3. Resulting formulas in *TO* range:

   C3: (1 – B3)*A3
   C4: (1 – B4)*A4
   C5: (1 – B5)*A5

Example 4. (Figure 12-7)

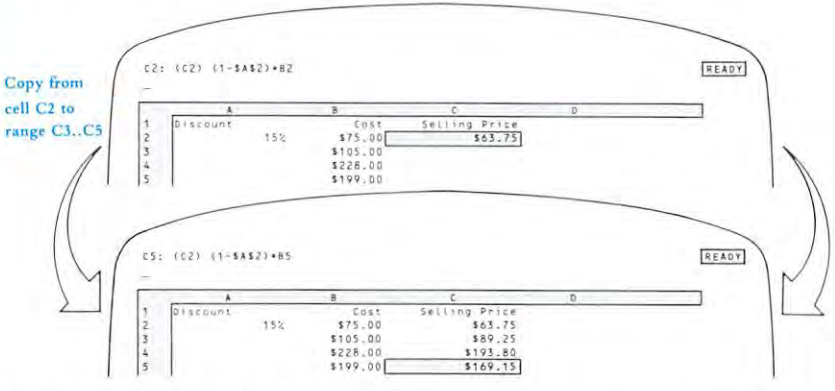


Figure 12-7. Example 4: Copying a Formula—Absolute and Relative Addresses

1. Formula typed in cell C2: (1 – A2)*B2

2. Resulting formulas when copied:

   C3: (1 – A2)*B3
   C4: (1 – A2)*B4
   C5: (1 – A2)*B5

Example 5. (Figure 12-8)

1. Formula typed in cell C65: @VLOOKUP(A65,A5..F60,B65)

2. Resulting formulas when copied:

   C66: @VLOOKUP(A66,A5..F60,B66)
   C67: @VLOOKUP(A67,A5..F60,B67)

The @VLOOKUP function will be discussed on page 19-17. Here we want to show how the cell addresses are adjusted in the copied formulas.

Figure 12-8. Example 5: Copying a Formula—Absolute Range

Example 6. This is the same as Example 5, but with a range name used to indicate the range A5..F60. Since the same range is to be used in all copies of the formula, we precede the range name with "$" to make it absolute.

1. Formula typed in cell C65: @VLOOKUP(A65,$DATARECS,B65)
2. Resulting formulas when copied:

   C66: @VLOOKUP(A66,$DATARECS,B66)
   C67: @VLOOKUP(A67,$DATARECS,B67)

Example 7. An additional example demonstrates how 1-2-3 handles the two corner cells in a range specification independently. As a consequence, a copied range reference in a formula may have a different shape than the original.

1. Formula typed in cell C15: @SUM(A10..C14)

   "Find the sum of all values in the rectangular range whose corners are cell A10 and the cell above this one".

2. Resulting formulas when copied:

   H15: @SUM(A10..H14)...a rectangle
   A25: @SUM(A10..A24)...a column
   J11: @SUM(A10..J10)...a row
   A11: @SUM(A10..A10)...a single cell.

Copying Mixed Addresses

1-2-3 handles a *mixed cell address*—part absolute, part relative—similarly:

- The absolute part (column letter or row number) of a mixed cell address is the same in the copied formula as in the original formula.
- The relative part (column letter or row number) of a mixed cell address is different in the copied formula than in the original formula (unless you /Copy a cell to itself).

Example 8. We can create running totals in Column B for a set of numbers in Column A. In words, each formula might be:

> "Add all numbers starting in row 1 of the column to the left, and ending in this row of the column to the left".

In cell B1, this formula would be written @SUM(A$1..A1). When copied, the result is:

B2: @SUM(A$1..A2)
B3: @SUM(A$1..A3)
B4: @SUM(A$1..A4)
B5: @SUM(A$1..A5)

Another mixed address example is illustrated in Figure 8-14.

13. Move Command

The /Move command transfers a range of cells from one part of the worksheet to another, while maintaining all functional relationships among the cells.

This command is a powerful tool for redesigning a worksheet. It allows you to postpone decisions regarding the final visual design of a worksheet, so that you can concentrate on building the formulas. You can change your mind without having to retype all your formulas.

For example, you might do a first pass on a loan-analysis worksheet that looks like Figure 13-1. This is the same worksheet we built in the 1-2-3 Tutorial.

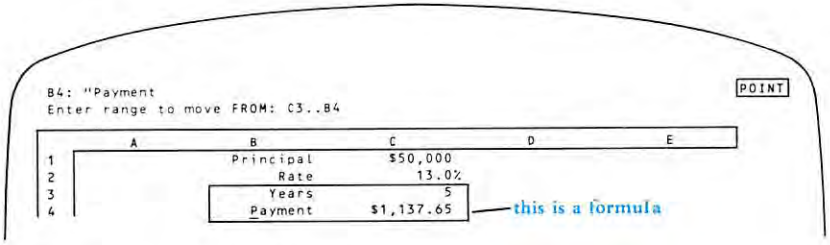


Figure 13-1. Moving Cell Entries—Before

At this stage, the formulas in the year-by-year table depend on the values in the input cells in rows 1 through 4. But then, you decide to compact the first few rows, in order to bring more of the table onto the screen. Will moving the input cells disrupt the formulas in the table (Figure 13-2)?

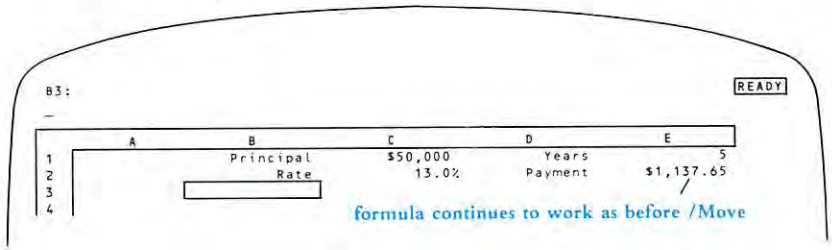


Figure 13-2. Moving Cell Entries—After

Absolutely not. 1-2-3 automatically adjusts all formulas in the worksheet to reflect the move. It's just as if you had created the input cells in their new locations, instead of in their original locations.

Some Explanations and Some Cautions

The /Move command is a powerful tool. But you must use it with care—the explicit changes you make with /Move can make implicit changes that, perhaps, you did not intend. For a full understanding of these changes, it is important to distinguish between the entries stored in the cells and the cells themselves.

The whole idea of the /Move command is to transfer cell entries between *FROM* and *TO* cells. Formulas that depend on the transferred entries will continue to do the same work. In such formulas 1-2-3 replaces the old address of an entry with its new address:

1. Before: J30 contains the formula +B10*66
2. /Move: *FROM* B10 *TO* C34
3. After: J30 contains the formula +C34*66

But what about formulas that depended on the contents of the *TO* cell(s). Unfortunately, the /Move operation has "destroyed" the previous contents of the *TO* cell(s). As a result, such formulas are invalidated:

1. Before: J30 contains the formula +B10*66
2. /Move: *FROM* X10 *TO* B10
3. After: J30 contains the formula +ERR*66 and displays the value *ERR*.

Figure 13-3 shows another example of a /Move invalidating a formula.

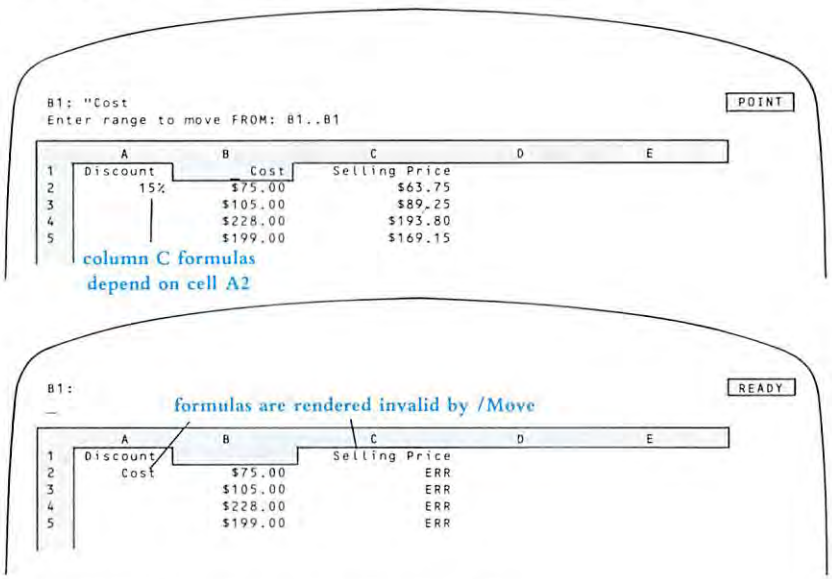


Figure 13-3. /Move Destroys Destination Cells

When moving entries, be sure to pick an unused or unneeded area of the worksheet as the entries' new home.

Named Ranges. If a cell is the upper left or lower right corner of a named range, moving the cell changes the range name definition (the location of its endpoints). Moving any other cell in a named range effectively removes it from the range, but does not alter the range name definition (Figure 13-4).

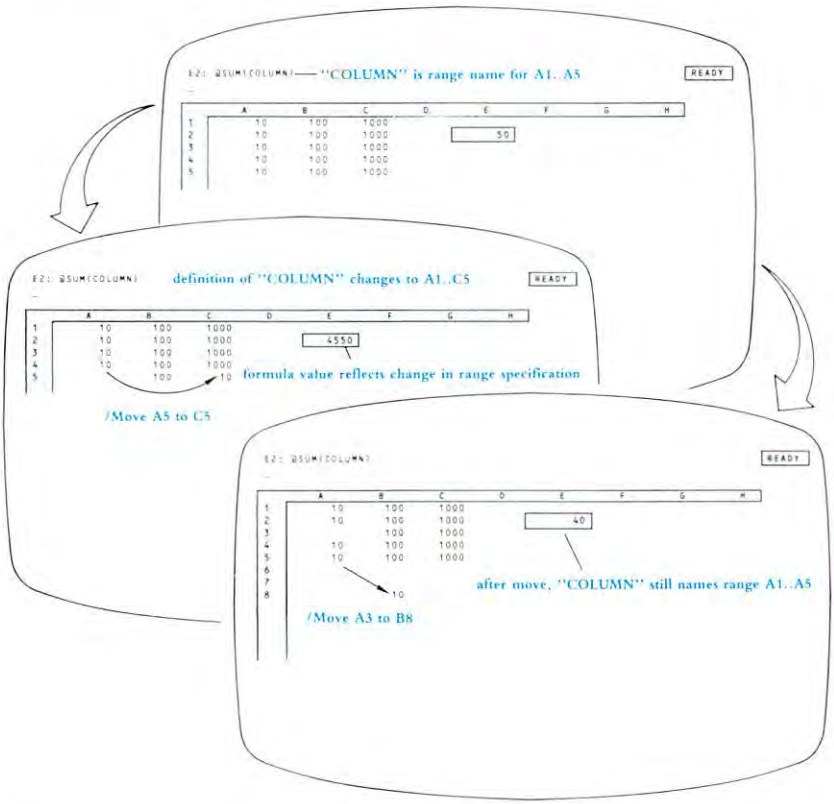


Figure 13-4. Effect of /Move on a Named Range

Command Ranges. Other ranges that 1-2-3 remembers (named or unnamed) are affected similarly. These include the Fill range (/Data Fill), the X-range (/Graph X-range), etc. (See "Command Ranges and Range Names—Implementation Details", page 7-14.)

14. File Commands

1-2-3 has a set of commands that allow you to store information on a disk.

Why is this necessary? There are two basic reasons:

- All information in the worksheet is lost when you end a 1-2-3 session, or when your computer's electric power is shut off. Thus, you need some way to store your work between sessions.
- 1-2-3 processes one worksheet at a time. Thus, you need a place to store worksheets when you're not using them.

In addition, there are many benefits in 1-2-3's ability to "talk" to disks:

- Disks are interchangeable. You may remove a data disk from a drive and insert another one during a 1-2-3 session. The more disks, the more storage capacity—so the total amount of data that you can store is unlimited.
- The disk acts as a library of information. You can combine data from a stored worksheet with the one you're currently using. Or you might excerpt part of a worksheet and store it separately. 1-2-3 can store data to be used by another program, and it can process data that other programs have stored on a disk.

Files and Filenames

It's the job of a program called the *operating system* to organize and manage the storage of information on the computer's disk(s). The operating system (yours is called MS-DOS) stores information in **files**:

- Each 1-2-3 worksheet you create is stored in its own **worksheet file**.
- The 1-2-3 program itself is stored in a file.
- Word processing programs typically store each document in its own file.

For each file you create with 1-2-3, you must select a **filename** to identify it. MS-DOS maintains a directory of filenames—a listing of all the files on a disk. To keep things organized, MS-DOS insists that all files in each directory of a disk must have different filenames. In different directories, though, two files may have the same name.

The filenames you select to store 1-2-3 data may be up to eight characters long, but may not include spaces or any other characters except A...Z, 0...9, and _.

Legal Names	Illegal Names	
ACCTSREC	ACCOUNTSRECEIVABLE	too long (filename will be truncated to eight characters)
CHECKS	CHK BOOK	spaces not allowed

Uppercase and lowercase letters are equivalent in filenames.

1-2-3 automatically appends a **filename extension** to each file you create. If you do not use a **disk prefix**, 1-2-3 uses the **current directory** to store or retrieve the data (page 14-5).

How 1-2-3 Uses Files

Think of the computer's main memory as being your workspace, where you create, change, and use worksheets one at a time. The disk is a permanent storage area, where many worksheets (and other data) can be stored, each in its own file.

1-2-3 allows you to either: (1) create a file on a disk to save data currently in the worksheet, or (2) retrieve data from a file that already exists. (These functions are called *output* and *input*, respectively.) You can perform only one of these functions at a time, so 1-2-3 has a different file command for each:

/File Save. Creates a file (you supply a filename) that stores all data currently in the worksheet. This includes all entries, display formats, column widths, range names, graph and print settings, and whatever other customization you've done to the worksheet. It even saves the current position of the cell pointer. (A variation of this is the /File Xtract command—page 14-9.)

/File Retrieve. Restores a worksheet to main memory (and the display screen) exactly as you stored it using /File Save or /File Xtract. (A variation of this is the /File Combine command—page 14-8.)

Partial Worksheets: Storing, Retrieving, Combining

The /File Retrieve and /File Save commands are your basic tools for processing files. But 1-2-3 allows you much more flexibility, should you need it, in both input and output functions.

There may arise situations in which you wish to store only part of a worksheet in a file. Figure 14-1 shows one example.

On the input side, it is quite likely that you will want to combine the data from two or more worksheets, or that you'll want to consolidate several small worksheets into one large one.

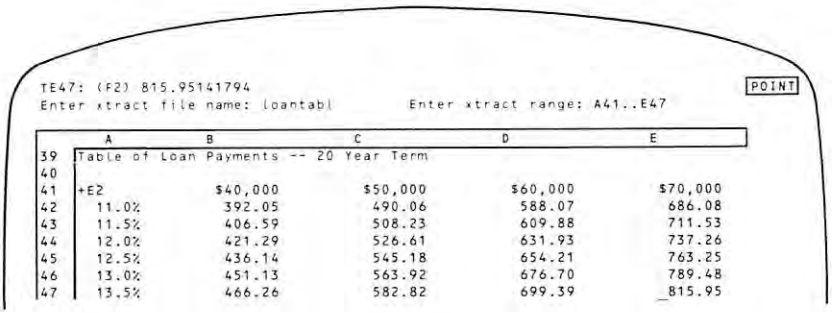


Figure 14-1. Storing Part of a Worksheet

There are counterparts to the /File Retrieve and /File Save commands that allow you to do these tasks, and more:

/File Xtract. Creates a file (you supply a filename) that stores all data currently in a particular cell range (you indicate the range). As with Save, 1-2-3 saves display formats, column widths, etc., in addition to cell contents.

/File Combine. Combines part or all of a stored worksheet with the worksheet you're currently using. The stored worksheet is an overlay, placed on the current worksheet at any location you specify. There are several ways to combine the new data with the old:

- Copy. Entries from the worksheet file replace entries in the current worksheet.
- Add. 1-2-3 adds numeric values from the worksheet file to the cells they overlay. Only blank cells and number cells in the current worksheet are affected. Label and formula cells remain unaffected.
- Subtract. Analogous to Add. Incoming values are subtracted from values in the current worksheet.

Foreign Correspondence—Passing Data Between 1-2-3 and Other Programs

1-2-3 is a very powerful and flexible program. You can usually pass information back and forth between 1-2-3 and other computer programs. For instance:

- You can include summary figures produced by a BASIC general ledger program in a 1-2-3 worksheet to provide base figures for a financial projection.
- You can include a memo produced by a word processing program in the worksheet (and revise the memo once it's there).

The following commands handle 1-2-3's "foreign correspondence"—passing data to and from other programs:

/File Import. Copies numbers and/or labels from a file, and enters them into the worksheet, starting at the cell pointer location. It's just as if you typed them in yourself.

/File Import differs from Retrieve and Combine in the same way /Print File differs from Save and Xtract: Retrieve and Combine process worksheet files created by 1-2-3. Import processes a standard-format, non-worksheet file.

/Print File. Stores data in a text file, for use by other programs. (Note that this is not a /File command, but a /Print command.) It creates a file containing exactly what appears in the worksheet—either in the entire worksheet or in a cell range.

When the 1-2-3 session is over, you can use the MS-DOS command PRINT to print a copy (hence the command name /Print File). Or you can use the file as data to be processed by an accounting program, a statistical program, or a word processing program, for instance.

/Print File does not perform the same function as /File Save or /File Xtract. It does not save any of the formulas or other calculation aspects of the worksheet, but only its appearance on the screen.

Overwriting Files

No matter how careful you try to be, there comes the time when you instruct 1-2-3 to create a file with a name that you've already used. In fact, in "updating" situations, you'll do this on purpose—retrieve a worksheet from storage, make a change to it, and tell 1-2-3 to store it again under the same name.

Whenever you try to create a file with a name already in use, 1-2-3 informs you of the situation (Figure 14-2).

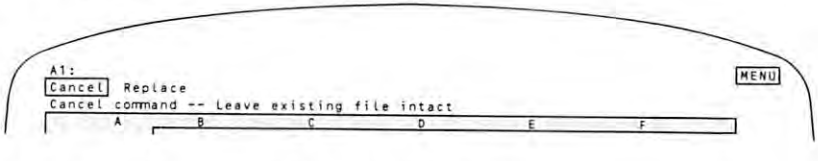


Figure 14-2. Overwriting Files—Your Choice

If you choose to replace the file, the data in the existing file will be lost. (1-2-3 does not automatically create a backup copy.) If you're updating a worksheet, as described above, this is probably what you want.

But if you don't want to lose the data currently stored under the filename, choose to cancel the storage operation. Then reinvoke the storage command, using a different filename.

To create backup copies of your data disk, use the MS-DOS command DISKCOPY.

Keeping Track of Your Files

The file-overwriting situation described above is one example of a general condition. Once you've been using 1-2-3 for a while, you will notice that it is very easy to create a large number of files. Keeping track of them all becomes a significant chore. 1-2-3 helps you out in several ways.

File Types and Filename Extensions

You may be storing several types of files on the same disk. At the very least, you'll probably use a single disk to store both *worksheet files* (processed by /File Retrieve, Save, Combine, and Xtract) and *print files* (processed by /File Import and /Print File). To help you distinguish these two types, 1-2-3 always adds three extra characters—a *filename extension*—to a filename as it creates a file.

- Worksheet files have the filename extension ".WKS".
- Print files (known also as text files) have the filename extension ".PRN".

There is a third type of file that 1-2-3 creates: "pictures" of graphs drawn with the /Graph Save command:

- Graph (or picture) files have the filename extension ".PIC". You need not remember these extensions while you are using 1-2-3. When appropriate, it asks you to select a file type.

Filename Menus

Whenever you wish to save or retrieve data from disk storage, you must supply 1-2-3 with a filename. When the moment of decision comes, 1-2-3 always displays a menu of filenames—the names of the files you've already created. (It uses filename extensions to restrict the menu to files of the correct type.) You can select one of these names by pointing to it, or you can type a name ("Using Menus", page 6-8).

Current Directory

1-2-3 allows you to store files on any disk in any of your disk drives. The standard 1-2-3 configuration is to keep the 1-2-3 System Disk in Drive A and use Drive B for your data disk(s). For details concerning the configuration, including how to change it, see Appendix A, "Configuring 1-2-3".

You may divide each disk's storage space into separate areas, called *subdirectories*. (See your MS-DOS Manual for details.)

At any one moment, one group of files—one directory—is the *current directory*. 1-2-3 always uses the current directory—and only the current directory—when it produces a menu of filenames of a /File List display.

You can change the current directory assignment with a 1-2-3 command:

/File Directory. Makes current one of the directories in a disk's "directory tree": B:\ACCTFLS, C:\PERSONAL, B:\REVENUE\May, etc.

If you wish to create or use a file that is not in the current directory, it is easiest to issue a /File Directory command first. But in many cases, you can use another directory by typing a disk prefix before the filename (e.g. B:ACCT1, C:RECVBL).

Filename Listing

1-2-3 has a command that blanks the display screen and produces a list of filenames:

/File List. Displays a list of the names of all files of a particular type (worksheet, print, or graph) in the current directory. Press any key to restore one worksheet display.

File Deletion

1-2-3 has a command that deletes a file from disk storage. This is equivalent to the MS-DOS command ERASE. Once you have deleted a file, you can reuse the filename, but the file's old contents are lost.

