

Lotus

Enhancement Add-Ins Handbook

Lotus 1-2-3 Release 3.1+

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How to Use *Enhancement Add-Ins Handbook*

Enhancement Add-Ins Handbook is a comprehensive handbook that teaches users with varying levels of experience how to use the 1-2-3® Auditor, Backsolver, Solver, and Viewer add-ins with Lotus® 1-2-3 Release 3.1. *Enhancement Add-Ins Handbook* is divided into five chapters:

- Chapter 1 introduces the Enhancement add-ins; describes how to install, read into memory, and invoke them; and explains how to use the Help system included with each add-in.
- Chapter 2 contains information about the Auditor add-in.
- Chapter 3 contains information about the Backsolver add-in.
- Chapter 4 contains information about the Solver add-in.
- Chapter 5 contains information about the Viewer add-in.

Each chapter that describes an add-in contains information on terms specific to that add-in and on how you use the add-in with 1-2-3.

Conventions

The instructions for selecting commands in this manual assume that you have an add-in read into memory and that the menu for that add-in is invoked (displayed in the control panel). For information on reading into memory and invoking an add-in, see “Starting the Enhancement Add-Ins” in Chapter 1. If reference is made to a 1-2-3 command, a / (slash) precedes the command. For example, in Chapter 4, Define Constraints indicates a command from the Solver menu, while /File Save indicates a command from the 1-2-3 menu.

Chapter 1

Before You Begin

The Enhancement add-ins provide a new way to work with and view your files and 1-2-3 data. Four Enhancement add-ins are included in this package: the Auditor, the Backsolver, the Solver, and the Viewer. You can use these add-ins to

- Analyze formulas in a worksheet and display information about the formulas (Auditor add-in).
- Make the result of a formula equal to a value you specify (Backsolver add-in).
- Find the best answer or the set of possible answers for a problem (Solver add-in).
- Retrieve, open, link, or browse through the contents of 1-2-3 or Symphony® files and view the contents of any file (Viewer add-in).

The first sections of this chapter briefly describe the Enhancement add-ins and their uses. The remaining sections explain how to install and run the add-ins and how the add-ins work with 1-2-3.

The Auditor Add-In

The Auditor add-in helps you analyze formulas in your worksheet files and displays information about these formulas. You can use the Auditor commands to

- Find all cells that provide data for a specified formula.
- Identify all formulas that use a specified cell.
- Locate all formulas in an entire worksheet file or in a specified range.
- Identify formulas in the file in the order that 1-2-3 recalculates them.
- Find errors in formulas or all cells involved in circular references.

You can set up the Auditor add-in to identify formula relationships by highlighting cells, by listing cell contents in the worksheet, or by moving the cell pointer forward or backward to display the next or previous formula.

The Backsolver Add-In

You use the Backsolver add-in to change a value in one cell of a problem so that a formula in another cell equals a value you specify. For example, you can use the Backsolver to determine the term of an automobile loan when you know you want the payback rate to be \$200 per month.

The Solver Add-In

You use the Solver add-in to analyze worksheet data and find solutions to what-if problems. When you have a problem that has several possible outcomes, the Solver can explore the different scenarios and show you the possible answers. The Solver works with constraints that you establish (such as a maximum inventory amount or a range of sales figures) and shows you the best answer or set of possible answers that meets your needs.

In general, you use the Solver add-in to solve problems that have more than one possible answer — problems in which you can vary one or more values to achieve different results. For example, you can use the Solver to find answers to the following problems:

- If you need to establish new sales quotas, the Solver can show you the different combinations of sales increases and cost reductions that make a business venture profitable.
- If you are planning an advertising campaign, the Solver can help you review the best mix of publications for your advertisements, given available budget levels and placement guidelines for each publication.
- If you are planning production levels at your company, the Solver can find the most profitable mix of items to produce, given available resources.
- If you need to determine the number of new staff to hire, the Solver can analyze your firm's manager-to-staff ratios and projected revenue requirements to determine the optimum number of employees to hire.

The Viewer Add-In

The Viewer add-in is a 1-2-3 data-management utility that extends your ability to find and view files that are on your hard disk. You can use the Viewer add-in to

- Retrieve or open a 1-2-3 or Symphony file.
- Browse through the contents of any 1-2-3 or Symphony file.
- Browse through the text in any file.
- Simplify the procedure for entering formulas that link 1-2-3 or Symphony files.

In addition, the Viewer displays DOS directory information, such as the date and time a file was last saved.

When you invoke the Viewer add-in and select Retrieve, Open, Link, or Browse from the menu, 1-2-3 provides a split-screen display of your files. The List window on the left displays the list of file names in the current directory. As you scroll through the list of files, you view their contents in the View window on the right.

Installing the Enhancement Add-Ins

Before you can use the Enhancement add-ins, you must use the Enhancement Add-Ins AInstall program. This section describes the AInstall program and guides you through the steps to complete it.

Before you start AInstall, be sure you have the following:

- 1-2-3 Release 3.1 installed on your hard disk.
- The Enhancement Add-Ins Disk(s) that came in your 1-2-3 Release 3.1 package.
- The minimum amount of hard-disk space required for the add-ins you want to install:

To install all four add-ins you need 980 KB of hard-disk space.

To install the Auditor add-in you need 40 KB of hard-disk space.

To install the Backsolver add-in you need 30 KB of hard-disk space.

To install the Solver add-in you need 710 KB of hard-disk space.

To install the Viewer add-in you need 200 KB of hard-disk space.

To use AInstall, follow the procedure below. This procedure assumes you are starting AInstall from drive A. You can start AInstall from drive B instead, but from no other drive. If you are starting AInstall from drive B, substitute drive B for drive A in this procedure.

If you need more information while you are running AInstall, press **HELP (F1)** to see a Help screen related to the step you are completing.

NOTE If you are a network administrator and are installing the Enhancement add-ins on a network drive, you may need to update the default add-in directory 1-2-3 uses to look for add-ins. If you do not update the default add-in directory, users will not automatically see the names of the Enhancement add-ins when they press **ADD-IN (ALT-F10)** and select Load. When you first install 1-2-3, the default add-in directory is the ADDINS subdirectory of the 1-2-3 Release 3.1 program directory. To change the default add-in directory, press **ADD-IN (ALT-F10)**, and then select Settings System Directory and specify the name of the directory to which you copied the Enhancement add-ins. Then, select Update to copy the new directory information to the add-in configuration file (LTSADDIN.CNF). If network users are running separate copies of 1-2-3, you need to update each user's default add-in directory, either by using the above command sequence for each user or by copying an updated add-in configuration file to each user's 1-2-3 Release 3.1 program directory.

Procedure

1. Insert Enhancement Add-Ins Disk 1 in drive A and close the drive door.

NOTE If you are using high-density disks, make sure you insert Enhancement Add-Ins Disk 1 in the high-density drive.

2. Type **a :** and press **ENTER** to make drive A current.

3. Type `ainstall` and press **ENTER**.

AInstall starts. The first screen you see is an introductory screen that explains what the AInstall program does.

4. Press **ENTER** to begin the program.

5. AInstall asks you to specify which Enhancement add-ins you want to transfer to your hard disk. You can select as many or as few as you like, but you can use only the ones you select during AInstall. If you do not select an add-in at this point and decide later that you want to use that add-in, you will need to rerun AInstall.

To select the add-ins you want to transfer to your hard disk, use the pointer-movement keys to move the cursor among the add-ins. When the cursor is next to the prompt for the add-in you want to select, type `y` to tell AInstall you want to transfer the add-in or type `n` if you do not want to transfer that add-in to your hard disk. When you are finished selecting the add-ins you want to transfer, press **ENTER**.

6. AInstall asks you to specify the drive letter of your hard disk. Enter the letter that corresponds to the drive your 1-2-3 Release 3.1 files are on and press **ENTER**. If your hard disk is partitioned, enter the letter that corresponds to the drive that contains the 1-2-3 Release 3.1 program directory and press **ENTER**.

7. AInstall asks you to specify the name of the directory to which you want to transfer the Enhancement add-ins. AInstall selects as the default directory a subdirectory called `ADDINS` in your 1-2-3 Release 3.1 program directory. If AInstall cannot locate your 1-2-3 Release 3.1 program directory, it suggests as the default directory a directory called `ADDINS` in the root directory of your hard disk. Either press **ENTER** to accept the name displayed or type the name you gave your 1-2-3 Release 3.1 add-ins subdirectory and press **ENTER**. If the directory name you type does not yet exist, AInstall creates the directory for you.

After you specify the directory for the add-ins, AInstall transfers the add-in files to that directory. Depending on the media you are using, AInstall may prompt you to replace Enhancement Add-Ins Disk 1 with another disk during the file transfer. Follow the directions on the screen for changing the disk.

When AInstall finishes transferring files, it displays the message 'Installation successful.'

8. Press **ENTER** to leave AInstall and return to the operating system prompt.

Starting the Enhancement Add-Ins

Before you can use the Enhancement add-ins, you must first read one or more of them into memory. The procedures that follow explain how to read an add-in into memory and invoke (display the menu for) that add-in. The procedures use the Solver add-in as an example; however, you use the same procedure to read into memory and invoke any of the Enhancement add-ins.

Reading an Enhancement Add-In into Memory

The first step in using an Enhancement add-in is to read the add-in into memory. At the same time that you read an add-in into memory, you can assign it to a function key. Assigning an add-in to a function key lets you display the add-in's main menu by pressing that key. For example, if you assign the Solver to the function key **APP1 (ALT-F7)**, you can display the Solver main menu at any time by pressing **APP1 (ALT-F7)**. If you do not assign an add-in to a function key, you can still display its main menu at any time by pressing **ADD-IN (ALT-F10)**, selecting **Invoke**, and specifying the add-in name. You can find more information on invoking the Enhancement add-ins in "Invoking an Enhancement Add-In" later in this section.

Procedure

1. Start 1-2-3 Release 3.1.
2. Press **ADD-IN (ALT-F10)**.
3. Select **Load**.

1-2-3 displays a list of files with the .PLC extension that are in the default add-in subdirectory of the Release 3.1 program directory.

4. Specify the add-in you want to read into memory. For example, if you want to read the Solver add-in into memory, specify **SOLVER.PLC**.
5. Select **No-Key** or assign a function key.

Select **No-Key** if you do not want to assign the add-in to a function key. If you select **No-Key**, you must press **ADD-IN (ALT-F10)**, select **Invoke**, and specify the name of the add-in to display its main menu.

Select 1, 2, or 3 to assign the add-in to **APP1 (ALT-F7)**, **APP2 (ALT-F8)**, or **APP3 (ALT-F9)**, respectively.

6. Repeat steps 4 and 5 for each add-in you want to read into memory.
7. Select **Quit** to return 1-2-3 to **READY** mode.

The add-ins you read into memory are now ready to be invoked.

Tips

- Although there is no limit to the number of add-ins you can read into memory in a single session, you are limited by the amount of memory your computer has available. If you find that you cannot successfully read all four Enhancement add-ins into memory at once, try one or more of the following procedures to temporarily free memory:
 - If undo is turned on, select /Worksheet Global Default Other Undo Disable to turn it off. Remember that you cannot undo any subsequent actions until you turn undo back on.
 - If Wysiwyg is in memory, press **ADD-IN (ALT-F10)**, select Remove, and specify WYSIWYG to remove it from memory. If you are using Wysiwyg formatting features in your worksheet files, remember to save the files before removing Wysiwyg from memory.
 - If you have additional add-ins in memory, try removing them temporarily by pressing **ADD-IN (ALT-F10)**, selecting Remove, and specifying the name of the add-in you want to remove or by pressing **ADD-IN (ALT-F10)** and selecting Clear to remove all add-ins from memory.

For example, if Wysiwyg, the Auditor, and the Viewer are all in memory, and you want to use the Solver but do not have enough memory to read it into memory at the same time, you can temporarily remove Wysiwyg to free enough memory for the Solver. Then, when you are finished using the Solver, you can remove it and read Wysiwyg into memory again.

- You can read into memory and remove add-ins any number of times during a 1-2-3 session, in much the same way that you retrieve and open files. For more information on removing add-ins from memory, see Appendix 6 of *Reference*.

NOTE You can use the **ADD-IN (ALT-F10)** Settings commands to tell 1-2-3 to read an add-in into memory automatically whenever you start 1-2-3 or whenever you retrieve or open a particular file. For information on reading add-ins into memory automatically, see Appendix 6 of *Reference*.

Invoking an Enhancement Add-In

Once you read an add-in into memory, you can invoke that add-in at any time during a 1-2-3 session in one of the following two ways:

- Press the function key (if any) to which the add-in is attached.
- Press **ADD-IN (ALT-F10)**, select Invoke, then specify the name of the add-in.

Because 1-2-3 Release 3.1 lets you assign up to three different add-ins to function keys, you can switch among add-ins easily and quickly.

NOTE Remember that Wysiwyg is also a 1-2-3 Release 3.1 add-in. If you assigned Wysiwyg to a function key, you have only two remaining keys to which you can assign Enhancement add-ins.

For more detailed information on reading add-ins into memory, invoking add-ins, and using the **ADD-IN (ALT-F10)** menu, see Appendix 6 of *Reference*.

Using the Enhancement Add-Ins with 1-2-3

The Enhancement add-ins make it easier to work with 1-2-3 data. When one or more add-ins are in memory, you have access to both the add-in commands and to the 1-2-3 commands simultaneously because you can switch among the command menus.

The Enhancement Add-Ins and Undo

When you use an Enhancement add-in and the undo feature is on, you can use **UNDO (ALT-F4)** to reverse the effects of the most recent command or series of commands you selected in that add-in.

1-2-3 treats as a single operation any series of add-in commands that you perform after you invoke the add-in and before you return 1-2-3 to READY mode. When you press **UNDO (ALT-F4)** immediately after completing the commands, 1-2-3 undoes the entire series of add-in commands. For example, if you invoke the Solver add-in, solve a problem, put one of the answers in the worksheet, create table reports, then return 1-2-3 to READY mode and press **UNDO (ALT-F4)**, 1-2-3 undoes the entire series of actions you performed using the Solver.

