```
curs.Data(:,2)
```

MATLAB returns

```
ans =  
    1400  
    2400  
    1800  
    3000  
    4300  
    5000  
    1200  
    3000  
    3000  
     0
```

- 8** Get the size of the matrix containing the fetched data set, assigning the dimensions to m and n. In a later step, you use these values to compute the monthly totals. Type

```
[m,n] = size(curs.Data)
```

MATLAB returns

```
m =  
    10  
n =  
    13
```

9 Compute the monthly totals by typing

```
for i = 2:n  
    tmp = curs.Data(:,i);  
    monthly(i-1,1) = sum(tmp(:));  
end
```

where `tmp` is the sales volume for all products in a given month `i`, and `monthly` is the total sales volume of all products for the month `i`.

For example, when `i` is 2, row 1 of `monthly` is the total of all rows in column 2 of `curs.Data`, where column 2 is the sales volume for January.

To see the result, type

```
monthly
```

MATLAB returns

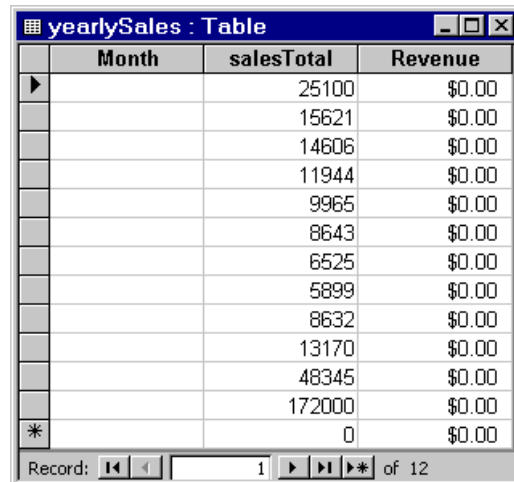
```
25100  
15621  
14606  
11944  
9965  
8643  
6525  
5899  
8632  
13170  
48345  
172000
```

- 10** Create a string array containing the column names into which you are inserting the data. In a later step, we insert the data into the `salesTotal` column of the `yearlySales` table. The `yearlySales` table contains no data. Here we assign the array to the variable `colnames`. Type

```
colnames{1,1} = 'salesTotal';
```

- 11** Insert the data into the `yearlySales` table by typing
- ```
insert(conn, 'yearlySales', colnames, monthly)
```

- 12** View the `yearlySales` table in the tutorial database to be sure the data was imported correctly.



| Month | salesTotal | Revenue |
|-------|------------|---------|
|       | 25100      | \$0.00  |
|       | 15621      | \$0.00  |
|       | 14606      | \$0.00  |
|       | 11944      | \$0.00  |
|       | 9965       | \$0.00  |
|       | 8643       | \$0.00  |
|       | 6525       | \$0.00  |
|       | 5899       | \$0.00  |
|       | 8632       | \$0.00  |
|       | 13170      | \$0.00  |
|       | 48345      | \$0.00  |
|       | 172000     | \$0.00  |
| *     | 0          | \$0.00  |

- 13** Close the cursor and database connection. Type

```
close(curs)  
close(conn)
```

## Retrieving BINARY or OTHER Java SQL Data Types

You can retrieve BINARY or OTHER Java SQL data types, however, the data might require additional processing once retrieved. For example, you can retrieve data from a MAT-file or an image file. MATLAB cannot process these data types directly. You need knowledge of the content and might need to massage the data in order to work with it in MATLAB, such as stripping off leading entries added by your driver during data retrieval.

In this example, you import data that includes bitmap images. You use a sample M-file included with the Database Toolbox in the vqb directory:

- parsebinary

Perform these steps to retrieve bitmap image data for the example:

- 1** Connect to the data source, SampleDB. Type

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

- 2** For the data return format preference, specify either cellarray or structure. For this example, set it to cellarray by typing

```
setdbprefs('DataReturnFormat','cellarray');
```

- 3** Import the data, which includes bitmap image files. For the example, import the EmployeeID and Photo columns of data from the Employees table. Type

```
curs = exec(conn, 'select EmployeeID,Photo from Employees')  
curs = fetch(curs);
```

**4** View the data you imported by typing

```
curs.Data
```

MATLAB returns

```
ans =
```

```

[1]    [21626x1 B[]]
[2]    [21626x1 B[]]
[3]    [21722x1 B[]]
[4]    [21626x1 B[]]
[5]    [21626x1 B[]]
[6]    [21626x1 B[]]
[7]    [21626x1 B[]]
[8]    [21626x1 B[]]
[9]    [21626x1 B[]]
```

The data in column 2 of the imported data, [21626x1 B[]], indicates that the data type is BINARY.

Some of the OTHER data type fields might be empty. This happens when Java cannot pass the data through the JDBC/ODBC bridge, for example.

**5** Assign the image element you want to the variable photo. Type

```
photo = curs.Data{1,2};
```

**6** Run the sample program,

\$matlabroot/toolbox/database/vqb/parsebinary.m, which displays photo as a bitmap image.

```
parsebinary(photo, 'BMP')
```

The bitmap image displays in a figure window.

The parsebinary M-file writes the retrieved data to a file, strips ODBC header information, and displays a bitmap image. For more details, type `help parsebinary` or view the parsebinary M-file in the MATLAB Editor by typing `open parsebinary`.

This is just one example of retrieving a `BINARY` or `OTHER` object. Your application might require different manipulations to process the data in `MATLAB`.



## Accessing Metadata

In this example, you access information about the database, which is called the *metadata*. You use these Database Toolbox functions:

- `dmd`
- `get`
- `supports`
- `tables`

**1** Connect to the `dbtoolboxdemo` data source. Type

```
conn = database('dbtoolboxdemo', '', '')
```

MATLAB returns information about the database object.

```
conn =  
    Instance: 'dbtoolboxdemo'  
    UserName: ''  
    Driver: []  
    URL: []  
    Constructor: [1x1  
        com.mathworks.toolbox.database.databaseConnect]  
    Message: []  
    Handle: [1x1 sun.jdbc.odbc.JdbcOdbcConnection]  
    Timeout: 0  
    AutoCommit: 'on'  
    Type: 'Database Object'
```

**2** To view additional information about the database, you first construct a database metadata object using the `dmd` function. Type

```
dbmeta = dmd(conn)
```

MATLAB returns the handle (identifier) for the metadata object.

```
dbmeta =  
    DMDHandle: [1x1 sun.jdbc.odbc.JdbcOdbcDatabaseMetaData]
```

- 3** To view a list of properties associated with the database, use the `get` function for the metadata object you just created, `dbmeta`.

```
v = get(dbmeta)
```

MATLAB returns a long list of properties associated with the database.

```
v =  
    AllProceduresAreCallable: 1  
    AllTablesAreSelectable: 1  
DataDefinitionCausesTransactionCommit: 1  
DataDefinitionIgnoredInTransactions: 0  
    DoesMaxRowSizeIncludeBlobs: 0  
        Catalogs: {4x1 cell}  
    CatalogSeparator: '.'  
    CatalogTerm: 'DATABASE'  
    DatabaseProductName: 'ACCESS'  
    DatabaseProductVersion: '04.00.0000'  
DefaultTransactionIsolation: 2  
    DriverMajorVersion: 2  
    DriverMinorVersion: 1  
        DriverName: [1x31 char]  
        DriverVersion: '2.0001 (04.00.6200)'  
    ExtraNameCharacters: [1x29 char]  
IdentifierQuoteString: ''  
    IsCatalogAtStart: 1  
MaxBinaryLiteralLength: 255  
MaxCatalogNameLength: 260  
MaxCharLiteralLength: 255  
MaxColumnNameLength: 64  
MaxColumnsInGroupBy: 10  
    MaxColumnsInIndex: 10  
MaxColumnsInOrderBy: 10  
    MaxColumnsInSelect: 255  
    MaxColumnsInTable: 255  
    MaxConnections: 64  
MaxCursorNameLength: 64  
    MaxIndexLength: 255  
MaxProcedureNameLength: 64  
    MaxRowSize: 4052  
    MaxSchemaNameLength: 0
```

```
MaxStatementLength: 65000
  MaxStatements: 0
MaxTableNameLength: 64
MaxTablesInSelect: 16
MaxUserNameLength: 0
  NumericFunctions: [1x73 char]
  ProcedureTerm: 'QUERY'
  Schemas: {}
  SchemaTerm: ''
  SearchStringEscape: '\\'
  SQLKeywords: [1x461 char]
  StringFunctions: [1x91 char]
  StoresLowerCaseIdentifiers: 0
  StoresLowerCaseQuotedIdentifiers: 0
  StoresMixedCaseIdentifiers: 0
  StoresMixedCaseQuotedIdentifiers: 1
  StoresUpperCaseIdentifiers: 0
  StoresUpperCaseQuotedIdentifiers: 0
  SystemFunctions: ''
  TableTypes: {13x1 cell}
  TimeDateFunctions: [1x111 char]
  TypeInfo: {16x1 cell}
  URL: 'jdbc:odbc:dbtoolboxdemo'
  UserName: 'admin'
NullPlusNonNullIsNotNull: 0
NullsAreSortedAtEnd: 0
NullsAreSortedAtStart: 0
  NullsAreSortedHigh: 0
  NullsAreSortedLow: 1
UsesLocalFilePerTable: 0
  UsesLocalFiles: 1
```

- 4** Some information is too long to fit in the field's display area and instead the size of the information in the field is reported. For example, the Catalogs element is shown as a {4x1 cell}. To view the actual Catalog information, type

```
v.Catalogs
```

MATLAB returns

```
ans =  
'D:\Work\databasetoolboxfiles\Nwind'  
'D:\Work\databasetoolboxfiles\Nwind_orig'  
'D:\Work\databasetoolboxfiles\tutorial'  
'D:\Work\databasetoolboxfiles\tutorial_copy'
```

For more information about the database metadata properties returned by `get`, see the methods of the `DatabaseMetaData` object at <http://java.sun.com/j2se/1.4.2/docs/api/java/sql/DatabaseMetaData.html>.

- 5** To see the properties that this database supports, use the `supports` function. Type

```
a = supports(dbmeta)
```

## MATLAB returns

a =

```
AlterTableWithAddColumn: 1
AlterTableWithDropColumn: 1
ANSI92EntryLevelSQL: 1
ANSI92FullSQL: 0
ANSI92IntermediateSQL: 0
CatalogsInDataManipulation: 1
CatalogsInIndexDefinitions: 1
CatalogsInPrivilegeDefinitions: 0
CatalogsInProcedureCalls: 0
CatalogsInTableDefinitions: 1
ColumnAliasing: 1
Convert: 1
CoreSQLGrammar: 0
CorrelatedSubqueries: 1
DataDefinitionAndDataManipulationTransactions: 1
DataManipulationTransactionsOnly: 0
DifferentTableCorrelationNames: 0
ExpressionsInOrderBy: 1
ExtendedSQLGrammar: 0
FullOuterJoins: 0
GroupBy: 1
GroupByBeyondSelect: 1
GroupByUnrelated: 0
IntegrityEnhancementFacility: 0
LikeEscapeClause: 0
LimitedOuterJoins: 0
MinimumSQLGrammar: 1
MixedCaseIdentifiers: 1
MixedCaseQuotedIdentifiers: 0
MultipleResultSets: 0
MultipleTransactions: 1
NotNullableColumns: 0
OpenCursorsAcrossCommit: 0
OpenCursorsAcrossRollback: 0
OpenStatementsAcrossCommit: 1
OpenStatementsAcrossRollback: 1
OrderByUnrelated: 0
```

```
OuterJoins: 1
PositionedDelete: 0
PositionedUpdate: 0
SchemasInDataManipulation: 0
SchemasInIndexDefinitions: 0
SchemasInPrivilegeDefinitions: 0
SchemasInProcedureCalls: 0
SchemasInTableDefinitions: 0
SelectForUpdate: 0
StoredProcedures: 1
SubqueriesInComparisons: 1
SubqueriesInExists: 1
SubqueriesInIns: 1
SubqueriesInQuantifieds: 1
TableCorrelationNames: 1
Transactions: 1
Union: 1
UnionAll: 1
```

A 1 means the database supports that property, while a 0 means the database does not support that property. For the above example, the `GroupBy` property has a value of 1, meaning the database supports the SQL group by feature.

For more information about the properties supported by the database, see the methods of the `DatabaseMetaData` object at <http://java.sun.com/j2se/1.4.2/docs/api/java/sql/DatabaseMetaData.html>.

- 6 There are other Database Toolbox functions you can use to access additional database metadata. For example, to retrieve the names of the tables in a catalog in the database, use the `tables` function. Type

```
t = tables(dbmeta, 'tutorial')
```

where `dbmeta` is the name of the database metadata object you created for the database using `dmd` in step 2, and `tutorial` is the name of the catalog for which you want to retrieve table names. (You retrieved catalog names in step 4.)

MATLAB returns the names and types for each table.

```
t =
  'MSysAccessObjects'      'SYSTEM TABLE'
  'MSysIMEXColumns'      'SYSTEM TABLE'
  'MSysIMEXSpecs'        'SYSTEM TABLE'
  'MSysObjects'          'SYSTEM TABLE'
  'MSysQueries'          'SYSTEM TABLE'
  'MSysRelationships'    'SYSTEM TABLE'
  'inventoryTable'       'TABLE'
  'productTable'         'TABLE'
  'salesVolume'          'TABLE'
  'suppliers'            'TABLE'
  'yearlySales'          'TABLE'
  'display'              'VIEW'
```

Two of these tables were used in a previous example: `salesVolume` and `yearlySales`.

For a list of all of the database metadata functions, see “Database Metadata Object” on page 4-5. Some databases do not support all of these functions.

- 7 Close the database connection. Type
 

```
close(conn)
```

## Resultset Metadata Object

Similar to the `dmd` function are the `resultset` and `rsmd` functions. Use `resultset` to create a resultset object for a cursor object that you created using `exec` or `fetch`. You can then view properties of the resultset object using `get`, create a resultset metadata object using `rsmd` and get its properties, or make calls to the resultset object using your own Java-based applications. For more information, see the reference pages for `resultset` and `rsmd`, or see the lists of related functions, “Resultset Object” and “Resultset Metadata Object” on page 4-6.

## Performing Driver Functions

This example demonstrates how to create database driver and drivermanager objects so that you can get and set the object properties. You use these Database Toolbox functions:

- drivermanager
- driver
- get
- isdriver
- set

---

**Note** There is no equivalent M-file demo to run because the example relies on a specific PC to JDBC connection and database. Your configuration will be different from the one in this example, so you cannot run these examples exactly as written. Instead, use values for your own system. See your database administrator for address information.

---

**1** Connect to the database.

```
c = database('orc1','scott','tiger',...  
            'oracle.jdbc.driver.OracleDriver',...  
            'jdbc:oracle:thin:@144.212.123.24:1822:');
```

**2** Use the driver function to construct a driver object for a specified database URL string of the form `jdbc:<subprotocol>:<subname>`. For example, type

```
d = driver('jdbc:oracle:thin:@144.212.123.24:1822:')
```

MATLAB returns the handle (identifier) for the driver object.

```
d =  
    DriverHandle: [1x1 oracle.jdbc.driver.OracleDriver]
```



- 3** To get properties of the driver object, type

```
v = get(d)
```

MATLAB returns information about the driver's versions.

```
v =  
    MajorVersion: 1  
    MinorVersion: 0
```

- 4** To determine if `d` is a valid JDBC driver object, type

```
isdriver(d)
```

MATLAB returns

```
ans =  
     1
```

which means `d` is a valid JDBC driver object. Otherwise, MATLAB would have returned a 0.

- 5** To set and get properties for all drivers, first create a `drivermanager` object using the `drivermanager` function. Type

```
dm = drivermanager
```

`dm` is the `drivermanager` object.

- 6** Get properties of the `drivermanager` object. Type

```
v = get(dm)
```

MATLAB returns

```
v =  
    Drivers: {'sun.jdbc.odbc.JdbcOdbcDriver@761630'...  
             [1x38 char]}  
    LoginTimeout: 0  
    LogStream: []
```

- 7** To set the `LoginTimeout` value to 10 for all drivers loaded during this session, type

```
set(dm,'LoginTimeout',10)
```

Verify the value by typing

```
v = get(dm)
```

MATLAB returns

```
v =  
    Drivers: {'sun.jdbc.odbc.JdbcOdbcDriver@761630'}  
 LoginTimeout: 10  
  LogStream: []
```

The next time you connect to a database, the `LoginTimeout` value will be 10.

For example, type

```
conn = database('SampleDB','','');  
logintimeout
```

MATLAB returns

```
ans =  
    10
```

For a list of all the driver object functions, see “Driver Object” and “Drivermanager Object” on page 4-6.