/File Erase. Deletes one or more files of a particular type (worksheet, print, or graph) on the disk.

/File Retrieve /FR

Load a worksheet from disk storage.

Procedure

Specify the filename under which the worksheet is stored by pointing to its name, or by typing its name.

If you don't use a disk prefix ("C:ACCTS" means current directory of disk C, file ACCTS), 1-2-3 looks for the file in the current directory (/File Directory, /Worksheet Global Default Directory).

Results


The current worksheet is first erased.

• The worksheet is retrieved from the specified worksheet file (extension .WKS). The file itself is unaffected. The worksheet appears exactly as it did when it was stored with /File Save (formats, column-widths, Titles, pointer location, etc).

Notes


1. Do not use this command when the current worksheet contains valuable information until you first save it.

2. Be careful when retrieving a worksheet from a file created with /File Xtract rather than /File Save. In general, data from Xtracted files should be reloaded with /File Combine, rather than /File Retrieve.

3. This command only processes worksheet files created by 1-2-3. To process files created by other programs, use /File Import.

4. At the beginning of a session, 1-2-3 automatically retrieves worksheet AUTO123 stored in the current directory, if the worksheet exists.

/File Save /FS

Save the current worksheet and all settings in a worksheet file (extension .WKS).

Before beginning work, be sure you have an adequate supply of disks. All disks must be formatted using the MS-DOS command FORMAT.

Procedure

1. Specify a filename under which the worksheet is to be stored: Point to an existing name in the menu, or type a new or existing name.

If you don't use a disk prefix ("C:ACCTS" means current directory of disk C, file ACCTS), 1-2-3 stores the file in the current directory (/File Directory, /Worksheet Global Default Directory).

2. If a file with the specified name already exists, choose to Replace the existing file's contents with the current worksheet, or to Cancel the command.


Choosing to Replace immediately erases the file's former contents. There is no way to recover this information. If you are updating a file, this may be exactly what you wish to do. Otherwise, Cancel the command.

Result

1-2-3 saves the worksheet along with all settings (global settings, named ranges, graph and print settings, split screen, etc.).

Notes

1. Use this command frequently. Your computer's main memory is temporary, but disk storage is permanent. If you suffer a power failure, the worksheet currently on the screen will be lost, but the most recently created worksheet file will be preserved. Frequent storage is also insurance against human error.

2. Use this command to save your worksheet temporarily, so you can examine another worksheet and then return to where you left off.

3. If you try to save a worksheet on a disk with inadequate available memory space, a "Disk Full" error message appears. Press [ESC], insert another data disk, and try again.

4. To save a worksheet that contains more information than one disk can hold, you must Xtract portions of it onto separate disks. To retrieve it, use Combine.

5. There is no simple relationship between the amount of main memory a worksheet occupies (as reflected in the /Worksheet Status Available Memory statistic) and the size of its worksheet file.

/File Combine /FC

Incorporate all or part of a worksheet file into the current worksheet at the current cell.

Procedure

Before issuing this command, be sure that the cell pointer is at the location where the stored information is to be incorporated.

1. Select a method of combining: Copy, Add, Subtract.

2. Choose to incorporate an Entire-File or just one Named-Range from the file.

3. Named-Range only: Type the name of the range to be extracted from the worksheet file. 1-2-3 does not display a menu of these names.

4. Specify the name of the worksheet file whose data is to be combined. Point to an existing name in the menu, or type a new or existing name.

If you don't use a disk prefix, 1-2-3 looks for the file in the current directory (/File Directory, /Worksheet Global Default Directory).

Results

• The incoming data are combined into the current worksheet (see details below). The upper left corner entry of the incoming data is incorporated at the current pointer location. All other incoming entries fall in corresponding cells to the right and below.

Copy. Each entry in the file replaces an entry in the current worksheet.

Add. 1-2-3 uses only the file's numeric data (numbers and formula values, but not labels and empty cells).

• If an incoming value overlays a number cell, the values are added.

• If an incoming value overlays an empty cell, the cell takes the value.

• If an incoming value overlays a label or formula cell, the incoming value is discarded and the original retained.

Subtract. Essentially similar to Add. Note that a positive number subtracted from an empty cell produces a negative result.

• Only cell entries are incorporated. No worksheet settings, print settings, range names, etc. are brought into the current worksheet.

Notes

1. Position the cell pointer carefully before executing this command—Using Combine carelessly can invalidate the entire worksheet. If you have any doubts, save the current worksheet (/File Save) before using /File Combine.

2. This command is especially useful for combining data or worksheets from several different sources, or to accumulate similar sets of data.

/File Xtract /FX

Save a range of cells, along with all settings, in a worksheet file (extension .WKS).

Procedure

1. Choose to save Formulas or only the current Values of formulas.

2. Specify a filename under which the range and settings are to be stored. Point to an existing name in the menu, or type a new or existing name. If you don't use a disk prefix, 1-2-3 stores the file in the current directory (/File Directory, /Worksheet Global Default Directory).

3. If a file with the specified name already exists, choose to Replace the existing file's contents with the current worksheet, or to Cancel the command.

Choosing to Replace immediately erases the file's former contents. There is no way to recover this information. If you are updating a file, this may be exactly what you wish to do. Otherwise, Cancel the command.

4. Specify the range to be Xtracted.

Result

1-2-3 saves the range along with all settings (global settings, named ranges, graph and print settings, split screen, etc.).

Notes

1. /File Xtract is useful when you want to split a large worksheet into smaller parts or to Xtract part of one worksheet for use in another (see also /File Combine).

2. The Values option is useful when Xtracting the results of a calculation that will not change in future use of the worksheet.

3. There are potential inconsistencies in extracting a range. Formulas may refer to cells that are not included in the Xtract range. Similarly, worksheet settings (e.g., range names) can refer to unextracted cells. To eliminate that problem, don't process an Xtract-created file with /File Retrieve. Such files should normally be processed only with /File Combine.

/File Erase /FE

Erase one or more 1-2-3 data files from disk storage.

Procedure

1. Select the type of file(s) to be erased: Worksheet (.WKS), Print (.PRN), or Graph (.PIC).

2. Specify the filename by pointing to its name in the menu, or by typing its name. You may use MS-DOS global filename characters in the name specification.

If you don't use a disk prefix, 1-2-3 looks for the file(s) on the current directory (/File Directory, /Worksheet Global Default Directory).

3. Choose Yes to confirm the Erase order, or choose No to cancel the command.

Results

1-2-3 erases the selected file(s). All information in the file(s) is permanently lost.

• If you type in a *pattern name* (filename template, generic name, wildcard, etc.) that uses MS-DOS global filename characters, all files matching it are erased. The global filename characters are:

? Matches any single character in its position in the filename. H?T matches "HIT", "HOT", and "HUT" but not "HUM".

* Matches all remaining characters up to the end of the filename. C* matches "CAT", "CATCHER", and "CONFERENCE" but not "ACROSS".

Notes

1. To erase files that are not stored on the current disk, either change the current disk (/File Directory) or use a disk prefix with the filename, (e.g., "C:ACCTS" current directory of Disk C, file named "ACCTS").

2. Entering * alone as the filename specifies the erasure of all files of the selected type on the current disk.

/File List /FL

Display all filenames of a given type stored in the current directory; display available file-storage capacity.

Procedure

1. Select the type of files you want to check: Worksheet (.WKS), Print (.PRN), or Graph (.PIC).

2. To clear the listing and return to Ready mode, press any key. (Pressing the key has no other effect.)

Result

1-2-3 temporarily replaces the worksheet display with a list of all names of the selected file type. It also displays the remaining amount of memory storage space (in kilobytes) in the current directory.

Notes

1. If there are no files of a given type on the disk, 1-2-3 *beeps* and an error message appears. Press [ENTER] or [ESC] to return to Ready mode.

2. Use /File Directory to determine whether a particular filename is already in use, or to ensure that adequate memory space is available on a disk before saving a worksheet.

/File Import /FI

Superimpose the contents of a print file (extension .PRN) on the worksheet at the current pointer location.

Procedure

Before issuing this command, position the pointer to the upper left corner of the region that the imported data is to occupy.

1. Select an Import format: Text or Numbers.

2. Specify the name of the print file to be imported: Point to its name, or type its name.

If you do not use a disk prefix, 1-2-3 looks for the file in the current directory (/File Directory, /Worksheet Global Default Directory).

Results

Text. For each line in the print file, 1-2-3 creates a separate left-aligned label containing the text in that line, and then moves down one row. The result is a single column of labels.

Numbers. 1-2-3 searches the print file for both numbers and any series of characters enclosed in double-quotes (e.g., "..."). All other file contents are ignored.

- For each number, 1-2-3 creates a number entry.
- For each double-quoted label 1-2-3 creates a left-aligned label.
- Successive numbers and labels from the same line of the print file are placed in successive columns of the same row of the current worksheet. Data from the next print file line is placed in the next row of the worksheet, continuing until the print file has been completely read.

Notes

1. When Importing either Text or Numbers, the new data replaces any existing cell entries. Blank lines in the incoming file cause a row in the current worksheet to be skipped: the contents of those worksheet rows are not affected.

2. Using this command, data can be imported from most programs which generate standard text files. Be sure that these incoming files have the filename extension .PRN—1-2-3 requires all print files to have this extension. Use the MS-DOS RENAME command or the Lotus Access System File Manager.

3. Some word processors generate document files containing special characters that lie outside the standard ASCII character range: 32-127 (decimal). 1-2-3 does not process codes in the range 128-255—it always strips off the high-order bit of each character's ASCII code. Codes below 32 can be included in an import file. They appear in cell entries as graphic characters.

Most word processors allow you to convert their document files to standard text files. The latter may be more suitable for use with 1-2-3.

/File Directory /FD

Set the current directory.

Procedure

The current directory assignment is displayed. To retain it, press [ENTER] alone.

To change the current directory, type a full or partial pathname. Partial pathnames are interpreted as starting at the current directory. For details concerning pathnames and "tree" directory structures, see the MS-DOS Manual.

Result

When you select one of the other /File commands that requests a filename, 1-2-3 will automatically present a menu of all the files of the appropriate type (worksheet, print, or graph) in the current directory. If you type a filename without a disk prefix (see below), 1-2-3 uses the current directory to store or retrieve the data.

Notes

1. In many cases, you have direct access to files that are not in the current directory. If you start the filename you type with a disk prefix, 1-2-3 uses the directory on the specified disk that was most recently made current. For instance, typing "C:ACCT1" specifies that a file named "ACCT1" is to be used, located in the directory on Disk C that was most recently the current directory.

2. The /Worksheet Global Default Directory command specifies a particular directory to be current at the start of a 1-2-3 session.

15. Print Commands

The /Print commands allow you to obtain a printed copy (*hardcopy*) of worksheet data. You can print an entire worksheet or you can excerpt one or more ranges for printing. You can send print output directly to the computer's printer, or you can store it in a **print file** for printing later with 1-2-3 or for use with some other program.

The /Print command offers many choices in addition to those mentioned above. You can dispense with 1-2-3's options if a quick printout is all you're after. If you're preparing the final version of a report for public distribution, you'll probably want to take advantage of 1-2-3's options: the ability to adjust formats, print page headings, number pages, and so forth. If you'd like a set of 1-2-3 print options to become your installation standard, you can store these options, always retaining the choice to override them. And you can even choose not to use formatting options at all for a particular printout.

Print It Now vs. Print It Later

If a printer is connected to the computer, you can obtain hardcopy of your work during a 1-2-3 session. Otherwise, you'll have to store the print output in a print file instead, then print at some other time.

After you end the 1-2-3 session, you can print this electronic (*softcopy*) version of the printout using the MS-DOS command PRINT or a special printing program.

Printing to a file is also useful if you want to revise the contents a bit before actually printing it—1-2-3's print files can be used by most word processing programs.

To allow you to print either now or later, the /Print command always starts with a choice:

/Print Printer. Print output is sent directly to the printer.

/Print File. Print output is stored in a print file for printing (or other processing) after the 1-2-3 session. 1-2-3 always adds the filename extension ".PRN" to print filenames.

What to Print (and How Many)

After you've chosen the destination of the print output, 1-2-3 displays a /Print menu:

Range Line Page Options Clear Align Go Quit

After you perform one of these functions, this menu returns to allow you to perform another one. Choosing Quit at this menu ends the /Print command and returns you to Ready mode.

During a /Print command, you can specify several *print ranges*—cell ranges to be printed—one at a time. With /Print File, all the ranges are appended together in a single print file (Figure 15-1). If you wish, you can use different formatting options for different ranges. Here's the general procedure:

1. (Optional) Specify one or more Options. We explain these in the next section.

2. Indicate a print range (perhaps the whole worksheet) with the Range menu choice.

3. Select Align to tell 1-2-3 you are at the top of the page. (This is only required if you reload or adjust the paper position manually.)

4. Select Go to send the contents of the print range to the printer or print file.

5. If you are done, select Quit to end the /Print command. Otherwise, keep going.

6. You'll probably want some separation between the last range you printed and the next one. Use one or both of these form-adjustment functions:

Line. Advances the printer one line.

Page. Advances the printer to the top of the next page. (If you've specified an optional "footer", 1-2-3 prints it at the bottom of the current page.)

7. Return to step 1 or 2.

Figure 15-1. A Print Job with Several Parts

Print Options

The Options selection on the /Print menu allows you to control the appearance of the printout and to add extra text (Figure 15-2):

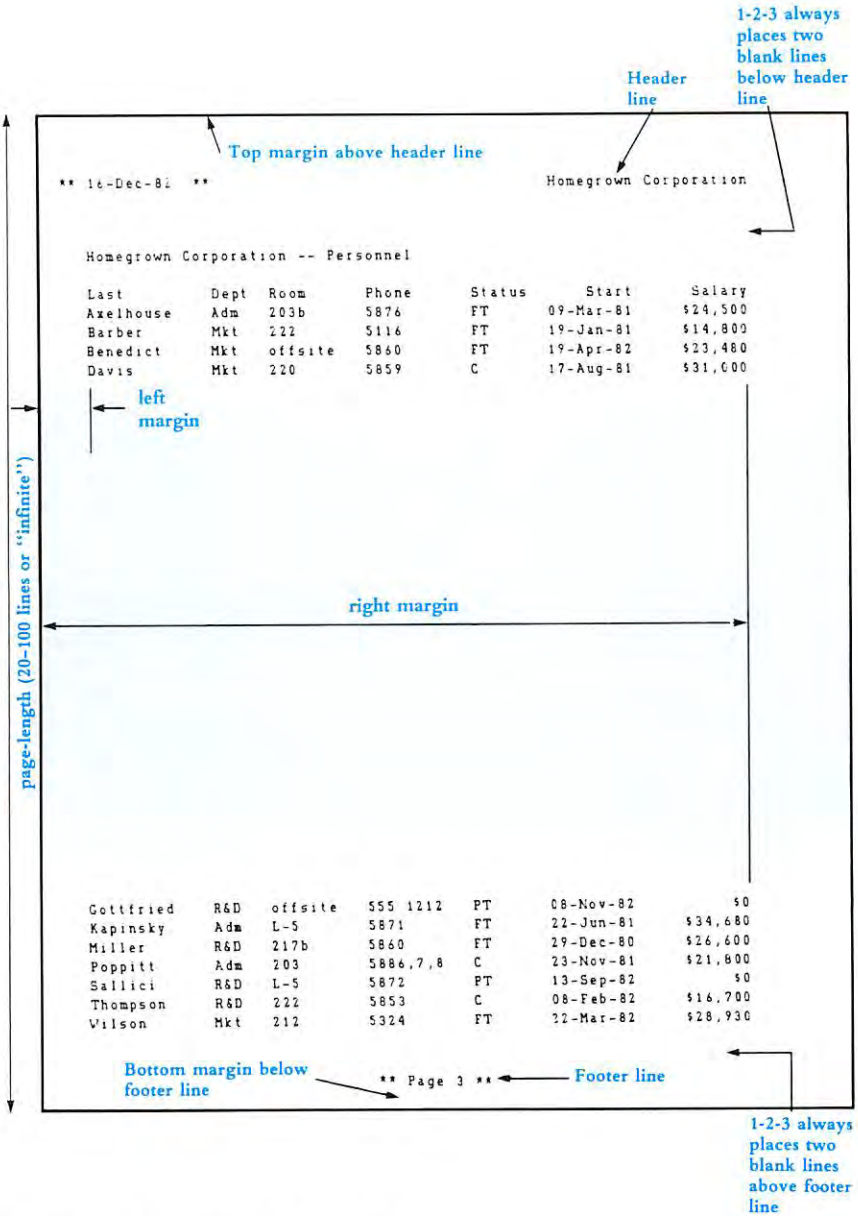


Figure 15-2. Page Layout Options

Printer Control. You can send a **setup string** directly to the printer hardware. Typically, you send a string of *control characters* in order to invoke such functions as changing the typeface, changing the type size, etc. (Appendix C, "Printer Control Codes").

Page Format. Left, right, top, and bottom margins; page length.

Extra Text. Page headers and page footers (you can have 1-2-3 include a page number and/or the current date in these).

Range Borders. The /Print command ignores *Titles* (and *Split Screen*, too) that you have established in the worksheet. But the Borders option allows you to temporarily establish title rows and/or columns, for use just during printing. The borders are printed along the top and/or side of each page of each print range you output (Figure 15-3).

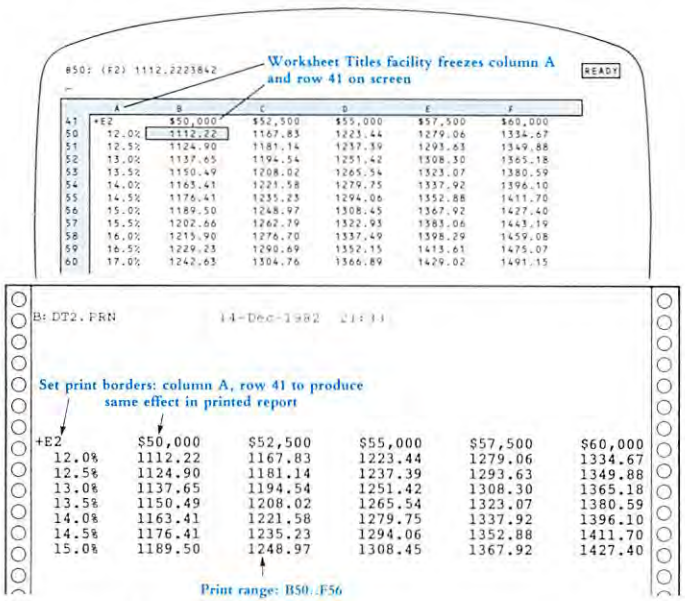


Figure 15-3. Print Borders

Format Suppression. For a particular printout, you can have 1-2-3 omit all vertical formatting (headers, footers, page length), effectively producing an "infinite" page length. This is useful when preparing data for use by other programs.

Worksheet Documentation. With the Cell-Formulas option, you can turn the printout into a one-cell-per-line listing of all entries—numbers, formulas, and labels—in the print range. In this listing, there is no attempt to position the entries as they appear in the worksheet (Figure 15-4).

Note. There may be more than one way to accomplish a particular printing effect. For instance, you can always set the print margins using the left-margin option. In addition, you may be able to set the left margin by sending control characters directly to the printer in a setup string. We recommend that you not mix these methods. In general, it should be easier to use 1-2-3's commands than printer control characters.

	Principal	50000	Years	5
	Rate	13.0%	Payment	$1,137.65
Year	Begin Bal.	End Bal.	Total Paid	Interest
1	50000.00	42406.26	13651.84	6058.10
2	42406.26	33764.33	13651.84	5009.92
3	33764.33	23929.53	13651.84	3817.05
4	23929.53	12737.22	13651.84	2459.53
5	12737.22	0.00	13651.84	914.63
			$68,259.22	$18,259.22

```
B1: "Principal
C1: 50000
D1: "Years
E1: 5
B2: "Rate
C2: (P1) 0.13
D2: "Payment
E2: (C2) @PMT(C1,C2/12,E1*12)
A4: "Year
B4: "Begin Bal.
C4: "End Bal.
```

Figure 15-4. As-Displayed vs. Cell-Formulas

Remembering and Clearing Print Specifications

As you enter print specifications, 1-2-3 automatically remembers them for future use. If you specify a print range of F4..K55, then 1-2-3 will repropose the same range the next time you select Range from the /Print menu.

1-2-3 stores print settings in the worksheet files it creates with /File Save and /File Xtract. In this way, it can remember your print settings between sessions, not only within a single session.

1-2-3 has a /Print Clear command. You can choose to cancel all print settings at once, or just some of them—Range, Border, or Format (which includes margins, page length, and setup string).

When you cancel a print setting, 1-2-3 returns to using the default setting. This is the value it read from the configuration file at the beginning of the session (unless you subsequently revised the default setting—see Appendix A, "Configuring 1-2-3").

/Print Printer and /Print File — /PP and /PF

Create a print job, sending it directly to the printer or to a print file.

Procedure

1. Choose Printer or File:

Printer. When you select Go, 1-2-3 will print the contents of the specified Range and return to the main /Print menu, allowing you to continue printing or Quit.

File. When you select Go, the same characters that would be sent to the printer are stored in a print file (extension .PRN).

2. *File only:* Specify a filename under which the print output is to be stored: Point to an existing name in the menu, or type a new or existing name.

If you don't use a disk prefix (e.g., "C:RECPRINT" means the current directory of disk C, file "RECPRINT"), 1-2-3 stores the file in the current directory (/File Directory, /Worksheet Global Default Directory).