If you need to free memory, you might want to turn off the undo feature before using the Enhancement add-ins. The undo feature can use a lot of your computer's available memory; how much it uses depends on the tasks you perform. To turn off undo, select /Worksheet Global Default Other Undo Disable. For more information about the undo feature, see Appendix 8 of *Reference*.

The Enhancement Add-Ins and Macros

You can create keystroke macros to automate any Enhancement add-in tasks. You can also use 1-2-3 Release 3 and 3.1 macros without modification while you are working with the Enhancement add-ins. And, if you are working with the Solver add-in, you can use the special **@SOLVER** function to determine the status of the Solver in your macros. For information on the **@SOLVER** function, see "Using the Solver in Macros" in Chapter 4.

When you use **RECORD (ALT-F2)** to create a macro, 1-2-3 records all keystrokes, including those that perform Enhancement add-in commands, and plays them back when you run the macro. For more information about the record feature, see "Using the Record Feature for Macros" in Chapter 4 of *Reference*.

Using the Help System

Each Enhancement add-in includes Help screens that provide information about the commands and functions for that add-in. You can view these screens by pressing **HELP (F1)** whenever an add-in menu is displayed or when you are using an add-in's commands. The Help system is context-sensitive, that is, when you press **HELP (F1)**, 1-2-3 displays a screen that directly relates to what you are currently doing with the add-in.

Most Help screens include cross-references to additional Help topics. To view the Help screen for a cross-referenced topic, use the pointer-movement keys to highlight the topic and press **ENTER**. You can view any number of Help screens while you are in the Help system. When you finish using Help, press **ESC** to return to the current worksheet or command at the same place you left it.

The following table lists the keys you use to navigate through Help topics.

Key	Effect
↑ or ↓	Moves the highlight up or down one topic in the current Help screen.
← or →	Moves the highlight left or right one topic in the current Help screen.
BACKSPACE	Displays the previous Help screen.
END	Moves the highlight to the last topic in the current Help screen.
ENTER	Displays the Help screen for the highlighted topic.
HELP (F1)	Displays the first Help screen you saw when you pressed HELP (F1) .
HOME	Moves the highlight to the first topic in the current Help screen.

Chapter 2

The Auditor Add-In

The Auditor add-in helps you analyze formulas in your worksheet files. You can use the Auditor commands to identify all the formulas that depend on a particular cell, to display cells involved in a circular reference, and to display information about formulas in a file. You can locate all of the formulas in all files in memory or formulas in a specified range.

How to Use this Chapter

The information in this chapter is divided into three sections:

- “Terms You Need to Know” introduces terms you need to know to use the Auditor.
- “Using the Auditor Add-In” provides information about the Auditor settings sheet.
- “The Auditor Commands” provides an alphabetical listing of each Auditor command with a description and a procedure for each.

Terms You Need to Know

Before you begin using the Auditor commands, you should be familiar with the following terms:

- The **audit range** is the range in a file that contains the formulas to analyze. By default, the audit range includes all worksheets in all files in memory. You can change how cells are identified and displayed in the audit range by specifying an **audit mode**.
- **Dependents** are all the formulas within the audit range that depend on a specified cell.
- **Precedents** are all cells in the audit range referred to by a specified formula.
- The **recalculation method** is one of three orders that 1-2-3 uses to recalculate formulas in active files. **Natural** recalculates any values on which a particular formula depends before recalculating that formula, **Columnwise** recalculates by column, and **Rowwise** recalculates by row.

Using the Auditor Add-In

Before you can use the Auditor, you must read it into memory and invoke it so that the Auditor main menu and settings sheet appear. For information about how to read into memory and invoke the Auditor, see “Starting the Enhancement Add-Ins” in Chapter 1.

The Auditor Settings Sheet

The Auditor settings sheet displays the current audit range and audit mode.

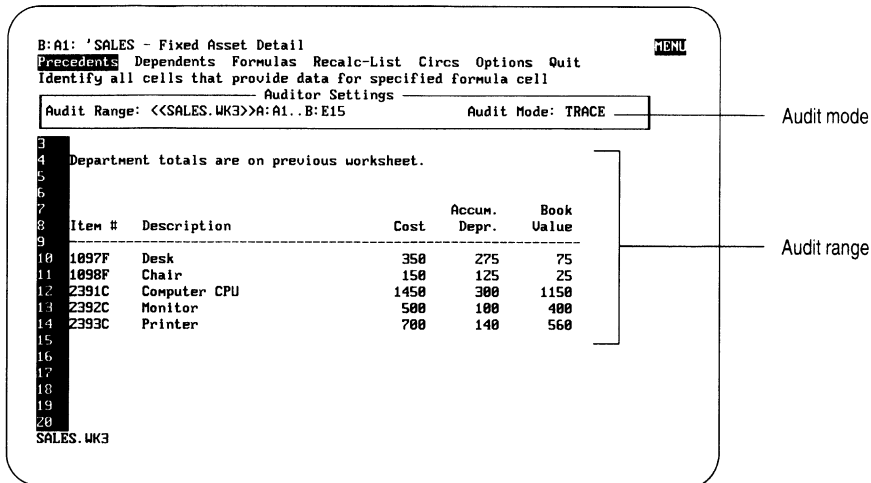


Figure 2-1 The Auditor settings sheet

Audit Mode

You can control the audit mode, or how the Auditor identifies cells when you select Formulas, Dependents, Precedents, Circs, or Recalc-List, by selecting Options from the Auditor menu. The Auditor can highlight cells, list them in a range you specify, or move the cell pointer to them one at a time.

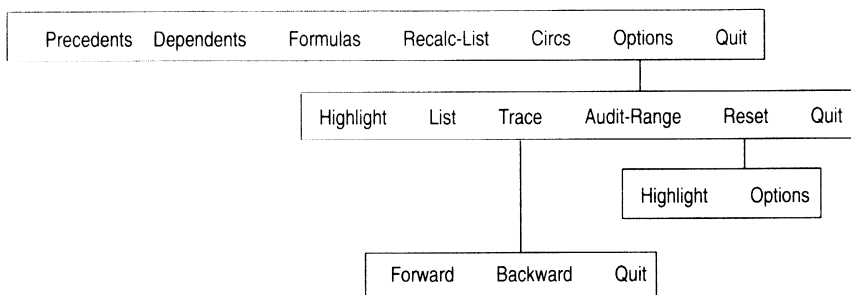
Command	Task
Highlight	Identifies cells in a bright intensity or different color. Use Highlight when you want to examine the relationships among cells visually. Highlight is the default.
List	Identifies cells by listing them in a range you specify.
Trace	Identifies cells by moving the cell pointer to them one at a time.

NOTE To clear the settings and restore the defaults, select Options Reset Options.

Audit Range

You can specify the audit range you want to use with the Formulas, Dependents, or Precedents command. By default, the audit range includes all worksheets in all files in memory. When you open additional files, the Auditor automatically extends the audit range to include all worksheets in the files. If you specify an audit range, however, you cannot extend the range across multiple active files, although you can specify an audit range across multiple worksheets within a single file. (The Circs and Recalc-List commands always apply to all active files.)

The Auditor Commands



The Auditor commands identify cells involved in a circular reference and display information about formulas in a file.

The Auditor commands perform the following tasks:

Command	Task
Circs	Identifies all cells involved in a circular reference.
Dependents	Identifies all formulas in the audit range that depend on a specified cell.
Formulas	Identifies all formulas in the audit range.
Options	Sets or resets options such as the audit range or the way in which the Auditor identifies cells.
Precedents	Identifies all cells in the audit range referred to by a specified formula.
Quit	Returns 1-2-3 to READY mode.
Recalc-List	Identifies all formulas in the order that 1-2-3 recalculates them.

Common Uses for Auditor Commands

You can use the Auditor commands to do any of the following:

- Find errors in formulas or all cells involved in circular references (Circs).
- Identify all formulas that use a specified cell (Dependents).
- Locate all formulas in an entire file or in a specified range (Formulas).
- Identify formulas in the file in order of recalculation (Options Recalc-List).
- Find all cells that provide data for a specified formula (Precedents).

Auditor Command Descriptions

The following sections describe each of the Auditor commands in alphabetical order.

Circs

Circs identifies all the cells in the file that are involved in a circular reference. A circular reference occurs when the recalculation method is Natural and a formula either directly or indirectly refers to itself.

For example, if cell A:M7 contains the formula `@AVG(A:M7..A:M15)`, the circular reference is direct. If, on the other hand, cell A:A1 contains `+A:A2`, cell A:A2 contains `+A:A3`, and cell A:A3 contains `+A:A1`, the circular reference is indirect.

When 1-2-3 detects a circular reference, it displays the CIRC indicator on the status line.

Use Circs to identify the cells involved in the circular reference. The Auditor identifies the cells in the circular reference using the option you selected: Options Highlight, Options List, or Options Trace.

Procedure

1. (Optional) To change the way the Auditor identifies circular references, select Options Highlight, Options List, or Options Trace, and then select Quit.
2. Select Circs.
3. If you selected Options List, specify a range for the list of cells the Auditor produces.
4. If there is more than one circular reference, select a source for the circular reference from the list the Auditor displays. (The source is always the upper left cell involved in a circular reference.)

5. If the source you selected is involved in more than one circular reference path, select the path you want to analyze.

If you specify a one-row range (for example, A:J7..A:N7), the Auditor automatically expands the range to the bottom of the worksheet.

If the range you specify contains data, the Auditor displays an error message and you must erase the range or specify an empty range.

If you selected Options Trace, select Forward, Backward, or Quit.

If you selected Options Highlight, the Auditor highlights all circular references.

Dependents

Dependents identifies all the formulas in the audit range that refer to a particular cell. For example, suppose cell A:E1 contains @SUM(A:B1..A:B10), cell A:E2 contains (A:B1*2)/A:A1, and cell A:E3 contains +A:B1. Cells A:E1, A:E2, and A:E3 are all dependents of cell A:B1 because they contain formulas that refer to A:B1.

Use Dependents when you want to see whether a formula refers to a specified cell. The Auditor identifies dependents using the option you selected: Options Highlight, Options List, or Options Trace.

Procedure

1. (Optional) To change the way the Auditor identifies dependents, select Options Highlight, Options List, or Options Trace, and then select Quit.
2. Select Dependents.
3. Specify the cell for which you want to identify dependents.
4. If you selected Options List, specify a range for the list of cells the Auditor produces.

If you specify a one-row range (for example, A:J7..A:N7), the Auditor automatically expands the range to the bottom of the worksheet.

If the range you specify contains data, the Auditor displays an error message and you must erase the range or specify an empty range.

If you selected Options Trace, select Forward, Backward, or Quit.

If you selected Options Highlight, the Auditor highlights all dependent formulas.

Formulas

Formulas identifies all the formulas (including linking formulas to cells in other files) in the audit range. The Auditor identifies formulas using the option you selected: Options Highlight, Options List, or Options Trace.

Procedure

1. (Optional) To change the way the Auditor identifies formulas, select Options Highlight, Options List, or Options Trace, and then select Quit.
2. Select Formulas.
3. If you select Options List, specify a range for the list of cells the Auditor produces.

If you specify a one-row range (for example, A:J7..A:N7), the Auditor automatically expands the range to the bottom of the worksheet.

If the range you specify contains data, the Auditor displays an error message and you must erase the range or specify an empty range.

If you selected Options Trace, select Forward, Backward, or Quit.

If you selected Options Highlight, the Auditor highlights all formulas in the audit range.

Options

The Options commands set or reset the following options:

Command	Task
Audit-Range	Specifies the range to audit.
Highlight	Identifies cells by displaying them in a bright intensity or different color.
List	Lists information about identified cells in a range you specify.
Quit	Returns to the Auditor main menu.
Reset	Clears highlights from cells or resets options to the defaults.
Trace	Displays identified cells one at a time.

Options Audit-Range

Options Audit-Range specifies the range to audit when you select the Formulas, Dependents, or Precedents command. (The Circs and Recalc-List commands always apply to all active files.)

By default, the audit range is all files in memory. When you open additional files, the Auditor automatically extends the audit range to include all worksheets in the files. If you specify an audit range, however, you cannot extend the range across multiple active files, although you can specify a range across multiple worksheets within a file. To extend the audit range to all active files, select Options Reset to restore the default.

Procedure

1. Select Options Audit-Range.
2. Specify the range to audit.

Options Highlight

Options Highlight identifies particular cells (for example, formulas or dependents) by displaying them in a bright intensity or different color. Highlight is the default way of identifying cells.

Use Highlight to examine the relationships among cells quickly.

Procedure

1. Select Options Highlight.

Tips

- To remove highlights from cells before you select another Auditor command, use Options Reset Highlight. The Auditor automatically removes highlights if you rearrange the file, for example, by moving data, inserting or deleting columns or rows, or using /Range Name Create and specifying an existing range name.
- Highlights require additional memory. If you run out of memory while the Auditor is highlighting cells, it may not highlight all the cells it identified.

Options List

Options List identifies cells by listing information about the contents of the cells in a range you specify.

Use Options List to examine detailed information about the contents of cells.

Procedure

1. Select Options List.

Options Reset

Options Reset clears highlights from the screen or resets the options to the defaults.

Procedure

1. Select Options Reset.
2. Select one of the following:

Highlight	Clears highlights from the screen.
Options	Resets the audit range to include all active files and resets the audit mode to Highlight.

Options Quit

Options Quit returns to the Auditor main menu.

Procedure

1. Select Options Quit.

Options Trace

Options Trace identifies cells one at a time by moving the cell pointer to them. You can go forward or backward through the cells the Auditor identified.

Procedure

1. Select Options Trace.

If you selected Formulas and Forward, the Auditor begins searching in the upper left corner of the audit range and proceeds down each column from left to right. Backward takes you to the previously identified cell.

When the Auditor cannot find any more cells in a particular direction, it beeps.

Precedents

Precedents identifies all the cells and ranges that provide data to a formula (so 1-2-3 can calculate the result of the formula). For example, if cell A:O7 contains the formula `+A:A3+@SUM(A:B1..A:B3)`, cells A:A3, A:B1, A:B2, and A:B3 are all precedents of cell A:O7.