## About Objects and Methods for the Database Toolbox

The Database Toolbox is an object-oriented application. The toolbox has the following objects:

- Cursor
- Database
- Database metadata
- Driver
- Drivermanager
- Resultset
- Resultset metadata

Each object has its own method directory, which begins with an @ sign, in the `$matlabroot\toolbox\database\database` directory. The methods for operating on a given object are the M-file functions in the object's directory.

You can use the Database Toolbox with no knowledge of or interest in its object-oriented implementation. But for those who are interested, some of its useful aspects follow:

- You use constructor functions to create objects, such as running the `fetch` function to create a cursor object containing query results. MATLAB returns not only the object but also the stored information about the object. Because objects are structures in MATLAB, you can easily view the elements of the returned object.

As an example, if you create a cursor object `curs` using the `fetch` function, MATLAB returns

```
curs =  
    Attributes: []  
           Data: {10x1 cell}  
 DatabaseObject: [1x1 database]  
           RowLimit: 0  
           SQLQuery: 'select country from customers'  
           Message: []  
           Type: 'Database Cursor Object'  
           ResultSet: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]  
           Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]  
           Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]  
           Fetch: com.mathworks.toolbox.database.fetchTheData]
```

You can easily access information about the cursor object, including the results, which are in the `Data` element of the cursor object. To view the contents of the element, which is a 10-by-1 cell array in this example, you type

```
curs.Data
```

MATLAB returns

```
ans =  
    'Germany'  
    'Mexico'  
    'Mexico'  
    'UK'  
    'Sweden'  
    'Germany'  
    'France'  
    'Spain'  
    'France'
```

- Objects allow the use of overloaded functions. For example, to view properties of objects in the Database Toolbox, you use the `get` function, regardless of the object. This means you have to remember only one function, `get`, rather than having to remember specific functions for each object. The properties you retrieve with `get` differ, depending on the object, but the function itself always has the same name and argument syntax.

- You can write your own methods, as M-files, to operate on the objects in the Database Toolbox. For more information, see “MATLAB Classes and Objects” in the MATLAB documentation.

## Working with Cell Arrays in MATLAB

When you import data from a database into MATLAB, the data is stored as a numeric matrix, a structure, or a MATLAB cell array, depending on the data return format preference you specified using `setdbprefs` or the **Database Toolbox Preferences** dialog box.

Once the data is in MATLAB, you can use MATLAB functions to work with it. Because some users are unfamiliar with cell arrays, this section provides a few simple examples of how to work with the cell array data type in MATLAB:

- “Viewing Cell Array Data Returned from a Query” on page 3-39
- “Viewing Elements of Cell Array Data” on page 3-41
- “Performing Functions on Cell Array Data” on page 3-43
- “Creating Cell Arrays for Exporting Data from MATLAB” on page 3-43

For more information on using cell arrays, see “MATLAB Data Types” in the MATLAB Programming documentation.

You might also need more information about working with strings in MATLAB. See the functions `char`, `cellstr`, and `strvcat` and “Characters and Strings” in the MATLAB Programming documentation.

## Viewing Cell Array Data Returned from a Query

### Viewing Query Results

How you view query results depends on if you import the data using the `fetch` function or if you use the Visual Query Builder.

**Using the `fetch` Function.** If you import data using the `fetch` function, MATLAB returns data to a cursor object, as in the following data, which was imported in the example “Exporting Data from MATLAB to a New Record in a Database” on page 3-11.

```
curs =
    Attributes: []
           Data: [3x1 double]
 DatabaseObject: [1x1 database]
    RowLimit: 0
   SQLQuery: 'select freight from orders'
    Message: []
           Type: 'Database Cursor Object'
   ResultSet: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]
           Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]
   Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]
           Fetch: [1x1
                  com.mathworks.toolbox.database.fetchTheData]
```

The retrieved data is in the field `Data`. To view it, type

```
curs.Data
```

Alternatively, you can assign the data to a variable, for example, `A`, by typing

```
A = curs.Data
```

and then view it by typing `A`.

**Using the Visual Query Builder.** If you import data using the Visual Query Builder, you assign the results to the workspace variable, which is `A` in this example, using the VQB. To see the data, type the workspace variable name at the MATLAB prompt in the Command Window, for example, type `A`.

MATLAB displays the data in the Command Window, for example

```
A =  
    32.3800  
    11.6100  
    65.8300
```

#### Viewing Results with Multiple Columns

If the query results consist of multiple columns, you can view all the results for a single column using a colon (:). See the example in “Exporting Multiple New Records from MATLAB” on page 3-18. For example, you view the results of column 2 by typing

```
A(:,2)
```

or if you used `fetch`, you can also view it by typing

```
curs.Data(:,2)
```

MATLAB returns the data in column 2, for example

```
ans =  
    1400  
    2400  
    1800  
    3000  
    4300  
    5000  
    1200  
    3000  
    3000  
     0
```

#### Expanding Results

If the results do not fit in the display space available, MATLAB displays size information only. If, for example, MATLAB returns these query results.

```
B =  
 [1]    'Beverages'    [1x43 char]  
 [2]    'Condiments'  [1x58 char]  
 [3]    'Confections' [1x35 char]
```



You can see the data in columns 1 and 2, but the third is expressed as an array because the results are too long to display.

To view the contents of the third column in the first row, type

```
B{1,3}
```

or if you used `fetch`, you can also view it by typing

```
curs.Data{1,3}
```

MATLAB returns

```
ans =  
    Soft drinks, coffees, teas, beers, and ales
```

## Viewing Elements of Cell Array Data

In these examples, the `curs.Data` notation is not used and instead the examples assume you assigned `curs.Data` to a variable. If you do not assign `curs.Data` to a variable, then just substitute `curs.Data` for the variable name in the examples.

This example is the same as that in “Exporting Data from MATLAB to a New Record in a Database” on page 3-11, but the `DataReturnFormat` is set to `cellarray`.

```
A =  
    [32.3800]  
    [11.6100]  
    [65.8300]
```

## Viewing a Single Element as a Numeric Value

To view the first element of `A`, type

```
A(1,1)
```

MATLAB returns

```
ans =  
    [32.3800]
```

The brackets result is not numeric but instead is an element in a cell array. You cannot perform numeric operations on cell array data.

To retrieve the first element as a numeric value, enclose it in curly braces. For example, type

```
A{1,1}
```

MATLAB returns

```
ans =  
    32.3800
```

This result is numeric and, therefore, you can perform numeric operations on it.

#### **Viewing an Entire Column or Row as a Numeric Vector**

To retrieve the data in an entire column or row of a cell array as a numeric vector, use colons within the curly braces. You then assign the results to a matrix by enclosing them in square brackets. For example, to retrieve all the data in column 1, type

```
AA=[A{: ,1}]'
```

MATLAB returns

```
AA =  
    32.3800  
    11.6100  
    65.8300
```

You can also retrieve the contents using the `celldisp` function. For example, type

```
celldisp(A)
```

MATLAB returns

```
A{1} =  
    32.3800
```

```
A{2} =  
    11.6100
```

```
A{3} =  
    65.8300
```

## Performing Functions on Cell Array Data

To perform certain MATLAB functions directly on cell arrays, you need to extract the contents of the cell array as numeric data.

For example, to compute the sum of the elements in the cell array `A`, type

```
sum([A{:}])
```

MATLAB returns

```
ans =  
109.8200
```

## Creating Cell Arrays for Exporting Data from MATLAB

If you use the `insert` and `update` functions to export data from MATLAB to a database and need to include data in a cell array, such as column names, use the following techniques.

### Enclosing Data in Curly Braces

One way to put data in a cell array is by enclosing the data in curly braces, with rows separated by semicolons, and elements within a row separated by commas.

For example, to identify the column names in an `insert` function, use curly braces as follows.

```
insert(conn, 'Growth', {'Date','Average'}, insertdata)
```

You can also insert the data itself using curly braces. For example, to insert `A` and `avgA`, and `B` and `avgB`, into the `Date` and `Average` columns of the `Growth` table, use the `insert` function as follows.

```
insert(conn, 'Growth', {'Date','Average'}, {A, avgA; B, avgB})
```

### Assigning Cell Array Elements

To put data into a cell array element, enclose it in curly braces. For example, if you have one row containing two values you want to export, `A` and `meanA`, put them in cell array `exdata`, which you will export. Type

```
exdata(1,1) = {A};  
exdata(1,2) = {meanA};
```

Alternatively, you can assign values to `exdata` in one step by typing

```
exdata = {A,meanA}
```

To export the data `exdata`, use the `insert` function as follows.

```
insert(conn, 'Growth', colnames, exdata)
```

### Converting a Numeric Matrix to a Cell Array

If you want to export data containing numeric and string values, you need to export it as a cell array. As an example, you will export a cell array, `exdata`, whose first column already contains the names of the twelve months. You have calculated the total sales figures for each month and the results are in the numeric matrix `monthly`. To assign the values in `monthly` to the second column of the cell array `exdata`, convert the numeric matrix `monthly` to a cell array `exdata` using the `num2cell`. Type

```
exdata(:,2) = num2cell(monthly);
```

`num2cell` takes the data in `monthly` and assigns each row to the second column in the cell array, `exdata`.

# Function Reference

---

- |                                        |                                                                                                 |
|----------------------------------------|-------------------------------------------------------------------------------------------------|
| Functions — Categorical List (p. 4-2)  | Tables of Database Toolbox functions, arranged by category.                                     |
| Functions — Alphabetical List (p. 4-8) | Alphabetical list of Database Toolbox functions, followed by reference pages for each function. |

### Functions – Categorical List

The following tables group Database Toolbox functions by category:

- “General” on page 4-3
- “Database Connection” on page 4-3
- “SQL Cursor” on page 4-3
- “Importing Data into MATLAB from a Database” on page 4-4
- “Exporting Data from MATLAB to a Database” on page 4-4
- “Database Metadata Object” on page 4-5
- “Driver Object” on page 4-6
- “Drivermanager Object” on page 4-6
- “Resultset Object” on page 4-6
- “Resultset Metadata Object” on page 4-6
- “Visual Query Builder” on page 4-7

## General

`logintimeout` Set or get time allowed to establish database connection.  
`setdbprefs` Set preferences for retrieval format, errors, and NULLs.

## Database Connection

`close` Close database connection.  
`database` Connect to database.  
`get` Get property of database connection.  
`isconnection` Detect if database connection is valid.  
`isreadonly` Detect if database connection is read only.  
`ping` Get status information about database connection.  
`set` Set properties for database connection.  
`setdbprefs` Set preferences for retrieval format, errors, and NULLs.  
`sql2native` Convert JDBC SQL grammar to system's native SQL grammar.

## SQL Cursor

`close` Close cursor.  
`exec` Execute SQL statement and open cursor.  
`get` Get property of cursor object.  
`querytimeout` Get time allowed for a database SQL query to succeed.  
`set` Set `RowLimit` for cursor fetch.

### **Importing Data into MATLAB from a Database**

|                           |                                                        |
|---------------------------|--------------------------------------------------------|
| <code>attr</code>         | Get attributes of columns in fetched data set.         |
| <code>cols</code>         | Get number of columns in fetched data set.             |
| <code>columnnames</code>  | Get names of columns in fetched data set.              |
| <code>fetch</code>        | Import data into MATLAB.                               |
| <code>querybuilder</code> | Start SQL query builder GUI to import and export data. |
| <code>rows</code>         | Get number of rows in fetched data set.                |
| <code>width</code>        | Get field size of column in fetched data set.          |

### **Exporting Data from MATLAB to a Database**

|                           |                                                        |
|---------------------------|--------------------------------------------------------|
| <code>commit</code>       | Make database changes permanent.                       |
| <code>insert</code>       | Export MATLAB data into database table.                |
| <code>querybuilder</code> | Start SQL query builder GUI to import and export data. |
| <code>rollback</code>     | Undo database changes.                                 |
| <code>update</code>       | Replace data in database table with data from MATLAB.  |



## Database Metadata Object

|                               |                                                               |
|-------------------------------|---------------------------------------------------------------|
| <code>bestrowid</code>        | Get database table unique row identifier.                     |
| <code>columnprivileges</code> | Get database column privileges.                               |
| <code>columns</code>          | Get database table column names.                              |
| <code>crossreference</code>   | Get information about primary and foreign keys.               |
| <code>dmd</code>              | Construct database metadata object.                           |
| <code>exportedkeys</code>     | Get information about exported foreign keys.                  |
| <code>get</code>              | Get database metadata properties.                             |
| <code>importedkeys</code>     | Get information about imported foreign keys.                  |
| <code>indexinfo</code>        | Get indices and statistics for database table.                |
| <code>primarykeys</code>      | Get primary key information for database table or schema.     |
| <code>procedurecolumns</code> | Get catalog's stored procedure parameters and result columns. |
| <code>procedures</code>       | Get catalog's stored procedures.                              |
| <code>supports</code>         | Detect if property is supported by database metadata object.  |
| <code>tableprivileges</code>  | Get database table privileges.                                |
| <code>tables</code>           | Get database table names.                                     |
| <code>versioncolumns</code>   | Get automatically updated table columns.                      |

### Driver Object

|                         |                                                 |
|-------------------------|-------------------------------------------------|
| <code>driver</code>     | Construct database driver object.               |
| <code>get</code>        | Get database driver properties.                 |
| <code>isdriver</code>   | Detect if driver is a valid JDBC driver object. |
| <code>isjdbc</code>     | Detect if driver is JDBC compliant.             |
| <code>isurl</code>      | Detect if the database URL is valid.            |
| <code>register</code>   | Load database driver.                           |
| <code>unregister</code> | Unload database driver.                         |

### Drivermanager Object

|                            |                                          |
|----------------------------|------------------------------------------|
| <code>drivermanager</code> | Construct database drivermanager object. |
| <code>get</code>           | Get database drivermanager properties.   |
| <code>set</code>           | Set database drivermanager properties.   |

### ResultSet Object

|                            |                                                      |
|----------------------------|------------------------------------------------------|
| <code>clearwarnings</code> | Clear the warnings for the resultset.                |
| <code>close</code>         | Close resultset object.                              |
| <code>get</code>           | Get resultset properties.                            |
| <code>isnullcolumn</code>  | Detect if last record read in resultset was NULL.    |
| <code>namecolumn</code>    | Map resultset column name to resultset column index. |
| <code>resultset</code>     | Construct resultset object.                          |

### ResultSet Metadata Object

|                   |                                      |
|-------------------|--------------------------------------|
| <code>get</code>  | Get resultset metadata properties.   |
| <code>rsmd</code> | Construct resultset metadata object. |

## Visual Query Builder

|                           |                                                                      |
|---------------------------|----------------------------------------------------------------------|
| <code>confds</code>       | Configure data source for use with Visual Query Builder (JDBC only). |
| <code>querybuilder</code> | Start SQL query builder GUI to import and export data.               |

### **Functions – Alphabetical List**

This section contains function reference pages listed alphabetically.

**Purpose** Get attributes of columns in fetched data set

**Syntax** `attributes = attr(curs, colnum)`  
`attributes = attr(curs)`

**Description** `attributes = attr(curs, colnum)` retrieves attribute information for the specified column number `colnum`, in the fetched data set `curs`.

`attributes = attr(curs)` retrieves attribute information for all columns in the fetched data set `curs`, and stores it in a cell array. Use `attributes(colnum)` to display the attributes for column `colnum`.