3. *If a print file with the specified name already exists:* Choose to Replace the existing file's contents with the new print output, or to Cancel the /Print command. (To *append* several print jobs together in one file, you must specify all the print ranges during a single /Print command—see page 15-2.)


Choosing to Replace immediately erases the file's former contents. There is no way to recover this information. If you are updating a file, this may be exactly what you wish to do. Otherwise, Cancel the command.

4. The main /Print menu appears:

Range Line Page Options Clear Align Go Quit

This is a "sticky" menu (page 6-5): To return to Ready mode, choose Quit or press [ESC]. To produce a print job, you must specify a print range (menu choice: Range) then tell 1-2-3 to send the output to the disk or printer (menu choice: Go). All other print settings are optional.

/Print Range — /PPR, /PFR

Specify a cell range to be printed.

Procedure

1-2-3 remembers (page 7-14) the most recently used print range, if any. When you issue the command, 1-2-3 offers to reuse this range: It highlights the range and shows the addresses of its upper left and lower right corner cells in the control panel.

1. Press [ENTER] alone to reuse the same print range. You can press [BACKSPACE] to cancel this remembered range and return the pointer to the current cell. Otherwise, revise the range specification or enter a new one.

2. The main /Print menu returns. If you're ready to print, choose Go. Then, you can: (1) Choose Range again to specify another print range, and/or (2) Change optional print settings. In this way, you can append several print tasks into one large job.

Result

When you choose Go, 1-2-3 sends an image of the range to the printer or print file. It uses the default print settings (page 10-4), except for those you've overridden with /Print Options commands.

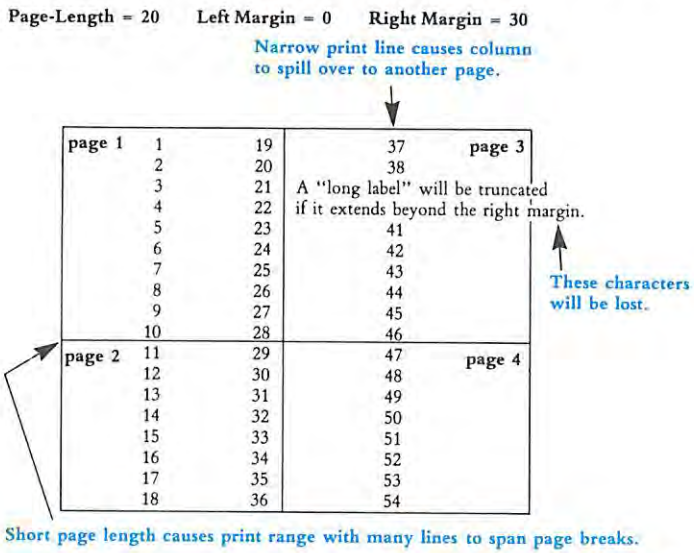
Notes

1. You may not get the results you want if your print range is too wide for the current margin settings. A column of the print range can "spill over" the right margin in two ways:

- The column itself fits within the margins, but a long label in the column spills over the right margin. 1-2-3 handles this situation by truncating (cutting off) the entry at the margin.

- The display width of the column (*column-width*) makes it spill over. In this case, 1-2-3 places the overflow column, and subsequent columns, on a new page.

Example:



2. To cancel a print range specification, use /Print Clear All or /Print Clear Range.

/Print Line /PPL, /PFL

Advance the printer to the beginning of the next line.

Results

- The printer advances to the beginning of the next line, and 1-2-3 remains in the main /Print menu. You may issue this command many times in succession.
- If you reach the bottom of a print page (as defined by the Page-Length, Margins Top, and Margins Bottom settings), 1-2-3 prints the Footer text (if any) and advances to the top of the next page.

/Print Page /PPP, /PFP

Advance the printer to the top of the next page.

Results

- The printer advances to the top of the next page, as defined by the Page-Length, Margins Top, and Margins Bottom settings. The Footer text (if any) is placed at the bottom of the current page. 1-2-3 remains in the main /Print menu.
- In an unformatted print job (/Print Options Other Unformatted), Page still advances multiple lines, using the current Page-Length setting (even though the page-length is "infinite").

Notes

1. Issue a Page before exiting the /Print command with Quit. This ensures that: (1) The Footer text (if any) will appear at the bottom of the final page, and (2) The next print job will begin at the top of a new page. (1-2-3 does not automatically advance to the top of a page with each /Print command.)

2. Use /Print Align to set 1-2-3's line number counter back to page 1.

/Print Go /PPG, /PFG

Output the specified print range.

Results

1. 1-2-3 "prints" the setup string, typically a set of non-printing control characters (page 15-14).

2. 1-2-3 prints the currently defined print range, along with Border rows and/or columns (if any). See page 15-8 for a discussion of how 1-2-3 handles a print range that is too wide for the current margin settings.

Interrupting a Print Job. To interrupt direct printing, press [BREAK]. The printer may continue printing for a while, until it has cleared its internal memory (*buffer*). After you interrupt a print job: (1) Switch the printer off, then on again; (2) Align the paper manually or with /Print Line; (3) Use /Print Align to reset 1-2-3's line and page counters to 1.

If your printer is *off-line* when you send data to it, 1-2-3 may get "stuck" in Wait mode. Even interrupting does not have an immediate effect in such cases. Switch the printer *on-line* to allow the interrupt order to take effect.

Notes

1. If 1-2-3 finds that your printer is not ready or is not functioning properly (it tries repeatedly to send the output), it *beeps* and displays a "Printer Error" message. Press [ESC] to clear the error message and continue working. No data are lost. Often, you need only switch your printer *on-line*, then choose Go again.

2. When storing short print jobs in a print file, you may notice that the disk drive light does not go on. Don't worry—1-2-3 will catch up when you finish the /Print command with Quit.

/Print Options Header and Footer — /PPOH and /PFOH and /PFOF

Include an additional text line at the top and/or bottom of each page.

A 1-2-3 print page (Figure 15-2) begins with the top margin (0-10 lines), the Header line (possibly empty, but always there), and two blank lines. The next line of the print job follows thereafter. The print page ends similarly. The last line of the print job is followed by two blank lines, the Footer line, and the bottom margin (0-10 lines).

Procedure

1-2-3 displays the current definition, if any, of the header or footer. Edit or replace the text, making sure that the new text fits within the left and right margins. The /Print Options menu returns.

Page Number. Whenever it finds the "#" character in a header or footer line, 1-2-3 substitutes the current page number. At the start of a 1-2-3 session, the page-number counter is set to 1. This number increases each time a print page is completed. The /Print Align command resets the page number to 1.

Current Date. Whenever it finds the character "@" in a header or footer line, 1-2-3 substitutes the current date (e.g., 08-Nov-85). Be sure to enter the current date when you start the computer.

Formatted Headers and Footers. You can use " ¦ " characters to separate a header or footer line into three parts:

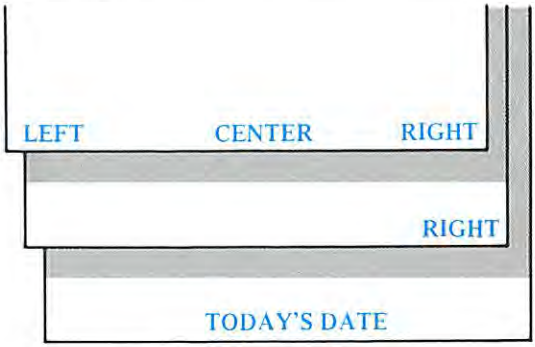


Figure 15-5. Placement of Headers and Footers

1. Flush against the left margin.
2. Centered between the margins.
3. Flush against the right margin.

Examples:

Text	Description	Appearance
ABC Company	1 part, flush left	ABC Company
¦ABC Company	1 part, centered	ABC Company
¦¦ABC Company	1 part, flush right	ABC Company
p. #¦ MEMO¦ ** @ **	3-part	p. 15 MEMO ** 23-Feb-85 **

on page 15 of print job

on February 23, 1985

Result

When you choose Go to print a range, the header or footer text will be included if the output spans a page break (see note 2 below).

Notes

1. To cancel a header or footer, edit the text down to zero characters (using [BACKSPACE] or [ESC]). The /Print Clear All command cancels the header and footer settings along with all other print settings.

2. In an unformatted ("infinite page length") print job (/Print Options Other Unformatted), 1-2-3 does not print headers and footers. If you switch back to formatted printing, the header and footer texts will reappear.

3. The footer is printed when you issue a Line or Page advance that crosses a page break.

/Print Options Margins /PPOM, /PFOM

Set the left, right, top, or bottom margin of the print page.

A 1-2-3 print page (Figure 15-2) begins with the top margin (0-10 lines), the Header line (possibly empty, but always there), and two blank lines. The next line of the print job follows thereafter. The print page ends similarly: The last line of the print job is followed by two blank lines, the Footer line, and the bottom margin (0-10 lines).

Procedure

1. Choose a margin to set: Left, Right, Top, or Bottom.

2. 1-2-3 displays the current margin setting. To use it, press [ENTER] or [ESC]. To change it, enter a new number (the existing one disappears automatically when you begin typing).

Margin	Possible Settings
Left	0-240
Right	0-240
Top	0-10
Bottom	0-10

Result

The new margin setting remains in effect until you (1) End the 1-2-3 session, (2) Retrieve a worksheet, or (3) Issue a /Print Clear All or /Print Clear Format command. In the final case, the default printer configuration (page A-1) is reinstated.

Notes

1. See page 15-8 for a discussion of print ranges that do not fit within the left and right margin settings.

2. At the beginning of a session, 1-2-3 reads the default printer configuration from file 123.CNF on the 1-2-3 System Disk. The /Print Options Margins commands override the default margin settings stored in this file.

(See Appendix A, "Configuring 1-2-3". The Lotus-supplied configuration file is designed for an 8.0 in. × 11 in. page, printed at six lines per inch, with a 72-character print line.)

3. Use /Print Options Other Unformatted to specify an "infinite" page length: 1-2-3 will ignore the top and bottom margin settings. This allows you to ignore the paper perforations.

4. If your printer automatically skips over paper perforations, set the top and bottom margins to 0 and reduce the Page-Length setting.

/Print Options Borders /PPOB, /PFOB

Specify rows to be included at the top of each page of a print range, or columns to be included at the left of each print range.

This is the printing counterpart to the Titles facility, which "freezes" rows and/or columns on the display screen. For an illustration, see Figure 15-3.

Procedure

1. Choose Columns or Rows:

Columns. Each time you choose Go to print a range, 1-2-3 will attach entries from the columns you specify as a left border.

Rows. Each time you choose Go to print a range, 1-2-3 will attach entries from the rows you specify as a top border. If the range spans one or more page breaks, an extra set of top-border rows will start each additional print page (after the header line).

> 1-2-3 remembers (page 7-14) the most recently used column-border and row-border ranges, if any. When you choose Columns or Rows, 1-2-3 offers to reuse the same border range: It highlights the range and shows the addresses of its upper left and lower right corner cells in the control panel.

2. Press [ENTER] alone to reuse the same border range. You can press [BACKSPACE] to cancel this remembered range and return the pointer to the current cell. Otherwise, revise the range specification or enter a new one.

For a row-border, only the vertical dimension is significant (A1..A4, B1..B4, and A1..H4 all are equivalent row-border ranges). Similarly, only the horizontal dimension of a column- border is significant.

Be careful! If no row or column border has been defined, pressing [ENTER] alone sets a single-row or single-column border at the pointer location. If you change your mind about setting a border, press [ESC], not [ENTER].

Notes

1. Use print borders to produce column headings at the top and/or row headings at the left edge of every page of a multi-page printout.

2. Use print borders to combine rows or columns in a print job that are non-adjacent.

3. In an unformatted print job (/Print Options Other Unformatted), there are no page breaks. Thus, a row-border is always printed once at the beginning of a range, no matter how many rows the range occupies.

4. Be careful not to duplicate headings by including them in both a border range and the print range.

5. To cancel border specifications, use /Print Clear All or /Print Clear Borders. "Unexpanding" the highlighted range with [BACKSPACE] or [ESC], then pressing [ENTER] is not enough.

/Print Options Setup /PPOS, /PFOS

Define a sequence of printer-control characters to be output just before each print range.

Procedure

1-2-3 displays the current setup string definition, if any, and switches to Edit mode. To leave the string unmodified, press [ENTER] alone. Otherwise, edit or replace the string. The setup string may be up to 39 characters long.

Control Codes. Indicate non-printing characters by their ASCII codes, in this form:

\nnn 3-digit decimal ASCII code

Examples (for DMP-420 printer):

\027, \020 (Control O): turn on compressed print
\027, \019 (Control R): turn off compressed print

Results

• Each time you choose Go to print a range, 1-2-3 will first send the setup string to the printer.

• The new setup string remains in effect until you: (1) End the 1-2-3 session, (2) Retrieve a worksheet, or (3) Issue a /Print Clear All or /Print Clear Format command. In the final case, the default printer configuration (page A-1) is reinstated.

Notes

1. Each printer has its own control codes. Consult your printer's User Manual for details. Translate your printer's codes into 1-2-3's \nnn format. Be sure to express the number in decimal, not octal or hex. (See Appendix B, "Printer Control Codes".)

2. To include a backslash itself in the setup string, type two in a row: \\.

3. At the beginning of a session, 1-2-3 reads the default printer configuration from the file 123.CNF on the 1-2-3 System Disk. The /Print Options Setup command overrides the default setup string stored in this file. (See Appendix A, "Configuring 1-2-3".)

4. If you select compressed print, you may want to change the right margin as well (/Print Options Margins Right). If you change the line spacing, change the page length as well (/Print Option Page-length).

5. With most printers, you must issue another setup string or power down the printer to "undo" a particular print format. Merely cancelling the setup string is not enough.

/Print Options Page-Length /PPOP, /PFOP

Set the total number of lines per print page.

A 1-2-3 print page (Figure 15-2) begins with the top margin (0-10 lines), the Header line (possibly empty, but always there), and two blank lines. The next line of the print job follows thereafter. The print page ends similarly. The last line of the print job is followed by two blank lines, the Footer line, and the bottom margin (0-10 lines).

Procedure

1-2-3 displays the current page-length setting. To use it, press [ENTER] or [ESC]. To change it, enter a new number between 20 and 100 (the existing one disappears automatically when you begin typing).

Results

- When printing, 1-2-3 computes the positions of page breaks, headers, and footers based on the Page-Length setting.

- The new page length remains in effect until you (1) End the 1-2-3 session, (2) Retrieve a worksheet, or (3) Issue a /Print Clear All or /Print Clear Format command. In the final case, the default printer configuration (page A-1) is reinstated.

Notes

1. At the beginning of a session, 1-2-3 reads the *default printer configuration* from the file 123.CNF on the 1-2-3 System Disk. The /Print Options Page-Length command overrides the default setting stored in this file.

(See Appendix A, "Configuring 1-2-3". The Lotus-supplied configuration file is designed for an 8.0 in. × 11 in. page, printed at six lines per inch, with a 72-character print line.)

2. The /Print Options Other Unformatted command specifies an "infinite" page length, suspending the Page-Length setting. Issuing a /Print Options Other Formatted command reinstates the setting.

/Print Options Other As-Displayed — /PPOOA, /PFOOA

/Print Options Other Cell-Formulas — /PPOOC, /PFOOC

Specify or cancel the alternative printing format: one-cell-per-line report of cell entries (including formula texts).

Results

Cell-Formulas. The contents of the cells in the print range will be printed one cell per line. Each line contains exactly what appears on Line 1 of the control panel when the pointer is on the cell:

- Cell address.
- Numeric display format.
- "U" unprotected flag (if the cell is currently unprotected).
- Complete text of the cell's entry (in particular, texts of formulas, not their values).

Blank cells in the print range are ignored.

As-Displayed (default setting). Returns printing to normal: the Range is printed as it appears on the screen.

Note

/Print Clear All also returns printing to As-Displayed.

/Print Options Other Unformatted — /PPOOU, /PFOOU

/Print Options Other Formatted — /PPOOF, /PFOOF

Specify or cancel an "infinite" page-length setting.

Results

Unformatted. The next time you choose Go to print a range, 1-2-3 will suspend the Page-Length setting, adopting an "infinite" page length:

- Print output will include no page breaks.
- The header and footer (if any) will never be printed.
- If they have been specified, border rows will be printed once for each print range, at the beginning of the range.
- If the print range is too wide for the margin settings, the overflow columns will follow the initial columns immediately.

Formatted (default setting). The next time you choose Go to print a range, the Page-Length setting will be restored. Printing of headers and footers, and border-rows will revert to normal.

Notes

1. Use /Print Options Other Unformatted to prepare a print file for use with another program (e.g., a word processor).
2. /Print Clear All returns printing to Formatted.

/Print Clear — /PPC, /PFC

Cancel some or all print settings; restore default printer configuration.

Procedure

Choose All, Range, Borders, or Format. The main /Print menu returns.

Results

Range. Cancels the print range setting (/Print Range).

Borders. Cancels the print border settings—both row and column borders.

Format. Reinstates the default settings for all four margins, the page length, and the setup string. These are the settings read from the configuration file, 123.CNF, and specified with the /Worksheet Global Default Printer commands.

All. Clears the Range, Borders, and Format, all at once. In addition, printing is restored to Formatted (rather than Unformatted) and As-Displayed (rather than Cell-Formulas).

Note

This command is especially useful in keyboard macros, to clear any pre-existing print settings.

/Print Align /PPA, /PFA

Reset the line number and page number counters to 1.

Procedure.

Before issuing this command, be sure that the paper in your printer is aligned to the top of a page. With continuous-feed paper, align the print head with the perforations.

Exception: If your printer automatically skips over perforations, align the paper to the point where the header line should appear.

Result

When you continue printing, 1-2-3 will include margins, page-breaks, headers, and footers in their proper locations.

Notes

1. 1-2-3 automatically assumes it is at the top of a print page just once—at the start of the 1-2-3 session. Use this command if you manually align the paper during a session.

2. 1-2-3 loses track of the page position if you use the printer's Form Feed control when the printer isn't already at the top of a page. Instead, use the /Print Page command to advance the page.

16. Graph Commands

1-2-3's /Graph command is a powerful and flexible tool for creating visual representations of data. 1-2-3 can turn rows or columns of numbers into several kinds of graphs (Figure 16-1).

As these examples indicate, you can also annotate graphs using titles, legends, axis labels, and data-value labels. 1-2-3 allows you to store such additional graph specifications either in the worksheet as cell entries, or separately, as optional graph settings.

The /Graph command is loaded with features that will help you draw effective graphs—pictures that communicate numeric data dramatically, pictures that help you to see relationships and trends that you might not spot in the numbers themselves. Here is a partial list of these features:

Color Graphing. 1-2-3 draws graphs in black & white and, if you have a graphics board in up to six additional colors.

Multiple Data Sets. You can represent up to six sets of data in the same graph, either color-coded or with contrasting cross-hatching, or with symbols.

Graph Labeling. 1-2-3 includes a comprehensive facility for adding labels, titles, and legends to graphs.

Automatic Scaling. 1-2-3 can automatically choose optimal numeric scales so that the graph "fits" the data. This prevents lines and bars from being cramped into a corner of the graph or disappearing off the graph completely. You can also set scales manually to produce particular visual effects. And you can choose any of 1-2-3's numeric display formats for the scale values (Fixed, Currency, Scientific, etc.).

"What if" Graphing. Changing some of the data that go into a graph does not invalidate your graph settings. In Ready mode, you can redraw the most recent graph simply by pressing **[F10/GRAPH]**.

Storage of Graph Settings. You instruct 1-2-3 how to draw a graph using /Graph commands to enter specifications. During the session, 1-2-3 automatically remembers the graph settings you enter. And it saves the settings in the worksheet files you create with /File Save and /File Xtract.

In addition, you can save graph settings under *graph names*. A single command retrieves the settings and redraws the graph. Using named graphs allows you to switch instantly between graphs, perhaps to view related sets of data, or to try different ways of representing the same data.