Use Precedents to identify the cells that supply data to a formula. The Auditor identifies precedents using the option you selected: Options Highlight, Options List, or Options Trace.

Procedure

1. (Optional) To change the way the Auditor identifies precedents, select Options Highlight, Options List, or Options Trace, and then select Quit.
2. Select Precedents.
3. Specify the cell that contains the formula whose precedents you want to identify.
4. If you selected Options List, specify a range for the list of cells the Auditor produces.

If you specify a one-row range (for example, A:J7..A:N7), the Auditor automatically expands the range to the bottom of the worksheet.

If the range you specify contains data, the Auditor displays an error message and you must erase the range or specify an empty range.

If you selected Options Trace, select Forward, Backward, or Quit.

If you selected Highlight, the Auditor highlights all precedents in the audit range.

Quit

Quit removes the Auditor menu, but keeps the Auditor in memory. The Auditor remains in memory until you end the 1-2-3 session with /Quit or until you remove the Auditor from memory by pressing **ADD-IN (ALT-F10)**, selecting Remove, and specifying AUDITOR as the add-in to remove from memory.

Use Quit to remove the Auditor menu so you can use 1-2-3 commands to enter or edit worksheet data.

Procedure

1. Select Quit.

Tip

- To display the Auditor menu again, press the function key to which you assigned the Auditor or press **ADD-IN (ALT-F10)**, select Invoke, and specify AUDITOR.

Recalc-List

Recalc-List identifies formulas in the file in the order of recalculation (Natural, Columnwise, or Rowwise). The Auditor always begins by identifying the formula that 1-2-3 calculates first and ends with the formula that 1-2-3 calculates last.

The Auditor identifies formulas using the option you selected: Options List or Options Trace.

Procedure

1. (Optional) To change the way the Auditor identifies formulas, select Options List or Options Trace, and then select Quit. Do not select Options Highlight because the Auditor will highlight all formulas in the file without identifying the recalculation method.
2. Select Recalc-List.
3. If you selected Options List, specify a range for the list of cells the Auditor produces.

If you specify a one-row range (for example, A:J7..A:N7), the Auditor automatically expands the range to the bottom of the worksheet.

If the range you specify contains data, the Auditor displays an error message and you must erase the range or specify an empty range.

If you selected Options Trace, select Forward, Backward, or Quit.

Chapter 3

The Backsolver Add-In

The Backsolver add-in changes a value in a problem so a formula that uses that value equals an amount you specify. You specify the variable you want to change and the value you want the formula to equal. Use the Backsolver when you know the answer you want for a problem and need to find out how that answer affects one variable used in the formula in the problem. For example, you may have a specific profit margin target you want to achieve, and you want to see what the total sales must be to reach that target.

How to Use this Chapter

The information in this chapter is divided into three sections:

- “Terms You Need to Know” introduces the terms you need to know to use the Backsolver.
- “Using the Backsolver Add-In” explains how the Backsolver works.
- “The Backsolver Commands” provides an alphabetical listing of each Backsolver command with a description and a procedure for each.

Terms You Need to Know

Before you begin using the Backsolver commands, you should be familiar with the following terms:

- **Adjustable cell** specifies the cell that contains the value you want the Backsolver to change, based on the desired result of a formula.
- **Formula cell** specifies the cell that contains the formula you want to equate to a specific value.
- **Value** is the value you want the formula to equal when the Backsolver has solved the problem.

Using the Backsolver Add-In

The Backsolver solves what-if problems by working backwards, changing the value in the adjustable cell to find the desired result for the formula cell. With the Backsolver, you pick a formula cell and value and then specify an adjustable cell.

For example, the worksheet below uses @PMT to calculate a monthly loan payment based on a total loan amount of \$100,000, an interest rate of 12%, and a term of 30 years.

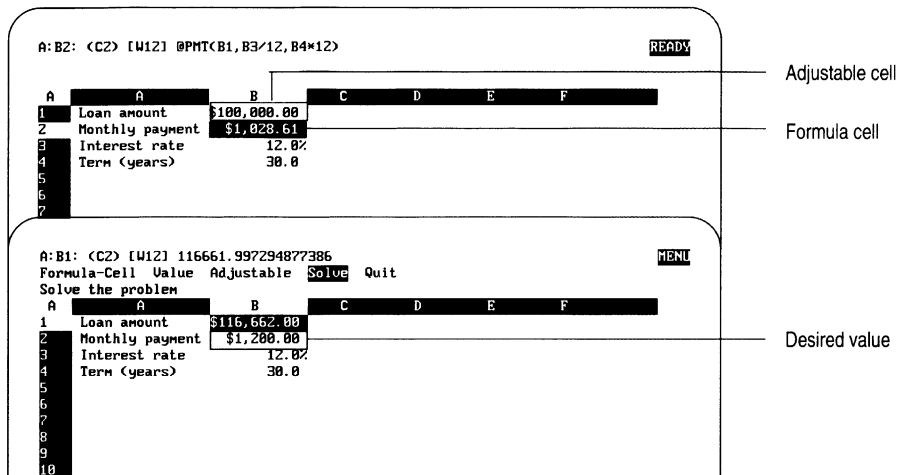


Figure 3-1 A sample Backsolver problem

The result of @PMT using these variables is a monthly loan payment of \$1,028.61. But suppose you can afford a \$1,200 monthly payment and you want to determine how much money you can borrow at that rate of payment.

To solve for the loan amount in this problem, the Backsolver needs to know the following information:

- The adjustable cell: the cell you want the Backsolver to adjust to reach the desired goal (in this case, cell B1, which contains the amount of the loan).
- The formula cell: the cell address of the formula for which you want to solve the problem (in this case, the @PMT formula in cell B2).
- The value: the desired value for the result of the formula (in this case, \$1,200).

If you use the Backsolver to solve the problem with this information, you will find that you can increase the loan amount by \$16,662.

NOTE If any other formulas depend on the solved formula or the adjustable cell, 1-2-3 recalculates those cells also.

CAUTION When you use the Backsolver to solve a problem, 1-2-3 replaces the original value in the adjustable cell with the value the Backsolver finds. If you do not want to lose the original value, either save your file before you use the Backsolver or make a copy of the original value in the adjustable cell in another location in the file.

Tip

- If the undo feature is on, you can use undo to return the adjustable cell to its original value after you use the Backsolver, providing you have not altered the worksheet in any way between the time you used the Backsolver and the time you press UNDO (ALT-F4).

The Backsolver Commands

Formula-Cell	Value	Adjustable	Solve	Quit
--------------	-------	------------	-------	------

The Backsolver commands solve a problem and specify the cells and values you want the Backsolver to use to solve a problem.

The Backsolver commands perform the following tasks:

Command	Task
Adjustable	Specifies the cell that contains the value the Backsolver can change.
Formula-Cell	Specifies the cell that contains the formula you want to equate to a specific value.
Quit	Returns 1-2-3 to READY mode.
Solve	Calculates the formula to produce the value you specified.
Value	Specifies the value you want as the result of the formula in the formula cell.

Common Uses for Backsolver Commands

You can use the Backsolver commands to do any of the following:

- Specify a cell that contains a value you want the Backsolver to change, based on the desired result of a formula (Adjustable).
- Specify a formula you want to equate to a specific value (Formula-Cell).
- Specify the value you want a formula to return (Value).
- Change the value of a variable in a problem based on a specified value for a formula in that problem (Solve).

Backsolver Command Descriptions

The following sections describe each of the Backsolver commands in alphabetical order.

Adjustable

Adjustable specifies the cell that contains the value the Backsolver can change. The formula you specify in the formula cell must refer to the adjustable cell either directly or indirectly. The adjustable cell can be either a cell address or a range name.

Procedure

1. Select Adjustable.
2. Enter the cell address or a valid range name that corresponds to the cell that contains the value you want to change.

Formula-Cell

Formula-Cell specifies the cell that contains the formula you want to equate to a specific value. The formula cell can be either a cell address or a valid range name.

Procedure

1. Select Formula-Cell.
2. Enter the cell address or a valid range name that corresponds to the cell that contains the formula you want the Backsolver to solve.

Quit

Quit removes the Backsolver menu, but keeps the Backsolver in memory. The Backsolver remains in memory until you end the 1-2-3 session with /Quit or until you remove it from memory by pressing **ADD-IN (ALT-F10)**, selecting **Remove**, and specifying **BSOLVER**.

Procedure

1. Select Quit.

Solve

Solve tells the Backsolver to find an answer to a problem based on the information you specified for the formula cell, adjustable cell, and value. Solve changes the value in the adjustable cell so that the formula produces the value you specified.

Procedure

1. Select Solve.

If the Backsolver finds an appropriate answer to the problem, it displays the new value in the adjustable cell. If the Backsolver cannot produce the value, it displays a message that tells you why and puts its best attempt in the adjustable cell (providing that attempt is better than the original value).

NOTE If the Backsolver cannot find an appropriate answer to a problem, you may be able to use the Solver to further analyze the problem. For more information on the Solver, see Chapter 4.

Value

Value specifies the value you want the formula in the formula cell to equate to when the Backsolver solves the problem. Value can be either a number or a formula.

Procedure

1. Select Value.
2. Enter the number or formula you want the formula in the formula cell to equate to when you solve the problem.

NOTE If you enter a formula as the value, the Backsolver evaluates the formula to a value before it finds an answer to the problem.

Chapter 4

The Solver Add-In

The Solver add-in helps you analyze data in a worksheet file and solves what-if problems. When you have a problem that has several possible answers, the Solver can explore different options and show you a variety of possible solutions. You define the problem, and the Solver does the work. Working with the goals you specify, the Solver shows you the answers that meet your needs. Most important, the Solver can find the answer that best matches what you want to accomplish.

How to Use this Chapter

The information in this chapter is divided into seven sections:

- “Terms You Need to Know” introduces the terms you need to know to use the Solver.
- “What-If Problems: When to Use the Solver” describes the types of problems with which you use the Solver.
- “How the Solver Works” describes the information and process the Solver uses to find answers to a problem.
- “Using the Solver Add-In” describes the steps you take to set up and find answers to a Solver problem.
- “Using @Functions in Solver Problems” provides information on using @functions in Solver problem cells. It includes a list of the @functions you can use with the Solver.
- “Using the Solver in Macros” describes the @SOLVER function that 1-2-3 reads into memory when you use the Solver add-in.
- “The Solver Commands” provides an alphabetical listing of each Solver command with a description and a procedure for each.

Terms You Need to Know

Before you begin using the Solver commands, you should be familiar with the following terms:

- An **adjustable cell** is a cell that contains a value the Solver can change when it searches for an answer to the problem. An adjustable cell cannot contain a formula or a label, and it cannot be protected or blank. To decide which cells in the problem are adjustable cells, think about the cells that contain numbers you would experiment with in a manual what-if calculation. Those cells are the adjustable cells.
- An **answer** is a solution the Solver finds for a problem. An answer can be the best answer, the optimal answer, or a sample answer. Depending on the problem, the Solver may find one answer or several answers.
 - **Best answer** appears when you specified an optimal cell and the Solver determined an answer that may or may not be the true mathematical optimum. This answer is the best one the Solver found for the problem, given the values in the adjustable cells. You may be able to find a better answer by changing the values in the adjustable cells.
 - **Optimal answer** is the mathematical optimum for the cell you specified as the optimal cell. This answer is the highest or lowest value, depending on whether you selected X-Maximize or N-Minimize.
 - **Sample answer** is a solution the Solver found that satisfies every constraint in the problem but that is not the best or optimal answer. Though you might think that a sample answer is not as useful as the best or optimal answer, you may find that one of the sample answers more closely suits your specific requirements.
- An **answer number** is the number the Solver assigns to each answer or attempt it finds. If you specified an optimal cell, the Solver sorts answers by the optimal cell's value, with answer 1 being the optimal answer (answer 1 has the highest or lowest value for the optimal cell, depending on whether you want to maximize or minimize the value in the cell). You can use Report Answer to create a worksheet that lists all the answers to a problem by number.
- An **attempt** is a result the Solver finds that does not satisfy all the constraints you specified for a problem. The Solver provides attempts only when it cannot find answers to the problem. When you display an attempt in a worksheet, one or more constraints are not satisfied and cause the logical formulas for those constraints to return a result of 0 (false).
- **Cell reports** are reports that explain the way the Solver used a particular cell in finding answers to a problem. 1-2-3 displays cell reports in a window at the bottom right of the screen and shows information about the first such cell. You can scroll through the cells one at a time to view information on each cell.

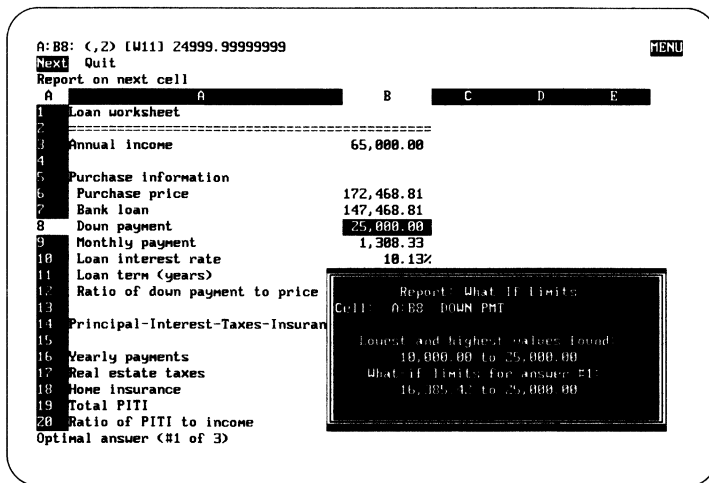


Figure 4-1 A sample cell report

- A **constraint cell** is a cell that contains a logical formula that helps define the answers you want the Solver to find. For each constraint cell, you specify a single condition that is important to the problem. For example, a constraint cell can limit the number of possible units sold for a single item or establish a minimum value for projected sales. For more information on creating constraint cells, see “Using the Solver Add-In” later in this chapter.
 - A **binding constraint** is a constraint formula that is satisfied at its most limiting condition for the current answer. For example, if a problem contains the constraint formula $+B4 \geq 5$ and an answer contains the value 5 in cell B4, that constraint formula is binding for that answer.
 - An **inconsistent constraint** is a constraint cell that contains a logical formula that is not satisfied by the attempts the Solver found to the problem. You can use Report Inconsistent to create a worksheet that lists all inconsistent constraint cells for each attempt the Solver finds.
 - An **unused constraint** is a constraint formula that is not binding for the current answer. For example, if a problem contains the constraint formula $+B4 \geq 5$ and an answer contains the value 17 in B4, the Solver did not use the constraint formula to find the answer.
- A **guess value** is a new number the Solver asks you to provide for an adjustable cell when the Solver needs more information to solve a problem.