The returned attributes are listed in the following table.

| Attribute                | Description                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------|
| <code>fieldName</code>   | Name of the column                                                                         |
| <code>typeName</code>    | Data type                                                                                  |
| <code>typeValue</code>   | Numerical representation of the data type                                                  |
| <code>columnWidth</code> | Size of the field                                                                          |
| <code>precision</code>   | Precision value for floating and double data types; an empty value is returned for strings |
| <code>scale</code>       | Precision value for real and numeric data types; an empty value is returned for strings    |
| <code>currency</code>    | If <code>true</code> , data format is currency                                             |
| <code>readOnly</code>    | If <code>true</code> , the data cannot be overwritten                                      |
| <code>nullable</code>    | If <code>true</code> , the data can be NULL                                                |
| <code>Message</code>     | Error message returned by fetch                                                            |

## Examples

### Example 1—Get Attributes for One Column

Get the column attributes for the fourth column of a fetched data set.

```
attr(curs, 4)

ans =
    fieldName: 'Age'
    typeName: 'LONG'
    typeValue: 4
    columnWidth: 11
    precision: []
    scale: []
    currency: 'false'
    readOnly: 'false'
    nullable: 'true'
    Message: []
```

### Example 2—Get Attributes for All Columns

Get the column attributes for curs, and assign them to attributes.

```
attributes = attr(curs)
```

View the attributes of column 4.

```
attributes(4)
```

MATLAB returns the attributes of column 4.

```
ans =
    fieldName: 'Age'
    typeName: 'LONG'
    typeValue: 4
    columnWidth: 11
    precision: []
    scale: []
    currency: 'false'
    readOnly: 'false'
    nullable: 'true'
    Message: []
```

## See Also

cols, columnnames, columns, dmd, fetch, get, tables, width

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>     | Get database table unique row identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Syntax</b>      | <pre>b = bestrowid(dbmeta, 'cata', 'sch') b = bestrowid(dbmeta, 'cata', 'sch', 'tab')</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p><code>b = bestrowid(dbmeta, 'cata', 'sch')</code> determines and returns the optimal set of columns in a table that uniquely identifies a row, in the schema <code>sch</code>, of the catalog <code>cata</code>, for the database whose database metadata object is <code>dbmeta</code>, where <code>dbmeta</code> was created using <code>dmd</code>.</p> <p><code>b = bestrowid(dbmeta, 'cata', 'sch', 'tab')</code> determines and returns the optimal set of columns that uniquely identifies a row in table <code>tab</code>, in the schema <code>sch</code>, of the catalog <code>cata</code>, for the database whose database metadata object is <code>dbmeta</code>, where <code>dbmeta</code> was created using <code>dmd</code>.</p> |
| <b>Examples</b>    | <p>Type</p> <pre>b = bestrowid(dbmeta, 'msdb', 'geck', 'builds')</pre> <p>MATLAB returns</p> <pre>b =     'build_id'</pre> <p>In this example:</p> <ul style="list-style-type: none"><li>• <code>dbmeta</code> is the database metadata object.</li><li>• <code>msdb</code> is the catalog <code>cata</code>.</li><li>• <code>geck</code> is the schema <code>sch</code>.</li><li>• <code>builds</code> is the table <code>tab</code>.</li></ul> <p>The results is <code>build_id</code>, which means that every entry in the <code>build_id</code> column is unique and can be used to identify the row.</p>                                                                                                                                     |
| <b>See Also</b>    | <code>columns</code> , <code>dmd</code> , <code>get</code> , <code>tables</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

# clearwarnings

---

**Purpose** Clear warnings for database connection or resultset

**Syntax** `clearwarnings(conn)`  
`clearwarnings(rset)`

**Description** `clearwarnings(conn)` clears the warnings reported for the database connection object `conn`, which was created using `database`.

`clearwarnings(rset)` clears the warnings reported for the resultset object `rset`, which was created using `resultset`.

For command line help on `clearwarnings`, use the overloaded methods.

```
help database/clearwarnings
help resultset/clearwarnings
```

**Examples** `clearwarnings(conn)` clears reported warnings for the database connection object `conn`, which was created using `conn = database(...)`.

**See Also** `database`, `get`, `resultset`



**Purpose** Close database connection, cursor, or resultset object

**Syntax** `close(object)`

**Description** `close(object)` closes `object`, freeing up associated resources. Following are the allowable objects for `close`.

| <b>Object</b>     | <b>Description</b>                                                  | <b>Action Performed by <code>close(object)</code></b> |
|-------------------|---------------------------------------------------------------------|-------------------------------------------------------|
| <code>conn</code> | Database connection object created using <code>database</code>      | closes <code>conn</code>                              |
| <code>curs</code> | Cursor object created using <code>exec</code> or <code>fetch</code> | closes <code>curs</code>                              |
| <code>rset</code> | Resultset object defined using <code>resultset</code>               | closes <code>rset</code>                              |

Database connections, cursors, and resultsets remain open until you close them using the `close` function. Always close a cursor, connection, or resultset when you finish using it so that MATLAB stops reserving memory for it. Also, most databases limit the number of cursors and connections that can be open at one time.

If you terminate a MATLAB session while cursors and connections are open, MATLAB closes them, but your database might not free up the connection or cursor. Therefore, always close connections and cursors when you finish using them.

Close a cursor before closing the connection used for that cursor.

For command line help on `close`, use the overloaded methods.

```
help database/close
help cursor/close
help resultset/close
```

# close

---

## Examples

To close the cursor `curs` and the connection `conn`, type

```
close(curs)
close(conn)
```

## See Also

`database`, `exec`, `fetch`, `resultset`

---

|                    |                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>     | Get number of columns in fetched data set                                                                                                                                            |
| <b>Syntax</b>      | <code>numcols = cols(curs)</code>                                                                                                                                                    |
| <b>Description</b> | <code>numcols = cols(curs)</code> returns the number of columns in the fetched data set <code>curs</code> .                                                                          |
| <b>Examples</b>    | This example shows that there are three columns in the fetched data set, <code>curs</code> .<br><pre>numcols = cols(curs)<br/><br/>numcols =<br/>    3</pre>                         |
| <b>See Also</b>    | <code>attr</code> , <code>columnnames</code> , <code>columnprivileges</code> , <code>columns</code> , <code>fetch</code> , <code>get</code> , <code>rows</code> , <code>width</code> |

# columnnames

---

**Purpose** Get names of columns in fetched data set

**Syntax** `colnames = columnnames(curs)`

**Description** `colnames = columnnames(curs)` returns the column names in the fetched data set `curs`. The column names are returned as a single string vector.

**Examples** The fetched data set `curs`, contains three columns having the names shown.

```
colnames = columnnames(curs)
```

```
colnames =  
  'Address', 'City', 'Country'
```

**See Also** `attr`, `cols`, `columnprivileges`, `columns`, `fetch`, `get`, `width`

**Purpose** Get database column privileges

**Syntax**

```
lp = columnprivileges(dbmeta, 'cata', 'sch', 'tab')  
lp = columnprivileges(dbmeta, 'cata', 'sch', 'tab', 'l')
```

**Description** `lp = columnprivileges(dbmeta, 'cata', 'sch', 'tab')` returns the list of privileges for all columns in table `tab`, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`lp = columnprivileges(dbmeta, 'cata', 'sch', 'tab', 'l')` returns the list of privileges for column `l`, in the table `tab`, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

**Examples**

```
Type  
lp = columnprivileges(dbmeta, 'msdb', 'geck', 'builds', 'build_id')
```

MATLAB returns

```
lp =  
    'builds'    'build_id'    {1x4 cell}
```

In this example:

- `dbmeta` is the database metadata object.
- `msdb` is the catalog `cata`.
- `geck` is the schema `sch`.
- `builds` is the table `tab`.
- `build_id` is the column name.

The results show:

- The table name, `builds`, in column 1.
- The column name, `build_id`, in column 2.
- The column privileges, `lp`, in column 3.

## columnprivileges

---

To view the contents of the third column in `lp`, type

```
lp{1,3}
```

MATLAB returns the column privileges for the `build_id` column.

```
ans =  
      'INSERT'      'REFERENCES'      'SELECT'      'UPDATE'
```

### See Also

`cols`, `columns`, `columnnames`, `dmd`, `get`

**Purpose** Get database table column names

**Syntax**

```
l = columns(dbmeta, 'cata')
l = columns(dbmeta, 'cata', 'sch')
l = columns(dbmeta, 'cata', 'sch', 'tab')
```

**Description** `l = columns(dbmeta, 'cata')` returns the list of all column names in the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`l = columns(dbmeta, 'cata', 'sch')` returns the list of all column names in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`l = columns(dbmeta, 'cata', 'sch', 'tab')` returns the list of columns for the table `tab`, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

## Examples

Type

```
l = columns(dbmeta, 'orcl', 'SCOTT')
```

MATLAB returns

```
l =
    'BONUS'      {1x4 cell}
    'DEPT'       {1x3 cell}
    'EMP'        {1x8 cell}
    'SALGRADE'   {1x3 cell}
    'TRIAL'      {1x3 cell}
```

In this example:

- `dbmeta` is the database metadata object.
- `orcl` is the catalog `cata`.
- `SCOTT` is the schema `sch`.

The results show the names of the five tables and a cell array containing the column names in the tables.

# columns

---

To see the column names for the BONUS table, type

```
l{1,2}
```

MATLAB returns

```
ans =  
    'ENAME'    'JOB'    'SAL'    'COMM'
```

which are the column names in the BONUS table.

## See Also

`attr`, `bestrowid`, `cols`, `columnnames`, `columnprivileges`, `dmd`, `get`,  
`versioncolumns`



---

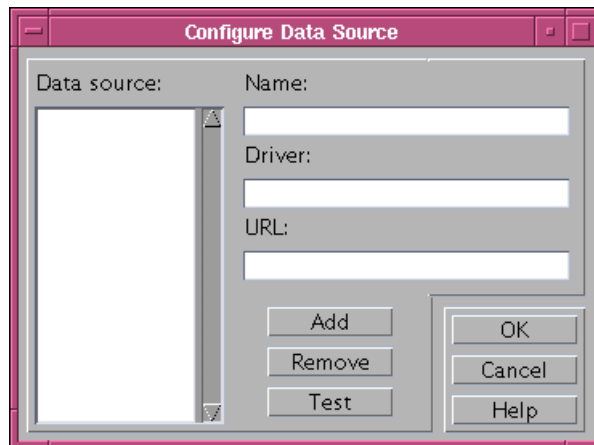
|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>     | Make database changes permanent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Syntax</b>      | <code>commit(conn)</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <code>commit(conn)</code> makes permanent the changes made via <code>insert</code> or <code>update</code> to the database connection <code>conn</code> . The <code>commit</code> function commits all changes made since the last <code>commit</code> or <code>rollback</code> function was run, or the last <code>exec</code> function that performed a <code>commit</code> or <code>rollback</code> . The <code>AutoCommit</code> flag for <code>conn</code> must be off to use <code>commit</code> .                                                                                             |
| <b>Examples</b>    | <p>Ensure the <code>AutoCommit</code> flag for connection <code>conn</code> is off by typing</p> <pre>get(conn, 'AutoCommit')</pre> <p>MATLAB returns</p> <pre>ans =<br/>off</pre> <p>Insert the data contained in <code>exdata</code> into the columns <code>DEPTNO</code>, <code>DNAME</code>, and <code>LOC</code>, in the table <code>DEPT</code> for the data source <code>conn</code>. Type</p> <pre>insert(conn, 'DEPT', {'DEPTNO';'DNAME';'LOC'}, exdata)</pre> <p>Commit the data inserted in the database by typing</p> <pre>commit(conn)</pre> <p>The data is added to the database.</p> |
| <b>See Also</b>    | <code>database</code> , <code>exec</code> , <code>get</code> , <code>insert</code> , <code>rollback</code> , <code>update</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

# confds

**Purpose** Configure data source for Visual Query Builder (JDBC on UNIX only)

**Syntax** confds

**Description** confds displays the **Configure Data Source** dialog box, from which you add and remove data sources. Use confds only if you want to build and run queries using the Visual Query Builder via JDBC drivers on a UNIX platform. (You cannot use the Visual Query Builder on a Windows platform with a JDBC driver.) To add and remove data sources for connections that use ODBC drivers, see “Setting Up a Data Source” on page 1-11.



- 1 Complete the **Name**, **Driver**, and **URL** fields. For some data sources, the entry in **Name** must exactly match the name of the **Data source**. For example:  
**Name:** orcl  
**Driver:** oracle.jdbc.driver.OracleDriver  
**URL:** jdbc:oracle:thin:@144.212.123.24:1822:
- 2 Click **Add** to add the data source.
- 3 Click **Test** to establish a test connection to the data source. You are prompted to supply a username and password if the database requires it.

- 4 Click **OK** to save the changes and close the **Configure Data Source** dialog box.

To remove a data source, select it, click **Remove**, and click **OK**.

**See Also**

database (for examples of JDBC drivers and URLs)

# crossreference

---

**Purpose** Get information about primary and foreign keys

**Syntax** `f = crossreference(dbmeta, 'pcata', 'psch', 'ptab', 'fcata', 'fsch', 'ftab')`

**Description** `f = crossreference(dbmeta, 'pcata', 'psch', 'ptab', 'fcata', 'fsch', 'ftab')` returns information about the relationship between foreign keys and primary keys. Specifically, the information is for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`. The primary key information is for the table `ptab`, in the primary schema `psch`, of the primary catalog `pcata`. The foreign key information is for the foreign table `ftab`, in the foreign schema `fsch`, of the foreign catalog `fcata`.

**Examples** Type

```
f = crossreference(dbmeta, 'orcl', 'SCOTT', 'DEPT', ...
    'orcl', 'SCOTT', 'EMP')
```

MATLAB returns

```
f =
Columns 1 through 7
    'orcl'    'SCOTT'    'DEPT'    'DEPTNO'    'orcl'    'SCOTT'    'EMP'
Columns 8 through 13
    'DEPTNO'    '1'    'null'    '1'    'FK_DEPTNO'    'PK_DEPT'
```

In this example:

- `dbmeta` is the database metadata object.
- `orcl` is the catalog `pcata` and the catalog `fcata`.
- `SCOTT` is the schema `psch` and the schema `fsch`.
- `DEPT` is the table `ptab` that contains the referenced primary key.
- `EMP` is the table `ftab` that contains the foreign key.

The results show the primary and foreign key information.

| Column | Description                                                                                       | Value     |
|--------|---------------------------------------------------------------------------------------------------|-----------|
| 1      | Catalog containing primary key, referenced by foreign imported key                                | orcl      |
| 2      | Schema containing primary key, referenced by foreign imported key                                 | SCOTT     |
| 3      | Table containing primary key, referenced by foreign imported key                                  | DEPT      |
| 4      | Column name of primary key, referenced by foreign imported key                                    | DEPTNO    |
| 5      | Catalog that has foreign key                                                                      | orcl      |
| 6      | Schema that has foreign key                                                                       | SCOTT     |
| 7      | Table that has foreign key                                                                        | EMP       |
| 8      | Foreign key column name, that is the column name that references the primary key in another table | DEPTNO    |
| 9      | Sequence number within foreign key                                                                | 1         |
| 10     | Update rule, that is, what happens to the foreign key when the primary key is updated             | null      |
| 11     | Delete rule, that is, what happens to the foreign key when the primary key is deleted             | 1         |
| 12     | Foreign imported key name                                                                         | FK_DEPTNO |
| 13     | Primary key name in referenced table                                                              | PK_DEPT   |

In the schema SCOTT, there is only one foreign key. The table DEPT contains a primary key DEPTNO that is referenced by the field DEPTNO in the table EMP. DEPTNO in the EMP table is a foreign key.

## crossreference

---

For a description of the codes for update and delete rules, see <http://java.sun.com/j2se/1.4.2/docs/api/java/sql/DatabaseMetaData.html> for the `getCrossReference` property.

### **See Also**

`dmd`, `exportedkeys`, `get`, `importedkeys`, `primarykeys`

**Purpose**

Connect to database

**Syntax**

```
conn = database('datasourcename', 'username', 'password')  
conn = database('databasename', 'username', 'password',  
    'driver', 'databaseurl')
```

**Description**

`conn = database('datasourcename', 'username', 'password')` connects a MATLAB session to a database via an ODBC driver, returning the connection object to `conn`. The data source to which you are connecting is `datasourcename`. You must have previously set up the data source—for instructions, see “Setting Up a Data Source” on page 1-11. `username` and `password` are the username and/or password required to connect to the database. If you do not need a username or a password to connect to the database, use empty strings as the arguments. After connecting, use `exec` to retrieve data.

`conn = database('databasename', 'username', 'password', 'driver', 'databaseurl')` connects a MATLAB session to a database, `databasename`, via the specified JDBC driver, returning the connection object to `conn`. The username and/or password required to connect to the database are `username` and `password`. If you do not need a username or a password to connect to the database, use empty strings as the arguments. `databaseurl` is the JDBC URL object, `jdbc:subprotocol:subname`. The subprotocol is a database type, such as `oracle`. The subname may contain other information used by driver, such as the location of the database and/or a port number. The subname may take the form `//hostname:port/databasename`. Find the correct driver name and `databaseurl` format in the driver manufacturer’s documentation. Some sample `databaseurl` strings are listed in “Example 3—Establish JDBC Connection” on page 4-29.

If database establishes a connection, MATLAB returns information about the connection object.

```
Instance: 'SampleDB'  
UserName: ''  
Driver: []  
URL: []  
Constructor: [1x1  
              com.mathworks.toolbox.database.databaseConnect]  
Message: []  
Handle: [1x1 sun.jdbc.odbc.JdbcOdbcConnection]  
Timeout: 0  
AutoCommit: 'off'  
Type: 'Database Object'
```

Use `logintimeout` before you use `database` to specify the maximum amount of time for which database tries to establish a connection.

You can have multiple database connections open at one time.

After connecting to a database, use the `ping` function to view status information about the connection, and use `dmd`, `get`, and `supports` to view properties of `conn`.

The database connection stays open until you close it using the `close` function. Always close a connection after you finish using it.