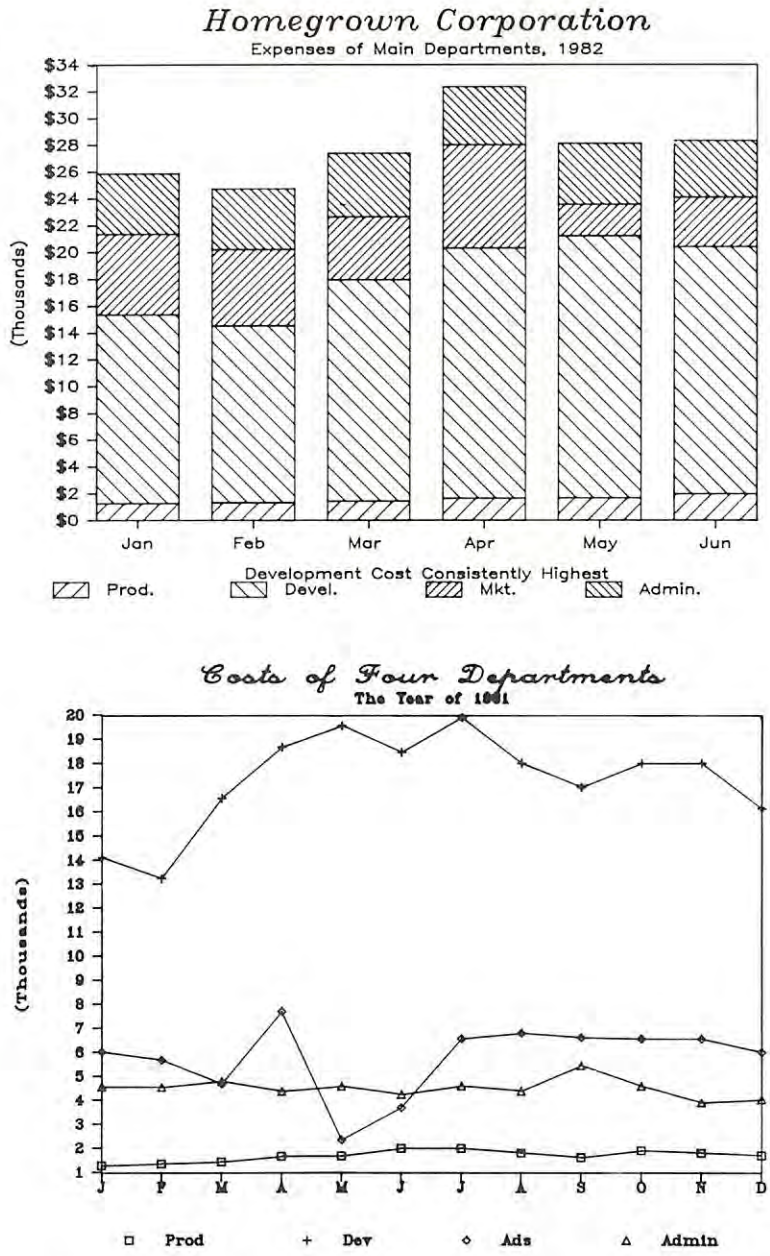
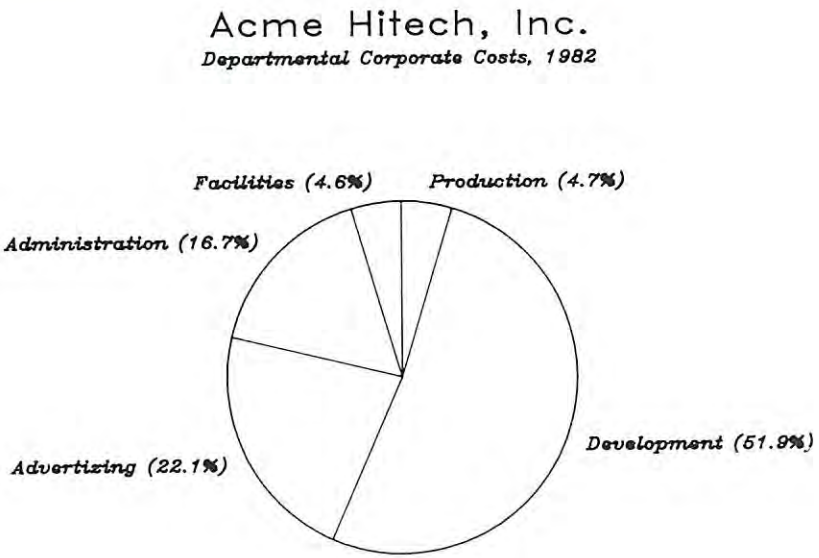


Figure 16-1. 1-2-3 Graph Types



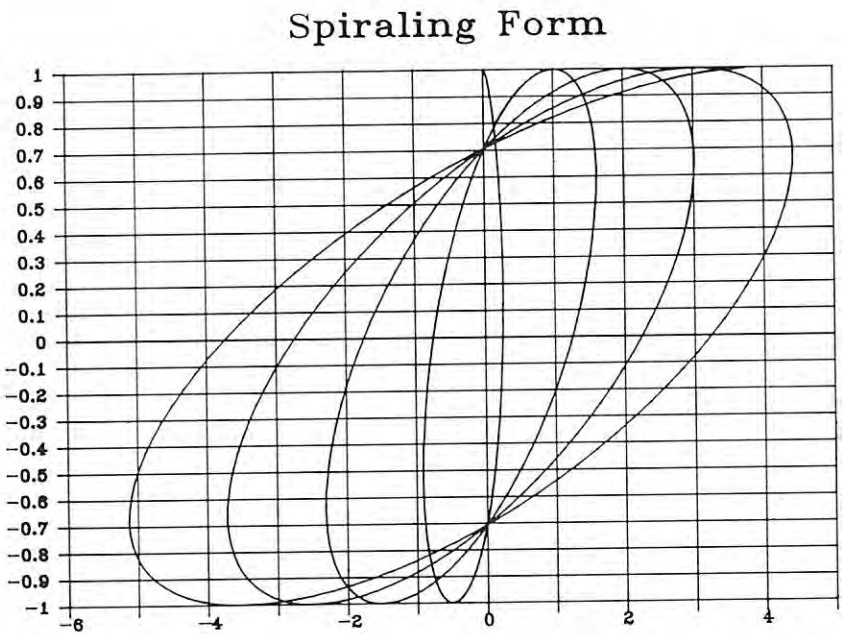


Figure 16-1. 1-2-3 Graph Types (continued)

Graph Printing. You can store any of the images 1-2-3 creates in a **graph file** (picture file). You can preview and print the graphs you've created using the PrintGraph program and an appropriate printer or plotter. PrintGraph introduces a new level of flexibility: high-resolution output, enlargements, reductions, rotations, additional or different colors, and more. You invoke the PrintGraph program through the Lotus Access System. For a complete description, see Chapter 20, "Printing 1-2-3 Graphs".

With such a wide range of features available, making full use of the /Graph command can become quite involved. But making a straightforward graph is easy. We'll start with a simple situation to demonstrate just how easy it is to draw a graph. Then, step-by-step, we'll show how the various /Graph command features are used to embellish the graph. Let's begin with an overview of the graphing process.

How to Define a Graph

To define a graph, you issue /Graph commands that specify the various aspects of the picture to be drawn. Certain information is essential:

1. What type of graph you want to draw: Line, Bar, Stacked-Bar, Pie, or XY. These graph types are explained below.

2. The cell range(s) in which the data values to be graphed are stored. Note that the graph definition involves the location, and not the current contents of those cells. For instance:

B10..B25	Part of a column, indicated either by pointing or by typing cell addresses.
RECEIPTS	Named range.

All other specifications are optional: labels, manual selection of scales, grid lines, etc.

To aid the process of entering several settings at once, 1-2-3 remains in the /Graph menu (sometimes in a submenu) after you issue a /Graph command. To return to Ready mode, select Quit at this menu.

At any point during entry of graph settings, you can select /Graph View. If 1-2-3 has enough information, it draws the graph. 1-2-3 first erases the worksheet from the screen and then draws the graph. To return to using the /Graph command menu after viewing a graph, press any key. 1-2-3 erases the graph and restores the worksheet.

The [F10/GRAPH] Key

Pressing **[F10/GRAPH]** performs a /Graph View when you're in Ready mode and draws a graph according to the most recently entered settings. Recall that the settings include range specifications, not the particular data stored in the cells. Thus, you can use **[F10/GRAPH]** to do "what if" graphing analyses:

1. Define and draw a graph to represent certain ranges of values.
2. Modify entries within the ranges.
3. Recalculate.
4. Press [F10/GRAPH] to view a graph that incorporates the modified values.

Starting Simple

What is the quickest way to draw a graph—no frills, no options, just a straightforward graph? Consider the worksheet shown in Figure 16-2.

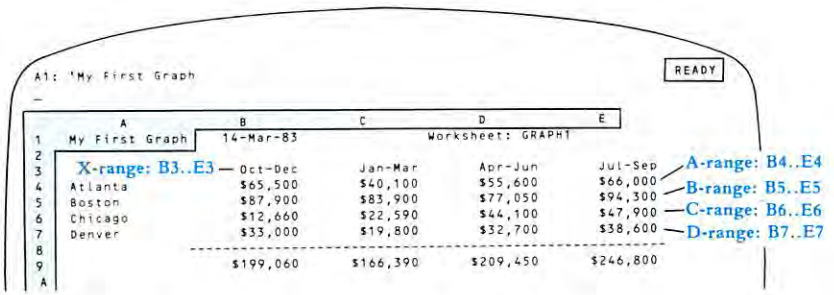


Figure 16-2. A Worksheet of Values to Be Graphed

Here's how to graph the sales performance of the Atlanta office during the four sales periods:

1. Select the /Graph command. The /Graph main menu appears:

   Type X A B C D E F Reset View Save Options Name Quit

2. Select Type from this menu. 1-2-3 offers a choice of five graph types—select Bar.
3. The /Graph main menu returns. Choose to specify an A-range of data values.
4. Indicate the cell range that contains the four sales figures to be graphed: B4..E4.
5. Once again, the /Graph main menu reappears. Select View to have 1-2-3 draw the graph (Figure 16-3).

Multiple Sets of Data

Representing several sets of data on the same graph is easy. 1-2-3 can show up to six ranges at once—in addition to an A-range of data values, you can specify B-, C-, D-, E-, and F-ranges. Figure 16-4 shows how the graph would look with all four cities represented.

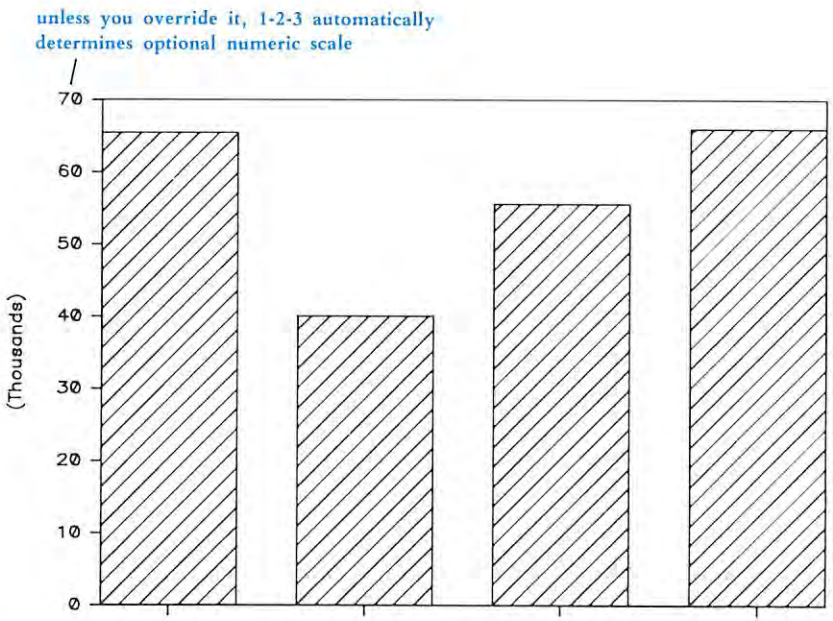


Figure 16-3. A Bar Graph—One Data Range

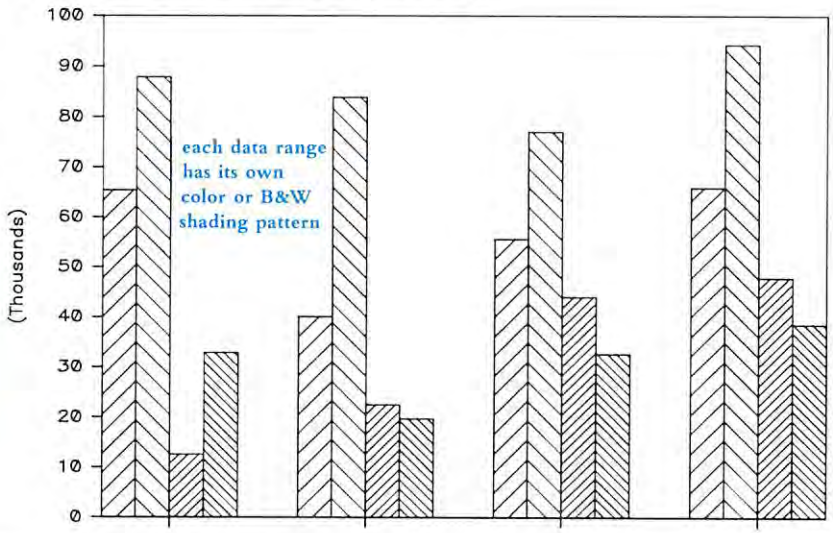


Figure 16-4. A Bar Graph—Four Data Ranges

Color and B&W

1-2-3's standard procedure is to draw graphs in black and white, using a different crosshatching pattern for each of the data ranges. But 1-2-3 can also use color to distinguish among the data ranges.

Notes. There is no way to change the colors that 1-2-3 uses in drawing color graphs except by reassigning data values to different ranges. However, you can include B- or C-ranges without an A-range if that produces the display you want. And you can modify the colors when printing the graph if you have a color printer or plotter (Chapter 20, "Printing 1-2-3 Graphs").

If you have installed the B&W high-resolution graphics board on your Model 2000, you will not be able to display graphics in color—even if you have the Tandy color monitor.

Switching Types of Graphs

The Stacked-Bar type of graph arranges the bars for the A—F data ranges on top of each other instead of side-by-side. Changing graph types is easy: (1) Select Type at the /Graph main menu, then Stacked-Bar; (2) Select View again (Figure 16-5).

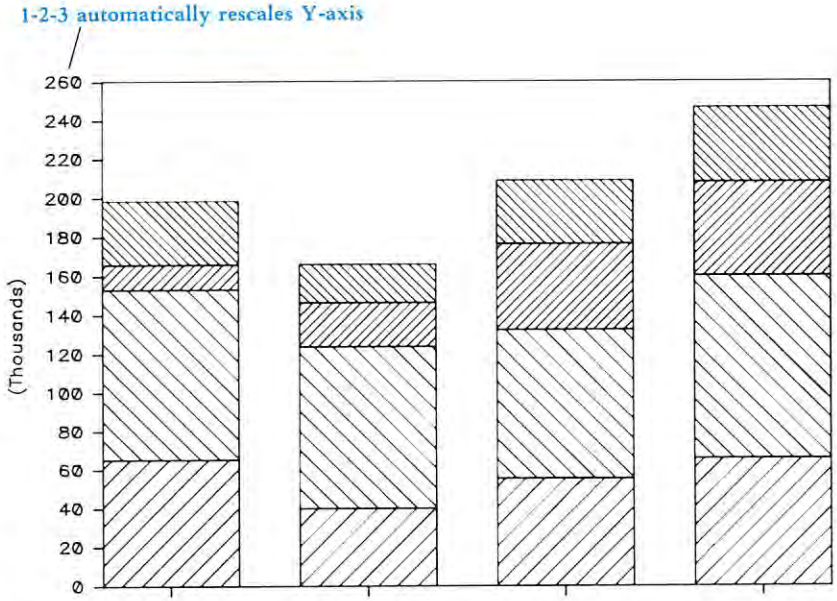


Figure 16-5. Switching the Graph Type—Stacked-Bar

In our example, this type of graph has the virtue of implicitly showing the total sales figure for each sales period.

Adding Labels

1-2-3 can add labels to graphs in several different ways. In bar graphs, an X-range of entries in the worksheet serves as labels. 1-2-3 places these entries along the horizontal axis, so that each entry labels one bar (or set of bars if you have multiple data ranges).

In our example, we could define the X-range to be B3..E3, then View the graph again (Figure 16-6).

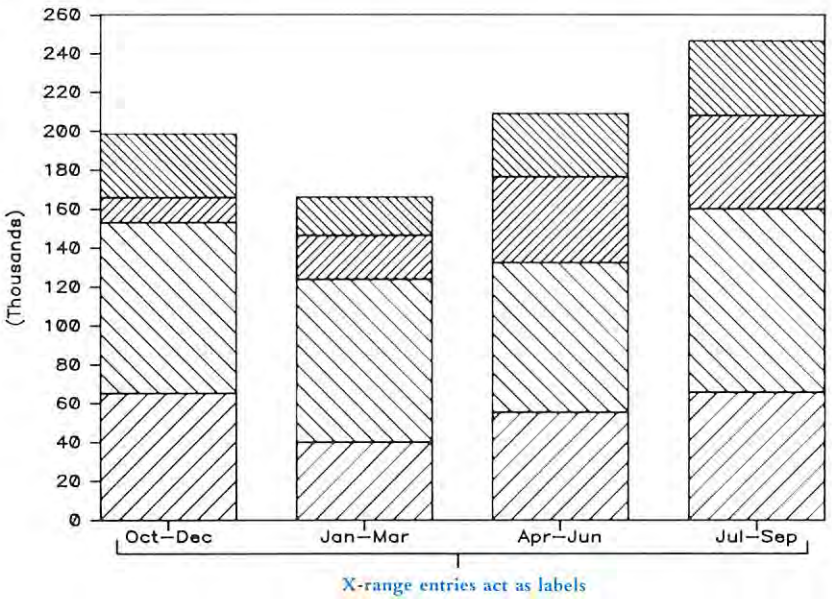


Figure 16-6. Adding X-Axis Labels

How about adding some **titles**? 1-2-3 can center a two-line graph title at the top of the screen. It can also place a label on both the horizontal and vertical axes. You enter and revise these titles, each up to 39 characters long, with the /Graph Options Titles command. And you can choose to type the title text directly at the command prompt, or to indicate a cell address in the worksheet where the title text is stored (Figure 16-7).

With several ranges on the graph, it would be handy to have *legends* to remind us which color (or B&W crosshatching pattern) represents which city. The /Graph Options Legends command handles this task. Legends, like titles, can be typed directly at the command prompt or stored in a cell (Figure 16-8).

Keep legends as short as possible because of display limitations.

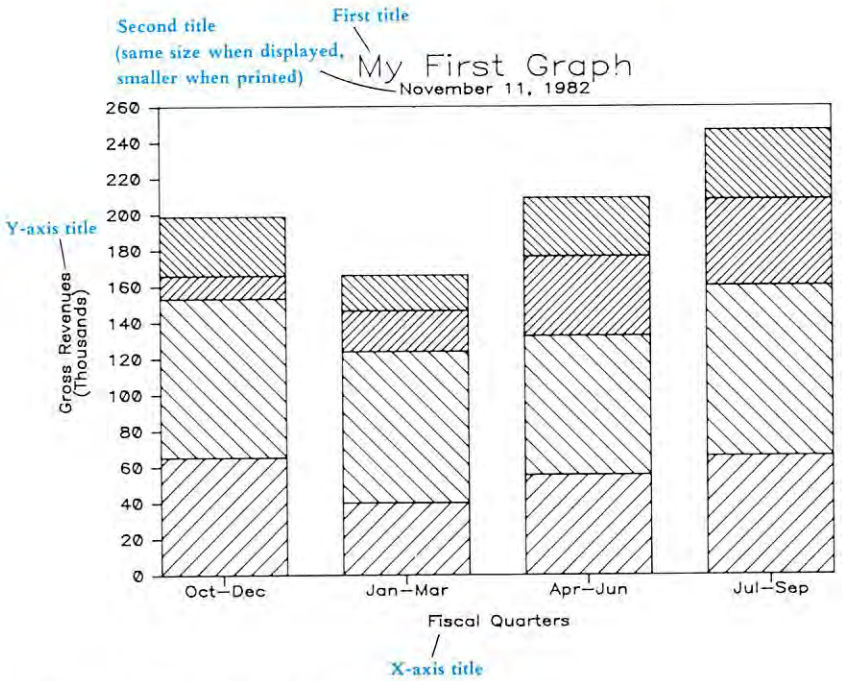


Figure 16-7. Adding Graph Titles

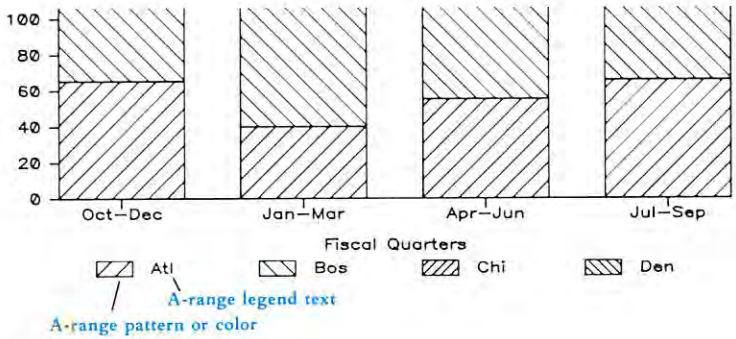


Figure 16-8. Adding Legends

Printing Graphs

Now that we've created a feature-loaded graph, how about getting a printout? 1-2-3 does not have a Graph Print command that allows you to send a graph image directly to your printer or plotter. Instead, it has the command /Graph Save, which stores the currently displayed image in a **graph file**. After you've ended the 1-2-3 session, you can use the PrintGraph program to produce a printout of one or more graphs. This is an extra step, but PrintGraph more than compensates by extending the graphing capability in many ways, including:

- Image resolution greater than that available on graphics video monitors.
- A variety of type fonts.
- Image enlargement, reduction, and rotation.
- Up to seven colors, depending on your printer or plotter.
- Batch graph printing, for unattended operation.

(See Chapter 20 for details.)

We could add even more features to our bar graph, but things would get a bit crowded. So let's double back to cover some points we missed the first time around. In particular, we've looked only at Bar and Stacked-Bar graphs so far. 1-2-3 can draw several other types of graphs, as well.

Pie Charts

The graph we drew above (Figure 16-3) represents a single range of numeric values as a set of vertical bars. Pie charts are an alternative way of picturing a single set of data. Compare the graph in Figure 16-3 with the one in Figure 16-9.