The Solver displays the message ‘Guesses required’ when the Solver needs more information to solve a problem.
- An **optimal cell** is the cell in a problem that you want the Solver to make either as large or as small as possible and still satisfy all the specified constraints.

- **Problem cells** are the cells the Solver uses in a problem. Problem cells include the adjustable cells, the constraint cells, the optimal cell, and any other cells that contain values or formulas that affect the result of one or more constraint cells or of the optimal cell. You can select Report Cells to see the adjustable cells, constraint cells, and optimal cell (if any), or you can select Report Answer to see all the problem cells except the constraint cells. Problem cells can exist in one or more files that contain a Solver problem.
- **Progress messages** inform you of the Solver's progress in finding answers to a problem.
 - 'Analyzing problem' indicates that the Solver is examining the file to locate the values, formulas, and other information it needs to solve the problem.
 - '% complete' indicates the Solver's estimate of its progress in solving the problem.
- **Roundoff error** is a message 1-2-3 displays when the Solver has found an answer, but one or more constraint cells display 0 (false) after rounding to five decimal places.
- **Table reports** are reports that explain how the Solver found answers to a problem and how it used cells and values in the problem for each answer or attempt. 1-2-3 inserts a single-sheet file for each report after all other active files. Table reports are like any other 1-2-3 worksheets: You can print, graph, or edit the data they contain, and you can save them in the file for later use.

A: A1: [W1] 'Solver Table Report - What-if limits' MENU

Answer Hou What-If Differences Inconsistent Unused Cells Quit

Report allowable ranges for adjustable cells

A	B	C	D	E
1	Solver Table Report - What-if limits			
2	Worksheet: C:\123RE\ADDINS\LOAN.WK3			
3	Solved: 16-Apr-91 09:50 AM			
4				
5	Answer #1			
6				
7	Range of values found for all answers			
8	Cell	Name	Lowest value	Highest value
9	A: B7	LOAN	147,468.81	147,468.81
10	A: B8	DOWN_PMT	16,385.42	25,000.00
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

LIMITS01.WK3

Figure 4-2 A sample table report

When you create a table report, it becomes the current worksheet. Each table lists the type of report it contains, the file name of the worksheet that contains the problem it is reporting on, and the date and time the report was created.

All table reports list both cell addresses and range names for cells the Solver used in the problem. If you did not name a cell, the Solver combines the first label it finds above the cell and the first label it finds to the left of the cell to create a name.

- The **what-if limit** is the approximate range of values for which an adjustable cell can change and still satisfy all constraints, assuming no other adjustable cell values are changed.
- A **what-if problem** is a problem in which you use 1-2-3 to calculate the effect in the worksheet of using different values in one or more adjustable cells.

What-If Problems: When to Use the Solver

You use the Solver to analyze data in a problem that contains more than one variable or equation, when you want to see the effect that different values have on the problem. These kinds of problems, known as what-if problems, can have many different answers, one or more of which might be right for your particular situation. The number of answers depends on the number of variables, the number of constraints you put on the potential answers, and the formulas you ask the Solver to solve. You can use the Solver to solve most problems that have more than one possible answer — problems in which you can vary one or more values to achieve different results.

For example, the Solver can find answers for the following problems:

- If you need to establish new sales quotas, the Solver can show you different combinations of sales increases and cost reductions that make a business venture profitable.
- If you are planning production levels at your company, the Solver can find the most profitable mix to produce, given available resources.
- If you need to determine the number of new staff to hire, the Solver can analyze your firm's manager-to-staff ratios and projected revenue requirements to show you the optimum number of new employees to hire.

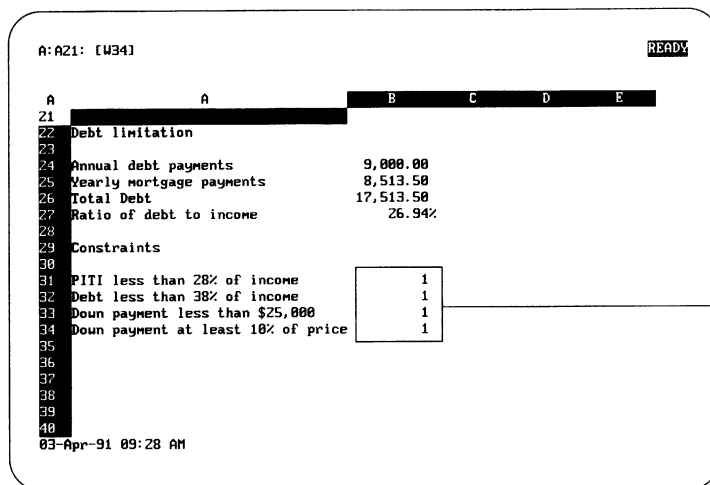
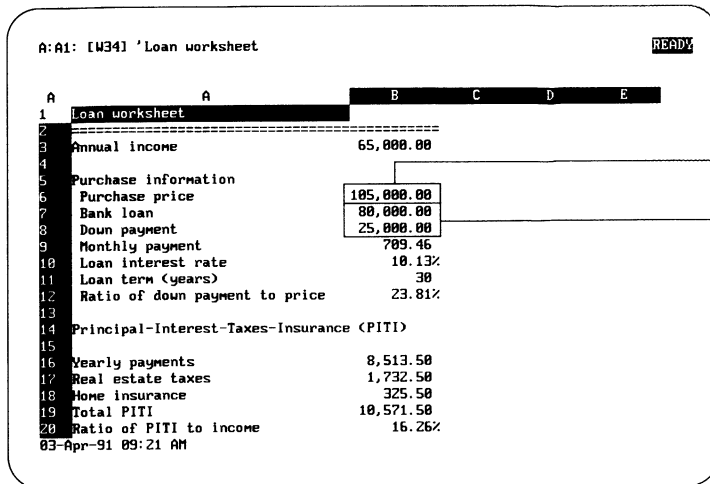


Figure 4-3 A sample Solver problem

The Solver uses the formulas that are already in your file and shows you the answers for the what-if problem you identified. For example, suppose you are trying to decide whether you can afford to purchase a house. Before you make an offer to buy the house or apply for a loan, you might create a file that summarizes your income and projects housing costs based on the price of a house you think you can afford.

You might also set up the file to compute your monthly loan payments and the percentage of your income that would cover housing costs. To see if you qualify for the loan, you might have the Solver perform the calculations shown in Figure 4-4.

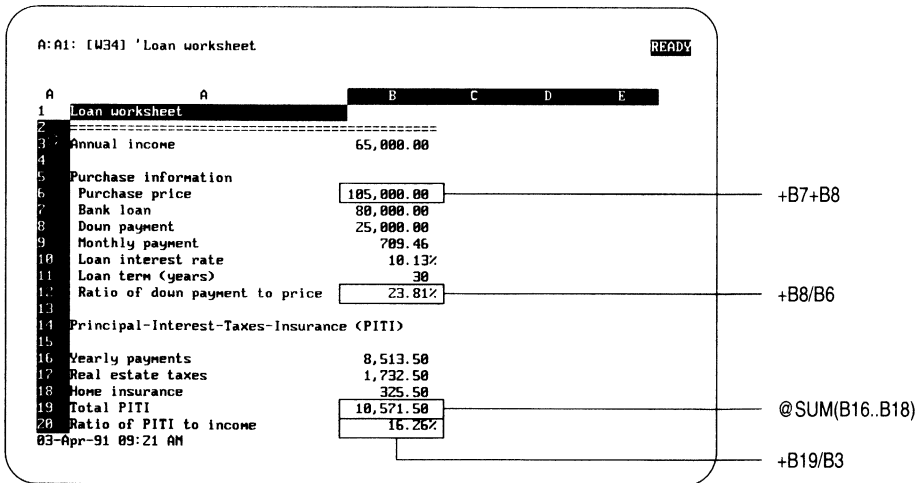


Figure 4-4 A housing loan problem

Once you set up the file, the Solver can show you the most expensive house you can afford. The Solver can also display other answers that give you an idea of what your options would be if, for example, you choose to purchase a less expensive house or make a larger down payment.

How the Solver Works

The Solver uses the formulas and values in a file to find answers for a problem you define. You can start with any problem that contains values you want to experiment with.

To set up a problem, you enter logical formulas in the file that specify conditions you want each answer to satisfy. A **logical formula** is a formula that returns either 1 (true) or 0 (false), depending on whether a condition is satisfied. For example, $+INTEREST < .13$ specifies that the interest rate must be less than 13%, and $+LOAN <= 150000$ specifies that the loan amount must not exceed \$150,000.

Figure 4-5 shows the results of logical formulas, called constraints when they apply to a what-if problem, that you might enter for the housing loan problem. The values in the worksheet satisfy the formulas, so the formulas return 1 (true).

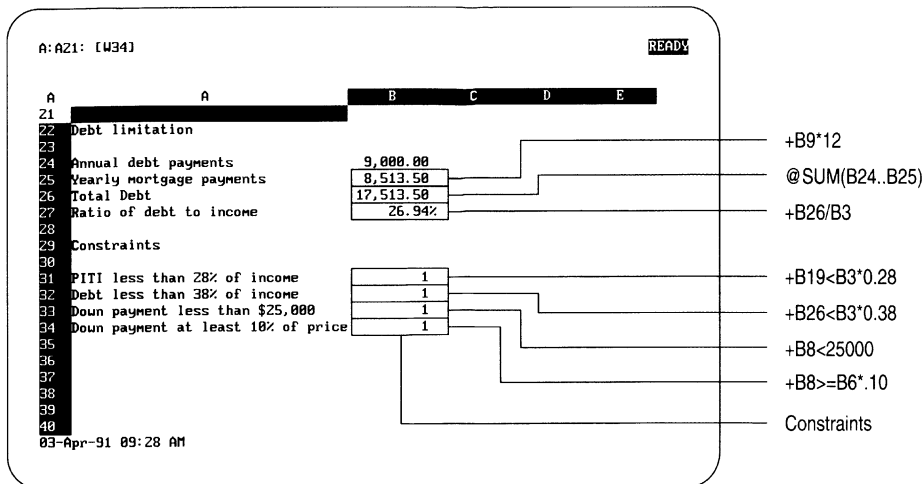


Figure 4-5 Constraints for the housing problem

After you set up the problem, you invoke the Solver add-in and specify the cells that define the problem. You specify cells the Solver can adjust (adjustable cells), such as those that contain the loan amount and the down payment amount; cells that contain formulas that constrain the problem (constraint cells), such as $+B8 < 25000$; and (optionally) the single cell that contains the value that the Solver is to maximize or minimize to find the optimal answer (optimal cell), such as the purchase price for the house.

The Solver uses the cells you specify to solve the problem. After you select Solve Problem, the Solver evaluates the problem and looks for answers. When the Solver is finished solving a problem, you use other Solver commands to display the answers one at a time in the file.

The Solver provides reports about the answers it found. For example, the Solver can list all answers, show how it found an answer, compare answers, show upper-value and lower-value limits for adjusted cells, or report formulas used to find answers. You can print, graph, or use the Data commands with the answers that appear in reports.

Using the Solver Add-In

This section guides you through the steps you take to solve a problem with the Solver. It provides the basic rules for using the Solver with a worksheet application, and it explains the Solver messages and some of the Solver commands.

This section shows you how to

- Set up a problem in a worksheet.
- Have the Solver find answers to the problem.
- Review answers that the Solver finds.
- End a Solver session.

Setting Up a Solver Problem

To use the Solver, you begin with an application in a worksheet. You can set up a Solver problem in one or more active worksheets and in one or more active files. To set up a problem, you decide which cells to adjust and enter logical formulas that you want each of the Solver's answers to satisfy.

Defining Adjustable Cells

Adjustable cells contain values the Solver can change when it searches for an answer. You specify these cells and the Solver automatically finds new values for them. Adjustable cells cannot contain formulas or labels, or be protected. The cells that contain the values you would experiment with in a manual what-if calculation are the ones you identify to the Solver as adjustable cells.

For example, in the housing loan application, the cells that contain the bank loan and the down payment (B7..B8 in Figure 4-4) are the adjustable cells. An increase or decrease in either of these values affects the values for the mortgage payment and the total debt. The adjustable cells for the housing loan application problem are highlighted in Figure 4-3. These are the cells you specify with the Define Adjustable command when you are ready to find answers to the problem.

NOTE The housing loan application uses only two cells that the Solver can adjust, but the problems you create may have more adjustable cells. The number of adjustable cells in a Solver problem is limited only by the complexity of your application and by the amount of available memory your computer has.

Defining Constraint Cells

Constraint cells contain logical formulas that you use to limit the scope of the answers you want the Solver to find. Constraint cells tell the Solver how to evaluate what-if results with your problem.

The housing loan application has guidelines for the maximum amount of principal-interest-taxes-insurance (PITI) debt, of total debt, and of the down payment, and for the minimum amount of the down payment (based on the purchase price of the house). When you set up the problem, you enter logical formulas that tell the Solver to show only answers that satisfy all four of these constraints (see Figure 4-5). These are the cells you specify with the Define Constraint command when you are ready to have the Solver find answers to the problem.

NOTE The housing loan application uses only four constraint cells, but the problems you create may contain any number of constraints. Problems with many constraints generally take longer for the Solver to find answers, however. In addition, the number of constraint cells in a Solver problem is limited by the complexity of the application and the amount of available memory your computer has.