## Examples

### Example 1 — Establish ODBC Connection

To connect to an ODBC data source called `Pricing`, where the database has a user `mike` and a password `bravo`, type

```
conn = database('Pricing', 'mike', 'bravo');
```

### Example 2 — Establish ODBC Connection Without Username and Password

To connect to an ODBC data source `SampleDB`, where a username and password are not needed, use empty strings in place of those arguments. Type

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



## Example 3—Establish JDBC Connection

In this JDBC connection example, the database is `oracle`, the username is `scott`, and the password is `tiger`. The `oci7` JDBC driver name is `oracle.jdbc.driver.OracleDriver` and the URL that specifies the location of the database server is `jdbc:oracle:oci7`.

```
conn = database('oracle','scott','tiger',...
               'oracle.jdbc.driver.OracleDriver','jdbc:oracle:oci7:');
```

The JDBC name and URL take different forms for different databases, as shown in the examples in the following table.

| Database            | JDBC Driver and Database URL Examples                                                                                                                                                                                                                      |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Informix            | JDBC driver: <code>com.informix.jdbc.IfxDriver</code><br>Database URL: <code>jdbc:informix-sqli://161.144.202.206:3000:INFORMIXSERVER=stars</code>                                                                                                         |
| MySQL               | JDBC driver: <code>twz1.jdbc.mysql.jdbcMySqlDriver</code><br>Database URL: <code>jdbc:z1MySQL://natasha:3306/metrics</code><br><br>JDBC driver: <code>com.mysql.jdbc.Driver</code><br>Database URL: <code>jdbc:mysql://devmetrics.mrkps.com/testing</code> |
| Oracle oci7 drivers | JDBC driver: <code>oracle.jdbc.driver.OracleDriver</code><br>Database URL: <code>jdbc:oracle:oci7:@rex</code>                                                                                                                                              |
| Oracle oci8 drivers | JDBC driver: <code>oracle.jdbc.driver.OracleDriver</code><br>Database URL: <code>jdbc:oracle:oci8:@111.222.333.44:1521:</code><br>Database URL: <code>jdbc:oracle:oci8:@frug</code>                                                                        |
| Oracle thin drivers | JDBC driver: <code>oracle.jdbc.driver.OracleDriver</code><br>Database URL: <code>jdbc:oracle:thin:@144.212.123.24:1822:</code>                                                                                                                             |
| Postgre             | JDBC driver: <code>org.postgresql.Driver</code><br>Database URL: <code>jdbc:postgresql://masd/MOSE</code>                                                                                                                                                  |

# database

---

| Database                           | JDBC Driver and Database URL Examples (Continued)                                                                                                                                                                                                                              |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Microsoft SQL Server               | JDBC driver: <code>com.microsoft.jdbc.sqlserver.SQLServerDriver</code><br>Database URL: <code>jdbc:microsoft:sqlserver://127.0.0.1:1403</code><br><br>JDBC driver: <code>com.inet.tds.TdsDriver</code><br>Database URL: <code>jdbc:inetdae:sqlgckprod:1433?database=gck</code> |
| Sybase SQL Server and SQL Anywhere | JDBC driver: <code>com.sybase.jdbc.SybDriver</code><br>Database URL: <code>jdbc:sybase:Tds:yourhostname:yourportnumber/</code>                                                                                                                                                 |

For the Oracle thin drivers example, in the database URL `jdbc:oracle:thin:@144.212.123.24:1822`, the target machine that the database server resides on is `144.212.123.24`, and the port number is `1822`.

For Microsoft SQL Server 2000, you may also need to pass the database name, username, and password via the URL. For example,

```
conn = database('pubs','sa','sec',  
               'com.microsoft.jdbc.sqlserver.SQLServerDriver',  
               'jdbc:microsoft:sqlserver://127.0.0.1:1403;  
               database=pubs;user=sa;password=sec')
```

## See Also

`close`, `dmd`, `exec`, `get`, `isconnection`, `isreadonly`, `logintimeout`, `ping`, `supports`

**Purpose** Construct database metadata object

**Syntax** `dbmeta = dmd(conn)`

**Description** `dbmeta = dmd(conn)` constructs a database metadata object for the database connection `conn`, which was created using `database`. Use `get` and `supports` to obtain properties of `dbmeta`. Use `dmd` and `get(dbmeta)` to obtain information you need about a database, such as the database table names to retrieve data using `exec`.

For a list of other functions you can perform on `dbmeta`, type

```
help dmd/Contents
```

**Examples** `dbmeta = dmd(conn)` creates the database metadata object `dbmeta` for the database connection `conn`.

`v = get(dbmeta)` lists the properties of the database metadata object.

**See Also** `columns`, `database`, `get`, `supports`, `tables`

# driver

---

|                    |                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>     | Construct database driver object                                                                                                                                                                                                                                                                                           |
| <b>Syntax</b>      | <code>d = driver('s')</code>                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <code>d = driver('s')</code> constructs a database driver object <code>d</code> , from <code>s</code> , where <code>s</code> is a database URL string of the form <code>jdbc:odbc:&lt;name&gt;</code> or <code>&lt;name&gt;</code> . The driver object <code>d</code> is the first driver that recognizes <code>s</code> . |
| <b>Examples</b>    | <code>d = driver('jdbc:odbc:thin:@144.212.123.24:1822:')</code> creates driver object <code>d</code> .                                                                                                                                                                                                                     |
| <b>See Also</b>    | <code>get</code> , <code>isdriver</code> , <code>isjdbc</code> , <code>isurl</code> , <code>register</code>                                                                                                                                                                                                                |

|                    |                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>     | Construct database drivermanager object                                                                                                                                                                                                                          |
| <b>Syntax</b>      | <code>dm = drivermanager</code>                                                                                                                                                                                                                                  |
| <b>Description</b> | <code>dm = drivermanager</code> constructs a database drivermanager object. You can then use <code>get</code> and <code>set</code> to obtain and change the properties of <code>dm</code> , which are the properties for all loaded database drivers as a whole. |
| <b>Examples</b>    | <code>dm = drivermanager</code> creates the database drivermanager object <code>dm</code> .<br><code>get(dm)</code> returns the properties of the drivermanager object <code>dm</code> .                                                                         |
| <b>See Also</b>    | <code>get</code> , <code>register</code> , <code>set</code>                                                                                                                                                                                                      |

**Purpose** Execute SQL statement and open cursor

**Syntax** `curs = exec(conn, 'sqlquery')`

**Description** `curs = exec(conn, 'sqlquery')` executes the valid SQL statement `sqlquery`, against the database connection `conn`, and opens a cursor. Running `exec` returns the cursor object to the variable `curs`, and returns information about the cursor object. The `sqlquery` argument can be a stored procedure for that database connection, of the form `{call sp_name (parm1,parm2,...)}`

- Remarks**
- After opening a cursor, use `fetch` to import data from the cursor. Use `resultset`, `rsmd`, and `statement` to get properties of the cursor.
  - Use `querytimeout` to determine the maximum amount of time for which `exec` will try to complete the SQL statement.
  - You can have multiple cursors open at one time.
  - A cursor stays open until you close it using the `close` function. Always close a cursor after you finish using it.
  - You can use the Visual Query Builder GUI instead of functions to import data. See “Visual Query Builder” on page 2-1 for details.
  - Perform database administrative tasks, such as creating tables, using your database system application. The Database Toolbox is not intended to be used as a tool for database administration.
  - If you attempt to modify database tables from the Database Toolbox, be sure that you (or another user for a shared database) do not have the database open for editing (design mode in Microsoft Access). If the database is open for editing and you try to modify it, you will receive the following error in MATLAB.  
  
[Vendor][ODBC Driver] The database engine could not lock table 'TableName' because it is already in use by another person or process.
  - For Microsoft Excel, tables in `sqlquery` are Excel sheets. By default, some sheet names include \$. To select data from a sheet with this name format, the SQL statement should be of this form: `select * from "Sheet1$" (or `Sheet1$`)`.

- For the Microsoft SQL Server database management system, you might experience problems with text field formats. One workaround is to convert fields of the formats NVARCHAR, TEXT, NTEXT, and VARCHAR to CHAR on the database side. Another possible workaround is to convert data to VARCHAR as part of sqlquery. As an example, use a sqlquery of the form 'select convert(varchar(20), field1) from table1'
- The Postgre database management system supports multidimensional fields, but SQL select statements fail when getting these fields unless an index is specified.

## Examples

### Example 1—Select All Data from Database Table

Select all data from the customers table accessed via the database connection, conn. Assign the returned cursor object to the variable curs.

```
curs = exec(conn, 'select * from customers')

curs =
    Attributes: []
    Data: 0
    DatabaseObject: [1x1 database]
    RowLimit: 0
    SQLQuery: 'select * from customers'
    Message: []
    Type: 'Database Cursor Object'
    ResultSet: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]
    Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]
    Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]
    Fetch: 0
```

### Example 2—Select One Column of Data from Database Table

Select country data from the customers table accessed via the database connection, conn. Assign the SQL statement to the variable sqlquery and assign the returned cursor to the variable curs.

```
sqlquery = 'select country from customers';
curs = exec(conn, sqlquery);
```

### **Example 3—Use Variable in a Query**

Select data from the customers table accessed via the database connection `conn`, where `country` is a variable. In this example, the user is prompted to supply their country, which is assigned to the variable `UserCountry`.

```
UserCountry = input('Enter your country: ', 's')
```

MATLAB prompts

```
Enter your country:
```

The user responds

```
Mexico
```

Without using a variable, the function to retrieve the data would be

```
curs = exec(conn, ['select * from customers where country...  
= 'Mexico'''])  
curs=fetch(curs)
```

To instead perform the query using the user's response, use

```
curs = exec(conn, ['select * from customers where country...  
= '', UserCountry, '''])  
curs=fetch(curs)
```

The select statement is created by using square brackets to concatenate the two strings `'select * from customers where country ='` and `'UserCountry'`.

### **Example 4—Roll Back or Commit Data Exported to Database Table**

Use `exec` to roll back or commit data after running an insert or an update for which the `AutoCommit` flag is off. To roll back data for the database connection `conn`, type

```
exec(conn, 'rollback')
```

To commit the data, type:

```
exec(conn, 'commit');
```



### Example 5—Run Stored Procedure

Execute the stored procedure `sp_customer_list` for the database connection `conn`.

```
curs = exec(conn, 'sp_customer_list');
```

You can run a stored procedure with input parameters, for example

```
curs = exec(conn, '{call sp_name (parm1,parm2,...)}');
```

### Example 6—Change Catalog

To change the catalog for the database connection `conn` to `intlprice`.

```
curs = exec(conn, 'Use intlprice');
```

### See Also

`close`, `database`, `fetch`, `insert`, `procedures`, `querybuilder`, `querytimeout`, `resultset`, `rsmd`, `set`, `update`

“Data Retrieval Restrictions” on page 1-7

# exportedkeys

---

**Purpose** Get information about exported foreign keys

**Syntax**  
`e = exportedkeys(dbmeta, 'cata', 'sch')`  
`e = exportedkeys(dbmeta, 'cata', 'sch', 'tab')`

**Description** `e = exportedkeys(dbmeta, 'cata', 'sch')` returns the foreign exported key information (that is, information about primary keys that are referenced by other tables), in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`e = exportedkeys(dbmeta, 'cata', 'sch', 'tab')` returns the exported foreign key information (that is, information about the primary key which is referenced by other tables), in the table `tab`, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

**Examples** Type

```
e = exportedkeys(dbmeta,'orcl','SCOTT')
```

MATLAB returns

```
e =  
Columns 1 through 7  
'orcl' 'SCOTT' 'DEPT' 'DEPTNO' 'orcl' 'SCOTT' 'EMP'  
Columns 8 through 13  
'DEPTNO' '1' 'null' '1' 'FK_DEPTNO' 'PK_DEPT'
```

In this example:

- `dbmeta` is the database metadata object.
- the `cata` field is empty because this database does not include catalogs.
- `SCOTT` is the schema `sch`.

The results show the foreign exported key information.

| Column | Description                                                                                       | Value     |
|--------|---------------------------------------------------------------------------------------------------|-----------|
| 1      | Catalog containing primary key that is exported                                                   | null      |
| 2      | Schema containing primary key that is exported                                                    | SCOTT     |
| 3      | Table containing primary key that is exported                                                     | DEPT      |
| 4      | Column name of primary key that is exported                                                       | DEPTNO    |
| 5      | Catalog that has foreign key                                                                      | null      |
| 6      | Schema that has foreign key                                                                       | SCOTT     |
| 7      | Table that has foreign key                                                                        | EMP       |
| 8      | Foreign key column name, that is the column name that references the primary key in another table | DEPTNO    |
| 9      | Sequence number within the foreign key                                                            | 1         |
| 10     | Update rule, that is, what happens to the foreign key when the primary key is updated             | null      |
| 11     | Delete rule, that is, what happens to the foreign key when the primary key is deleted             | 1         |
| 12     | Foreign key name                                                                                  | FK_DEPTNO |
| 13     | Primary key name that is referenced by foreign key                                                | PK_DEPT   |

In the schema SCOTT, there is only one primary key that is exported to (referenced by) another table. The table DEPT contains a field DEPTNO, its primary key, that is referenced by the field DEPTNO in the table EMP. The referenced table is DEPT and the referencing table is EMP. In the DEPT table, DEPTNO is an exported key. Reciprocally, the DEPTNO field in the table EMP is an imported key.

## exportedkeys

---

For a description of the codes for update and delete rules, see <http://java.sun.com/j2se/1.4.2/docs/api/java/sql/DatabaseMetaData.html> for the `getExporedtedKeys` property.

### **See Also**

crossreference, dmd, get, importedkeys, primarykeys

**Purpose** Import data into MATLAB

**Syntax**

```
curs = fetch(curs, RowLimit)
curs = fetch(curs)
curs.Data
```

**Description** `curs = fetch(curs, RowLimit)` imports rows of data from the open SQL cursor `curs` (created using `exec`), up to the maximum `RowLimit`, into the object `curs`. Data is stored in MATLAB in a cell array, structure, or numeric matrix, based on specifications made using `setdbprefs`. It is common practice to assign the object returned by `fetch` to the variable `curs` from the open SQL cursor. The next time you run `fetch`, records are imported starting with the row following `RowLimit`. If you fetch large amounts of data that cause out of memory or speed problems, use `RowLimit` to limit how much data is retrieved at once. You can use the Visual Query Builder GUI instead of functions to import data. See “Visual Query Builder” on page 2-1 for details.

`curs = fetch(curs)` imports rows of data from the open SQL cursor `curs`, up to the `RowLimit` specified by `set`, into the object `curs`. Data is stored in MATLAB in a cell array, structure, or numeric matrix, based on specifications you made using `setdbprefs`. It is common practice to assign the object returned by `fetch` to the variable `curs` from the open SQL cursor. The next time you run `fetch`, records are imported starting with the row following `RowLimit`. If no `RowLimit` was specified by `set`, `fetch` imports all remaining rows of data.

Running `fetch` returns information about the cursor object, `curs`, created using `exec`. The `Data` element of the cursor object contains the data returned by `fetch`. The data types are preserved. After running `fetch`, display the returned data by typing `curs.Data`.

When a fetched field contains `BOOLEAN` data, it is represented as a logical data type in MATLAB.

When a field in `curs.Data` contains `BINARY` or `OTHER` data types, you might need to understand the content and process it before using it in MATLAB. See “Retrieving `BINARY` or `OTHER` Java SQL Data Types” on page 3-22 for a specific example about processing bitmap image data using functions, and “Retrieving `BINARY` and `OTHER` Java Data” on page 2-55 for a VQB example.

Use `get` to view properties of `curs`.