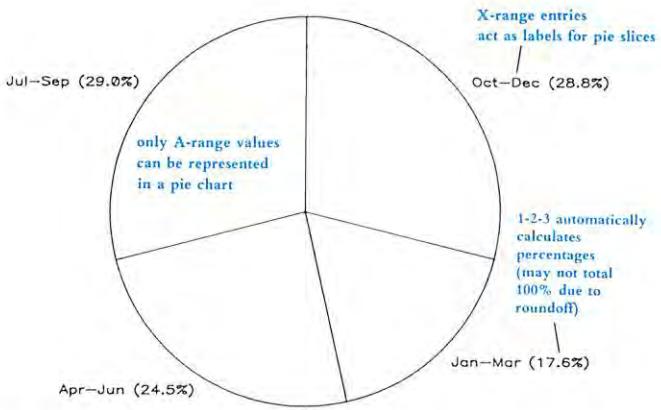


Figure 16-9. A Pie Chart

Like bar graphs, pie charts can use a range of X values as labels. With a pie chart, there is no horizontal axis—1-2-3 places these labels next to the corresponding pie slices.

Unlike bar graphs, a pie chart can represent only a single value range. There's no way to draw two pies at once, or to have "two-flavored" pie slices.

Line Graphs

Another way to picture our sales data is with a Line graph. Instead of representing each value as the height of a bar, 1-2-3 represents it with a single symbol (Figure 16-10).

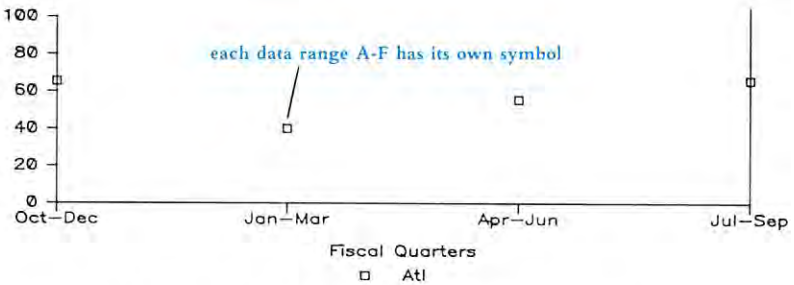


Figure 16-10. A Line Graph—Formatted with Symbols Only

We admit that this doesn't look especially like a line graph. Displaying "symbols only" is one of four options with a line graph. Figure 16-11 illustrates the other three.

Each data range has its own graphing symbol, just as it has its own color or shading pattern in a bar graph. In the final case, no symbols appear at all. This final setting is normally only used in conjunction with a range of **data-labels**, specified with /Graph Options Data-Labels. Using data-labels resembles using an X-range to provide labels. But instead of appearing along the horizontal axis, data-labels appear on the graph where the graphing symbols would (or do) appear. Data-labels may be used as an alternative to lines and symbols, or in conjunction with them.

Like bar graphs, line graphs allow you to:

- Display up to six data ranges at once.
- Define an X-range to supply labels along the horizontal axis.

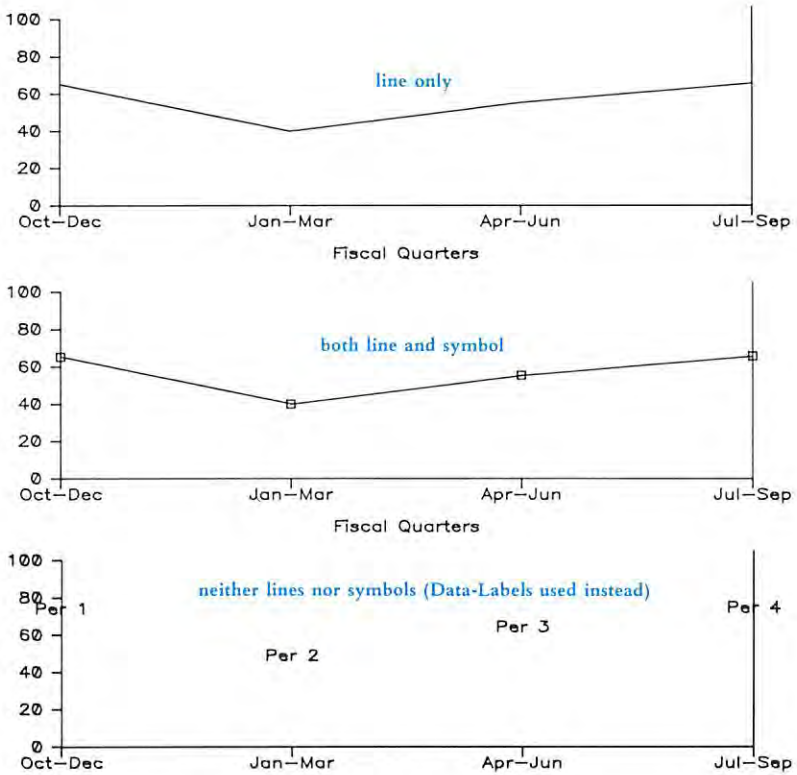


Figure 16-11. Additional Format Options

XY Graphs

1-2-3 can draw one more type of graph, called an XY graph. We've saved it for last because it is different from all the other types in a fundamental way.

Bar graphs and line graphs represent a set of numeric values as vertical distances. There is only one numeric scale in these graphs, along the vertical axis. The horizontal axis does not indicate any numeric quantity. In fact, horizontal positioning may be completely irrelevant. For instance, the two graphs in Figure 16-12 convey exactly the same information.

In pie charts, this one-dimensional quality is even more apparent. Each quantity in the range is represented as a distance around the outside of a circle.

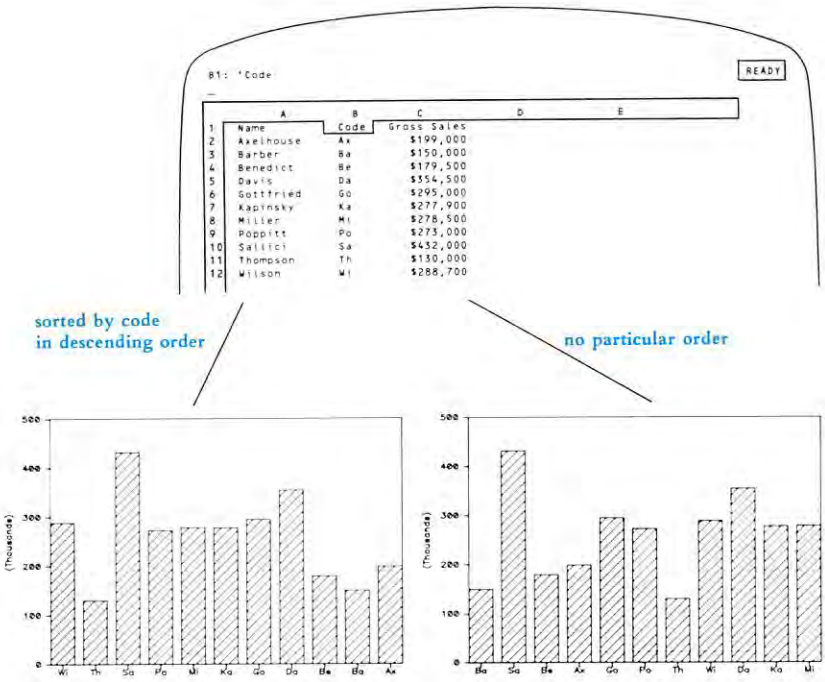


Figure 16-12. Two Bar Graphs of the Same Data

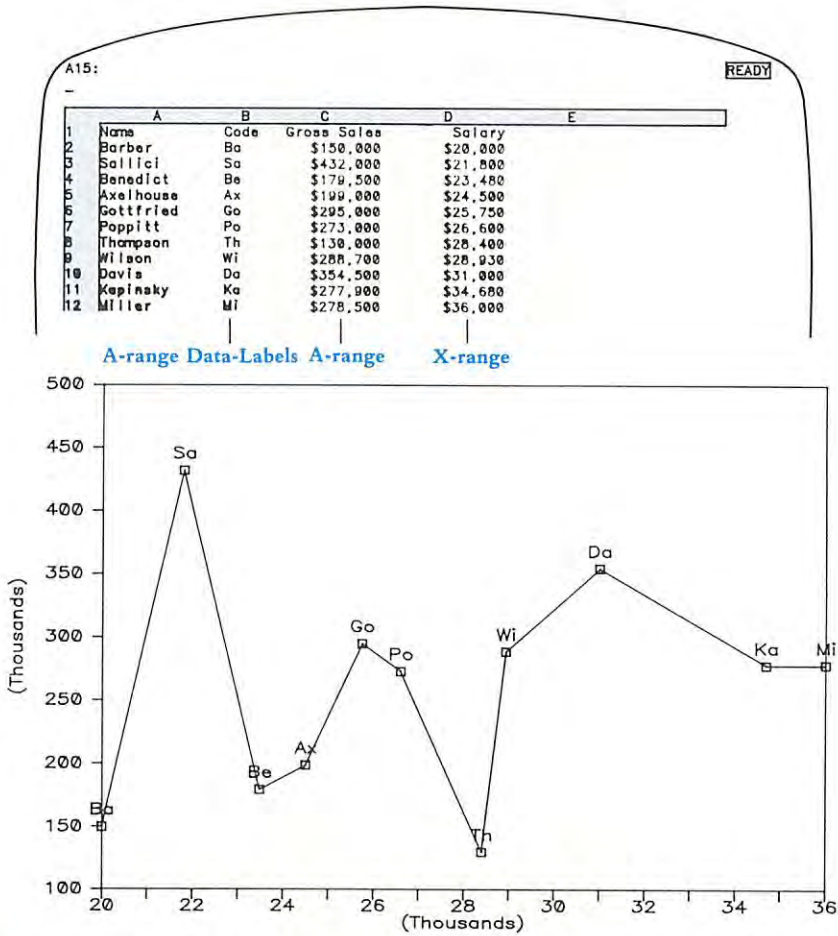
XY graphs, on the other hand, are two-dimensional. The graph does not represent a group of single values as vertical distances. Instead, it represents pairs of values as the combination of a horizontal (X) distance and a vertical (Y) distance. The horizontal axis is no longer for-labels-only. Now, it's a numeric scale, just like the vertical axis.

Example: Suppose we added each salesperson's salary to the worksheet pictured above. We can draw an XY graph showing each salesperson's salary paired with his/her billings. As we did before, we define the set of sales figures to be the A-range. But this time, the X-range is also a set of numbers—the salaries—not just a set of labels. 1-2-3 pairs each X value with the corresponding A value, and draws a symbol for each pair (Figure 16-13).

Named Graphs

If you save a worksheet with /File Save or /File Xtract, 1-2-3 stores the graph settings, too. At a later time, redrawing the graph requires just a /File Retrieve and pressing **[F10/GRAPH]**.

What if you want to define several different graphs using a single worksheet's data? For instance, you might want to define a series of line graphs, each of which plots one sales office's performance against total sales.



	A	B	C	D	E
1	Name	Code	Gross Sales	Salary	
2	Barber	Ba	$150,000	$20,000	
3	Sallici	Sa	$432,000	$21,800	
4	Benedict	Be	$179,500	$23,480	
5	Axelhouse	Ax	$199,000	$24,500	
6	Gottfried	Go	$295,000	$25,750	
7	Poppitt	Po	$273,000	$26,600	
8	Thompson	Th	$130,000	$28,400	
9	Wilson	Wi	$288,700	$28,930	
10	Davis	Da	$354,500	$31,000	
11	Kapinsky	Ka	$277,900	$34,680	
12	Miller	Mi	$278,500	$36,000	

Figure 16-13. An XY Graph

We'd like to be able to switch back and forth among these graphs easily, but 1-2-3 can maintain only one group of current graph settings. The solution is *named graphs*.

The /Graph Name Create command assigns a name up to 15 characters long to the current group of graph settings. The idea is to assign different names to different groups of settings. Issuing a /Graph Name Use command reinstates a named group of settings and automatically redraws the graph. You can modify the settings, then save them again under the same graph name.

1-2-3 records all graph names in the worksheet files created with /File Save and /File Xtract.

Making 1-2-3 Forget

/Graph Name, /Graph Save, and /File Save all represent 1-2-3's ability to remember graph settings. But sometimes you'll want to wipe the slate clean—have 1-2-3 forget graph settings. The /Graph Reset Graph command cancels all graph settings currently in effect. It does not, however, affect the settings stored under /Graph Name.

You can also cancel data range settings individually. For instance, when you cancel a B-range setting, 1-2-3 does not automatically cancel the related legend and format settings. Instead, it holds them in reserve until you've redefined a B-range.

When you reset a range, a related Data-Labels setting is cancelled.

/Graph Name Delete and /Graph Name Reset cancel graph name specifications, one at a time or all at once.

The /Worksheet Erase command cancels all graph settings, including graph names.

/Graph Type /GT

Select the type of graph to be drawn.

Procedure

Select a graph type: Line, Bar, Stacked-Bar, Pie, XY. The graph main menu returns.

Result

When you select View or when you press **[F10/GRAPH]** in Ready mode, 1-2-3 will draw the selected type of graph.

Notes

1. Don't use a Stacked-Bar or Pie graph if the data includes both positive and negative values. The display is potentially confusing.

2. To change an existing graph into another type, just select the new type and View it again.

3. After returning to Ready mode, you can enter new data into the specified graph ranges and then draw a graph updated with the new information. Just press the **[F10/GRAPH]** key.

4. You cannot overlay two types of graphs, e.g., Line over Bar.

5. 1-2-3 automatically labels each slice of a pie chart with the percentage it represents of the entire pie (e.g., 14.6%). Since these numbers are rounded off, their total may not be exactly 100%.

/Graph X /GX

Define an X-range of numeric values (XY graph) or optional labels (all other types).

Procedure

Specify a range. If the range is more than one column wide, 1-2-3 considers the values to be one long sequence, in column-by-column order.

1-2-3 remembers (page 7-14) the most recently used X-range, if any. When you issue the command, 1-2-3 offers to reuse this range: It highlights the range and shows the addresses of its upper left and lower right corner cells in the control panel.

Press **[ENTER]** alone to reuse the same range for graphing. You can press **[BACKSPACE]** to cancel this remembered range and return the pointer to the current cell. Otherwise, revise the range specification or enter a new one.

Line, Bar, and Stacked-Bar graphs: The range may contain any entries: labels, numbers, formulas, and empty cells. The entries act as horizontal axis labels—1-2-3 places the entries, evenly spaced, along the X-axis. Each entry is centered under the set of bars or data points for the corresponding set of A—F range values.

You can prevent X-axis labels from overprinting each other by specifying a *skip factor* (/Graph Options Scale Skip): Only selected entries from the X-range are placed along the horizontal axis.

Pie charts: The range may contain any entries: labels, numbers, formulas, and empty cells. The entries are placed outside the circle, as labels for the pie-slices. The first X-range entry labels the slice representing the first A-range value, etc.

XY graphs: Data points are plotted in the XY plane (Cartesian coordinates). Each A—F range value is paired with the corresponding X-range value.

/Graph A B C D E F /GA.../GF

Define up to six ranges of values to be graphed.

Procedure

Specify a range. If the range is more than one column wide, 1-2-3 considers the values to be one long sequence, in column-by-column order.

1-2-3 remembers (page 7-14) each of the most recently used ranges, if any. When you issue the command, 1-2-3 offers to reuse this range: It highlights the range and shows the addresses of its upper left and lower right corner cells in the control panel.

Press **[ENTER]** alone to reuse the same range for graphing. You can press **[BACKSPACE]** to cancel this remembered range and return the pointer to the current cell. Otherwise, revise the range specification or enter a new one.

Results

Pie charts: 1-2-3 will create a "slice" for each value in the A-range. For graphing purposes only, negative values are considered to be positive. Empty cells and label cells have zero values, producing slices with no width. The B-F ranges are ignored.

Bar and Stacked-Bar graphs: Each range's values are represented by a series of bars, which are spaced evenly from left to right. Each range's bars have their own color or B&W crosshatching pattern.

Line graphs: Each range's values are represented by a series of points, which are spaced evenly from left to right.

XY graphs: Each range's values are paired with the corresponding X-range values, then plotted on the XY plane.

In XY and Line graphs, points on each range are represented by unique shapes (square, triangle, etc.). You can specify whether or not the points are to be connected with /Graph Options Format.

Notes

1. At least one graph range is required for all graphs.

2. To cancel one or all of the graph range settings, use /Graph Reset.

3. After returning to Ready mode, you can revise the entries in the specified graph ranges and then draw a graph updated with the new information. Just press the **[F10/GRAPH]** key.

/Graph Reset /GR

Cancel individual range settings or all graph settings.

Procedure

1a. Choose Graph to cancel all graph settings. The Graph main menu returns.

or

1b. Choose one of the graph range letters (X, A, B, C, D, E, F). You remain in the /Graph Reset menu, making it easy to cancel another individual range.

Results

Graph: All current graph settings are cancelled. Graph settings that you've stored as named graphs are unaffected.

X, A—F: The particular graph range specification is cancelled. When you next View a graph, this range will not be represented. The Data-Labels range (page 16-21) associated with the particular range is also cancelled. But associated Legend and Format settings (pages 16-19, 16-20) are not cancelled: They will be reused if you specify the graph range anew.

Notes

1. Reset the X-range to keep 1-2-3 from using its entries as labels in Bar, Stacked-Bar, Line, and Pie graphs.

2. In many situations, you'll want to define several graphs for a single worksheet. With each graph, use /Graph Name to store the current graph settings under a name. Then, reset the graph and/or enter new specifications.

/Graph View /GV

Display a graph using the current graph settings.

The worksheet disappears and the graph appears. To restore the worksheet to the screen, press any key. The key you press has no other effect.

Note

When you are altering graph settings, the easiest way to redraw a graph is with View. When you are revising cell entries, the easiest way to redraw a graph is by pressing **[F10/GRAPH]** in Ready mode. (Since graph ranges are defined by cell locations rather than cell contents, you can revise entries and immediately redraw the graph. The new data are automatically incorporated.)

/Graph Save /GS

Store the image of the currently defined graph in a graph (picture) file (extension .PIC).

The PrintGraph program uses this file to produce a printed version of the graph.

Procedure

1. Specify the filename under which the graph image is to be stored: Point to its name or type its name.

If you don't use a disk prefix ("C:NEW_GRPH" means current directory on disk C, file "NEW_GRPH"), 1-2-3 creates a graph file in the current directory (/File Directory, /Worksheet Global Default Directory).

2. If a file with the specified name already exists, choose to Replace the existing file's contents with the new image, or to Cancel the command.

Choosing to Replace immediately erases the file's former contents. There is no way to recover this information. If you are updating a file, this may be exactly what you wish to do. Otherwise, Cancel the command.

Result

The graph image is stored in the specified file.

Note. This command does not save graph settings. To store settings, use the /File Save and /Graph Name Create commands.

/Graph Options Legend /GOL

Define legends that explain the colors, crosshatching, or symbols used in a graph.

Procedure

1. Select a graph range: A, B, C, D, E, or F. 1-2-3 displays the most recently entered legend for that range, if any, and switches to Edit mode.

2. Reconfirm the legend by pressing [ENTER] alone, or revise/replace the legend.

You can enter a legend up to 19 characters long directly. Alternatively, you can instruct 1-2-3 to use a cell's contents as the legend:

\cell-address or \range-name

In the latter case, 1-2-3 uses the contents of the range's upper left corner cell as the legend. Be careful if you use a cell address: 1-2-3 will not adjust the address if the cell is subsequently relocated by /Move, /Worksheet Insert, or /Worksheet Delete.

3. The /Graph Options menu returns.

Results

The next time 1-2-3 draws the graph, the legend text will appear at the bottom of the screen, next to an indicator.

Bar and Stacked-Bar graphs: The indicator shows the color or crosshatching pattern used for the range's bars.

Line and XY graphs: The indicator shows the symbol used to plot the range's data points.

Pie charts: Legends are ignored, since there is only one graph range.

Notes

1. Keep legends as short as possible because of display limitations.

2. If you reset a graph range (page 16-18), 1-2-3 remembers the associated legend specification. It will "reactivate" the legend if you define this range anew.

3. Be careful when specifying lengthy titles and legends. In some cases, the screen shows more characters than the printer can print. Thus, you may lose characters from the printed image.

/Graph Options Format /GOF

Specify the way in which 1-2-3 draws and connects data points in Line and XY graphs.

Procedure

1a. Choose a particular range: A, B, C, D, E, F

or

1b. Choose Graph to set the format for all ranges at once (you can subsequently override this standard format for individual ranges);

or

1c. Choose Quit to return to the /Graph Options menu.

2. Select a format option:

Line. For each range, the data-point locations will be connected with straight lines. No symbols will be plotted at the data points.

Symbols. For each range, a distinctive symbol (square, triangle etc.) will be plotted at each data point.

Both. Data points will be represented by symbols connected with lines.

Neither. Neither lines nor symbols will be drawn. Use Data-Labels (see below) to indicate the data-point locations.

3. The Format submenu returns, making it easy to assign additional formats.

Result

The next time 1-2-3 draws a graph, the range(s) you specified will be assigned the newly-chosen formats. 1-2-3 uses these symbols in Line and XY graphs:

A: □ B: + C: ◇ D: △ E: × F: ▽

Notes

1. If you choose the Neither format, you must specify Data-Labels in order to make the data points visible.

2. If you reset a graph range (page 16-18), 1-2-3 remembers the associated format specification. It will reactivate the format if you define this range anew.

/Graph Options Data-Labels /GOD

Specify a range whose entries will be placed onto the graph at the data-point locations.

Procedure

1. Choose the graph range to be labeled: A, B, C, D, E, F; or choose Quit to return to the /Graph Options menu.

2. Specify the cell range that will provide the data-labels.

   1-2-3 remembers (page 7-14) the most recently used data-labels ranges, if any. When you choose a range letter (A—F), 1-2-3 highlights the data-labels range currently assigned to it, showing the addresses of its upper left and lower right corner cells in the control panel.