Defining the Optimal Cell (Optional)

An optimal cell is a cell for which you want the Solver to find the highest or lowest possible value. The optimal cell in a problem may be an adjustable cell or a cell whose value depends on an adjustable cell. In the housing loan application, cell B6 contains the projected purchase price for a house (see Figure 4-4). This is the cell you specify as the optimal cell with the Define Optimal command when you are ready to find answers for the problem. Specifying this cell as the optimal cell, and asking the Solver to find the maximum value for the cell, tells the Solver that you want to find the highest possible purchase price that you can afford.

NOTE You do not need to specify an optimal cell if you are interested only in the group of answers that satisfy your constraint formulas. If you do not specify an optimal cell, the Solver will not find an optimal or best answer to the problem.

Starting a Solver Session

Once you decide on adjustable cells, constraint cells, and an optional optimal cell, you are ready to use the Solver to find answers to the problem. To start solving a problem, read into memory and invoke the Solver add-in, and use the Define commands to specify which cells you want to use as the adjustable, constraint, and (optionally) optimal cells. The Solver uses the values in the adjustable cells and the logical formulas in the constraint cells, along with other values and formulas in the application, to find answers for the problem.

For information on reading the Solver into memory and invoking the Solver, see “Starting the Enhancement Add-Ins” in Chapter 1. For information on the Define commands, see “The Solver Commands” later in this chapter.

Finding the Answers

After you define the problem, you select Solve Problem to tell the Solver to look for answers.

While the Solver looks for answers, 1-2-3 displays a progress message that tells you the Solver is analyzing the problem. After the Solver analyzes the problem, the progress message shows you that the Solver is looking for answers and tells you how many answers the Solver has found (if any).

When the Solver finishes finding answers, it displays the first answer in the worksheet. If the Solver does not find an answer because you made an error entering information when you defined the adjustable, constraint, or optimal cells, it displays an error message and returns you to the Solver main menu. The Solver also displays an error message if 1-2-3 runs out of memory while the Solver is trying to solve a

problem. If the Solver cannot find answers that satisfy all the logical formulas in the constraint cells, it displays attempts instead, beginning with the first attempt it found. If the Solver needs additional information to solve the problem, it displays a message prompting you to supply guesses for one or more adjustable cells. For more information on guesses, see “Reviewing the Answers” below.

Reviewing the Answers

After the Solver finds answers or attempts for a problem, it displays the number of answers it found in the progress message area and displays the first answer (or attempt) in the worksheet. You can display each answer the Solver found with the Answer commands.

If you specified an optimal cell, the first answer is the optimal answer or the best answer the Solver could find. The adjustable cells show values the Solver used to find the current answer. The constraint cells show that the current answer satisfies all constraints. All the other cells show the values that the Solver calculated for the current answer. For example, the Solver finds three answers to the housing loan problem used earlier in this chapter.

A: B6: (, 2) [U11] +B7*B8 READY

	A	B	C	D	E
1	Loan worksheet				
2	-----				
3	Annual income	65,000.00			
4	Purchase information				
5	Purchase price	172,468.81			
6	Bank loan	147,468.81			
7	Down payment	25,000.00			
8	Monthly payment	1,308.33			
9	Loan interest rate	10.13%			
10	Loan term (years)	30			
11	Ratio of down payment to price	14.50%			
12	Principal-Interest-Taxes-Insurance (PITI)				
13	-----				
14	Yearly payments	15,700.00			
15	Real estate taxes	1,732.50			
16	Home insurance	325.50			
17	Total PITI	17,758.00			
18	Ratio of PITI to income	27.32%			
19	LOAN.WK3				

Figure 4-6 First (optimal) answer to the housing loan problem

The Solver displays the optimal answer in the worksheet first. The optimal answer shows that the maximum amount of money you are able to spend on a house, based on the constraints you applied to the problem, is \$172,468.81.

To see the second answer the Solver found to the problem, select Answer Next. To see the last answer the Solver found to the problem, select Answer Last. You can use the Answer commands to continue cycling through the answers.

Attempts

If the Solver cannot find answers for the problem, it provides representative attempts, if available. Attempts do not satisfy all constraints, but they may be helpful to look at because they can give you some idea of the portions of the problem you may need to change in order to completely solve the problem. Each attempt does not satisfy at least one constraint formula.

For example, if you change the formula in the constraint cell B33 to specify that the down payment can be no more than \$1,000, and then try to solve the problem, the Solver cannot find an answer that satisfies all the constraints. Instead, the Solver provides one attempt that leaves one constraint unsatisfied.

Guesses

Sometimes a problem is too complex or does not contain enough information for the Solver to find an answer. When either situation occurs, the Solver displays an attempt in the worksheet and displays the message 'Guesses required.' Use Solve Guesses to enter guess values for one or more of the adjustable cells, then select Solve Problem to tell the Solver to try to solve the problem again with the new information.

NOTE Because the Solver uses numeric solving rules with guess values (as opposed to symbolic rules) that depend on reasonable starting point values, the Solver may also prompt for guesses because the initial value in one or more of the adjustable cells is not close enough to any possible answers. In this situation, the Solver also displays the message 'Guesses required.'

Ending a Solver Session

When you finish looking at the answers the Solver found for your problem, you end the Solver session by selecting Quit from the Solver menu. Before you end the session, however, you need to determine which of the answers the Solver found contain values you want to keep.

If you want to keep the values from only one answer the Solver found, use the Answer menu to select that answer and select /File Save to save the file.

If you want to save more than one answer to the problem, you need to save each set of values in a separate worksheet (or, if you prefer, in a separate file).

NOTE When you select Quit to leave the Solver menu, 1-2-3 does not remove the Solver from memory. You can begin using the Solver again at any time during your 1-2-3 session by reinvoking the Solver.

NOTE When you leave the Solver menu, 1-2-3 does not remove the answers the Solver found until the next time it recalculates the file.

Using @Functions in Solver Problems

To find answers to a problem, the Solver uses information in the adjustable cells, the constraint cells, and (optionally) the optimal cell. If the Solver needs formulas or values in other cells to find the value of one or more constraints or of the optimal cell, the Solver also uses the cells that contain those formulas to solve the problem. All the cells that the Solver uses when it finds answers to a problem are the problem cells.

Although the Solver can find answers to most problems that contain one or more @functions in formulas in the problem cells, there are some @functions that the Solver cannot use. When you try to solve a problem that contains such an @function in a problem cell, 1-2-3 displays the warning message 'Cell <cell address> refers to an unsupported string' or 'Unsupported @function in cell <cell address>' when the Solver begins to analyze the problem, and solving terminates. In general, the @functions the Solver cannot use to solve a problem include the string @functions, the date and time @functions, database @functions, @functions with strings as arguments, and some of the special @functions.

If you are not sure whether a problem uses @functions the Solver can process, try solving the problem. If the Solver detects an @function that keeps the problem from being solved, it displays the warning message.

The following table lists the @functions you can always use in problem cells when you are using the Solver add-in. For detailed information about @functions, see Chapter 3 of *Reference*.

@Function	Description
@ABS	Calculates the absolute (positive) value of a value.
@ACOS	Calculates the arc cosine of a value.
@ASIN	Calculates the arc sine of a value.
@ATAN	Calculates the arc tangent of a value.
@ATAN2	Calculates the four-quadrant arc tangent of two values.
@AVG	Averages a list of values.
@CHOOSE	Finds a specified value or string in a list of values and/or strings.
@COLS	Counts the columns in a range.
@COS	Calculates the cosine of an angle.
@COUNT	Counts the nonblank cells in a list of ranges.
@CTERM	Calculates the number of compounding periods necessary for an investment to grow to a future value.
@DDB	Calculates the double-declining balance depreciation allowance of an asset.
@EXP	Calculates the number <i>e</i> raised to a specified power.
@FALSE	Returns the logical value 0 (false).

(Continued)

@Function	Description
@FV	Calculates the future value of a series of equal payments.
@HLOOKUP	Finds the contents of a cell in a specified row in a horizontal lookup table.
@IF	Takes one action if a condition is true, another if the condition is false.
@INDEX	Finds the contents of a cell in a specified row, column, and worksheet in a range.
@INT	Returns the integer portion of a value.
@IRR	Calculates the internal rate of return for a series of cash flows.
@ISNUMBER	Returns 1 (true) for a value or a blank cell, 0 (false) for a string.
@LN	Calculates the natural logarithm (base e) of a value.
@LOG	Calculates the common logarithm (base 10) of a value.
@MAX	Finds the maximum value in a list of values.
@MIN	Finds the minimum value in a list of values.
@MOD	Calculates the remainder (modulus) of two values.
@NPV	Calculates the net present value of a series of cash flows.
@PI	Returns the value π (calculated at 3.14159265358979324).
@PMT	Calculates the amount of the periodic payment needed to pay off a loan.
@PV	Calculates the present value of a series of equal payments.
@RATE	Calculates the periodic interest rate necessary for an investment to grow to a future value.
@ROUND	Rounds a value to a specified number of decimal places.
@ROWS	Counts the rows in a range.
@SHEETS	Counts the worksheets in a range.
@SIN	Calculates the sine of an angle.
@SLN	Calculates the straight-line depreciation allowance of an asset for one period.
@SQRT	Calculates the positive square root of a value.
@STD	Calculates the population standard deviation of a list of values.
@STDS	Calculates the sample standard deviation of a list of values.
@SUM	Sums a list of values.
@SUMPRODUCT	Sums the products of corresponding elements in multiple ranges.
@SYD	Calculates the sum-of-the-years'-digits depreciation allowance of an asset.
@TAN	Calculates the tangent of an angle.
@TERM	Calculates the number of payment periods of an investment.
@TRUE	Returns the logical value 1 (true).
@VAR	Calculates the population variance of a list of values.

(Continued)

@Function	Description
@VARS	Calculates the sample variance of a list of values.
@VDB	Calculates depreciation using the double-declining balance method and allows the percentage of straight-line depreciation to be values other than 200%.
@VLOOKUP	Finds the contents of a cell in a specified column in a vertical lookup table.

Using the Solver in Macros

When you read the Solver into memory, 1-2-3 also automatically reads in an additional @function, named @SOLVER, that you can use in macros to determine the status of the Solver. The @SOLVER function is useful in macros that use the Solver to find answers to a problem because you can use it to determine, among other things, when the Solver is finished finding answers or attempts to a problem and whether guesses are needed.

@SOLVER

@SOLVER returns a value that informs you about the status of the Solver. Its syntax is @SOLVER("query-string"). @SOLVER can answer eight queries:

"Query-string"	Value	Meaning
"consistent" (Are all constraints satisfied by the current answer?)	1	All constraints returned 1 (true)
	2	At least one constraint returned 0 (false)
	ERR	There is no answer in the file
"done" (Is the Solver done?)	1	Done solving
	2	Currently solving
	3	Solver is in memory, but has not begun solving
"moreanswers" (Can the Solver find more answers to the problem?)	1	All answers found
	2	The Solver might find more answers if you choose Solve Continue
	ERR	Solver has not solved the problem yet
"needguess" (Does the Solver need guesses to find an answer?)	1	Needs no guesses
	2	Needs guesses
	ERR	There is no answer in the file
"numanswers" (How many answers or attempts did the Solver find?)	<i>n</i>	Number of answers or attempts the Solver found
	ERR	Solver has not solved the problem yet

(Continued)

“Query-string”	Value	Meaning
“optimal” (What is the status of the optimal answer?)	1	Optimal answer found
	2	Best answer found
	3	The problem does not have binding constraints
	4	No optimization requested, or no answer found
	ERR	Solver has not solved the problem yet
“progress” (How much progress has the Solver made in solving the problem?)	<i>n</i>	Percentage of solving completed (for example, .5 means solving is 50% done)
	ERR	Solver has not begun to find answers to the problem
“result” (What is the Solver’s result?)	1	Solver found one or more answers
	2	No answers found, but attempts are available
	ERR	Solver has not solved the problem yet

Example

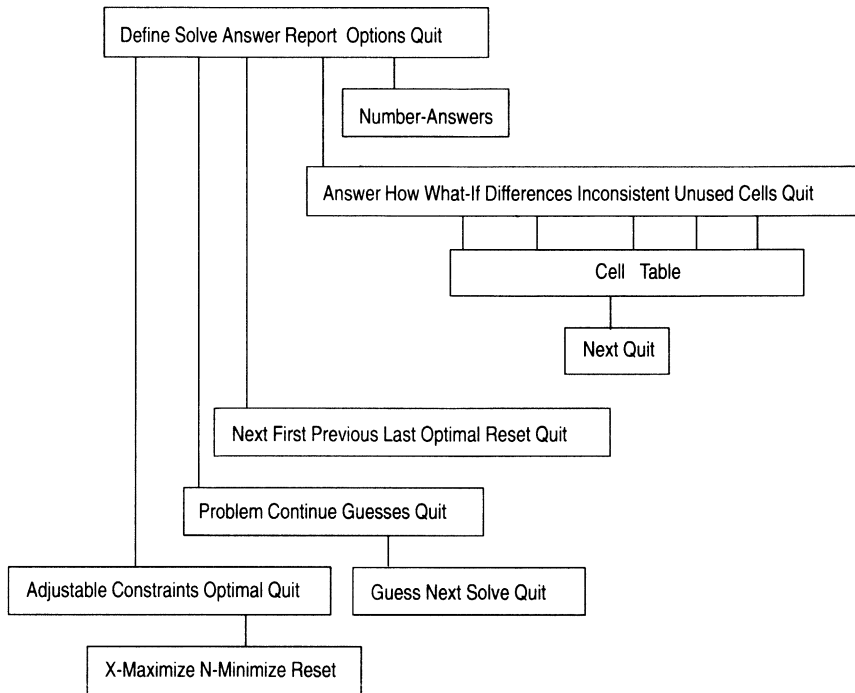
The following lines are an excerpt from a longer macro that uses the Solver. The macro uses @SOLVER to determine if the Solver finished finding answers to a problem. If the Solver found all the answers, the macro enters the next answer in the worksheet and stops. If the Solver has not finished finding answers to the problem, the macro selects Solve Continue to find more answers and then repeats the {IF} macro instruction to see if the Solver is done. The loop continues until the Solver finishes finding all answers. Then, the macro puts the next answer in the worksheet and stops.