## Examples

### Example 1 — Import All Rows of Data

Import all of the data into the cursor object `curs`.

```
curs = fetch(curs)
```

MATLAB returns

```
curs =  
  Attributes: []  
    Data: {91x1 cell}  
 DatabaseObject: [1x1 database]  
   RowLimit: 0  
  SQLQuery: 'select country from customers'  
   Message: []  
    Type: 'Database Cursor Object'  
  ResultSet: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]  
    Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]  
  Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]  
    Fetch: [1x1  
            com.mathworks.toolbox.database.fetchTheData]
```

The `fetch` operation stores the data in a cell array contained in the cursor object field `curs.Data`. To display data in `curs.Data`, type

```
curs.Data
```

MATLAB returns all of the data, which in this example consists of 1 column and 91 rows, some of which are shown here.

```
ans =  
    'Germany'  
    'Mexico'  
    'Mexico'  
    'UK'  
    'Sweden'  
    .  
    .  
    .  
    'USA'  
    'Finland'  
    'Poland'
```

### Example 2—Import Specified Number of Rows of Data

Specify the `RowLimit` argument to retrieve the first 3 rows of data.

```
curs = fetch(curs, 3)
```

MATLAB returns

```
curs =  
    Attributes: []  
    Data: {3x1 cell}  
    DatabaseObject: [1x1 database]  
    RowLimit: 0  
    SQLQuery: 'select country from customers'  
    Message: []  
    Type: 'Database Cursor Object'  
    ResultSet: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]  
    Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]  
    Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]  
    Fetch: [1x1  
            com.mathworks.toolbox.database.fetchTheData]
```

Display the data by typing

```
curs.Data
```

MATLAB returns

```
ans =  
    'Germany'  
    'Mexico'  
    'Mexico'
```

Entering the `fetch` function again returns the second 3 rows of data. Adding the semicolon suppresses display of the results.

```
curs = fetch(curs, 3);
```

Display the data by typing

```
curs.Data
```

MATLAB returns

```
ans =  
    'UK'  
    'Sweden'  
    'Germany'
```

### Example 3—Import Numeric Data

Import a column of data that is known to be numeric. Use `setdbprefs` to specify the format for the retrieved data as numeric.

```
conn = database('SampleDB', '', '');  
curs=exec(conn, 'select all UnitsInStock from Products');  
setdbprefs('DataReturnFormat','numeric')  
curs=fetch(curs,3);  
curs.Data
```

MATLAB retrieves the data into a numeric matrix.

```
ans =  
    39  
    17  
    13
```



### Example 4—Import BOOLEAN Data

Import data that includes a BOOLEAN field. Use `setdbprefs` to specify the format for the retrieved data as `cellarray`.

```
conn = database('SampleDB', '', '');
curs=exec(conn, 'select ProductName,Discontinued from Products');
setdbprefs('DataReturnFormat','cellarray')
curs=fetch(curs,5);
A=curs.Data
A =
    'Chai'                [0]
    'Chang'               [0]
    'Aniseed Syrup'       [0]
    [1x28 char]           [0]
    [1x22 char]           [1]
```

View the class of the second column in A.

```
class(A{1,2})
ans =
    logical
```

### See Also

`attr`, `cols`, `columnnames`, `exec`, `get`, `logical`, `rows`, `resultset`, `set`, `width`  
“Retrieving BINARY or OTHER Java SQL Data Types” on page 3-22

# get

---

## Purpose

Get object properties

## Syntax

```
v = get(object)
v = get(object, 'property')
v.property
```

## Description

`v = get(object)` returns a structure of the properties of `object` and the corresponding property values, assigning the structure to `v`.

`v = get(object, 'property')` retrieves the value of `property` for `object`, assigning the value to `v`.

`v.property` returns the value of `property`, after you have created `v` using `get`.

Use `set(object)` to see a list of writable properties for `object`.

Allowable objects are

- “Database Connection Object” on page 4-47, created using `database`
- “Cursor Object” on page 4-48, created using `exec` or `fetch`
- “Driver Object” on page 4-48, created using `driver`
- “Database Metadata Object” on page 4-49, created using `dmd`
- “Drivermanager Object” on page 4-49, created using `drivermanager`
- “ResultSet Object” on page 4-50, created using `resultset`
- “ResultSet Metadata Object” on page 4-50, created using `rsmd`

If you are calling these objects from your own Java-based applications, see <http://java.sun.com/j2se/1.4.2/docs/api/java/sql/DatabaseMetaData.html> for more information about the object properties.

## Database Connection Object

Allowable property names and returned values for a database connection object are listed in the following table.

| Property               | Value                                                                                                                     |
|------------------------|---------------------------------------------------------------------------------------------------------------------------|
| 'AutoCommit'           | Status of the AutoCommit flag, either on or off, as specified by set                                                      |
| 'Catalog'              | Names of catalogs in the data source, for example, 'Nwind'                                                                |
| 'Driver'               | Driver used for the JDBC connection, as specified by database                                                             |
| 'Handle'               | Identifying JDBC connection object                                                                                        |
| 'Instance'             | Name of the data source for an ODBC connection or the database for a JDBC connection, as specified by database            |
| 'Message'              | Error message returned by database                                                                                        |
| 'ReadOnly'             | 1 if the database is read only; 0 if the database is writable                                                             |
| 'TimeOut'              | Value for LoginTimeout                                                                                                    |
| 'TransactionIsolation' | Value of current transaction isolation mode                                                                               |
| 'Type'                 | Object type, specifically Database Object                                                                                 |
| 'URL'                  | For a JDBC connection only, the JDBC URL object, jdbc:subprotocol:subname, as specified by database                       |
| 'UserName'             | Username required to connect to the database, as specified by database; note that you cannot use get to retrieve password |
| 'Warnings'             | Warnings returned by database                                                                                             |

### Cursor Object

Allowable property names and returned values for a cursor object are listed in the following table.

| <b>Property</b>  | <b>Value</b>                                                                 |
|------------------|------------------------------------------------------------------------------|
| 'Attributes'     | Cursor attributes                                                            |
| 'Data'           | Data in the cursor object data element (the query results)                   |
| 'DatabaseObject' | Information about the database object                                        |
| 'RowLimit'       | Maximum number of rows to be returned by fetch, as specified by set          |
| 'SQLQuery'       | SQL statement for the cursor, as specified by exec                           |
| 'Message'        | Error message returned from exec or fetch                                    |
| 'Type'           | Object type, specifically Database Cursor Object                             |
| 'ResultSet'      | Resultset object identifier                                                  |
| 'Cursor'         | Cursor object identifier                                                     |
| 'Statement'      | Statement object identifier                                                  |
| 'Fetch'          | 0 for cursor created using exec; fetchTheData for cursor created using fetch |

### Driver Object

Allowable property names and examples of values for a driver object are listed in the following table.

| <b>Property</b> | <b>Example of Value</b> |
|-----------------|-------------------------|
| 'MajorVersion'  | 1                       |
| 'MinorVersion'  | 1001                    |

## Database Metadata Object

There are dozens of properties for a database metadata object. Some of the allowable property names and examples of their values are listed in the following table.

| Property                 | Example of Value                  |
|--------------------------|-----------------------------------|
| 'Catalogs'               | {4x1 cell}                        |
| 'DatabaseProductName'    | 'ACCESS'                          |
| 'DatabaseProductVersion' | '03.50.0000'                      |
| 'DriverName'             | 'JDBC-ODBC Bridge (odbcjt32.dll)' |
| 'MaxColumnNameLength'    | 64                                |
| 'MaxColumnsInOrderBy'    | 10                                |
| 'URL'                    | 'jdbc:odbc:dbtoolboxdemo'         |
| 'NullsAreSortedLow'      | 1                                 |

## Drivermanager Object

Allowable property names and examples of values for a drivermanager object are listed in the following table.

| Property       | Example of Value                                            |
|----------------|-------------------------------------------------------------|
| 'Drivers'      | {'oracle.jdbc.driver.OracleDriver@1d8e09ef'<br>[1x37 char]} |
| 'LoginTimeout' | 0                                                           |
| 'LogStream'    | []                                                          |

### Resultset Object

Some of the allowable property names for a resultset object and examples of their values are listed in the following table.

| Property     | Example of Value                          |
|--------------|-------------------------------------------|
| 'CursorName' | { 'SQL_CUR92535700x' 'SQL_CUR92535700x' } |
| 'MetaData'   | {1x2 cell}                                |
| 'Warnings'   | {{} {}}                                   |

### Resultset Metadata Object

Allowable property names for a resultset metadata object and examples of values are listed in the following table.

| Property         | Example of Value           |
|------------------|----------------------------|
| 'CatalogName'    | { '' '' }                  |
| 'ColumnCount'    | 2                          |
| 'ColumnName'     | { 'Calc_Date' 'Avg_Cost' } |
| 'ColumnTypeName' | { 'TEXT' 'LONG' }          |
| 'TableName'      | { '' '' }                  |
| 'isNullable'     | {{1} {1}}                  |
| 'isReadOnly'     | {{0} {0}}                  |

The empty strings for CatalogName and TableName indicate that the database does not return these values.

For command line help on `get`, use the overloaded methods.

```
help cursor/get
help database/get
help dmd/get
help driver/get
help drivermanager/get
help resultset/get
help rsmd/get
```

## Examples

### Example 1—Get Connection Property, Data Source Name

Connect to the database, `SampleDB`. Then get the name of the data source for the connection and assign it to `v`.

```
conn = database('SampleDB', '', '');
v = get(conn, 'Instance')
```

MATLAB returns

```
v =
    SampleDB
```

### Example 2—Get Connection Property, AutoCommit Flag Status

Determine the status of the `AutoCommit` flag for the database connection `conn`.

```
get(conn, 'AutoCommit')
```

```
ans =
    on
```

### Example 3—Display Data in Cursor

Display the data in the cursor object, `curs`, by typing

```
get(curs, 'Data')
```

or by typing

```
curs.Data
```

MATLAB returns

```
ans =  
    'Germany'  
    'Mexico'  
    'France'  
    'Canada'
```

In this example, `curs` contains one column with four records.

### Example 4—Get Database Metadata Object Properties

View the properties of the database metadata object for connection `conn`. Type

```
dbmeta = dmd(conn);  
v = get(dbmeta)
```

MATLAB returns a list of properties, some of which are shown here.

```
v =  
    AllProceduresAreCallable: 1  
    AllTablesAreSelectable: 1  
    DataDefinitionCausesTransaction: 1  
    DataDefinitionIgnoredInTransact: 0  
    DoesMaxRowSizeIncludeBlobs: 0  
    Catalogs: {4x1 cell}  
    ...  
    NullPlusNonNullIsNull: 0  
    NullsAreSortedAtEnd: 0  
    NullsAreSortedAtStart: 0  
    NullsAreSortedHigh: 0  
    NullsAreSortedLow: 1  
    UsesLocalFilePerTable: 0  
    UsesLocalFiles: 1
```

To view the names of the catalogs in the database, type

```
v.Catalogs
```



---

MATLAB returns the catalog names

```
ans =  
    'D:\matlab\toolbox\database\dbdemos\db1'  
    'D:\matlab\toolbox\database\dbdemos\origtutorial'  
    'D:\matlab\toolbox\database\dbdemos\tutorial'  
    'D:\matlab\toolbox\database\dbdemos\tutorial1'
```

**See Also**

columns, database, dmd, driver, drivermanager, exec, fetch, resultset, rows, rsmd, set

# importedkeys

---

**Purpose** Get information about imported foreign keys

**Syntax**

```
i = importedkeys(dbmeta, 'cata', 'sch')  
i = importedkeys(dbmeta, 'cata', 'sch', 'tab')
```

**Description** `i = importedkeys(dbmeta, 'cata', 'sch')` returns the foreign imported key information, that is, information about fields that reference primary keys in other tables, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`i = importedkeys(dbmeta, 'cata', 'sch', 'tab')` returns the foreign imported key information, that is, information about fields in the table `tab`, that reference primary keys in other tables, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

**Examples** Type

```
i = importedkeys(dbmeta, 'orcl', 'SCOTT')
```

MATLAB returns

```
i =  
Columns 1 through 7  
'orcl' 'SCOTT' 'DEPT' 'DEPTNO' 'orcl' 'SCOTT' 'EMP'  
Columns 8 through 13  
'DEPTNO' '1' 'null' '1' 'FK_DEPTNO' 'PK_DEPT'
```

In this example:

- `dbmeta` is the database metadata object.
- `orcl` is the catalog `cata`.
- `SCOTT` is the schema `sch`.

The results show the foreign imported key information as described in the following table.

| Column | Description                                                                                       | Value     |
|--------|---------------------------------------------------------------------------------------------------|-----------|
| 1      | Catalog containing primary key, referenced by foreign imported key                                | orcl      |
| 2      | Schema containing primary key, referenced by foreign imported key                                 | SCOTT     |
| 3      | Table containing primary key, referenced by foreign imported key                                  | DEPT      |
| 4      | Column name of primary key, referenced by foreign imported key                                    | DEPTNO    |
| 5      | Catalog that has foreign imported key                                                             | orcl      |
| 6      | Schema that has foreign imported key                                                              | SCOTT     |
| 7      | Table that has foreign imported key                                                               | EMP       |
| 8      | Foreign key column name, that is the column name that references the primary key in another table | DEPTNO    |
| 9      | Sequence number within foreign key                                                                | 1         |
| 10     | Update rule, that is, what happens to the foreign key when the primary key is updated             | null      |
| 11     | Delete rule, that is, what happens to the foreign key when the primary key is deleted             | 1         |
| 12     | Foreign imported key name                                                                         | FK_DEPTNO |
| 13     | Primary key name in referenced table                                                              | PK_DEPT   |

In the schema SCOTT there is only one foreign imported key. The table EMP contains a field, DEPTNO, that references the primary key in the DEPT table, the DEPTNO field. EMP is the referencing table and DEPT is the referenced table.

# importedkeys

---

DEPTNO is a foreign imported key in the EMP table. Reciprocally, the DEPTNO field in the table DEPT is an exported foreign key, as well as being the primary key.

For a description of the codes for update and delete rules, see <http://java.sun.com/j2se/1.4.2/docs/api/java/sql/DatabaseMetaData.html> for the `getImportedKeys` property.

## See Also

crossreference, dmd, exportedkeys, get, primarykeys

**Purpose** Get indices and statistics for database table

**Syntax** `x = indexinfo(dbmeta, 'cata', 'sch', 'tab')`

**Description** `x = indexinfo(dbmeta, 'cata', 'sch', 'tab')` returns the indices and statistics for the table `tab`, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

**Examples** Type

```
x = indexinfo(dbmeta, '', 'SCOTT', 'DEPT')
```

MATLAB returns

```
x =
Columns 1 through 8
'orcl' 'SCOTT' 'DEPT' '0' 'null' 'null' '0' '0'
'orcl' 'SCOTT' 'DEPT' '0' 'null' 'PK_DEPT' '1' '1'

Columns 9 through 13
'null' 'null' '4' '1' 'null'
'DEPTNO' 'null' '4' '1' 'null'
```

In this example:

- `dbmeta` is the database metadata object.
- `orcl` is the catalog `cata`.
- `SCOTT` is the schema `sch`.
- `DEPT` is the table `tab`.

The results contain two rows, meaning there are two index columns. The statistics for the first index column are shown in the following table.

# indexinfo

---

| Column | Description                                                                      | Value |
|--------|----------------------------------------------------------------------------------|-------|
| 1      | Catalog                                                                          | orcl  |
| 2      | Schema                                                                           | SCOTT |
| 3      | Table                                                                            | DEPT  |
| 4      | Non-unique: 0 if index values can be non-unique, 1 otherwise                     | 0     |
| 5      | Index catalog                                                                    | null  |
| 6      | Index name                                                                       | null  |
| 7      | Index type                                                                       | 0     |
| 8      | Column sequence number within index                                              | 0     |
| 9      | Column name                                                                      | null  |
| 10     | Column sort sequence                                                             | null  |
| 11     | Number of rows in the index table or number of unique values in the index        | 4     |
| 12     | Number of pages used for the table or number of pages used for the current index | 1     |
| 13     | Filter condition                                                                 | null  |

For more information about the index information, see <http://java.sun.com/j2se/1.4.2/docs/api/java/sql/DatabaseMetaData.html> for a description of the `getIndexInfo` property.

## See Also

dmd, get, tables

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>             | Add MATLAB data to database table                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Graphical Interface</b> | As an alternative to the insert function, you can export data using the Visual Query Builder, with the <b>Data operation</b> set to <b>Insert</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Syntax</b>              | <code>insert(conn, 'tab', colnames, exdata)</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>         | <p><code>insert(conn, 'table', colnames, exdata)</code> exports records from the MATLAB variable <code>exdata</code>, into new rows in an existing database table <code>tab</code>, via the connection <code>conn</code>. The variable <code>exdata</code> can be a cell array, numeric matrix, or structure. You do not define the type of data you are exporting; the data is exported in its current MATLAB format. Specify the column names for <code>tab</code> as strings in the MATLAB cell array, <code>colnames</code>. If <code>exdata</code> is a structure, field names in the structure must exactly match <code>colnames</code>.</p> <p>The status of the <code>AutoCommit</code> flag determines if <code>insert</code> automatically commits the data or if you need to commit the data following the insert. View the <code>AutoCommit</code> flag status for the connection using <code>get</code> and change it using <code>set</code>. Commit the data using <code>commit</code> or issue an SQL commit statement via an <code>exec</code> function. Roll back the data using <code>rollback</code> or issue an SQL rollback statement via an <code>exec</code> function.</p> <p>To replace existing data instead of adding new rows, use <code>update</code>.</p> |
| <b>Remarks</b>             | <p>If you get an error, it may be because the table is open in design mode in Access (edit mode for other databases). Close the table in the database and repeat the insert function. For example, the error might be</p> <pre>[Vendor][ODBC Product Driver] The database engine could not lock table 'TableName' because it is already in use by another person or process.</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Examples</b>            | <p><b>Example 1—Insert a Record</b></p> <p>Insert one record consisting of two columns, <code>City</code> and <code>Avg_Temp</code>, into the <code>Temperatures</code> table. The data is San Diego, 88 degrees. The database connection is <code>conn</code>.</p> <p>Assign the data to the cell array.</p> <pre>exdata = {'San Diego', 88}</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

Create a cell array containing the column names in Temperatures.

```
colnames = {'City', 'Avg_Temp' }
```

Perform the insert.

```
insert(conn, 'Temperatures', colnames, exdata)
```

The row of data is added to the Temperatures table.