Press [ENTER] alone to reuse the same data-labels range. You can press [BACKSPACE] to cancel this remembered range and return the pointer to the current cell. Otherwise, revise the range specification or enter a new one.

3. Choose a data-label alignment: Centered, Left, Above, Right, Below. (For instance, "Above" means that the data-label will be placed on the graph just above the corresponding data point.)

4. The Data-Labels submenu returns, making it easy to assign additional data-labels.

Results

The next time 1-2-3 draws a graph, the entries in the data-labels range will appear on the graph, exactly as they appear in the worksheet. Each data-label will be placed near (above, below, centered, etc.) the data point for the corresponding value of the graph range (A—F).

Bar and Stacked-Bar graphs: The alignment specification is ignored: 1-2-3 always centers data-labels above positive bars and below negative bars.

Pie charts: Data-label ranges are ignored.

Note

If you reset a graph range, 1-2-3 also cancels the corresponding data-labels range.

/Graph Options Titles /GOT

Specify a title for the entire graph and/or for the horizontal and vertical axes.

Procedure

1. Choose a type of title:

First. Appears centered at the top of the graph.

Second. Appears centered just below the First title.

X-Axis. Appears centered below the horizontal axis.

Y-Axis. Appears in "sideways" type to the left of the vertical axis.

When you make this choice, 1-2-3 displays the most recently entered title, if any, and switches to Edit mode.

2. Reconfirm the title by pressing [ENTER] alone, or revise/replace the title.

You can enter a title up to 39 characters long directly. Alternatively, you can instruct 1-2-3 to use a cell's contents as the title:

\cell-address or \range-name

In the last case, 1-2-3 uses the contents of the range's upper left corner cell as the title. Be careful if you use a cell address: 1-2-3 will not adjust the address if the cell is subsequently relocated by /Move, /Worksheet Insert, or /Worksheet Delete.

3. 1-2-3 returns to the /Graph Options menu. To specify another title, choose Titles again.

Result

The next time 1-2-3 draws a graph, it will include the title(s) you have specified.

Notes

1. When you print a graph using the PrintGraph program (page 20-1), the First title always appears quite a bit larger than the Second title. You can optionally specify different type styles for the two titles.

2. First and Second titles are independent of the names you use with /Graph Name and /Graph Save.

3. Be careful when specifying lengthy titles and legends. In some cases, the screen shows more characters than the printer can print. Thus you may lose characters from the printed image.

/Graph Options Grid /GOG

Specify inclusion or exclusion of a grid-line overlay.

Procedure

1. Choose one of the following options:

Horizontal. Starting at each Y-axis scale number, 1-2-3 will draw a horizontal line across the entire graph.

Vertical. At each tick mark along the X-axis scale, 1-2-3 will draw a vertical line from top to bottom.

Both. Both horizontal and vertical grid lines will be drawn.

Clear. Neither horizontal nor vertical grid lines will be drawn.

2. The /Graph Options menu returns.

Results

Non-Pie graphs: The new grid-line specifications will be reflected the next time 1-2-3 draws a graph.

Pie charts: This setting is ignored.

/Graph Options Scale /GOS

Determine the way in which numeric X-axis and Y-axis scales will be constructed and displayed.

Procedure

Select Y-axis, X-axis, or Skip. (X-axis numeric scaling applies only to XY graphs. The Skip factor applies only to Bar, Stacked-Bar, and Line graphs.)

If you select Skip, enter a skip factor.

The next time 1-2-3 draws a graph, it will use only some of the X-range entries as labels for the horizontal axis "tick marks". Example: If you enter a skip factor of 10, 1-2-3 will use the 1st, 11th, 21st,...X-range values only.

If you select Y-axis or X-axis, the Scale menu appears:

Automatic Manual Lower Upper Format Quit

This is a "sticky" menu. 1-2-3 returns here until you choose Quit. This allows you to specify several scale settings for the axis.

Automatic (default setting). Each time it draws a graph, 1-2-3 will determine optimal lower and upper scale values for the Y-axis and, if appropriate, for the X-axis. These values will make the graph fill the screen to the greatest possible extent.

Manual. You specify the lower and upper scale values. After you choose Manual:

1. Choose Lower and enter a number to indicate the smallest value to appear on the Y-axis scale.

2. Choose Upper and indicate the largest scale value.

(1-2-3 remembers the Lower and Upper settings and offers to reuse them when you reissue this command. You need not reenter a setting if you don't wish to change it. But you must enter both settings the first time you specify manual scaling.)

When 1-2-3 draws a graph with scales set manually, it may round off your lower and upper settings a bit. It is possible that some data points may "fall off" the graph. 1-2-3 does not inform you if this occurs.

Bar and Stacked-Bar graphs: When it draws a graph, 1-2-3 ignores a positive lower limit or a negative upper limit for the Y-axis scales. This ensures that the Y-axis scale includes zero.

Format. Specify a numeric display format for the scale numbers: Fixed, Scientific, Currency, , *(comma)*, General, + / −, Percent, Date (D1, D2, or D3), or Text.

The next time 1-2-3 draws a graph, the scale numbers for the chosen axis will be displayed in the chosen format.

Notes

1. Use manual scaling to "zero in" on an area of interest or to enforce uniform scaling in a set of similar graphs.

2. X-axis scale settings are ignored in all types of graphs except XY. In non-XY graphs, the horizontal scale has no numeric meaning.

3. All scale settings are ignored for Pie graphs.

4. Setting a graph scale format does not affect the way the graphed values appear in the worksheet.

5. With manual scaling, if a data range includes values that vary widely (e.g., 10, 20, 30, 1000000, 2000000), bars representing the large values may not be displayed at all.

/Graph Options Color /GOC
/Graph Options B&W /GOC

Specify display in different colors or in contrasting black-and-white crosshatch patterns.

Procedure

Choose Color or B&W.

Results

Color. Bars, lines, symbols, and legends are displayed in color.

B&W. Bars are crosshatched. Lines and symbols appear in white.

Range	Color	Crosshatching
A	Red	
B	Blue	
C	Green	
D	Purple (Magenta)	
E	Yellow	
F	Light Blue (Cyan)	

In both Color and B&W, all titles, scale numbers, axes, and grid lines are displayed in white. If you have a monochrome display screen, selecting Color produces white for each range.

Note

With the PrintGraph program and a color printer or plotter, you can print each graph range in its own color, even if you were using B&W when you saved the graph (/Graph Save).

/Graph Name Create /GNC

Store the current graph settings under a graph name.

Procedure

Enter a graph name (up to 15 characters): Point to an existing name in the menu, or type a new or existing name. Uppercase and lowercase letters are equivalent.

Results

1-2-3 stores the current graph settings under the specified name. When you save the worksheet (/File Save), all graph names are stored, as well. To reinstate graph settings stored under a name, issue the /Graph Name Use command.

If you use an existing name, 1-2-3 immediately replaces the old definition with the current graph settings. There is no confirmation step.

Notes

1. Use this command to create several graphs in a single worksheet. /Graph Name Use allows you to switch quickly among several named graphs.

2. /File Retrieve retrieves graph name definitions from a worksheet file. /File Combine does not.

3. /Graph Reset Graph does not cancel graph names. /Worksheet Erase does.

4. This command does not save a graph image for printing. Use /Graph Save for this purpose.

/Graph Name Use /GNU

Reinstate the graph settings stored under a graph name and draw the graph.

Procedure

Enter a graph name (up to 15 characters): Point to a name in the menu, or type an existing name. Uppercase and lowercase letters are equivalent.

Result

1-2-3 resets (*cancels*) all current graph settings, restores the settings stored under the specified graph name, and performs a /Graph View.

Note

Because a graph definition involves *graph range* specifications rather than actual data values, you can reuse a named graph even if cell entries have changed.

/Graph Name Delete /GND

Delete one graph name.

Procedure

Enter a graph name (up to 15 characters): Point to a name in the menu, or type an existing name. Uppercase and lowercase letters are equivalent.

Result

The specified graph name is immediately erased from memory. There is no confirmation step. The graph settings currently in effect are not cancelled.

Note

To delete all graph names, use /Graph Name Reset.

/Graph Name Reset /GNR

Cancel all graph names.

Result

All graph names are immediately erased from memory. There is no confirmation step. The graph settings currently in effect are not cancelled.

Note

/Graph Reset Graph does not cancel graph names. /Worksheet Erase does.

17. Data Commands

1-2-3's /Data commands create and process information in tabular form—numbers, formulas, letters, words, and phrases. Some of these commands are extensions of 1-2-3's calculation ability, enhancing its speed and flexibility. These commands can reduce to a single step what might otherwise require many steps.

In addition to enhancing 1-2-3's already impressive ability to calculate, the /Data commands open up an entirely new area of information processing—database management. 1-2-3 becomes a tool for record keeping as well as for financial planning and numeric analysis.

By helping you to organize information neatly into rows and columns, the /Data commands also make it easy for you to use the /Graph command. In this way, you can display data and the results of calculations in a simple, dramatic manner.

Database Management

You will find that a database is an enormously useful tool. Records of all types: sales, personnel, checks, addresses, parts, telephone numbers, computer disks, almost anything you have more than three of, can be usefully organized in a database.

What makes a database so useful is that you can put your finger on just the information you need, in the form you want it. You could print a list of all salespeople with over $100,000 in December sales. Or find out which parts are almost out of stock. Or print separate lists of private and business telephone numbers. Or prepare a graph of average sales per salesperson per month in each of six stores. Or print the names of all your friends with birthdays next month.

Most database management systems (DBMS) require you to learn procedures that are entirely different from those you use in calculation programs. But 1-2-3's data-management capability is fully integrated. Data records are stored in the same simple columns-and-rows structure as all other entries. The /Data commands that process databases are invoked in the same way and have much the same "flavor" as other 1-2-3 commands.

Let's run through some basic definitions of the various aspects of a database.

A 1-2-3 **database** is a cell range consisting of one or more columns and at least two rows. The first row contains **field names** (page 17-3). Each subsequent row of the database is a **record**—information to be processed as a unit. Typically, a record consists of the name of some item of interest (customer, machine part, sales prospect, etc.) along with all additional data that apply to the item. Figure 17-1 contains typical examples of records.

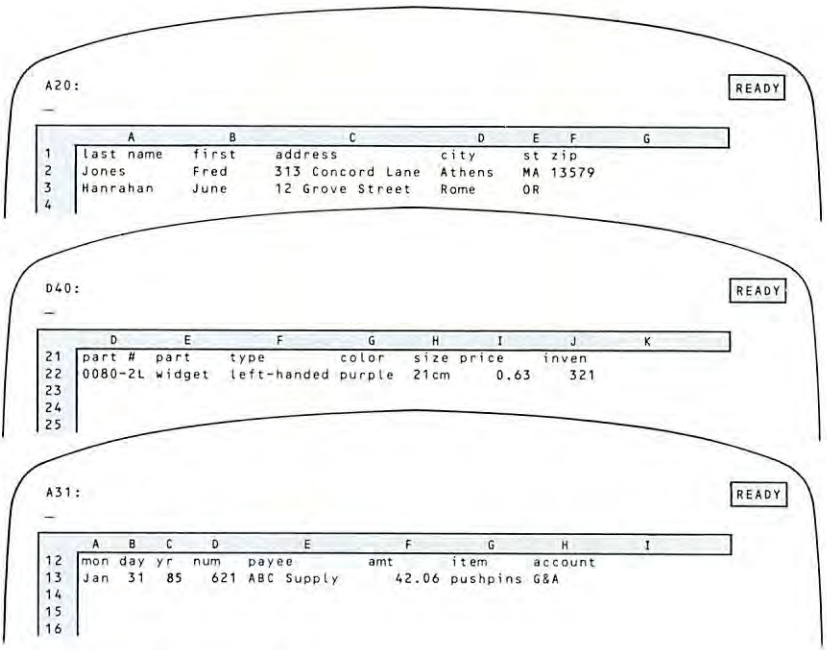


Figure 17-1. Examples of Records

Note that each record in these examples consists of several pieces of information. Each piece is stored as a cell entry. To keep things organized and neat, the same type of information is stored in the same column for each record. For instance, column F in the first example stores each customer's ZIP code.

Each column in a database is called a **field**. (Sometimes, we'll use this term to indicate the entire column, and sometimes we'll use it to indicate an entry in a particular row. The meaning should be clear from the context.) A 1-2-3 worksheet has a total of 256 columns, and you can use all of them to create your database. But the maximum width of Criterion and Output ranges used with the /Data commands is 32 fields (pages 17-28 and 17-30).

This terminology makes it easier to describe the contents of a database. For instance, we can make the following statements about the examples illustrated above:

- The "zip" field in Mr. Jones' record is 13579.
- The "zip" field in Ms. Hanrahan's record is blank.
- The "amt" field for check number 0621 is $42.06.

By the way, don't worry about what order the records are in; you'll be able to rearrange them later, very easily.

Field Names

In each of the examples above, the top row of the database is occupied by labels that identify the contents of each column. Not only are these labels useful, they're a requirement:

- The first row of a database to be processed by the /Data Query command must consist of labels. These labels act as the database's *field names*. In any one database, no two fields may have the same name.

You will be using these field names to tell 1-2-3 just which fields of which records you want to look at, or print, or plot, or base calculations on. And that is what makes a database so useful. You get just the information you need—1-2-3 gets you that information fast.

Note. Be careful not to precede or follow a field name with a blank space. 1-2-3 knows when [SPACE] characters are present and includes them as part of a field name, sometimes with unintended results, even though they are invisible on the screen.

A Database Is a Collection of Cell Entries

A database is a particular way of using the worksheet's column-row structure to store information. That's why 1-2-3's database capability is so easy to use. Up until the time that you use the /Data commands to process a database, it's just a collection of cell entries. That means that you can use all of 1-2-3's power and flexibility in creating and revising data records. Some of the tasks that are most cumbersome (if not impossible) for other database-management programs are simple for 1-2-3:

Adding another field to the database. With 1-2-3, you just use another column. The /Worksheet Insert Column command allows you to place new columns wherever you wish.

Adding another record to the database. Use the /Worksheet Insert Row command.

Rearranging the fields in a database. Use the /Worksheet Insert Column and /Move commands.

Assigning a group of records the same value in a certain field. Use the /Copy command.

Updating the contents of a field. Move the cell pointer to the incorrect entry and revise it using Edit mode. Or just type the new information to replace the incorrect entry.

Determining field widths. This task is particularly tricky if the number of characters to be stored is not the same as the number of characters to appear in reports. In 1-2-3, each cell can store up to 240 characters. You can use the /Worksheet Column-Width command to determine how much of the actual contents of each cell appears in the worksheet and, therefore, in printouts. And you can change that setting as often as you want.

Determining the formats for numbers and the alignment of labels in their cells. Use the /Range Format and /Range Label-Prefix commands.

Printing selected fields. Specify an appropriate /Print Range. To print nonadjacent fields, use /Print Options Borders Columns.

Printing the field names along the top of each page of the printed database. Use /Print Options Borders Rows.

Keeping field names on the screen while scrolling through the database. Use /Worksheet Titles Horizontal.

The /Data Commands for Database Management

But what about the common database-management operations that aren't ordinary 1-2-3 commands? These include:

- Searching for a particular record.
- Sorting records alphabetically, chronologically, or by some other criterion.
- Locating all records that satisfy certain conditions.

That's where the /Data commands come in. In a consistent, easy-to-learn manner, 1-2-3 integrates a powerful database-management capability with its calculation, graphing, and worksheet-management capacities.

/Data Sort

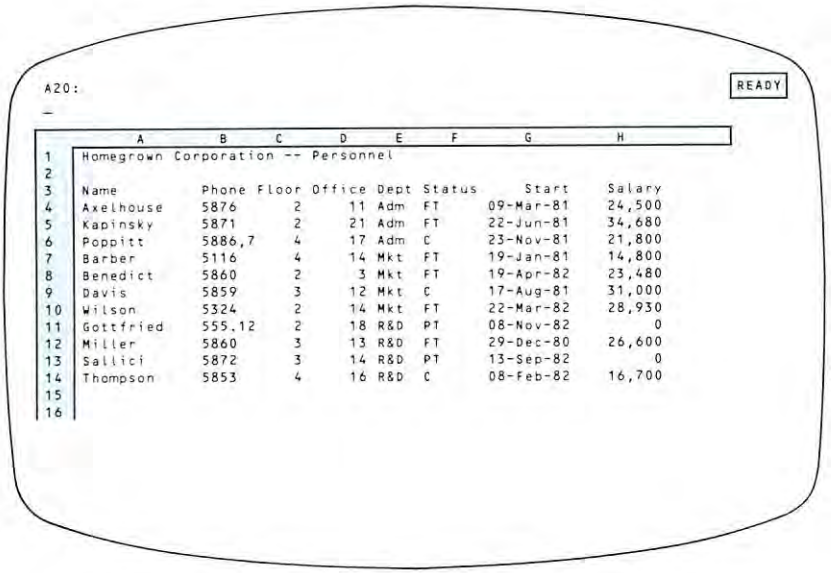
One thing you want to be able to do with a database is change the order of the records. (In fact, it is often useful to change the order of rows of entries in other kinds of ranges as well.) For instance, an address list may be in alphabetical order but you want to change it to zip code order. Your personnel list may also be organized alphabetically, but sometimes you want a list in order of salary, or hiring date.

Before you do any sorting at all, you have to tell 1-2-3 where the database is.

1. When you select the /Data Sort command, you will see a menu.
2. Select Data-Range and specify the database. Do not include the field names.

The field that determines the order of the records is called the *key*. If your key is "hiring date", you may want to see the last employee hired at the top of the list, or you may want to have the list sorted so that the first employee hired is at the top. When you specify a key, 1-2-3 asks you if you want the values of the key field in Ascending (smallest first) or Descending (largest first) order.

What about putting your personnel list in order by department? You can do it, of course, but many records have the same entries in the "Department" field. What you really want is to sort the list by "Department", and within each department, sort the personnel alphabetically by "Name". 1-2-3 lets you do this by letting you specify both a Primary and Secondary key. In this case, the "Department" is the Primary key and the "last name" is the Secondary key (Figure 17-2).



	A	B	C	D	E	F	G	H
1	Homegrown Corporation -- Personnel							
2								
3	Name	Phone	Floor	Office	Dept	Status	Start	Salary
4	Axelhouse	5876	2	11	Adm	FT	09-Mar-81	24,500
5	Kapinsky	5871	2	21	Adm	FT	22-Jun-81	34,680
6	Poppitt	5886,7	4	17	Adm	C	23-Nov-81	21,800
7	Barber	5116	4	14	Mkt	FT	19-Jan-81	14,800
8	Benedict	5860	2	3	Mkt	FT	19-Apr-82	23,480
9	Davis	5859	3	12	Mkt	C	17-Aug-81	31,000
10	Wilson	5324	2	14	Mkt	FT	22-Mar-82	28,930
11	Gottfried	555.12	2	18	R&D	PT	08-Nov-82	0
12	Miller	5860	3	13	R&D	FT	29-Dec-80	26,600
13	Sallici	5872	3	14	R&D	PT	13-Sep-82	0
14	Thompson	5853	4	16	R&D	C	08-Feb-82	16,700
15								
16								

Figure 17-2. A Database Sorted by Name Within Department

3. Select Primary-Key and specify the column of the primary key field. Then tell 1-2-3 whether you want the records to be sorted in Ascending or Descending order of the values in this column.

4. The Secondary-Key is optional. It is used to break "ties" that occur when two or more records have the same entry in the Primary-Key field. If you want one, select Secondary-Key, specify the column and the order, Ascending or Descending. The order does not have to be the same for both keys.

5. Select Go to tell 1-2-3 to go ahead and rearrange the records according to your specifications.

Note. Any [SPACE] character at the beginning or end of a cell entry may affect the order of sorted labels. For example: "A [SPACE]" comes after "A" in sort order.

After the sort is done, 1-2-3 returns to Ready mode. 1-2-3 remembers all your specifications, so the next time you sort the same database, just select the specifications you want to change before you select Go. To make 1-2-3 forget all your specifications, select Reset.

Remember: /Data Sort works on any range in any worksheet.

/Data Query

The /Data Query operations select records from a database, using *selection criteria* that you specify. There are four Query operations:

Find. 1-2-3 highlights each selected record.

Extract. 1-2-3 copies each selected record to another part of the worksheet. You can make partial copies, too (selected fields only).

Unique. 1-2-3 extracts records, making sure no two copies are the same.

Delete. 1-2-3 removes selected records from the worksheet, closing up the blank space.

The selection conditions you specify may be simple:

- Select all records whose "Last Name" field is Smith.
- Select all records whose "Last Name" field begins with Mc.
- Select all records whose "Credit Limit" field is 5000.
- Create a list of all states in which there are customers.

Or the conditions may be complex:

- Copy the names and addresses of all accounts in which the "Balance" field exceeds the "Credit Limit" field and whose "Dunning Letter" field is not Yes.
- Select all records in which the "Late Payments" field exceeds 3 or the "Balance" field exceeds the value entered in cell C2.
- Select all records meeting either of the previous two conditions.
- Select all records in which the "Daily Gross" field is less than that in the previous record.
- Delete all records of customers who have not ordered since January 1, 1981, and whose last order was less than $350.00, except for those of Frederick J. Pennywhistle, Freetown, VT.

In addition, you can obtain information such as the sums, averages, even the standard deviations of fields in the database, for a particular field in those records that fit the conditions.

To do all this, you must prepare two or three special ranges before issuing the /Data Query command: the Input, Criterion, and optional Output ranges (Figure 17-3). These three ranges are described below: first the Input range, then the Criterion range (this description will take several pages), and then the optional Output range.