. . .

```
CHKSLV    {IF @SOLVER(“moreanswers”)=1}an{RETURN}
          sc{BRANCH CHKSLV}
```

. . .

The Solver Commands



The Solver commands find answers to a what-if problem, specify the cells and values you want the Solver to use to solve a problem, and report on the problem cells and answers.

The Solver commands perform the following tasks:

Command	Task
Answer	Displays in the file the answers or attempts the Solver finds to a problem.
Define	Specifies the adjustable, constraint, and optimal cells for a problem.
Options	Specifies the number of answers you want the Solver to find to a problem.
Quit	Returns 1-2-3 to READY mode.
Report	Provides information about answers or attempts the Solver finds.
Solve	Finds answers to a problem and lets you enter guess values for a problem.

Common Uses for Solver Commands

You can use the Solver commands to do any of the following:

- Display the first, last, or optimal answer to a problem (Answer First, Answer Last, Answer Optimal).
- Specify the cells that contain formulas that limit the range of results that the Solver can find. For example, if your problem contains an inventory item, you might want the Solver to limit the total amount of inventory at any one time to 10,000 units (Define Constraints).
- Specify the number of answers you want the Solver to find to a problem (Options Number-Answers).
- Create a report that lists all the answers or attempts the Solver found to a problem (Report Answer).
- Create a report that shows which cells' values for two answers differ at least by a specified amount (Report Differences).
- Find additional answers to a problem (Solve Continue).

Solver Command Descriptions

The following sections describe each of the Solver commands in alphabetical order.

NOTE For all Solver commands that require you to specify a range, the specified range must be in an active file.

Answer

The Answer commands display an answer or attempt in the file or files that contain cells the Solver uses to solve the problem. The available answers are the answers the Solver found the last time it solved the problem.

The Answer commands perform the following tasks:

Command	Task
First	Displays the first answer or attempt the Solver found.
Last	Displays the last answer or attempt the Solver found.
Next	Displays the answer or attempt that follows the current answer or attempt the Solver found.
Optimal	Displays the optimal answer the Solver found.
Previous	Displays the answer or attempt that precedes the current answer or attempt the Solver found.

(Continued)

Command	Task
Quit	Returns you to the Solver main menu.
Reset	Resets the adjustable cells to the values they had before the problem was solved.

Answer First

First displays the first answer (or attempt) the Solver found to the problem. If you specified an optimal cell and the Solver found an optimal or best answer, Answer First displays that answer.

Procedure

1. Select Answer First.

Answer Last

Last displays the last answer (or attempt) the Solver found to the problem.

Procedure

1. Select Answer Last.

Answer Next

Next displays the answer (or attempt) that follows the current answer or attempt. If the last answer the Solver found is currently displayed in the worksheet, Answer Next displays the first answer.

Procedure

1. Select Answer Next.

Answer Optimal

Optimal displays the optimal (or best) answer to the problem, if the Solver was able to find one.

Procedure

1. Select Answer Optimal.

1-2-3 displays the optimal answer if the Solver found one. If the Solver was not able to find an optimal answer, 1-2-3 displays an error in the progress message area.

Answer Previous

Previous displays the answer (or attempt) that precedes the current answer or attempt. If the first answer the Solver found is currently displayed in the worksheet, Answer Previous displays the last answer.

Procedure

1. Select Answer Previous.

Answer Quit

Quit returns you to the Solver main menu.

Procedure

1. Select Answer Quit.

The Solver leaves the last answer you displayed in the worksheet when you select Answer Quit.

Answer Reset

Reset returns the adjustable cells to the values they had before the Solver found answers to the problem. Use Answer Reset if you need to recheck or work with the original values.

Procedure

1. Select Answer Reset.

Define

The Define commands specify the adjustable, constraint, and optimal cells for a problem.

The Define commands perform the following tasks:

Command	Task
Adjustable	Specifies the cells that contain values that the Solver can change while it looks for an answer to the problem.
Constraints	Specifies the cells that contain the logical formulas that each answer the Solver finds must satisfy.
Optimal	Specifies the optional cell for which you want the Solver to find either the highest or lowest value.
Quit	Returns you to the Solver main menu.

Define Adjustable

Adjustable specifies the cells that contain values that the Solver can change while it looks for an answer for the problem.

Procedure

1. Select Define Adjustable.
2. Specify the cells you want the Solver to change to find answers for the problem. Specify only unprotected cells that contain numbers. The Solver does not use blank cells or cells that contain formulas or labels as adjustable cells.

If you specify a range name or range address, the Solver uses as the adjustable cells any unprotected cells in the range that contain values.

Define Constraints

Constraints specifies the cells whose logical formulas the Solver must satisfy. A constraint is satisfied when the Solver changes the values in the adjustable cells and causes the logical formula to return 1 (true).

Procedure

1. Select Define Constraints.
2. Specify the cells that contain the formulas you want the Solver to use to limit the answers it finds to a problem. Specify cells whose formulas use the = >= <= > or < operators. The Solver does not accept compound logical formulas that use #AND#, #NOT#, #OR#, or <> (not equal).

If you specify a single-cell address, a range name, or a range address, the Solver uses the logical formulas in the cells as constraints. If any cell in the range is blank or contains a label or a formula that does not include one of the logical operators, the Solver does not use that cell as a constraint.

NOTE When you use logical operators (such as = or >=) with other constraints in a formula, make sure that the logical operators have the lowest precedence in the formula. If not, the Solver ignores any other parts of the formula that have lower precedence. For example, in the formula @IF(A1>A2,1,0), the Solver does not use the @IF function as a constraint because it has a lower precedence than the > (greater than) operator. If you want the Solver to use both portions of this formula, enter two formulas in separate cells. For example, enter the formula +A1>A2 in cell A3 and the @IF function @IF(A3,1,0) in A4.

Define Optimal

Optimal specifies the single cell for which you want the Solver to find either the highest or lowest value. Specifying an optimal cell is optional.

Procedure

1. Select Define Optimal.
2. Select X-Maximize, N-Minimize, or Reset.

X-Maximize	Finds the highest value for the optimal cell.
N-Minimize	Finds the lowest value for the optimal cell.
Reset	Tells the Solver you do not want to select an optimal cell.

3. Specify a single cell that is one of the adjustable cells or specify a cell whose formula depends on an adjustable cell. You can specify either a cell address or the range name of a cell.

Define Quit

Quit returns you to the Solver main menu.

Procedure

1. Select Define Quit.

Options

The Options menu has one selection, Number-Answers, which specifies the number of answers you want the Solver to find.

Options Number-Answers

Number-Answers specifies the number of answers you want the Solver to find.

Procedure

1. Select Options Number-Answers.

Enter a number from 1 to 999, or press **ENTER** to select the default number, 10. The number you enter is an estimate only; the Solver may find fewer or more answers than you request. For example, the Solver may find only 2 answers for a problem, even if you request 10 answers.

Each time you choose Solve Continue, the Solver uses the estimate you specified to find the next group of answers, if the Solver can find more answers.

Quit

Quit removes the Solver menu, but keeps the Solver in memory. The Solver remains in memory until you end the 1-2-3 session with /Quit or until you remove it from memory by pressing **ADD-IN (ALT-F10)**, selecting Remove, and specifying SOLVER.

Procedure

1. Select Quit.

Report

The Report commands provide information about answers or attempts the Solver finds. The Solver offers seven types of reports. You can choose to see a report in a table in a separate worksheet or in a window that displays information on cells one at a time. The report format you choose depends on the level of detail you need for a specific answer.

The Report commands perform the following tasks:

Command	Task
Answer	Lists all answers or attempts the Solver found.
Cells	Reports the cells the Solver used to solve the problem.
Differences	Reports which cells' values for two answers (or two attempts) differ by at least a specified amount.
How	Reports how the Solver found the current answer or attempt.
Inconsistent	Reports constraint cells that contain formulas that did not return 1 (true) when the Solver attempted to solve a problem.
Quit	Returns you to the Solver main menu.
Unused	Reports constraint cells that are not binding for the current answer or attempt.
What-If	Reports how much you can change values in adjustable cells for the current answer and still have constraint formulas satisfied.

NOTE When you create a table report, 1-2-3 creates a worksheet in a new file after all active files. The name of the new file depends on the report you specify and on the number of similar reports you have active or on disk. For example, when you select Report Answer, 1-2-3 creates a new file called ANSWER nn .WK3 after all active files, where nn stands for the number of the report. If you do not have any other active files or files on disk that contain Answer reports, 1-2-3 names this report ANSWER01.WK3; if you have two other active Answer report files, 1-2-3 names this report ANSWER03.WK3. In the following descriptions, the name of the report file 1-2-3 creates for each command assumes you have no other active report files of that type.

Report Answer

Answer reports all answers (or attempts) for the problem.

A:A1: [W1] 'Solver Table Report - Answer table' MENU

ANSWER01.WK3

Report all answers

A	B	C	D	E	F
1	Solver Table Report - Answer table				
2	Worksheet: D:\123R31\ADDINS\LOAN.WK3				
3	Solved: 22-Apr-91 10:52 AM				
4					
5	Optimal cell				Answers
6	Cell	Name	Lowest value	Highest value	Optimal (#1)
7	A:B6	Purchase	163,854.23	172,468.81	172,468.81
8					
9	Adjustable cells				Answers
10	Cell	Name	Lowest value	Highest value	Optimal (#1)
11	A:B7	LOAN	147,468.81	147,468.81	147,468.81
12	A:B8	DOWN_PMT	16,385.42	25,000.00	25,000.00
13					
14	Supporting formula cells				Answers
15	Cell	Name	Lowest value	Highest value	Optimal (#1)
16	A:B9	Monthly p	1,308.33	1,308.33	1,308.33
17	A:B16	Yearly pay	15,700.00	15,700.00	15,700.00
18	A:B19	Total PITI	17,758.00	17,758.00	17,758.00
19	A:B25	Yearly mor	15,700.00	15,700.00	15,700.00
20	A:B26	Total Debt	24,700.00	24,700.00	24,700.00

ANSWER01.WK3

Figure 4-7 Sample Answer report

Procedure

1. Select Report Answer.

1-2-3 creates a worksheet in a new file, called ANSWER01.WK3, after all active files. When an optimal answer exists, it appears first, followed by all other answers. The worksheet contains the following information:

Optimal cell	Reports the range of values for the optimal cell in all answers, followed by the value of the optimal cell in each answer.
Cell	Displays the address of the cell whose values appear to the right.
Name	Displays the range name of the cell, if available, or uses the labels in the column and row closest to the cell.
Adjustable cells	Reports the range of values for adjustable cells in all answers, followed by the individual values of adjustable cells in each answer.
Supporting formula cells	Reports the values of all other cells the Solver used to solve the problem, except for constraint cells. The range of values for these cells across all answers appears first, followed by the values of the cells in each answer.

Report Cells

Cells reports the adjustable, constraint, and optimal cells the Solver used to solve the problem.

```
A:A1: [W1] 'Solver Table Report - Cells used
Answer How What-If Differences Inconsistent Unused Cells Quit
Report about all cells defined for the problem
A B C D E F G H I
1 Solver Table Report - Cells used
2 Worksheet: D:\123R31\ADDINS\LOAN.WK3
3 Solved: 16-Apr-91 09:57 AM
4
5 Optimal cell:
6 Cell Name
7 A:B6 Purchase price
8
9 Adjustable cells:
10 Cell Name
11 A:B7 LOAN
12 A:B8 DOWN_PMT
13
14 Constraint cells:
15 Cell Name
16 A:B31 PITI less than 28% of income
17 A:B32 Debt less than 38% of income
18 A:B33 Down payment less than $25,000
19 A:B34 Down payment at least 10% of
20
CELLS001.WK3
```

Figure 4-8 Sample Cells report

Procedure

1. Select Report Cells.
2. Select Cell or Table.

Cell	Displays a report window that gives information about cells the Solver used to solve the problem.
Table	Opens a worksheet, in a new file after all active files, that lists cells the Solver used to solve the problem.

If you selected Cell, 1-2-3 displays a report window that contains the following information on the first cell in the file the Solver used to find answers to the problem: the address and name (if available) of the cell and the way the Solver used the cell in the problem.

If you selected Table, 1-2-3 creates a worksheet in a new file, called CELLS001.WK3, after all active files. The worksheet contains the following information:

Optimal cell	Reports the cell address and name of the optimal cell.
Cell	Displays the address of the cell whose name appears to the right.

Name	Displays the range name of the cell, if available, or uses the labels in the column and row closest to the cell.
Adjustable cells	Displays the cell address and name of each adjustable cell the Solver used to solve the problem.
Constraint cells	Displays the cell address and name of each constraint cell the Solver used to solve the problem.

3. If you selected Cell, select Next or Quit.

Next	Displays information in the report window about the next cell the Solver used to find answers to the problem.
Quit	Returns you to the Report menu.

Report Differences

Differences compares two answers (or two attempts) and reports problem cells whose values differ by at least the amount you specify.

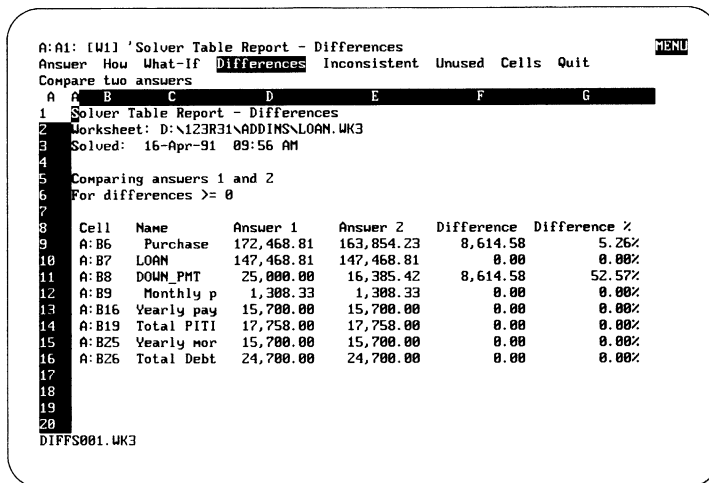


Figure 4-9 Sample Differences report

Procedure

1. Select Report Differences.
2. Select Cell or Table.

Cell	Displays a report window that shows the amount and percentage by which two answers or attempts differ.
Table	Opens a worksheet in a new file after all active files that lists cells for two answers (or two attempts) whose values differ by at least the amount you specify.