## Example 2—Insert Multiple Records

Insert a cell array, `exdata`, containing 28 rows of data with three columns, into the Growth table. The data columns are Date, Avg\_Length, and Avg\_Wt. The database connection is `conn`.

Insert the data.

```
insert(conn, 'Growth', {'Date'; 'Avg_Length'; 'Avg_Wt'}, exdata)
```

The records are inserted in the table.

## Example 3—Import Records, Perform Computations, and Export Data

Perform calculations on imported data and then export the data. First import all of the data in the products table. Because the data contains numeric and character data, import the data into a cell array.

```
conn = database('SampleDB', '', '');  
curs = exec(conn, 'select * from products');  
setdbprefs('DataReturnFormat', 'cellarray')  
curs = fetch(curs);
```

Assign the first column of data to the variable `id`.

```
id = curs.Data(:,1);
```

Assign the sixth column of data to the variable `price`.

```
price = curs.Data(:,6);
```

Calculate the discounted price (25% off) and assign it to the variable `new_price`. You must convert the cell array `price` to a numeric matrix in order to perform the calculation.

```
new_price = .75*[price{:}]
```



Export the `id`, `price`, and `new_price` data to the `Sale` table. Because `id` is a character array and `new_price` is numeric, put the exported data in a cell array. The variable `new_price` is a numeric matrix because it was the result of the discount calculation. You must convert `new_price` to a cell array. To convert the columns of data in `new_price` to a cell arrays, type

```
new_price = num2cell(new_price);
```

Create an array, `exdata`, that contains the three columns of data to be exported. Put the `id` data in column 1, `price` in column 2, and `new_price` in column 3.

```
exdata(:,1) = id(:,1);  
exdata(:,2) = price;  
exdata(:,3) = new_price;
```

Assign the column names to a string array, `colnames`.

```
colnames={'product_id', 'price', 'sale_price'};
```

Export the data to the `Sale` table.

```
insert(conn, 'Sale', colnames, exdata)
```

All rows of data are inserted into the `Sale` table.

#### Example 4—Insert Numeric Data

Export the `new_price` data into the `sale_price` column of the `Sale` table, where `new_price` is a numeric matrix.

```
insert(conn, 'Sale', {'sale_price'}, new_price)
```

When exporting, you do not need to define the type of data you are exporting.

#### Example 5—Insert Followed by commit

This example demonstrates the use of the SQL `commit` function following an `insert`. The `AutoCommit` flag is off.

Insert the cell array `exdata` into the column names `colnames` of the `Error_Rate` table.

```
insert(conn, 'Error_Rate', colnames, exdata)
```

# insert

---

Commit the data using the commit function.

```
commit(conn)
```

Alternatively, you could commit the data using the exec function with an SQL commit statement.

```
cursor = exec(conn, 'commit');
```

## Example 6—Insert BOOLEAN Data

Insert BOOLEAN data (the logical data type in MATLAB) from MATLAB to a database.

```
conn = database('SampleDB', '', '');  
P.ProductName{1}='Chocolate Truffles';  
P.Discontinued{1}=logical(0);  
insert(conn, 'Products', {'ProductName';'Discontinued'}, P)
```

View the new record in the database to verify that value in the Discontinued field is BOOLEAN. For Microsoft Access, the MATLAB logical 0 is shown as a BOOLEAN false.

## See Also

commit, database, exec, logical, querybuilder, rollback, set, update

**Purpose** Detect if database connection is valid

**Syntax** `a = isconnection(conn)`

**Description** `a = isconnection(conn)` returns 1 if the database connection `conn` is valid, or returns 0 otherwise, where `conn` was created using `database`.

**Examples** Type  
`a = isconnection(conn)`  
and MATLAB returns  
`a =`  
    1  
indicating that the database connection `conn` is valid.

**See Also** `database`, `isreadonly`, `ping`

# isdriver

---

**Purpose** Detect if driver is a valid JDBC driver object

**Syntax** `a = isdriver(d)`

**Description** `a = isdriver(d)` returns 1 if `d` is a valid JDBC driver object, or returns 0 otherwise, where `d` was created using `driver`.

**Examples** Type  
`a = isdriver(d)`  
and MATLAB returns  
`a =`  
`1`  
indicating that the database driver object `d` is valid.

**See Also** `driver`, `get`, `isjdbc`, `isurl`

- Purpose** Detect if driver is JDBC compliant
- Syntax** `a = isjdbc(d)`
- Description** `a = isjdbc(d)` returns 1 if the driver object `d` is JDBC compliant, or returns 0 otherwise, where `d` was created using `driver`.
- Examples** Type  
`a = isjdbc(d)`  
and MATLAB returns  
`a =`  
    1  
indicating that the database driver object `d` is JDBC compliant.
- See Also** `driver`, `get`, `isdriver`, `isurl`

# isnullcolumn

---

**Purpose** Detect if last record read in resultset was NULL

**Syntax** `a = isnullcolumn(rset)`

**Description** `a = isnullcolumn(rset)` returns 1 if the last record read in the resultset `rset`, was NULL, and returns 0 otherwise.

## **Examples** **Example 1 – Result Is Not NULL**

Type

```
curs = fetch(curs,1);  
rset = resultset(curs);  
isnullcolumn(rset)
```

MATLAB returns

```
ans =  
    0
```

indicating that the last record of data retrieved was *not* NULL. To verify this, type

```
curs.Data
```

MATLAB returns

```
ans =  
    [1400]
```

## **Example 2 – Result Is NULL**

```
curs = fetch(curs,1);  
rset = resultset(curs);  
isnullcolumn(rset)
```

MATLAB returns

```
ans =  
    1
```

indicating that the last record of data retrieved was NULL. To verify this, type

```
curs.Data
```

MATLAB returns

```
ans =  
    [NaN]
```

**See Also**

get, resultset

# isreadonly

---

**Purpose** Detect if database connection is read only

**Syntax** `a = isreadonly(conn)`

**Description** `a = isreadonly(conn)` returns 1 if the database connection `conn` is read only, or returns 0 otherwise, where `conn` was created using `database`.

**Examples** Type  
`a = isreadonly(conn)`  
and MATLAB returns  
`a =`  
    1

indicating that the database connection `conn` is read only. Therefore, you cannot perform insert or update functions for this database.

**See Also** `database`, `isconnection`



---

|                    |                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>     | Detect if the database URL is valid                                                                                                                                                                                                                                                                                                         |
| <b>Syntax</b>      | <code>a = isurl('s', d)</code>                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <code>a = isurl('s', d)</code> returns 1 if the database URL <code>s</code> , for the driver object <code>d</code> , is valid, or returns 0 otherwise. The URL <code>s</code> is of the form <code>jdbc:odbc:&lt;name&gt;</code> or <code>&lt;name&gt;</code> , and <code>d</code> is the driver object created using <code>driver</code> . |
| <b>Examples</b>    | Type<br><pre>a = isurl('jdbc:odbc:thin:@144.212.123.24:1822:', d)</pre> and MATLAB returns<br><pre>a =<br/>    1</pre> indicating that the database URL, <code>jdbc:odbc:thin:@144.212.123.24:1822:</code> , is valid for driver object <code>d</code> .                                                                                    |
| <b>See Also</b>    | <code>driver</code> , <code>get</code> , <code>isdriver</code> , <code>isjdbc</code>                                                                                                                                                                                                                                                        |

# logintimeout

---

**Purpose** Set or get time allowed to establish database connection

**Syntax**

```
timeout = logintimeout('driver', time)
timeout = logintimeout(time)
timeout = logintimeout('driver')
timeout = logintimeout
```

**Description** `timeout = logintimeout('driver', time)` sets the amount of time, in seconds, allowed for a MATLAB session to try to connect to a database via the specified JDBC driver. Use `logintimeout` before running the database function. If MATLAB cannot connect within the allowed time, it stops trying.

`timeout = logintimeout(time)` sets the amount of time, in seconds, allowed for a MATLAB session to try to connect to a database via an ODBC connection. Use `logintimeout` before running the database function. If MATLAB cannot connect within the allowed time, it stops trying.

`timeout = logintimeout('driver')` returns the time, in seconds, you set previously using `logintimeout` for the JDBC connection specified by `driver`. A returned value of zero means that the time-out value has not been set previously; MATLAB stops trying to make a connection if it is not immediately successful.

`timeout = logintimeout` returns the time, in seconds, you set previously using `logintimeout` for an ODBC connection. A returned value of zero means that the time-out value has not been set previously; MATLAB stops trying to make a connection if it is not immediately successful.

If you do not use `logintimeout` and MATLAB tries to connect without success, your MATLAB session could hang up.

## Examples

### Example 1—Get Time-Out Value for ODBC Connection

Your database connection is via an ODBC connection. To see the current time-out value, type

```
logintimeout
```

MATLAB returns

```
ans =  
    0
```

The time-out value has not been set.

### Example 2—Set Time-Out Value for ODBC Connection

Set the time-out value to 5 seconds for an ODBC driver. Type

```
logintimeout(5)
```

MATLAB returns

```
ans =  
    5
```

### Example 3—Get and Set Time-Out Value for JDBC Connection

Your database connection is via the Oracle JDBC driver. First see what the current time-out value is. Type

```
logintimeout('oracle.jdbc.driver.OracleDriver')
```

MATLAB returns

```
ans =  
    0
```

The time-out value is currently 0. Set the time-out to 10 seconds. Type

```
timeout = logintimeout('oracle.jdbc.driver.OracleDriver', 10)
```

MATLAB returns

```
timeout =  
    10
```

# logintimeout

---

Verify the time-out value for the JDBC driver. Type

```
logintimeout('oracle.jdbc.driver.OracleDriver')
```

MATLAB returns

```
ans =  
    10
```

## See Also

database, get, set

**Purpose** Map resultset column name to resultset column index

**Syntax** `x = namecolumn(rset, n)`

**Description** `x = namecolumn(rset, n)` maps a resultset column name `n`, to its resultset column index, for the resultset `rset`, where `rset` was created using `resultset`, and `n` is a string or cell array of strings containing the column names. Get the column names for a given cursor using `columnnames`.

**Examples** Type

```
x = namecolumn(rset, {'DNAME';'LOC'})
```

MATLAB returns

```
x =  
    2    3
```

In this example, the resultset object is `rset`. The column names for which you want the column index are `DNAME` and `LOC`. The results show that `DNAME` is column 2 and `LOC` is column 3.

To get the index for only the `LOC` column, type

```
x = namecolumn(rset, 'LOC')
```

**See Also** `columnnames`, `resultset`

# ping

---

**Purpose** Get status information about database connection

**Syntax** ping(conn)

**Description** ping(conn) returns the status information about the database connection, conn. If the connection is open, ping returns status information and otherwise it returns an error message.

**Examples** **Example 1 – Get Status Information About ODBC Connection**

Type

```
ping(conn)
```

where conn is a valid ODBC connection. MATLAB returns

```
ans =  
    DatabaseProductName: 'ACCESS'  
    DatabaseProductVersion: '03.50.0000'  
           JDBCDriverName: 'JDBC-ODBC Bridge (odbcjt32.dll)'  
           JDBCDriverVersion: '1.1001 (04.00.4202)'  
    MaxDatabaseConnections: 64  
           CurrentUserName: 'admin'  
           DatabaseURL: 'jdbc:odbc:SampleDB'  
    AutoCommitTransactions: 'True'
```

## Example 2—Get Status Information About JDBC Connection

Type

```
ping(conn)
```

where conn is a valid JDBC connection.

MATLAB returns

```
ans =  
    DatabaseProductName: 'Oracle'  
    DatabaseProductVersion: [1x166 char]  
    JDBCDriverName: 'Oracle JDBC driver'  
    JDBCDriverVersion: '7.3.4.0.2'  
    MaxDatabaseConnections: 0  
    CurrentUserName: 'scott'  
    DatabaseURL: 'jdbc:oracle:thin:...  
                @144.212.123.24:1822:orcl'  
    AutoCommitTransactions: 'True'
```

## Example 3—Unsuccessful Request for Information About Connection

Type

```
ping(conn)
```

where the database connection conn has been terminated or was not successful.

MATLAB returns

```
Cannot Ping the Database Connection
```

### See Also

database, dmd, get, isconnection, set, supports

# primarykeys

---

**Purpose** Get primary key information for database table or schema

**Syntax**

```
k = primarykeys(dbmeta, 'cata', 'sch')  
k = primarykeys(dbmeta, 'cata', 'sch', 'tab')
```

**Description** `k = primarykeys(dbmeta, 'cata', 'sch')` returns the primary key information for all tables in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`k = primarykeys(dbmeta, 'cata', 'sch', 'tab')` returns the primary key information for the table `tab`, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

**Examples** Type

```
k = primarykeys(dbmeta, 'orcl', 'SCOTT', 'DEPT')
```

MATLAB returns

```
k =  
    'orcl'    'SCOTT'    'DEPT'    'DEPTNO'    '1'    'PK_DEPT'
```

In this example:

- `dbmeta` is the database metadata object.
- `orcl` is the catalog `cata`.
- `SCOTT` is the schema `sch`.
- `DEPT` is the table `tab`.



The results show the primary key information as described in the following table.

| <b>Column</b> | <b>Description</b>                 | <b>Value</b> |
|---------------|------------------------------------|--------------|
| 1             | Catalog                            | orcl         |
| 2             | Schema                             | SCOTT        |
| 3             | Table                              | DEPT         |
| 4             | Column name of primary key         | DEPTNO       |
| 5             | Sequence number within primary key | 1            |
| 6             | Primary key name                   | PK_DEPT      |

## See Also

crossreference, dmd, exportedkeys, get, importedkeys

# procedurecolumns

---

**Purpose** Get catalog's stored procedure parameters and result columns

**Syntax**

```
pc = procedurecolumns(dbmeta, 'cata')  
pc = procedurecolumns(dbmeta, 'cata', 'sch')
```

**Description** `pc = procedurecolumns(dbmeta, 'cata')` returns the stored procedure parameters and result columns for the catalog `cata`, for the database whose database metadata object is `dbmeta`, which was created using `dmd`.

`pc = procedurecolumns(dbmeta, 'cata', 'sch')` returns the stored procedure parameters and result columns for the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, which was created using `dmd`.

MATLAB returns one row for each column in the results generated by running the stored procedure.

**Examples** Type

```
pc = procedurecolumns(dbmeta, 'tutorial', 'ORG')
```

where:

- `dbmeta` is the database metadata object.
- `tutorial` is the catalog `cata`.
- `ORG` is the schema `sch`.

MATLAB returns

```
pc =  
Columns 1 through 7  
[1x19 char] 'ORG' 'display' 'Month' '3' '12' 'TEXT'  
[1x19 char] 'ORG' 'display' 'Day' '3' '4' 'INTEGER'  
  
Columns 8 through 13  
'50' '50' 'null' 'null' '1' 'null'  
'50' '4' 'null' 'null' '1' 'null'
```

The results show the stored procedure parameter and result information. Because two rows of data are returned, there will be two columns of data in the results when you run the stored procedure. From the results, you can see that running the stored procedure `display` returns the Month and Day. Following is a full description of the `procedurecolumns` results for the first row (Month).

| Column | Description           | Value for First Row   |
|--------|-----------------------|-----------------------|
| 1      | Catalog               | 'D:\orgdatabase\orcl' |
| 2      | Schema                | 'ORG'                 |
| 3      | Procedure name        | 'display'             |
| 4      | Column/parameter name | 'MONTH'               |
| 5      | Column/parameter type | '3'                   |
| 6      | SQL data type         | '12'                  |
| 7      | SQL data type name    | 'TEXT'                |
| 8      | Precision             | '50'                  |
| 9      | Length                | '50'                  |
| 10     | Scale                 | 'null'                |
| 11     | Radix                 | 'null'                |
| 12     | Nullable              | '1'                   |
| 13     | Remarks               | 'null'                |

For more information about the `procedurecolumns` results, see <http://java.sun.com/j2se/1.4.2/docs/api/java/sql/DatabaseMetaData.html> for the `getProcedureColumns` property.