The Input Range

When using the /Data Query commands, the database itself, including the field names at the top, is called the Input range. In Figure 17-3, the fields are: "Name", "Phone", "Floor", "Office", and "Dept".

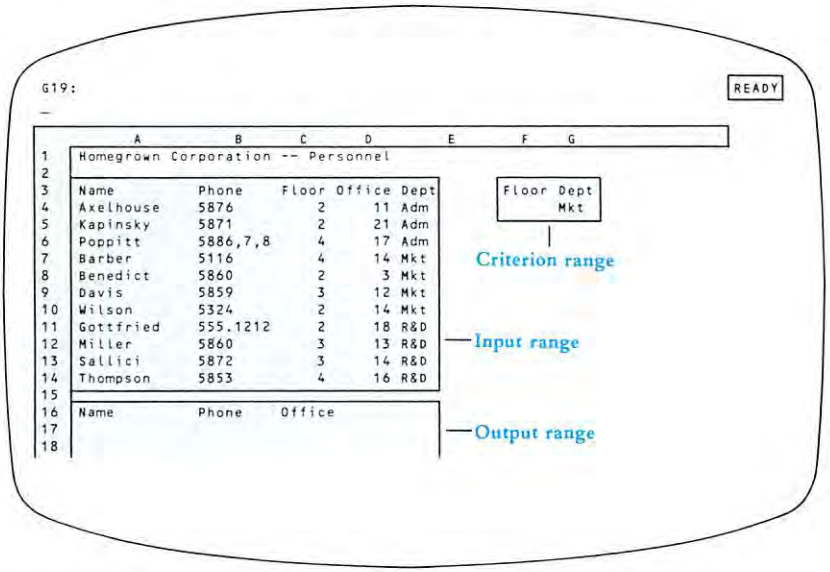


Figure 17-3. /Data Query Ranges

The Criterion Range and Criteria

The Criterion range is required. It tells 1-2-3 which records to select. It consists of two or more rows; the first row contains some or all of the Input range field names. The following rows contain the Criteria.

In Figure 17-3, the Criterion range consists of two rows in two columns. In the first row are two of the five database field names, "Floor" and "Dept". Under "Dept" is one of the possible "Dept" entries, "Mkt" (short for Marketing); the cell under "Floor" is blank.

"Mkt" is a *criterion*, an entry that tells 1-2-3 which records to select. This one tells it to select only those records which have the label "Mkt" in the "Dept" field.

Imagine that records have to pass through a "gateway" before they're allowed to be selected. The criterion is the rule that 1-2-3 (the gatekeeper) uses to decide whether a record is allowed to pass.

Empty cells in the Criterion range are open gates; an empty row allows all records to be accepted: be aware of the number of rows you include when you initially specify the location of your Criterion range. If a record can pass through the gates in any row, it is selected. It need not be able to pass through all the rows of the Criterion range. (See "More Than One Criterion", page 17-10.)

• Other than blank cells, there are three types of criteria: label-matches, number-matches, and formulas.

Matching Criteria: Label-Matches and Number-Matches

You enter a number or label in the Criterion range, below any field name. During a Query operation, 1-2-3 will examine the field in the database with the same field name. The record is allowed to pass if the value in the appropriate database field matches the criterion.

Label-Match Criteria

In our example, the label "Mkt" is compared with the label in the "Dept" field of every record. Only those records with "Mkt"in the "Dept" field are allowed to pass.

Note. Trailing blank spaces in either data records or criteria can prevent entries that appear identical from matching.

Actually, with label criteria, the labels need not match exactly if you include any of these three special characters: "?", "*", and "~". When any of these appear in the label in the Criterion range, you are instructing the gatekeeper that you want it to pass more than one specific label.

? matches any single character, so "h?t" matches "hat", "hot", and "hut", but not "huts". You can use more than one ? in a label: "h??d" matches "hood" and "head", but not "heel".

* matches all characters to the end of the label, so "cat*" matches "cat", "catsup", and "catechism", but not "cutthroat".

The tilde character (~) at the beginning of a label instructs 1-2-3 to accept any label except the one following the tilde. (Empty cells, however, are never selected by any label-match criterion.)

Examples: ~Smith selects all records with a non-empty Name entry other than Smith. ~S* selects all records with a non-empty Name entry that do not begin with S.

Number-Match Criteria

Number criteria are used in a similar manner. A record is selected if the number, or value of the formula, in the appropriate field of the Input range is equal to the criterion value. Input range cells in the database that are blank or contain labels are considered to have a value of zero.

Formula Criteria (Numeric Comparisons)

The last type of criterion, a formula, is different from labels and numbers. When you select the desired /Data Query command the criterion formula is recalculated once for each record, each time substituting a value from a specified field in the record. If the formula is *TRUE*, meaning it has a numeric value other than zero, the record is accepted.

Note. You may not use the seven database statistical functions inside the Criterion range.

Follow this rule in creating formula criteria:

Write the formula as a test of the first record (second row) of the database. Be sure that:

- Cell addresses that refer to database fields are relative (e.g., C2 or NAME).
- Cell addresses that refer to reference values outside the database are absolute (e.g., K21 or $NAME).

A formula criterion works because of its cell addresses, not because of its position: it doesn't matter in which column of the Criterion range you put the formula.

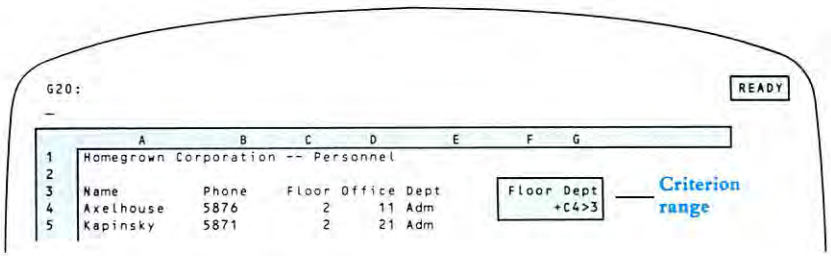


Figure 17-4. A Formula Criterion

The criterion in the example selects records of people in offices above the third floor. It does not matter that it is in the column headed *Dept.*; its function as a criterion is defined by the relative address +C4 to the *Floor* field in the first record of the database (i.e., the second row of the Input range).

The formula is evaluated once for each record in the database. 1-2-3 sequentially replaces +C4 in the formula with the "Floor" field's cell address in each record. So, for the second record, +C5 is used in the formula, and so on down to the bottom of the database. A particular record is selected if the formula is valued *TRUE* (non-zero).

You can make it easier to write and read criterion formulas if you first use the /Range Name Labels Down command to make each field name the range name of the cell just below it in the first row of the database. Give all cells in the Criterion range the numeric display format Text.

Formulas can refer to more than one field, as shown in Figure 17-5. This formula selects records of people whose salary increased more than 10% between 1981 and 1982.

Formulas can even include references to more than one record in the same database, as shown in Figure 17-6. This formula selects records of days in which the value of the stock dropped more than 0.5 points.

Note. The second cell reference in the formula is to the record above the one being tested. When 1-2-3 evaluates the formula for the first record, this reference will refer to a field name cell. Labels have a value of zero, so the first record will not be selected. In this case, this is what you want. In general, when writing criteria formulas that refer to cells in more than one record, be careful of what happens at the top and bottom of the database.

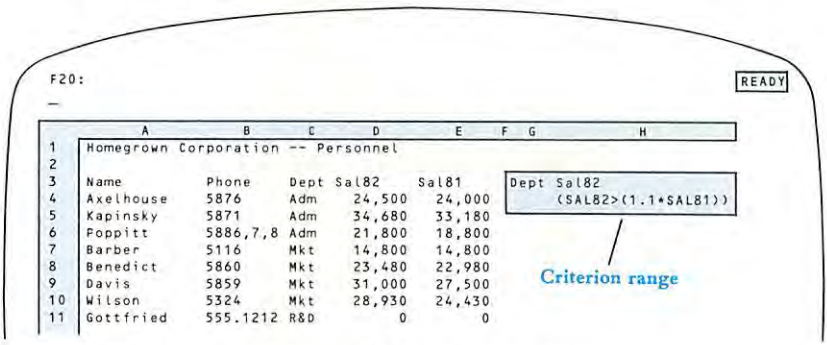


Figure 17-5. Formula Criterion—More Than One Field

More than one criterion. We've already covered quite a lot. But 1-2-3 can do much more. To answer questions like, "What are the names of all the right-handed outfielders batting over .280 in Boston, New York, and Philadelphia?", 1-2-3 has to be able to use more than one criterion at a time. And it can!

There are two ways in which multiple criteria are used:

1. A record can be selected only if it fits all the criteria, e.g., both Criterion A and Criterion B, or

2. A record can be selected if it fits any one of the criteria (e.g., either Criterion A or Criterion B).

You tell 1-2-3 how to combine your criteria by where you put them in the Criterion range:

- Criteria in the same row are combined with "and". For a record to pass, it must fit both Criterion A and Criterion B.

• Criteria in different rows are combined with "or". For a record to pass, it must fit either Criterion A or Criterion B.

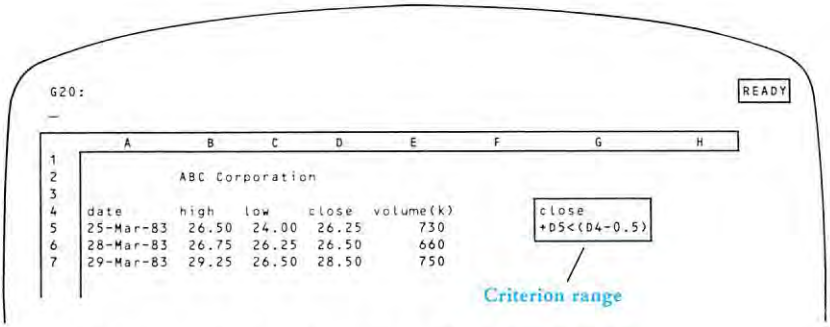


Figure 17-6. Formula Criterion—More Than One Record

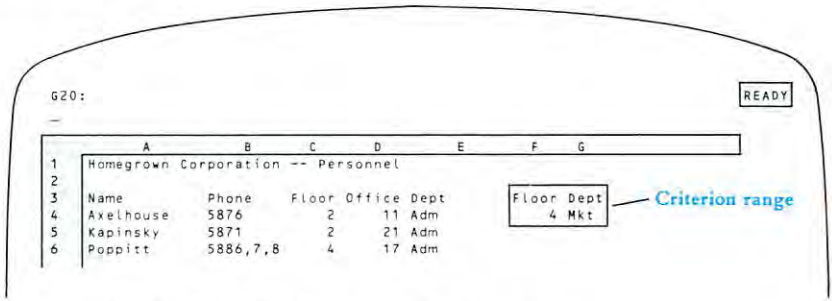


Figure 17-7. "And"—Two Criteria in the Same Row

Using our gate analogy, we can think of each row in the Criterion range as a narrow chute with a number of gates. A record gets through any one chute only if it passes gate A and gate B and gate C, etc. But to get through, it can go through the first chute (row) or the second chute or the third chute, etc.

Figure 17-7 shows a Criterion range that could be used to produce a list of personnel who are on the fourth floor and are in the Marketing Department.

And Figure 17-8 would give you a list of everybody on the fourth floor plus everyone in Marketing regardless of their floor: to be selected, a record must indicate the fourth floor or the Marketing Department.

Lastly, to get a list of people in the Marketing Department on the second and fourth floors use the Criterion range shown in Figure 17-9. Note that the label "Mkt" is repeated in both rows, guaranteeing that only Marketing Department personnel will be listed. This Criterion range means: "To be selected, a record must be of a person on the second floor and in marketing, or of a person on the fourth floor and in marketing".

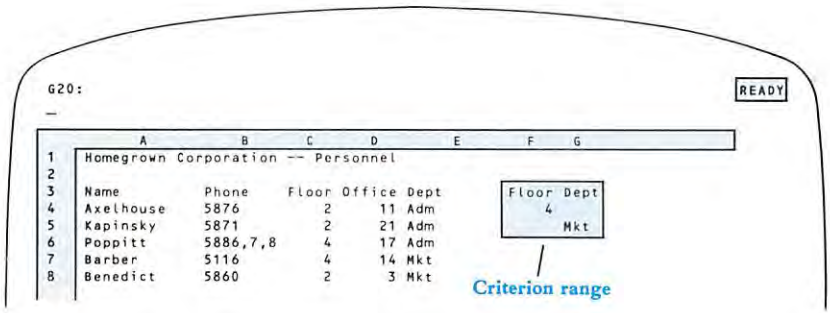


Figure 17-8. "Or"—Two Criteria in Different Rows

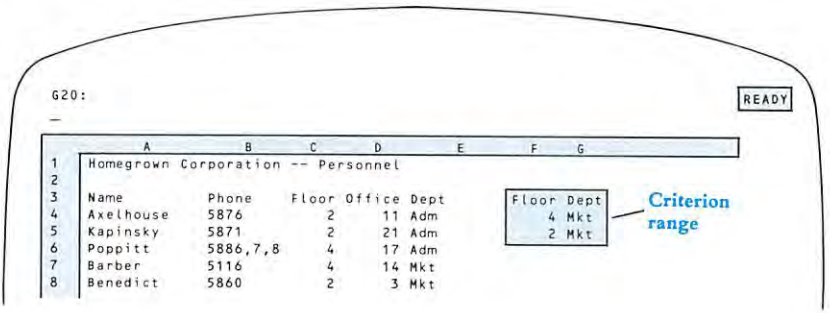


Figure 17-9. Four Criteria at Once

By now it should be apparent that the number of possible criterion combinations is limitless. With a little experimentation, you will be able to specify just those records you need.

The Output Range

The third /Data Query range—the Output range—is required only if you intend to make copies of the data records (Extract and Unique).

The first row of the Output range contains the field names of the database fields you want to be copied. These must be identical to the corresponding field names in the Input range, but may be in any order. The rest of the Output range should be empty or expendable, since 1-2-3 is going to copy data into it. In our continuing example, if you place only the "Name" and "Phone" field names in the Output range, 1-2-3 will make copies of those fields only.

You have the option of specifying an Output range that is just one row deep—the row of field names. By doing this, you tell 1-2-3 to use the entire area below the field names, down to the bottom of the worksheet, to copy the output records. 1-2-3 erases all but the top (field names) row of the Output range before making copies, so make sure there is nothing you need below a one-row Output range.

Summing Up the /Data Query Ranges

To recapitulate, before using /Data Query:

1. Prepare an Input range—your database with field names at the top of each column.

2. Prepare a Criterion range with some or all of the database field names in the top row and criteria (labels, numbers or formulas) in the remaining row(s).

3. If you are using the /Data Query Extract or Unique commands to create copies of some or all fields of some of your records, prepare an Output range with the names of the fields you want copied in the top row.

We've finally described all the ranges you have to prepare before actually using /Data Query, and you may be wondering if it's all worth it. The key to the usefulness of the /Data Query commands is the fact that they can be used time and again. Once you have specified the ranges, 1-2-3 remembers them, and you don't have to think about them again until you want to change their positions. You can change their contents without having to re-specify them, and in fact, that is how these commands are usually used. The range specifications, like the actual data, are part of the worksheet. By simply changing criteria, you can quickly Find or Delete, Extract or Uniquely extract, the records you need.

The Query Operations

Having defined an Input range (database), a Criterion range (selection criteria), and perhaps an Output range (area to receive copies)—now you're ready to perform any of the four Query operations: Find, Extract, Unique, and Delete.

Find

The Find operation simply points out selected records to you. When you select Find, the cell pointer moves to highlight the first record that satisfies the selection criteria. Thereafter, ↑ and ↓ move the pointer among all the selected records. **[HOME]** and **[END]** move the cell pointer to the first and last records in the database, whether or not they satisfy the criteria. If the database is too wide to fit on the display screen, you can use ← and → to scroll back and forth among the fields.

Use Find for quick access to a few records, to look up a telephone number or a catalog number. For instance, you could create a database of a company telephone list, including name, department, and position. When someone calls and asks for a person, either by name or by position, write that information into the Criterion range, and use /Data Query Find. The appropriate record is highlighted. Once the ranges have been specified, and the command used once, you can return to Ready mode to perform other work, then enter new names or titles into the Criterion range and instantly repeat the operation by pressing **[F7/QUERY]** (page 17-14).

Extract

The Extract function makes copies of specified fields of all records that satisfy the selection criteria. The copies are placed in a separate location that you specify, the Output range.

Use Extract to copy just the information you need to a specified area of the worksheet, often for printing. You could print telephone lists by floor, or by department. Or a list of files to be pulled in the file room.

Unique

The Unique function is a variant of Extract. It weeds out duplicate copies, guaranteeing that no two of the copied records in the Output range are identical.

Performing a Unique operation with a blank criterion row can be useful. An empty Criterion range row causes all records to be selected. But the Unique operation weeds out duplicates. If you specify a one field Output range, the result is a list of all existing values in that field.

Example: For a Name-Address database, you specify a Criterion range that consists of the field name "State" and an empty cell below it. Specify an Output range that consists of the field name "State" only. When you issue a /Data Query Unique command, 1-2-3 produces a list of all "State" entries in the database.

Delete

The Delete function removes from the database all records that satisfy the selection criteria. Remaining records move upward to fill in the resulting empty space. To ensure that no information is accidentally lost, 1-2-3 asks you to confirm your order to Delete records.

This is a database maintenance function. You might use this to purge a database of long-inactive accounts.

The [F7/QUERY] Key

The keyboard has a special function key to help you make repeated use of 1-2-3's database-management abilities: to use the same /Data Query command over and over, after changing criteria or data, with just the press of a single key.

If you press [F7/QUERY] in Ready mode, 1-2-3 repeats the most recent Query operation—Find, Extract, Unique, or Delete—using the same database (Input range), the same Criterion range, and the same Output range (if any).

To make 1-2-3 forget the Query ranges, and the last Query command, select /Data Query Reset.

The Database Statistical Functions

Perhaps the biggest payoff of 1-2-3's database-management capability is its synergy or cooperative action with other aspects of the program. All of the powerful features that you've used in other contexts can be applied to databases, too: formulas that define relationships among cells, automatic recalculation of these formulas, data transfer using /Copy and /Move, etc.

Since calculation is one of 1-2-3's strong points, you might expect the program to offer some facilities for numeric analysis of a database. You'd be right—there are database counterparts to 1-2-3's statistics functions: @SUM, @AVG, etc. They have the same names as these functions, with the addition of the letter "D" after the "@". Like their cousins, these database functions are actually a type of formula, but they are designed to use values selected from a database.

Each of these functions uses a set of selection criteria to select records from a database (much like the Query operations). Using only one field of the selected records, the function performs a statistical operation.

These functions have the form:

@functionname (Input range,offset,Criterion range)

- Input range and Criterion range have exactly the same meanings here as in the /Data Query commands. They specify the database to be analyzed (don't forget the field names row) and the selection criteria with which to test the data records.

Specify these ranges either with range names or with cell addresses. If you intend to copy the formula you're entering, you'll want to make these ranges absolute (e.g., $DATARECS or F10..J150).

- The *offset* tells 1-2-3 which field (column) in the database to use in its calculation. To determine the offset, count the columns in the Input range starting with zero for the first column; the next column is 1, etc. The number of the column (field) of interest is its offset. The contents of cells in this column, for records selected by the criteria in the Criterion range, are used by the function in its calculations.

The database statistical functions are:

@DCOUNT: Counts the non-blank cells in the offset field of the selected records.

@DSUM, @DAVG, @DVAR, @DSTD, @DMAX, @DMIN: Using the values in the offset field of the selected records, finds the sum, average, variance, standard deviation, largest value, or smallest value.

Example: Using a database of sales transactions (Figure 17-10), you could obtain the total sales, number of sales, and largest sale for any salesperson. The transaction "amount" field is in column 2 of the database (recall that the first column is numbered "0"). Type the name of the salesperson in the row of the Criterion range below the field name "Name", recalculate the worksheet if necessary, and the resulting values of the formulas give you the numbers you want.

total sales = @DSUM(DB,2,CRIT)
number of sales = @DCOUNT(DB,2,CRIT)
largest sale = @DMAX(DB,2,CRIT)

You can see that these functions are powerful tools. A logical use for database functions is creation of tables (e.g., a list of all the sales people) with figures like the ones shown above (total sales, number of sales, largest sale) across from each name, under appropriate column headings. Using the commands discussed so far that would be possible but tedious. A solution is presented in the next section.