3. Enter the number of one of the answers you want the Solver to use in the comparison report or press ENTER to select the default number (1).
4. Enter the number of the other answer you want the Solver to use in the report or press ENTER to select the default number (the number of the answer currently displayed).
5. Enter the amount of the difference between answers for which you want the Solver to report or press ENTER to select the default number (0).

If you selected Cell in step 2, the Solver creates a report window that contains the following information on the first cell in the file that satisfies the above criteria:

Cell	Displays the address and name (if any) of the cell whose values appear in the report window.
Answer # value	Reports the cell's values for the answers being compared.
Difference	Displays the amount by which the values for this cell differ in the two answers.
Difference %	Displays the percentage by which the values for the two answers differ.

If you selected Table, 1-2-3 creates a worksheet in a new file, called DIFFS001.WK3, after all active files. The worksheet contains the following information:

Comparing answers # and #	Displays the numbers of the two answers you are comparing.
For differences >=	Displays the number you specified as the minimum difference you want the Solver to use when it compares answers.
Cell	Displays the address of the cell whose values appear to the right.
Name	Displays the range name of the cell, if available, or uses the labels in the column and row closest to the cell.
Answer # value	Displays the cell's values for the two answers.
Difference	Displays the amount by which the values for this cell differ in the two answers.
Difference %	Displays the percentage by which the values for this cell differ in the two answers.

6. If you selected Cell, select Next or Quit.

Next	Displays information in the report window about the next cell that satisfies the differences criteria.
Quit	Returns you to the Report menu.

Report How

How reports on the method the Solver used to find the answer (or attempt) currently displayed in the file.

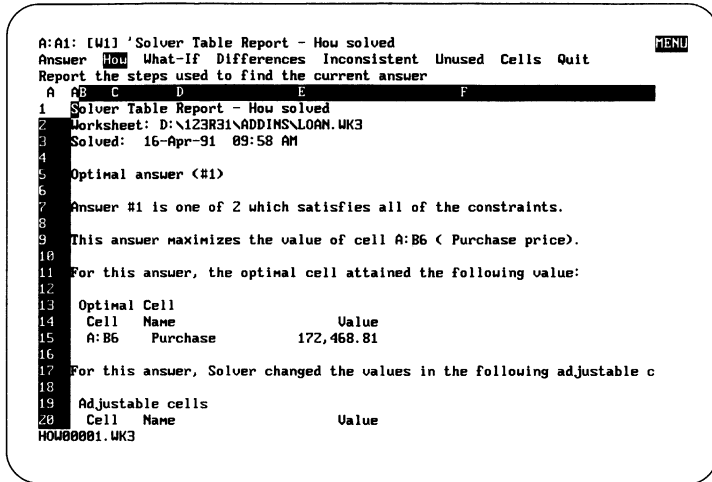


Figure 4-10 Sample How report

Procedure

1. Select Report How.

1-2-3 creates a worksheet in a new file, called HOW00001.WK3, after all active files. The report lists the steps the Solver used to find the answer. The number or kind of steps the Solver reports depends on the complexity of the problem. The report contains the following information:

Optimal cell	Displays the cell address, name, and value for the cell you specified as the optimal cell (if any).
Cell	Displays the address of the cell whose values appear to the right.
Name	Displays the range name, if there is one, of the cell. If the cell has no name, the Solver uses the labels in the row and column closest to the cell.
Value	Displays the value of each cell for the current answer or attempt.

Adjustable cells	Displays all adjustable cells and their values for the current answer or attempt.
Current value	Displays the current value of an adjustable cell. (Appears only when an attempt requires guesses.)
Guessable cells	Reports adjustable cells that require guess values. For each cell that requires a guess, displays the cell's initial value, current value, and guess status. (Appears only when an attempt requires guesses.)
Initial guess	Specifies the initial value of the adjustable cell before the Solver began finding answers to the problem. (Appears only when an attempt requires guesses.)
Status	Displays the current status of an adjustable cell for which you can provide guess values.
Binding constraints	Displays the constraints that are binding for the current answer or attempt.
Formula	Displays the logical formula for each constraint cell.
Unused constraints	Reports constraint cells the Solver did not use to find the current answer or attempt.
Becomes binding if written as	Displays the logical formula you can enter to make that formula binding for the current answer or attempt.
Becomes satisfied if written as	Displays the logical formula you can enter in the constraint cell to make the formula result in 1 (true). (Appears only when the Solver found attempts instead of answers.)
Unsatisfied constraints	Reports cells that contain constraints that the current attempt did not satisfy. Displays the logical formulas you can enter that the current attempt satisfies. (Appears only when the Solver found attempts instead of answers.)

Report Inconsistent

Inconsistent reports constraint cells that return 0 (false) for the current attempt. For each inconsistent constraint, the Solver also reports a revised logical formula that would return 1 (true). This report is available only when you display an attempt in the worksheet.

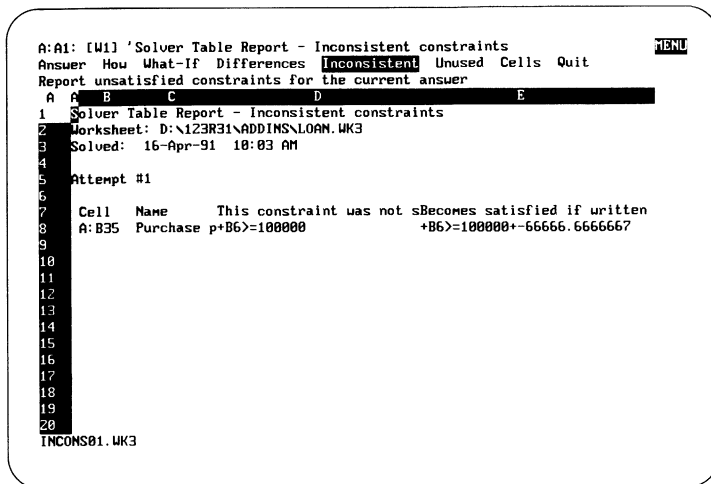


Figure 4-11 Sample Inconsistent report

Procedure

1. Select Report Inconsistent.
2. Select Cell or Table.

Cell	Displays information on cells that contain formulas that return 0 (false). The report window shows how you can change the logical formula in the constraint cell so it returns 1 (true).
Table	Opens a worksheet in a new file after all active files that lists all constraint cells whose formulas return 0 (false) for the current attempt.

If you selected Cell, the report window displays the following information:

Cell	Displays the address and name of the cell whose values appear below it. If the cell has no name, the Solver uses the labels in the row and column closest to the cell.
This constraint was not satisfied	Displays the current constraint formula that returns 0 (false) for the current attempt.
Becomes satisfied if written as	Displays how you can change the constraint formula so it returns 1 (true).

If you selected Table, 1-2-3 creates a worksheet in a new file, called INCONS01.WK3, after all active files. The worksheet contains the following information:

Cell	Displays the address of the cell whose formula appears to the right of it.
Name	Displays the range name, if there is one, of the cell. If the cell has no name, the Solver uses the labels in the row and column closest to the cell.
This constraint was not satisfied	Displays the constraint cell's formula that returns 0 (false) for the current attempt.
Becomes satisfied if written as	Displays how you can change the constraint formula so it returns 1 (true).

3. If you selected Cell, select Next or Quit.

Next	Displays information in the report window about the next inconsistent constraint cell.
Quit	Returns you to the Report menu.

Report Quit

Quit returns you to the Solver main menu.

Procedure

1. Select Report Quit.

Report Unused

Unused reports constraint cells that contain formulas the Solver did not need to use to find the currently displayed answer (or attempt). For example, if the problem contains the two constraints $+B1 \geq 10$ and $+B1 \geq 12$, the Solver uses only the second constraint to find each answer.

For each unused constraint, the Solver reports how you need to change the logical formula so the constraint becomes binding for the answer. The change the Solver proposes is an approximation of what makes the constraint binding and returns a result of 1 (true).

Report Unused is available only when an answer or attempt is in the worksheet.

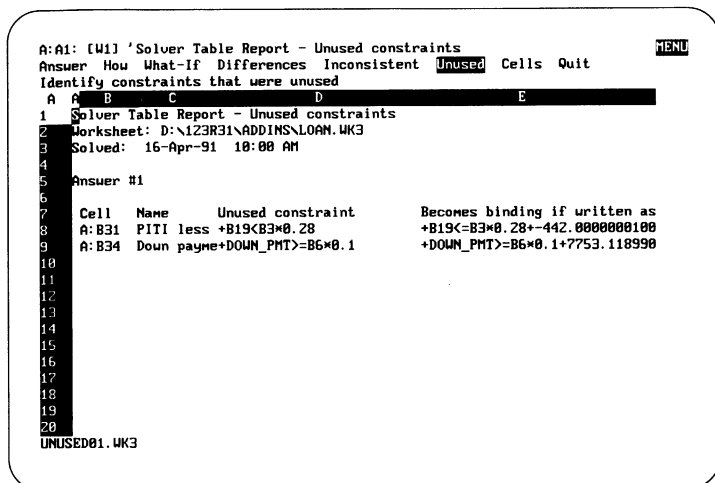


Figure 4-12 Sample Unused report

Procedure

1. Select Report Unused.
2. Select Cell or Table.

Cell	Displays information about cells whose constraints the Solver did not need to use to find the current answer or attempt.
Table	Opens a new worksheet file, after all active files, that lists cells whose constraints the Solver did not need to use to find the current answer or attempt.

If you selected Cell, the report window displays the following information:

Cell	Displays the address and name of the cell that contains the unused constraint. If the cell has no name, the Solver uses the labels in the row and column closest to the cell.
This constraint was not used	Displays the logical formula in the current constraint cell.
Becomes binding if written as	Displays how you can change the logical formula so it becomes binding for the answer or attempt.

If you selected Table, 1-2-3 creates a worksheet in a new file, called UNUSED01.WK3, after all active files. The worksheet contains the following information:

Cell	Displays the address of the cell that contains the unused constraint.
Name	Displays the range name, if there is one, of the cell. If the cell has no name, the Solver uses the labels in the row and column closest to the cell.
Unused constraint	Displays the logical formula the current unused constraint cell contains.
Becomes binding if written as	Displays how you can change the logical formula so it becomes binding for the answer or attempt.

3. If you selected Cell, select Next or Quit.

Next	Displays information in the report window about the next unused constraint cell.
Quit	Returns you to the Report menu.

Report What-If

What-If shows the range of values you can use in one adjustable cell and still have all constraints for the current answer return 1 (true).

NOTE In some cases, the range of values the Solver reports for adjustable cells is an approximation, not the absolute lowest and highest values.

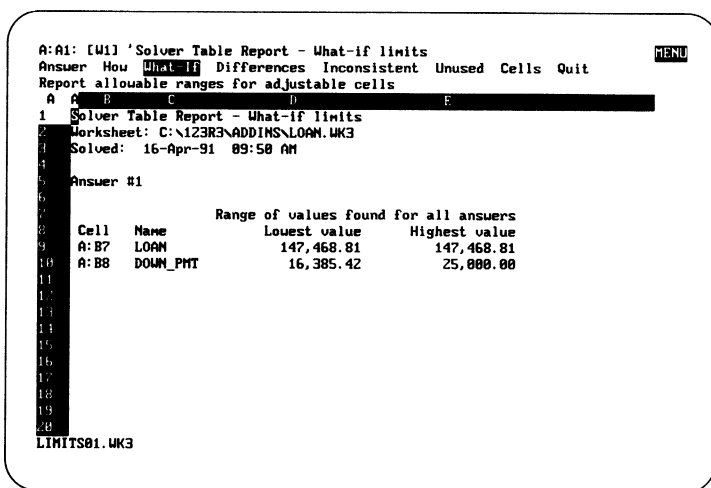


Figure 4-13 Sample What-If report

Procedure

1. Select Report What-If.
2. Select Cell or Table.

Cell	Displays information about adjustable cells the Solver used. The report window shows the highest and lowest values for all the answers the Solver found. It also shows how much the value in each adjustable cell can change for the current answer and still allow all the constraint formulas to return 1 (true).
Table	Creates a worksheet in a new file after all active files that displays information about adjustable cells for the problem. The report shows the highest and lowest values for all the answers the Solver found. It also shows how much the values in the adjustable cells can change and still allow all constraint formulas to return 1 (true).

If you selected Cell, the report window displays the following information:

Cell	Displays the address and name of the cell whose values appear below it. If the cell has no name, the Solver uses the labels in the row and column closest to the cell.
Lowest and highest values found	Displays the range of values for this adjustable cell across all of the Solver's answers.
What-if limits for answer #	Displays the estimated range of values within which you can adjust the value in the cell for this answer and have all constraint formulas return 1 (true), provided you change no other adjustable cells for the current answer.

If you selected Table, 1-2-3 creates a worksheet in a new file, called LIMITS01.WK3, after all active files. The worksheet contains the following information:

Cell	Displays the address of the cell whose values appear to the right.
Name	Displays the range name, if there is one, of the cell. If the cell has no name, the Solver uses the labels in the row and column closest to the cell.
Range of values found for all answers	Displays the highest and lowest values the Solver found for this adjustable cell across all answers.

3. If you selected Cell, select Next or Quit.

Next	Displays information in the report window about the next cell.
Quit	Returns you to the Report menu.

Solve

The Solve commands tell the Solver to look for answers to the problem. Use the Solve commands only after you use Define to specify the adjustable, constraint, and optional optimal cells.

The Solve commands perform the following tasks:

Command	Task
Continue	Finds additional answers or resumes solving a problem.
Guesses	Lets you enter guess values when the Solver needs more information to find an answer, and then solves the problem using these values.
Problem	Solves the problem you defined with the Define commands.
Quit	Returns you to the Solver main menu.

Solve Continue

Continue resumes solving the problem. Use Solve Continue to look for more answers after the Solver finds a group of answers.