## See Also

`dmd`, `get`, `procedures`

# procedures

---

**Purpose** Get catalog's stored procedures

**Syntax**

```
p = procedures(dbmeta, 'cata')  
p = procedures(dbmeta, 'cata', 'sch')
```

**Description** `p = procedures(dbmeta, 'cata')` returns the stored procedures in the catalog `cata`, for the database whose database metadata object is `dbmeta`, which was created using `dmd`.

`p = procedures(dbmeta, 'cata', 'sch')` returns the stored procedures in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, which was created using `dmd`.

Stored procedures are SQL statements that are saved with the database. You can use the `exec` function to run a stored procedure, providing the stored procedure as the `sqlquery` argument instead of actually entering the `sqlquery` statement as the argument.

**Examples** Type

```
p = procedures(dbmeta, 'DBA')
```

where `dbmeta` is the database metadata object and the catalog is `DBA`. MATLAB returns the names of the stored procedures

```
p =  
    'sp_contacts'  
    'sp_customer_list'  
    'sp_customer_products'  
    'sp_product_info'  
    'sp_retrieve_contacts'  
    'sp_sales_order'
```

Execute the stored procedure `sp_customer_list` for the database connection `conn` and fetch all of the data. Type

```
curs = exec(conn, 'sp_customer_list');  
curs = fetch(conn)
```

MATLAB returns

```
curs =  
    Attributes: []  
        Data: {10x2 cell}  
 DatabaseObject: [1x1 database]  
        RowLimit: 0  
    SQLQuery: 'sp_customer_list'  
        Message: []  
        Type: 'Database Cursor Object'  
    ResultSet: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]  
        Cursor: [1x1 com.mathworks.toolbox.database.sqlExec]  
    Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]  
        Fetch: [1x1  
                com.mathworks.toolbox.database.fetchTheData]
```

View the results by typing

```
curs.Data
```

MATLAB returns

```
ans =  
 [101]    'The Power Group'  
 [102]    'AMF Corp.'  
 [103]    'Darling Associates'  
 [104]    'P.S.C.'  
 [105]    'Amo & Sons'  
 [106]    'Ralston Inc.'  
 [107]    'The Home Club'  
 [108]    'Raleigh Co.'  
 [109]    'Newton Ent.'  
 [110]    'The Pep Squad'
```

## See Also

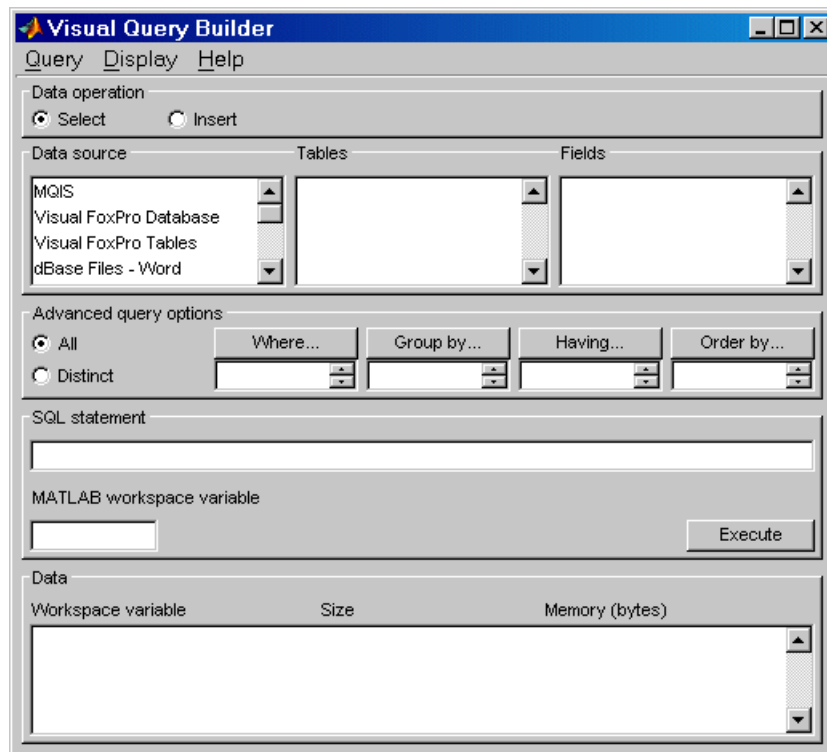
dmd, exec, get, procedurecolumns

# querybuilder

**Purpose** Start SQL query builder GUI to import and export data

**Syntax** querybuilder

**Description** querybuilder starts the Visual Query Builder (VQB), an easy-to-use interface for building and running SQL queries to exchange data with databases.



**Examples** For examples of and more information about using the Visual Query Builder, use the VQB **Help** menu or see Chapter 2, "Visual Query Builder." You can also get help in any of the Visual Query Builder dialog boxes by clicking the **Help** button in the dialog box.

**Purpose** Get time allowed for a database SQL query to succeed

**Syntax** `timeout = querytimeout(curs)`

**Description** `timeout = querytimeout(curs)` returns the amount of time, in seconds, allowed for an SQL query of `curs` to succeed, where `curs` is created by running `exec`. If a query cannot be completed in the allowed time, MATLAB stops trying to perform the `exec`. The time-out value is defined for a database by the database administrator. If the time-out value is zero, a query must be completed immediately.

**Examples** Get the current database time-out setting for `curs`.

```
querytimeout(curs)
ans =
    10
```

**Limitations** If a database does not have a database time-out feature, MATLAB returns `[Driver]Driver not capable`.  
The Microsoft Access ODBC driver and Oracle ODBC driver do not support `querytimeout`.

**See Also** `exec`

# register

---

**Purpose** Load database driver

**Syntax** register(d)

**Description** register(d) loads the database driver object d, which was created using driver. Use unregister to unload the driver.

Although database automatically loads the driver, register allows you to get properties of the driver before connecting. The register function also allows you to use drivermanager with set and get for properties for all loaded drivers.

**Examples** register(d) loads the database driver object d.

get(d) returns properties of the driver object.

**See Also** driver, drivermanager, get, set, unregister



**Purpose** Construct resultset object

**Syntax** `rset = resultset(curs)`

**Description** `r = resultset(curs)` creates a resultset object `rset`, for the cursor `curs`, where `curs` was created using `exec` or `fetch`. You can get properties of `rset`, create a resultset metadata object using `rsmd`, or make calls to `rset` using your own Java-based applications. You can also perform other functions on `rset`: `clearwarnings`, `isnullcolumn`, and `namecolumn`. Use `close` to close the resultset, which frees up resources.

**Examples** Type  
`rset = resultset(curs)`

MATLAB returns

```
rset =  
    Handle: [1x1 sun.jdbc.odbc.JdbcOdbcResultSet]
```

**See Also** `clearwarnings`, `close`, `exec`, `fetch`, `get`, `isnullcolumn`, `namecolumn`, `rsmd`

# rollback

---

**Purpose** Undo database changes

**Syntax** `rollback(conn)`

**Description** `rollback(conn)` reverses changes made via `insert` or `update` to the database connection `conn`. The `rollback` function reverses all changes made since the last `commit` or `rollback`, or the last `exec` that performed a `commit` or `rollback`. The `AutoCommit` flag for `conn` must be `off` to use `rollback`.

**Examples** Ensure the `AutoCommit` flag for connection `conn` is `off` by typing

```
get(conn, 'AutoCommit')
```

MATLAB returns

```
ans =  
off
```

Insert the data contained in `exdata` into the columns `DEPTNO`, `DNAME`, and `LOC`, in the table `DEPT`, for the data source `conn`. Type

```
insert(conn, 'DEPT', {'DEPTNO'; 'DNAME'; 'LOC'}, exdata)
```

Roll back the data inserted in the database by typing

```
rollback(conn)
```

The data in `exdata` is removed from the database so the database contains the same data it did before the `insert`.

**See Also** `commit`, `database`, `exec`, `get`, `insert`, `update`

**Purpose** Get number of rows in fetched data set

**Syntax** `numrows = rows(curs)`

**Description** `numrows = rows(curs)` returns the number of rows in the fetched data set `curs`.

**Examples** There are four rows in the fetched data set `curs`.

```
numrows = rows(curs)
```

```
numrows =
     4
```

To see the four rows of data in `curs`, type

```
curs.Data
```

MATLAB returns

```
ans =
    'Germany'
    'Mexico'
    'France'
    'Canada'
```

**See Also** `cols`, `fetch`, `get`, `rsmd`

# rsmd

---

**Purpose** Construct resultset metadata object

**Syntax**  
`rsmeta = rsmd(rset)`  
`rsmeta = rsmd(curs)`

**Description** `rsmeta = rsmd(rset)` creates a resultset metadata object `rsmeta`, for the resultset object `rset`, or the cursor object `curs`, where `rset` was created using `resultset`, and `curs` was created using `exec` or `fetch`. Get properties of `rsmeta` using `get`, or make calls to `rsmeta` using your own Java-based applications.

**Examples**  
Type  
`rsmeta=rsmd(rset)`

MATLAB returns

```
rsmeta =  
    Handle: [1x1 sun.jdbc.odbc.JdbcOdbcResultSetMetaData]
```

Use `v = get(rsmeta)` and `v.property` to see properties of the resultset metadata object.

**See Also** `exec`, `get`, `resultset`

**Purpose** Set properties for database, cursor, or drivermanager object

**Syntax** `set(object, 'property', value)`  
`set(object)`

**Description** `set(object, 'property', value)` sets the value of *property* to *value* for the specified object.

`set(object)` displays all properties for object.

Allowable values you can set for object are

- “Database Connection Object” on page 4-90, created using database
- “Cursor Object” on page 4-91, created using `exec` or `fetch`
- “Drivermanager Object” on page 4-91, created using `drivermanager`

Not all databases allow you to set all of these properties. If your database does not allow you to set a particular property, you will receive an error message when you try to do so.

### Database Connection Object

The allowable values for *property* and *value* for a database connection object are listed in the following table.

| Property               | Value            | Description                                                                                                                                                                                                                                                                  |
|------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 'AutoCommit'           | 'on'             | Database data is written and committed automatically when you run an insert or update function. You cannot use rollback to reverse it and you do not need to use commit because the data is committed automatically.                                                         |
|                        | 'off'            | Database data is not committed automatically when you run an insert or update function. In this case, after you run insert or update, you can use rollback to reverse the insert or update. When you are sure the data is correct, follow an insert or update with a commit. |
| 'ReadOnly'             | 0                | <i>Not</i> read only, that is, writable                                                                                                                                                                                                                                      |
|                        | 1                | Read only                                                                                                                                                                                                                                                                    |
| 'TransactionIsolation' | positive integer | Current transaction isolation level                                                                                                                                                                                                                                          |

Note that if you do not run commit after running an update or insert function, and then close the database connection using close, the data usually is committed automatically at that time. Your database administrator can tell you how your database deals with this.

### Cursor Object

The allowable *property* and *value* for a cursor object are listed in the following table.

| Property   | Value            | Description                                                                                                                                                                                                 |
|------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 'RowLimit' | positive integer | Sets the RowLimit for fetch. This is an alternative to defining the RowLimit as an argument of fetch. Note that the behavior of fetch when you define RowLimit using set differs depending on the database. |

### Drivermanager Object

The allowable *property* and *value* for a drivermanager object are listed in the following table.

| Property       | Value            | Description                                                                    |
|----------------|------------------|--------------------------------------------------------------------------------|
| 'LoginTimeout' | positive integer | Sets the logintimeout value for the set of loaded database drivers as a whole. |

For command line help on set, use the overloaded methods.

```
help cursor/set
help database/set
help drivermanager/set
```

## Examples

### Example 1 – Set RowLimit for Cursor

This example uses set to define the RowLimit. It establishes a JDBC connection, retrieves all data from the EMP table, sets the RowLimit to 5, and uses fetch with no arguments to retrieve the data.

Only five rows of data are returned by fetch.

```
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 =
    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]
```

As seen above, the RowLimit property of curs is now 5 and the Data property is 5x8 cell, meaning five rows of data were returned.

For the database in this example, the RowLimit acts as the maximum number of rows you can retrieve. Therefore, if you run the fetch function again, no data is returned.

## Example 2—Set AutoCommit Flag to On for Connection

This example shows a database update when the AutoCommit flag is on. First determine the status of the AutoCommit flag for the database connection conn.

```
get(conn, 'AutoCommit')

ans =
    off
```

The flag is off.



Set the flag status to on and verify it.

```
set(conn, 'AutoCommit', 'on');
get(conn, 'AutoCommit')

ans =
on
```

Insert data, cell array `exdata`, into the column names `colnames`, of the `Growth` table.

```
insert(conn, 'Growth', colnames, exdata)
```

The data is inserted and committed.

### **Example 3—Set AutoCommit Flag to Off for Connection and Commit Data**

This example shows a database insert when the `AutoCommit` flag is off and the data is then committed. First set the `AutoCommit` flag to off for database connection `conn`.

```
set(conn, 'AutoCommit', 'off');
```

Insert data, cell array `exdata`, into the column names `colnames`, of the `Avg_Freight_Cost` table.

```
insert(conn, 'Avg_Freight_Cost', colnames, exdata)
```

Commit the data.

```
commit(conn)
```

### **Example 4—Set AutoCommit Flag to Off for Connection and Roll Back Data**

This example shows a database update when the `AutoCommit` flag is off and the data is then rolled back. First set the `AutoCommit` flag to off for database connection `conn`.

```
set(conn, 'AutoCommit', 'off');
```

Update the data in the column names specified by `colnames`, of the `Avg_Freight_Weight` table, for the record selected by `whereclause`, using data contained in cell array `exdata`.

```
update(conn, 'Avg_Freight_Weight', colnames, exdata, whereclause)
```

The data was written but not committed.

Roll back the data.

```
rollback(conn)
```

The data in the table is now the same as it was before update was run.

### Example 5—Set LoginTimeout for Drivermanager Object

In this example, create a drivermanager object `dm`, and set the `LoginTimeout` value to 3 seconds. Type:

```
dm = drivermanager;  
set(dm, 'LoginTimeout', 3);
```

To verify the result, type

```
logintimeout
```

MATLAB returns

```
ans =  
    3
```

### See Also

database, drivermanager, exec, fetch, get, insert, logintimeout, ping, update

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>             | Set preferences for retrieval format, errors, and NULLs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Graphical Interface</b> | As an alternative to the <code>setdbprefs</code> function, you can select <b>Preferences</b> from the Visual Query Builder <b>File</b> menu and use the <b>Preferences</b> dialog box.                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Syntax</b>              | <pre>setdbprefs setdbprefs('property') setdbprefs('property', 'value') setdbprefs({'property1'; ... }, {'value1'; ... })</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>         | <p><code>setdbprefs</code> returns the current values for database action preferences.</p> <p><code>setdbprefs('property')</code> returns the current preference value for the specified property.</p> <p><code>setdbprefs('property', 'value')</code> sets the preference to value for the specified property for the current session.</p> <p><code>setdbprefs({'property1'; ... }, {'value1'; ... })</code> for the properties starting with <code>property1</code>, sets the preference values starting with <code>value1</code>, for the current session.</p> |

## setdbprefs

Allowable properties are listed in the following table.

| Allowable Properties | Allowable Values         | Description                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 'DataReturnFormat'   |                          | Format for data imported into MATLAB. Select a value based on the type of data you are importing, memory considerations, and your preferred method of working with retrieved data. Set the value before using <code>fetch</code> .                                                                                                                                                                                                        |
|                      | 'cellarray'<br>(default) | Imports data into MATLAB cell arrays. Use for nonnumeric data types. Requires substantial system memory when retrieving large amounts of data. Has slower performance than <code>numeric</code> format. To address memory problems, use the <code>RowLimit</code> option with <code>fetch</code> . For more information about cell arrays, see “Working with Cell Arrays in MATLAB” on page 3-38.                                         |
|                      | 'numeric'                | Imports data into a MATLAB matrix of doubles. Nonnumeric data types are considered to be NULL numbers and are shown as specified for the <code>NullNumberRead</code> property. Uses less system memory and offers better performance than the <code>cellarray</code> format. Use only when data to be retrieved is in numeric format, or when the nonnumeric data retrieved is not relevant.                                              |
|                      | 'structure'              | Imports data as a MATLAB structure. Can use for all data types. Makes it easy to work with returned columns. Requires substantial system memory when retrieving large amounts of data. Has slower performance than <code>numeric</code> format. To address memory problems, use the <code>RowLimit</code> option with <code>fetch</code> . For more information on using structures, see “MATLAB Data Types” in the MATLAB documentation. |

| Allowable Properties | Allowable Values                    | Description (Continued)                                                                                                                                                                                                                                           |
|----------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 'ErrorHandling'      |                                     | Behavior for handling errors when importing data. Set the value before running exec.                                                                                                                                                                              |
|                      | 'store' (default)                   | Any errors from running database are stored in the Message field of the returned connection object. Any errors from running exec are stored in the Message field of the returned cursor object.                                                                   |
|                      | 'report'                            | Any errors from running database or exec display immediately in the Command Window.                                                                                                                                                                               |
|                      | 'empty'                             | Any errors from running database are stored in the Message field of the returned connection object. Any errors from running exec are stored in the Message field of the returned cursor object. Objects that cannot be created are returned as empty handles, []. |
| 'NullNumberRead'     | User-specified, for example, '0'    | How NULL numbers in a database are represented when imported into MATLAB. NaN is the default value. Cannot specify a string value, such as 'NULL', if 'DataReturnFormat' is set to 'numeric'. Set the value before using fetch.                                   |
| 'NullNumberWrite'    | User-specified, for example, 'NaN'  | Any numbers in the specified format, for example, NaN are represented as NULL when exported to a database. NaN is the default value.                                                                                                                              |
| 'NullStringRead'     | User-specified, for example, 'null' | How NULL strings in a database are represented when imported into MATLAB. NaN is the default value. Set the value before using fetch.                                                                                                                             |
| 'NullStringWrite'    | User-specified, for example, 'NULL' | Any strings in the specified format, for example, NaN, are represented as NULL when exported to a database. NaN is the default value.                                                                                                                             |

# setdbprefs

---

## Remarks

When you run `clear all`, the `setdbprefs` values are cleared and return to default values. It is a good practice to set or verify the `setdbprefs` values before each fetch.

## Examples

### Example 1—Display Current Values

Type `setdbprefs` and MATLAB returns

```
DataReturnFormat: 'cellarray'  
  ErrorHandling: 'store'  
  NullNumberRead: 'NaN'  
  NullNumberWrite: 'NULL'  
  NullStringRead: 'null'  
  NullStringWrite: 'null'
```

This specifies that

- Data is imported into MATLAB cell arrays.
- Any errors that occur during a connection or an SQL query are stored in the Message field of the connection or cursor data object.
- Any NULL number in the database is read into MATLAB as NaN. Any NaN number in MATLAB is exported to the database as a NULL number. Any NULL string in the database is read into MATLAB as 'null'. Any 'null' string in MATLAB is exported to the database as a NULL string.

### Example 2—Change a Value

Type `setdbprefs ('NullNumberRead')` and MATLAB returns

```
NullNumberRead: 'NaN'
```

This specifies that any NULL number in the database is read into MATLAB as NaN.

To change the value to 0, type

```
setdbprefs ('NullNumberRead', '0')
```

This specifies that any NULL number in the database is read into MATLAB as 0.

### Example 3—Change the DataReturnFormat

**Cell array.** To specify the cellarray format, type

```
setdbprefs ('DataReturnFormat','cellarray')
```

This specifies that data is imported into MATLAB cell arrays. The following illustrates a subsequent import.

```
conn = database('SampleDB', '', '');
curs=exec(conn, 'select all ProductName,UnitsInStock from...
Products');
curs=fetch(curs,3);
curs.Data
ans =
    'Chai'           [39]
    'Chang'          [17]
    'Aniseed Syrup' [13]
```

**Numeric.** Specify the numeric format by typing

```
setdbprefs ('DataReturnFormat','numeric')
```

Performing the same set of import functions results in

```
curs.Data
ans =
    NaN    39
    NaN    17
    NaN    13
```

In the database, the values for ProductName are all character strings, as seen in the previous results when DataReturnFormat is set to cellarray. The ProductName values cannot be read when they are imported using the numeric format. Therefore, MATLAB treats them as NULL numbers and assigns them as NaN, which is the current value for the NullNumberRead property of setdbprefs in this example.

**Structure.** Specify the structure format by typing

```
setdbprefs ('DataReturnFormat','structure')
```

Performing the same set of import functions results in

```
curs.Data
ans =
    ProductName: {3x1 cell}
    UnitsInStock: [3x1 double]
```

View the contents of the structure to see the data.

```
curs.Data.ProductName
ans =
    'Chai'
    'Chang'
    'Aniseed Syrup'

curs.Data.UnitsInStock
ans =
    39
    17
    13
```

## Example 4—Change the Write Format for NULL Numbers

To specify the `NullNumberWrite` format as `NaN`, type

```
setdbprefs('NullNumberWrite', 'NaN')
```

This specifies that any numbers represented as `NaN` in MATLAB are exported to a database as `NULL`.

For example, the variable `ex_data`, contains a `NaN`

```
ex_data =
    '09-24-2003'      NaN
```

Executing an insert for `ex_data` will export the `NaN` as `NULL` as in

```
insert(conn, 'Avg_Freight_Cost', colnames, ex_data)
```



| Calc_Date  | Avg_Cost |
|------------|----------|
| 09-24-2003 | 0        |

Change the NullNumberWrite value to Inf.

```
setdbprefs('NullNumberWrite', 'Inf')
```

Attempt to insert `ex_data`, which contains a NaN. MATLAB does not recognize the NaN in `ex_data` and generates an error.

```
insert(conn, 'Avg_Freight_Cost', colnames, ex_data
```

```
??? Error using ==> insert
```

```
[Microsoft][ODBC Microsoft Access Driver] Too few parameters.  
Expected 1.
```

### Example 5—Change the ErrorHandling

**Store:** To specify the store format, type

```
setdbprefs ('ErrorHandling', 'store')
```

This specifies that any errors from running database or `exec` are stored in the Message field of the returned connection or cursor object.

The following illustrates an example of trying to fetch from a closed cursor.

```
conn = database('SampleDB', '', '');
curs=exec(conn, 'select all ProductName from Products');
close(curs)
curs=fetch(curs,3);
curs=

    Attributes: []
           Data: 0
DatabaseObject: [1x1 database]
           RowLimit: 0
           SQLQuery: 'select all ProductName from Products'
           Message: 'Error: Invalid cursor'
           Type: 'Database Cursor Object'
           ResultSet: 0
           Cursor: 0
           Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]
           Fetch: [1x1 ...
                  com.mathworks.toolbox.database.fetchTheData]
```

The error indication appears in the Message field.

**Report:** To specify the report format, type

```
setdbprefs ('ErrorHandling','report')
```

This specifies that any errors from running database or exec display immediately in the Command Window.

The following illustrates the same example as above when trying to fetch from a closed cursor.

```
conn = database('SampleDB', '', '');
curs=exec(conn, 'select all ProductName from Products');
close(curs)
curs=fetch(curs,3);
??? Error using ==> cursor/fetch (errorhandling)

Invalid Cursor

Error in ==> D:\matlab\toolbox\database\database\@cursor\fetch.m

On line 36 ==> errorhandling(initialCursor.Message);
```

The error indication appears immediately in the Command Window.

**Empty:** To specify the empty format, type

```
setdbprefs ('ErrorHandling', 'empty')
```

This specifies that any errors from running database or exec are stored in the Message field of the returned connection or cursor object. In addition, objects that cannot be created are returned as empty handles, [].

The following illustrates the same example as above when trying to fetch from a closed cursor.

```
conn = database('SampleDB', '', '');
curs=exec(conn, 'select all ProductName from Products');
close(curs)
curs=fetch(curs,3);
curs =

    Attributes: []
           Data: []
DatabaseObject: [1x1 database]
      RowLimit: 0
      SQLQuery: 'select all ProductName from Products'
      Message: 'Invalid Cursor'
           Type: 'Database Cursor Object'
      ResultSet: 0
           Cursor: 0
      Statement: [1x1 sun.jdbc.odbc.JdbcOdbcStatement]
           Fetch: [1x1 ...
                  com.mathworks.toolbox.database.fetchTheData]
```

The error indication appears in the cursor object Message field. In addition, the Attributes field returned empty handles because no attributes could be created.

## Example 6—Change Multiple Settings

Type

```
setdbprefs({'NullStringRead'; 'DataReturnFormat'}, ...
{'NaN'; 'numeric'})
```

This specifies that any NULL string in the database is read into MATLAB as 'NaN', and data is retrieved into a matrix of doubles.

## See Also

clear, fetch

**Purpose** Convert JDBC SQL grammar to system's native SQL grammar

**Syntax** `n = sql2native(conn, 'sqlquery')`

**Description** `n = sql2native(conn, 'sqlquery')` for the connection `conn`, which was created using `database`, converts the SQL statement string `sqlquery`. The string is converted from JDBC SQL grammar into the database system's native SQL grammar, returning the native SQL statement to `n`.

# supports

---

**Purpose** Detect if property is supported by database metadata object

**Syntax**

```
a = supports(dbmeta)
a = supports(dbmeta, 'property')
a.property
```

**Description** `a = supports(dbmeta)` returns a structure of the properties of `dbmeta`, which was created using `dmd`, and the corresponding property values, 1 or 0, where 1 means the property is supported and 0 means the property is not supported.

`a = supports(dbmeta, 'property')` returns the value, 1 or 0, of property for `dbmeta`, which was created using `dmd`, where 1 means the property is supported and 0 means the property is not supported.

`a.property` returns the value of property, after you created `a` using `supports`.

There are dozens of properties for `dbmeta`. Examples include 'GroupBy' and 'StoredProcedures'.

**Examples**

Type

```
a = supports(dbmeta, 'GroupBy')
```

and MATLAB returns

```
a =
    1
```

indicating that the database supports the use of SQL group-by clauses.

To find the GroupBy value as well as values for all other properties, type

```
a = supports(dbmeta)
```

MATLAB returns a list of properties and their values. The GroupBy property is included in the list. You can also see its value by typing

```
a.GroupBy
```

to which MATLAB returns

```
a =
    1
```

**See Also**      database, dmd, get, ping

# tableprivileges

---

**Purpose** Get database table privileges

**Syntax**

```
tp = tableprivileges(dbmeta, 'cata')
tp = tableprivileges(dbmeta, 'cata', 'sch')
tp = tableprivileges(dbmeta, 'cata', 'sch', 'tab')
```

**Description** `tp = tableprivileges(dbmeta, 'cata')` returns the list of table privileges for all tables in the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`tp = tableprivileges(dbmeta, 'cata', 'sch')` returns the list of table privileges for all tables in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`tp = tableprivileges(dbmeta, 'cata', 'sch', 'tab')` returns the list of privileges for the table `tab`, in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

**Examples** Type

```
tp = tableprivileges(dbmeta, 'msdb', 'geck', 'builds')
```

MATLAB returns

```
tp =
    'DELETE'    'INSERT'    'REFERENCES'    'SELECT'    'UPDATE'
```

In this example:

- `dbmeta` is the database metadata object.
- `msdb` is the catalog `cata`.
- `geck` is the schema `sch`.
- `builds` is the table `tab`.

The results show the set of privileges.

**See Also** `dmd`, `get`, `tables`



**Purpose** Get database table names

**Syntax**

```
t = tables(dbmeta, 'cata')
t = tables(dbmeta, 'cata', 'sch')
```

**Description** `t = tables(dbmeta, 'cata')` returns the list of all tables and their table types in the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`t = tables(dbmeta, 'cata', 'sch')` returns the list of tables and table types in the schema `sch`, of the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

For command line help on `tables`, use the overloaded method

```
help dmd/tables
```

## Examples

Type

```
t = tables(dbmeta, 'orcl', 'SCOTT')
```

MATLAB returns

```
t =
      'BONUS'      'TABLE'
      'DEPT'      'TABLE'
      'EMP'        'TABLE'
      'SALGRADE'  'TABLE'
      'TRIAL'     'TABLE'
```

In this example:

- `dbmeta` is the database metadata object.
- `orcl` is the catalog `cata`.
- `SCOTT` is the schema `sch`.

The results show the names and types of the five tables.

## See Also

`attr`, `bestrowid`, `dmd`, `get`, `indexinfo`, `tableprivileges`

# unregister

---

**Purpose** Unload database driver

**Syntax** `unregister(d)`

**Description** `unregister(d)` unloads the database driver object `d`, which was loaded using `register`. Running `unregister` frees up system resources. If you do not use `unregister` to unload a registered driver, it automatically unloads when you end the MATLAB session.

**Examples** `unregister(d)` unloads the database driver object `d`.

**See Also** `register`

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>     | Replace data in database table with data from MATLAB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Syntax</b>      | <code>update(conn, 'tab', colnames, exdata, 'whereclause')</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p><code>update(conn, 'tab', colnames, exdata, 'whereclause')</code> exports data from the MATLAB variable <code>exdata</code>, into the database table <code>tab</code>, via the database connection <code>conn</code>. The variable <code>exdata</code> can be a cell array, numeric matrix, or structure. You do not define the type of data you are exporting; the data is exported in its current MATLAB format. Existing records in the table are replaced as specified by the SQL command <code>whereclause</code>. Specify the column names for <code>tab</code> as strings in the MATLAB cell array, <code>colnames</code>. If <code>exdata</code> is a structure, field names in the structure must exactly match <code>colnames</code>.</p> <p>The status of the <code>AutoCommit</code> flag determines if <code>update</code> automatically commits the data or if a <code>commit</code> is needed. View the <code>AutoCommit</code> flag status for the connection using <code>get</code> and change it using <code>set</code>. Commit the data using <code>commit</code> or issue an SQL <code>commit</code> statement via the <code>exec</code> function. Roll back the data using <code>rollback</code> or issue an SQL <code>rollback</code> statement via the <code>exec</code> function.</p> <p>To add new rows instead of replacing existing data, use <code>insert</code>.</p> |
| <b>Remarks</b>     | <p>If you get an error, it may be because the table is open in design mode in Access (edit mode for other databases). Close the table in the database and repeat the <code>insert</code> function. For example, the error might be</p> <pre>[Vendor][ODBC Product Driver] The database engine could not lock table 'TableName' because it is already in use by another person or process.</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Examples</b>    | <p><b>Example 1 – Update a Record</b></p> <p>In the <code>Birthdays</code> table, update the record where <code>First_Name</code> is <code>Jean</code>, replacing the current value for <code>Age</code> with the new value, 40. The connection is <code>conn</code>.</p> <p>Define a cell array containing the column name you are updating, <code>Age</code>.</p> <pre>colnames = {'Age'}</pre> <p>Define a cell array containing the new data.</p> <pre>exdata(1,1) = {40}</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

# update

---

Perform the update.

```
update(conn, 'Birthdays', colnames, exdata, ...  
       'where First_Name = ''Jean''')
```

## Example 2—Update Followed by rollback

This example shows a database update when the AutoCommit flag is off and the data is then rolled back. First set the AutoCommit flag to off for database connection conn.

```
set(conn, 'AutoCommit', 'off')
```

Update the data in the column Date of the Error\_Rate table for the record selected by whereclause using data contained in the cell array exdata.

```
update(conn, 'Error_Rate', {'Date'}, exdata, whereclause)
```

The data was written, but not committed.

Roll back the data.

```
rollback(conn)
```

The update was reversed; the data in the table is the same as it was before update was run.

## See Also

commit, database, insert, rollback, set

**Purpose**

Get automatically updated table columns

**Syntax**

```
v1 = versioncolumns(dbmeta, 'cata')  
v1 = versioncolumns(dbmeta, 'cata', 'sch')  
v1 = versioncolumns(dbmeta, 'cata', 'sch', 'tab')
```

**Description**

`v1 = versioncolumns(dbmeta, 'cata')` returns the list of all columns that are automatically updated when any row value is updated, for the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`v1 = versioncolumns(dbmeta, 'cata', 'sch')` returns the list of all columns that are automatically updated when any row value is updated, for the schema `sch`, in the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

`v1 = versioncolumns(dbmeta, 'cata', 'sch', 'tab')` returns the list of all columns that are automatically updated when any row value is updated, in the table `tab`, for the schema `sch`, in the catalog `cata`, for the database whose database metadata object is `dbmeta`, where `dbmeta` was created using `dmd`.

**Examples**

Type

```
v1 = versioncolumns(dbmeta, 'orcl', 'SCOTT', 'BONUS', 'SAL')
```

MATLAB returns

```
v1 =  
    {}
```

In this example:

- `dbmeta` is the database metadata object.
- `orcl` is the catalog `cata`.
- `SCOTT` is the schema `sch`.
- `BONUS` is the table `tab`.
- `SAL` is the column name `l`.

The results show an empty set, meaning no columns automatically update when any row value is updated.

# versioncolumns

---

## See Also

columns, dmd, get

**Purpose** Get field size of column in fetched data set

**Syntax** `colsize = width(curs, colnum)`

**Description** `colsize = width(cursor, colnum)` returns the field size of the specified column number `colnum`, in the fetched data set `curs`.

**Examples** Get 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).

**See Also** `attr`, `cols`, `columnnames`, `fetch`, `get`

**width**

---



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