Procedure

1. Select Solve Continue.

Each time you choose Solve Continue, the Solver looks for the number of answers you specified with Options Number-Answers. For example, if you specified 10 answers with Options Number-Answers, the Solver finds the first 10 answers, and Solve Continue makes the Solver look for up to 10 additional answers. If you requested an optimal answer, and the message 'Best answer found' appears in the answer window, the Solver may find a better answer or an optimal answer in the new group of answers.

Solve Guesses

Guesses lets you enter guess values for adjustable cells for an attempt and then tries to solve the problem using these values. The Solver prompts you to enter guess values only when it needs more information to solve a problem.

Procedure

1. Before you choose Solve Guesses, use the Answer commands to display the attempt for which 1-2-3 prompts you with 'Guesses required'.
2. Select Solve Guesses.

3. Select Guess, Next, Solve, or Quit.

Guess	Lets you specify a new guess value for the current adjustable cell.
Next	Displays information for the next adjustable cell.
Quit	Returns you to the Solve Guesses menu.
Solve	Tells the Solver to begin solving the problem.

If you selected Guess, the Solver prompts you to enter a guess value for the current adjustable cell. Enter a value that you think is as close as possible to the answer you are looking for.

If you selected Next, the Solver displays information for the next adjustable cell. Select Guess to enter the guess value for the cell. Then, select Next for each adjustable cell for which you want to enter a guess value.

If you selected Solve, the Solver begins to find answers for the problem, based on the new guess values you entered for the adjustable cells. If the Solver finds an answer, it discards the attempts it displayed previously.

Solve Problem

Problem starts solving the problem you defined. Use Solve Problem to solve a new problem or to solve an existing problem from the beginning.

NOTE When you choose Solve Problem, the Solver keeps a record of the current data in the worksheet. Answer Reset restores the adjustable cells to the values they contained before you last chose Solve Problem, provided you did not change the worksheet.

Procedure

1. Select Solve Problem.

The Solver analyzes the problem and attempts to find answers. If the Solver can find answers (or attempts) to the problem, it displays the first answer (or attempt) it found in the worksheet.

Solve Quit

Quit returns you to the Solver main menu.

Procedure

1. Select Solve Quit.

Chapter 5

The Viewer Add-In

The Viewer add-in manages your files by letting you look at worksheet files before you retrieve or open them, by linking worksheet files while you view their contents, and by looking at the contents of your text files without retrieving them with a particular program.

For example, if you want to update your year-end totals but cannot remember which worksheet file contains these totals, use the Viewer to scan the contents of all the worksheets in a directory without retrieving any of them. Once you find the file with the year-end totals, you can retrieve it, open it, or link to it.

How to Use this Chapter

The information in this chapter is divided into three sections:

- “Terms You Need to Know” introduces the terms you need to know to use the Viewer.
- “Using the Viewer Add-In” describes the Viewer screen, how to move around the Viewer, and how to change the Viewer directory.
- “The Viewer Commands” provides an alphabetical listing of each Viewer command with a description and a procedure for each.

Terms You Need to Know

Before you begin using the Viewer commands, you should be familiar with the following terms:

- When you **browse** a file, you can look at the file’s contents without reading it into memory using a particular program.
- When you **link** files, you enter formulas in one file that refer to data in another file.
- When you **open** a file, you read it into memory before or after the current file.
- When you **retrieve** a file, you replace the current file with the file you are retrieving.

Using the Viewer Add-In

Before you can use the Viewer, you must read it into memory and invoke it so the Viewer screen and menu appear. For information about how to read into memory and invoke the Viewer, see "Starting the Enhancement Add-Ins" in Chapter 1.

The Viewer Screen

1-2-3 provides a split-screen display of your data when you invoke the Viewer add-in. The List window on the left displays the list of file names in the current directory. As you scroll through the list of files, you view their contents in the View window on the right.

The Viewer screen consists of the following:

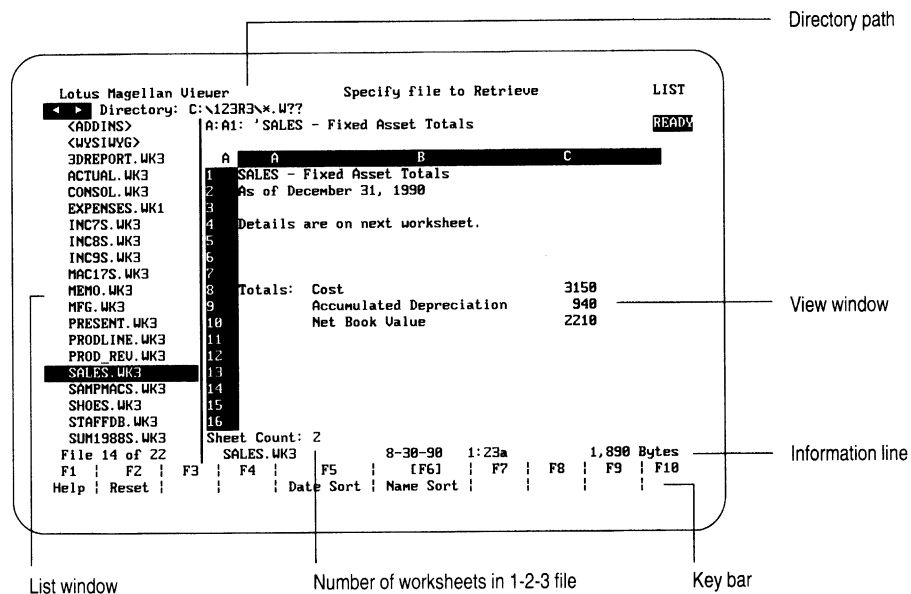


Figure 5-1 The Viewer screen

Moving Around the Viewer

You can move around the Viewer screen (List or View window) using the following keys:

Key	Effect
↑ or ↓	Moves the highlight up or down one line (List) or one row (View).
→	In the List window, moves the highlight to the View window if the List window contains file names. If the List window contains directory names, it makes the highlighted directory current. In the View window, moves the highlight right one column (in worksheets).
←	In the List window, displays a list of directories or drives. In the View window, moves the highlight left one column or to the List window.

You can use all pointer-movement keys available in 1-2-3 Release 3.1 in the List window. For more information on pointer-movement keys, see "Pointer-Movement Keys" in *Quick Reference*. You can move through worksheets in the View window using the pointer-movement keys listed in the section "Moving Around Multiple-Sheet Files," also in *Quick Reference*.

Changing Directories

You can change the directory that the Viewer displays when you select a Viewer command.

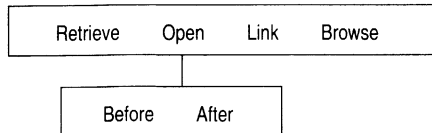
Procedure

1. While in the List window, press ← to move one level up the directory tree. As you hold down ←, a list of drive letters appears.
2. To make a directory current, highlight its name and press →. Repeat this step until you reach the directory you want.
3. To make the current directory in 1-2-3 the current Viewer directory, press RESET (F2).

The name of the current Viewer directory always appears below the status line at the top of the screen. This directory may or may not be the same as your current directory in 1-2-3.

When you use the Viewer for the first time, the directory it uses is the current directory in 1-2-3. If you change the current directory in the Viewer, the Viewer remembers the new directory from one Viewer session to another. Even if you change the current directory in 1-2-3 with /File Dir, the Viewer continues to use the directory you set in the Viewer. For example, your current directory in 1-2-3 is C:\SALES, but in the Viewer you set the directory to D:\FINANCE. Every time you use the Viewer, it assumes the current directory is D:\FINANCE, even if you use /File Dir to change the current directory in 1-2-3 to C:\PERSONAL.

The Viewer Commands



The Viewer commands perform the following tasks:

Command	Task
Browse	Displays the contents of worksheet and text files as you scroll through the list of files in the current Viewer directory.
Link	Enters one or more linking formulas in the current worksheet after you select one or more source cells in another worksheet file.
Open	Opens a worksheet file in memory, before or after the current file, after you see its contents.
Retrieve	Reads a worksheet file into memory after you see its contents.

Common Uses for Viewer Commands

You can use the Viewer add-in to do any of the following:

- Browse through the contents of any 1-2-3, Symphony, or text file (Browse).
- Simplify the procedure for entering linking formulas in 1-2-3 or Symphony files (Link).
- Retrieve or open a 1-2-3 or Symphony file (Retrieve, Open).

In addition, the Viewer displays DOS directory information, such as the time a file was last saved, the file size, and the number of worksheets (.WK3 files only) in a file.

The Viewer Command Descriptions

The following sections describe each of the Viewer commands in alphabetical order.

Browse

Browse displays the contents of a selected file in the current Viewer directory as you scroll through the list of file names in the directory. You can look at worksheet files (1-2-3 and Symphony) and text files.

Use Browse to check the contents of a file quickly without having to retrieve the file. When you look at a worksheet file with the Viewer, you see it just as it appears in READY mode (1-2-3) or SHEET mode (Symphony).

Procedure

1. Select Browse.

The Viewer displays a list of files in the current Viewer directory.

2. Scroll through the list of files in the current Viewer directory.

As you scroll, the contents of the file whose name you highlight appear in the View window on the right. (If nothing appears in the View window, the Viewer cannot display that type of file.)

3. To return to the Viewer menu, press ESC. To return 1-2-3 to READY mode, press ESC again.

Tips

- To see more of a particular file, switch to the View window.
- To see file names in alphabetical order, press NAME SORT (F6). To see file names in order by date (most recently saved file first), press DATE SORT (F5).
- To select another file to look through, switch to the List window.

Link

Link displays the contents of a selected worksheet file and links one or more selected cells in this file to the target cell in the current worksheet. When the Viewer links cells, it enters in the target cell a linking formula in the following format:

`+<<file reference>>cell reference`

file reference is the name of the file you select from the list the Viewer displays in the List window. (This file is also called the source file.) *cell reference* is the address of the cell in the source file that contains the data you want in the target cell. For example, the Viewer enters in the target cell the formula `+<<D:\SALES\QTR1.WK3>>A:J7` if you select the file QTR1.WK3 in D:\SALES and cell A:J7.

Use Link to enter a linking formula while you are looking at the contents of the source file, without having to type the linking formula. Also use Link to enter a series of linking formulas, starting at the current cell. For example, suppose you want to enter sales data for six products in the current worksheet, and this sales data is in a file named PRODUCTS.WK3. You can use Link to select PRODUCTS.WK3, then highlight the range that contains the sales data for the six products. The Viewer automatically enters a linking formula in six consecutive cells starting at the target cell.

Procedure

1. Retrieve or open the file in which you want to enter one or more linking formulas and move the cell pointer to the cell where you want the first formula in the range. This cell is the target cell.

2. Select Link.

The Viewer displays a list of worksheet files (1-2-3 and Symphony) in the current Viewer directory.

3. Scroll through the list of worksheet files in the current Viewer directory. As you scroll, the contents of the file whose name you highlight appear in the View window on the right.

4. Highlight the name of the file to link to (the source file) and switch to the View window.

5. Specify one or more source cells (the cell(s) that provide data for the target cell).

To specify a single source cell, use the pointer-movement keys to move to the source cell and press ENTER.

To specify a range of source cells, move the cell pointer to one end of the range, press . (period) to anchor the cell pointer, highlight the range, and press ENTER.

If you specify a range of source cells, the Viewer enters a series of linking formulas starting at the target cell. For example, if the target cell is A:J7, and you highlight the range A:D3..A:F3 in the source file, the Viewer enters linking formulas in cells A:J7, A:K7, and A:L7 in the current file (the target file).

6. If the target cell you select contains data, select one of the following:

No	Returns you to the Viewer without entering a linking formula.
Yes	Replaces the data in the target cell(s) with the linking formula(s).

Tips

- To see file names in alphabetical order, press NAME SORT (F6). To see file names in order by date (most recently saved file first), press DATE SORT (F5).
- To select another source file, switch to the List window.

Open

Open displays the contents of a worksheet file that you can open in memory before or after the current worksheet file.

Use Open to look at the contents of a worksheet file before you open it in memory. When you look at a worksheet with the Viewer, you see it just as it appears in READY mode (1-2-3) or SHEET mode (Symphony).

Procedure

1. Select Open.

The Viewer displays a list of worksheet files (1-2-3 and Symphony) in the current Viewer directory.

2. Scroll through the list of worksheet files in the current Viewer directory. As you scroll, the contents of the file whose name you highlight appear in the View window on the right.
3. Select Before or After to specify whether you want the file to appear before or after the current file.
4. Highlight the name of the file to open and press ENTER.
5. If you saved the file with a password, enter the password.
6. If you are trying to open a file shared on a network and someone else is using the file and has the file's reservation, select Yes to retrieve the file without the reservation or select No to cancel the command.

Tips

- To see more of a particular file, switch to the View window.
- To see file names in alphabetical order, press NAME SORT (F6). To see file names in order by date (most recently saved file first), press DATE SORT (F5).

Retrieve

Retrieve displays the contents of a selected worksheet file as you scroll through the list of files in the current Viewer directory and reads the selected file into memory.

Use Retrieve to look at the contents of a file before retrieving it. When you look at a file with the Viewer, you see it just as it appears in READY mode (1-2-3) or SHEET mode (Symphony).

Procedure

1. Select Retrieve.

The Viewer displays a list of worksheet files (1-2-3 and Symphony) in the current Viewer directory.

2. If you haven't saved the current worksheet, select No to return 1-2-3 to READY mode (so you can save the worksheet) or select Yes to retrieve the file without saving your work.
3. Scroll through the list of worksheet files in the current Viewer directory. As you scroll, the contents of the file whose name you highlight appear in the View window on the right.
4. Highlight the name of the file to retrieve and press ENTER.
5. If you saved the file with a password, enter the password.
6. If you are trying to retrieve a file shared on a network and someone else is using the file and has the file's reservation, select Yes to retrieve the file without the reservation or select No to cancel the command.

Tips

- To see more of a particular file, switch to the View window.
- To see file names in alphabetical order, press NAME SORT (F6). To see file names in order by date (most recently saved file first), press DATE SORT (F6).

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