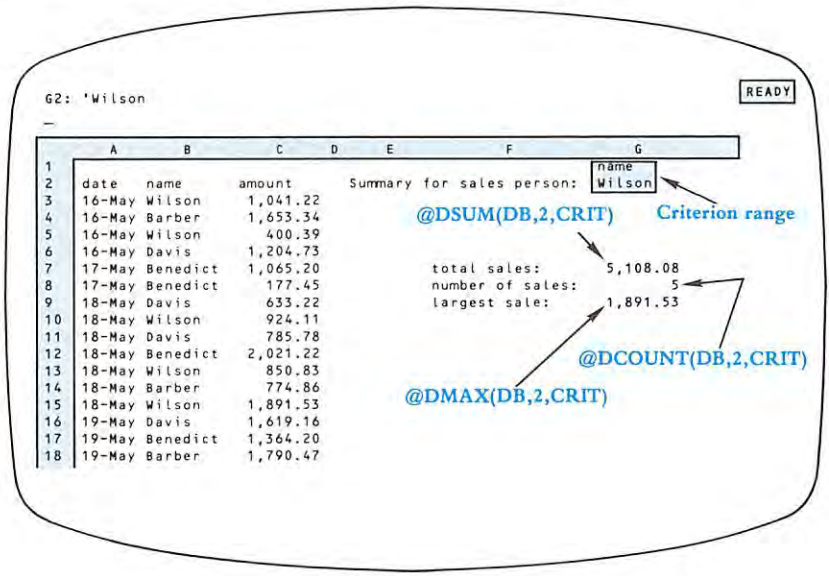


Figure 17-10. Using Database Statistical Functions to Construct a Table

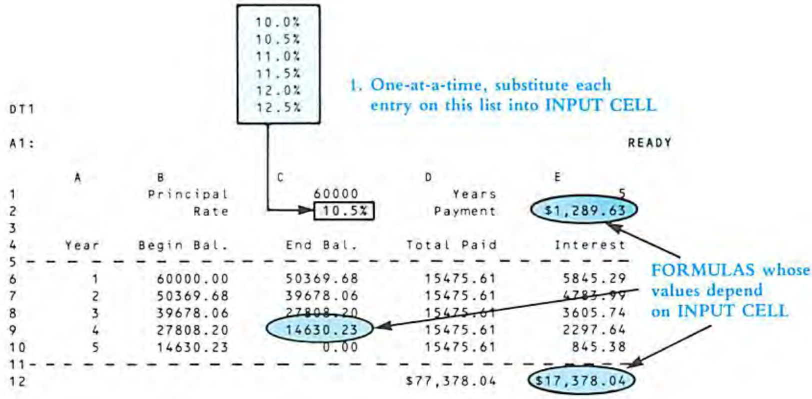
/Data Table

One of 1-2-3's main strengths is that it allows you to try out different values and see what happens. More precisely, you can change the entry in an *Input* cell and see how formulas in various *Output* cells change in value. For instance, you can find out how your projected bottom line changes if you sell 500 units next month, or 750, or 1000.

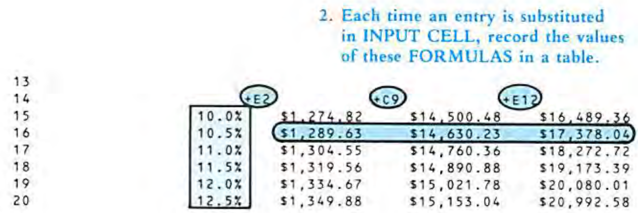
The /Data Table commands allow you to automate and organize this "what if" process. /Data Table 1 tries out a list of entries in one *Input cell*. /Data Table 2 uses two Input cells—it tries out pairs of entries taken from two separate lists. In both cases, 1-2-3 creates a table that records specific results of the "tryouts": the values of formulas that refer to the Input cell(s).

/Data Table 1

This diagram illustrates the single Input cell concept:



And here is how you make this concept a reality with the /Data Table 1 command:

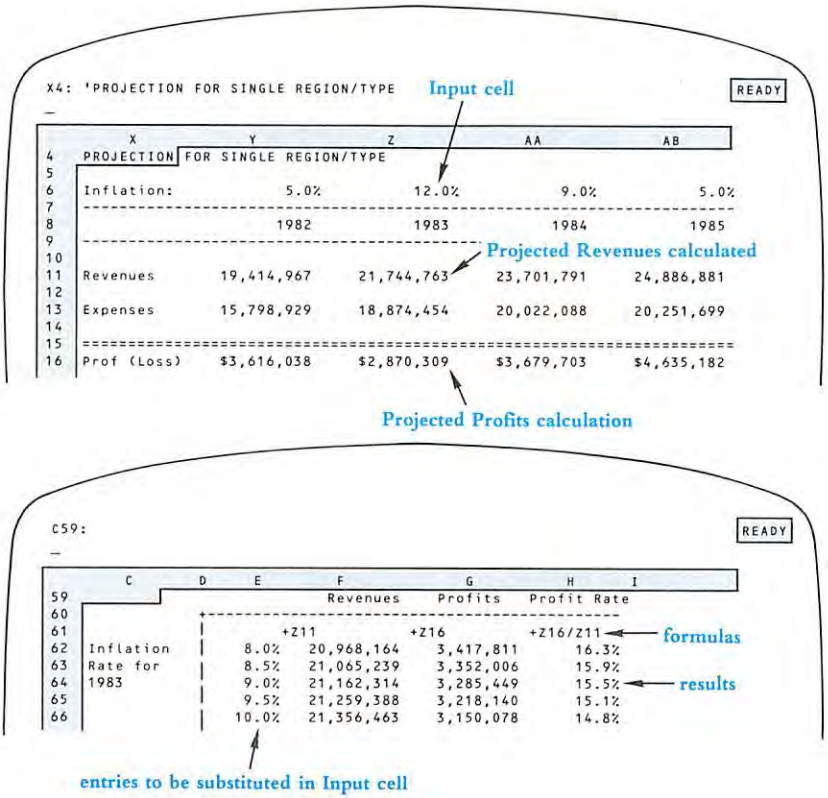


Note. If the worksheet already includes a formula which depends on the input cell, there's no need to enter it again in the top row of the data table. Just enter a reference to the formula. For example:

The Input cell is D14. Cell H50 contains a formula which depends on the input cell: +A1+D14*50. You needn't enter "+A1+D14*50" in the table; enter "+H50" instead.

Example: We would like to construct a sensitivity analysis table, showing the degree to which the Revenue and Profit projections are "sensitive" to changes in the projected inflation rate.

Data



For our present purposes, we need not be concerned with the details of the Revenue and Profit calculations. We need only know that:

- You enter a 1985 projected inflation rate in cell Z6.
- 1-2-3 calculations for both the Revenues projection (cell Z11) and the Profits projection (cell Z16) for 1985 depend on the inflation rate—that is, on cell Z6.

To construct the data table, we enter a variety of interest rates in cells E62..E66. Then we enter formulas in cells F61..H61: In F61, we "bring down" the Revenues projection with the formula +Z11; in G61, we "bring down" the Profits projection with the formula +Z16. The ratio of Profits to Revenues is not calculated elsewhere in the worksheet. So we can enter a "new" formula in cell H61: +Z16/Z11.

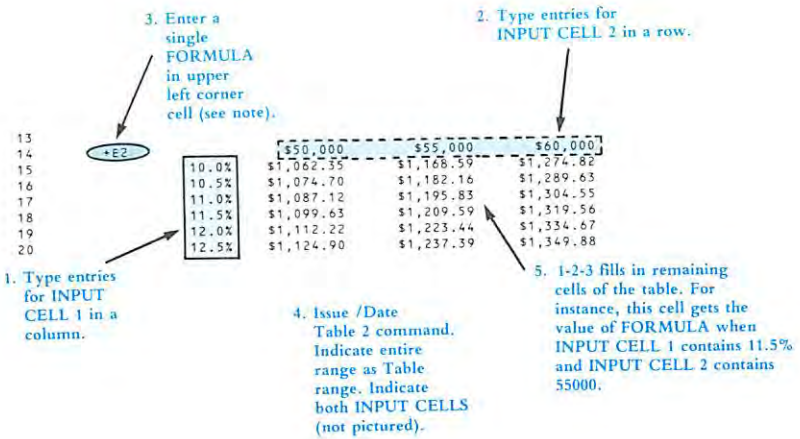
Finally, we perform the /Data Table 1 command, specifying E61..H66 as the Table range and Z6 as the Input cell.

/Data Table 2

This command is a natural extension of /Data Table 1. Instead of trying out a single list of entries /Data Table 2 processes two lists. It tries out all possible pairs—one entry from each list—in two Input cells, and tabulates the effect on a single formula. Here's an illustration of the /Data Table 2 implementation:

READY

	A	B	C	D	E
1		Principal	60000	Years	5
2		Rate	10.5%	Payment	$1,289.63
3					
4	Year	Begin Bal.	End Bal.	Total Paid	Interest
5					
6	1	60000.00	50369.68	15475.61	5845.29
7	2	50369.68	39678.06	15475.61	4783.99
8	3	39678.06	27808.20	15475.61	3605.74
9	4	27808.20	14630.23	15475.61	2297.64
10	5	14630.23	0.00	15475.61	845.38
11					
12				$77,378.04	$17,378.04



Note. As with /Data Table 1, there's no need to re-enter a formula that already exists in the worksheet. Just enter a reference to the formula.

Example: Input cell 1 is B6. Input cell 2 is H10. Cell F25 contains a formula which depends on both input cells: $35+(1-B6)*H10$. You do not need to enter $+35+(1-B6)*H10$ in the table; enter +F25 instead.

You can use /Data Table 2 to perform a sensitivity analysis, just as in the Revenues/Profits example above. But let's look at another application: creating a table of database statistics. For this purpose, you enter a database statistical function in the Table range's upper left corner cell.

Example (Figure 17-11): A sales personnel database includes the fields Month, Day, Name, and Amount. A Criterion range has been created that has two match-entry cells: (1) a Name match-entry can be typed in cell G2; (2) a Month match-entry can be typed in cell F2.

We can use the @DSUM function to create a table that shows sales totals on a by-salesperson-by-month basis:

Formula in cell F7: @DSUM(A2..D150,3,F1..G2)
Table range: F7..I11
Input cell 1: G2
Input cell 2: F2

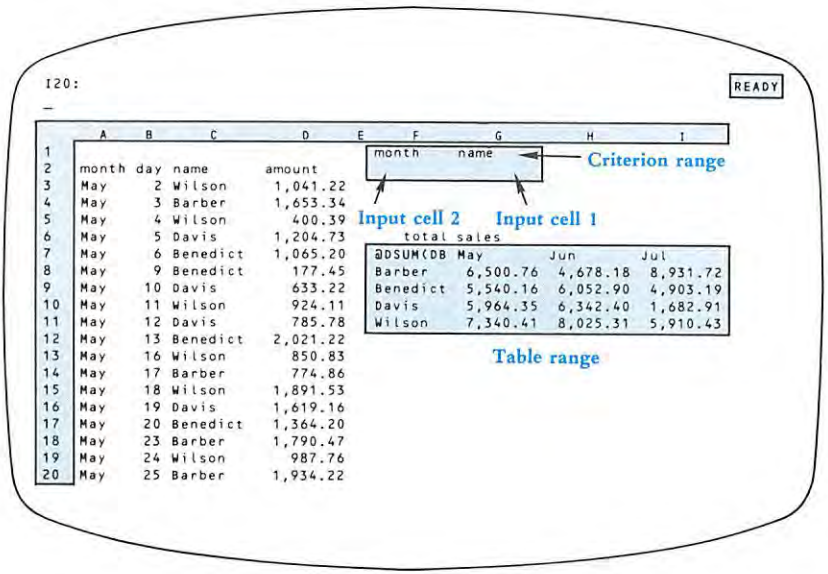


Figure 17-11. Using Database Statistical Functions with /Data Table 2

The [F8/TABLE] Key

There are times when you want to compute the same table more than once. One example is in adjusting the range of values for a sensitivity analysis; you may find that your original values provided graph lines that were too close together. Or you might want to do database statistical analyses with additional criterion entries (e.g., a table of sales by-salesperson-by-month for each of several merchandise categories).

1-2-3 remembers the Table range and Input cell(s) for the last /Data Table command. When you select /Data Table 1 or 2, the last chosen Table range will be highlighted; to use it again, press [ENTER]. Similarly, you can use the same Input cell(s) again by pressing [ENTER].

If you have already used a /Data Table command, and want to repeat it using exactly the same Table range and Input cell(s) as last time, just press [F8/TABLE]; the entire table will be recalculated. And here is the bonus: because the only things 1-2-3 remembers are the range and cell addresses; you can change the entries in those ranges and any other cells in the worksheet, and the [F8/TABLE] key will still work.

To make sure this doesn't happen accidentally, you can tell 1-2-3 to forget the /Data Table ranges, by selecting /Data Table Reset.

Summing Up the Database Commands

There are still two more /Data commands, Fill and Distribution, but they are not specific to databases, and so this is a good time to review.

The key to using a database is understanding *records* (rows) and *fields* (columns). Each record contains a group of entries to be kept together (e.g., name with address, part number with price). Corresponding information is entered into the same field (column) of each record.

/Data Sort allows you to rearrange the order of these records, while keeping the data in each record together. Remember that the Data range for a Sort does not include the field names.

/Data Query adds the idea of criteria: rules for choosing some records and rejecting others. In the Criterion range, these criteria can be combined so that you can put your finger on just the information you want. The /Data Query commands let you highlight selected records, to copy just those fields you want, to get lists of all values in a field or in a combination of fields, or to delete selected records.

The database statistical functions let you summarize numbers in a database, obtaining counts, sums, averages, minimums, maximums, variances, and standard deviations for values in a specified field of just those records that interest you.

/Data Table lets you perform sensitivity analyses, tabulating the effects of "what if" trials, and preparing those tables for graphing. In addition, you can create tables of the statistics generated by the database statistical functions.

The remaining commands, Distribution and Fill, are general-purpose commands. While they can be used in a database application, they can also be used for a variety of other purposes.

/Data Distribution

/Data Distribution allows you to summarize a large group of numbers, by producing a *frequency distribution* of the numbers.

Before you issue the command, first enter a series of ascending values in a column. These define a series of *intervals* or *bins*, which you will specify as a *Bin range*. They can be located anywhere in the worksheet, as long as the column segment to the right of the Bin range and extending one row below it is available. This will be the *Results* column.

After you select the command, specify the *Values range:* the range of numbers or formulas that you want counted. At the Bin range prompt, specify the column of values you have entered—not including the results area.

1-2-3 counts the number of entries in the Values range that are smaller than, or equal to, the smallest bin value, and puts that number to the right of the top bin value. It then counts how many entries are greater than the first bin value and less than, or equal to, the second bin value and places that number in the next row of the results column. This process continues for each bin value. To complete the count, 1-2-3 puts the number of entries larger than the last bin value in the bottom of the results column, one row below the bin range.

As with the other /Data commands, 1-2-3 remembers the last Values range and Bin range you specified, so that you can repeat the command, with the same range positions, even after changing entries, by typing "/DD[ENTER][ENTER]".

/Data Fill

The /Data Fill command enters a sequence of numbers into a range of cells, using a *Start* value, a *Step* value (positive or negative), and a *Stop* value which you specify.

This makes it easy to create the Bin range for use in a /Data Distribution command, or the Table range in a /Data Table command. There are a multitude of other uses, too, including numbering a list of entries, generating a range of labels or values to be used in a graph, etc.

/Data Fill /DF

Fill a range with a sequence of numbers.

Procedure

1-2-3 remembers (page 7-14) the most recently used /Data Fill range, if any. When you issue the command, 1-2-3 offers to reuse this range: It highlights the range and shows the addresses of its upper left and lower right corner cells in the control panel.

1. Press [ENTER] alone to reuse the same Fill range. You can press [BACKSPACE] to cancel this remembered range and return the pointer to the current cell. Otherwise, revise the range specification or enter a new one.

2. Press [ENTER] alone to accept the Start value 1-2-3 offers (initially 0), or enter a new value, positive or negative.

3. Press [ENTER] alone to accept the Step value 1-2-3 offers (initially 1), or enter a new value, positive or negative.

4. Press [ENTER] alone to accept the Stop value 1-2-3 offers (initially 2047), or enter a new value, positive or negative.

Results

1-2-3 first erases the previous contents of the entire Fill range.

- The Start value is placed in the upper left corner of the Fill range. 1-2-3 goes down each column in the range, adding the Step to the previous value, until the range is filled or the Stop value is reached, whichever comes first.

Notes

1. The values put into the range are numbers, not formulas. They do not change when the worksheet's formulas are recalculated or when they are copied elsewhere.

2. You can use this command to provide serial numbers for the records of a database. You can always restore the records to their original order by sorting (/Data Sort) on the serial number column.

3. You can use this command to provide a set of input values for an XY graph (page 16-12) or for a data table.

/Data Table 1 /DT1

Construct a sensitivity analysis table by varying the entry in one cell of the worksheet.

Before issuing this command, you must prepare the Table range (see page 17-16 for a full discussion):

A. Go to an unused range in the worksheet. You will specify this range to be the Table range. Leave the upper left corner cell empty.

B. Place input entries—entries to be substituted in the Input cell—in the first column of the Table range, starting in the second row. You can use any entries here—labels, numbers, or formulas.

C. Place the formulas whose values are to be tabulated across the top row of the Table range, starting in the second column. Often, a simple reference to an existing formula in another cell is sufficient. (For example, to tabulate the changing values of the formula in cell C12, enter "+C12" in the top row of the Table range.)

Procedure

1-2-3 remembers (page 7-14) the most recently used /Data Table range, if any. When you issue the command, 1-2-3 offers to reuse this range: It highlights the range and shows the addresses of its upper left and lower right corner cells in the control panel.

1. Press [ENTER] alone to reuse the same Table range. You can press [BACKSPACE] to cancel this remembered range and return the pointer to the current cell. Otherwise, revise the range specification or enter a new one.

2. Specify the Input cell, the cell of the worksheet in which the input entries are to be substituted one by one.

Results

1. 1-2-3 saves the current value of the Input cell.

2. For each input entry, 1-2-3:

- Copies the entry to the Input cell.
- Recalculates the entire worksheet, including the formulas in the first row of the Table range.
- Copies the values of these Table range formulas into the appropriate row of the Table range.

3. 1-2-3 restores the original value of the Input cell and recalculates the worksheet an additional time, to restore its original state.

Notes

1. This command can be used to explore and record how the value of one or more formulas vary as a result of changes in a single Input cell. This automated "what if" procedure is often called a *sensitivity analysis*.

2. To graph the results of a /Data Table 1 command, create an XY graph whose X range is the input entries column and whose other ranges are other columns of the Table range.

3. If an input entry is a formula, only its current value is copied to the Input cell.

4. By making the Input cell part of a Criterion range (page 17-7) and by using database statistical functions (page 17-15) in the formulas row, you can perform sophisticated statistical analyses quickly. (See Figures 17-10 and 17-11.)

5. Since many recalculations are involved in this command, it requires a bit more time than some other 1-2-3 commands.

6. If cell protection is Enabled, both the Input cell(s) and the entire Table range (not just the cells that 1-2-3 fills in) must be /Range Unprotected.

/Data Table 2 /DT2

Construct a sensitivity analysis table by varying the entries in two cells of the worksheet.

Before issuing this command, you must prepare the Table range (see page 17-16 for a full discussion):

A. Go to an unused range in the worksheet. You will specify this range to be the Table range.

B. Place the input entries—entries to be substituted in Input cell 1—in the first column of the Table range, starting in the second row. Place the input entries—entries to be substituted in Input cell 2—in the first row of the Table range, starting in the second column. Input entries can be labels, numbers, or formulas.

C. Place the formula whose value is to be tabulated in the upper left corner cell of the Table range. Often, a simple reference to an existing formula in another cell is sufficient. (For example, to tabulate the changing values of the formula in cell C12, enter +C12 in the upper left corner cell.)

Procedure

1-2-3 remembers (page 7-14) the most recently used /Data Table range, if any. When you issue the command, 1-2-3 offers to reuse this range: It highlights the range and shows the addresses of its upper left and lower right corner cells in the control panel.

1. Press [ENTER] alone to reuse the same Table range. You can press [BACKSPACE] to cancel this remembered range and return the pointer to the current cell. Otherwise, revise the range specification or enter a new one.

2. Specify Input cell 1, the cell of the worksheet in which the column of input entries is to be substituted one entry at a time.

3. Specify Input cell 2, the cell of the worksheet in which the row of input entries is to be substituted one entry at a time.

Results

1. 1-2-3 saves the current value of both Input cells.

2. For each pair of input entries, one from the first column, one from the first row, 1-2-3:

- Copies the column entry to Input cell 1.
- Copies the row entry to Input cell 2.
- Recalculates the entire worksheet, including the formula in the upper left corner of the Table range.
- Copies the value of this Table range formula into the appropriate cell of the Table range.

3. 1-2-3 restores the original values of the Input cells and recalculates the worksheet an additional time, to restore its original state.

Notes

1. This command can be used to explore and record how the value of a formula varies as a result of changes in two Input cells. This automated "what if" procedure is often called a *sensitivity analysis*.

2. If an input entry is a formula, only its current value is copied to its Input cell.

3. By making the Input cells part of a Criterion range (page 17-7), and by using a database statistical function (page 17-15) as the formula, you can perform sophisticated statistical analyses quickly. (See Figures 17-10 and 17-11.)

4. Since many recalculations are involved in this command, it requires a bit more time than some other 1-2-3 commands.

5. If cell protection is Enabled, both the Input cell(s) and the entire Table range (not just the cells that 1-2-3 fills in) must be /Range Unprotected.

/Data Sort /DS

Sort a range of data records (rows) on one or two sort keys.

Procedure

When you issue this command, 1-2-3 displays the Sort menu:

Data-Range Primary-Key Secondary-Key Go Reset Quit

This is a "sticky" menu. To return to Ready mode, choose either Go or Quit. With the other choices, you enter sort specifications, then the sort menu returns.

Note. 1-2-3 remembers all sort specifications. Thus, you may not need to re-enter one or more of the specifications the next time you want to sort the same records.

When you select Data-Range, Primary-Key, or Secondary-Key, 1-2-3 offers to reuse the most recently entered specification: It highlights the range (sometimes, just a single cell), displaying the addresses of its upper left and lower right corner cells in the control panel.

Press [ENTER] alone to reuse the same specification. You can press [BACKSPACE] to cancel this remembered range or cell and return the pointer to the current cell. Otherwise, revise the specification or enter a new one.

Procedure

Choose a sort specification. Before ordering 1-2-3 to perform the sort (Go), you must specify a Data-Range and a Primary-Key column. The Secondary-Key specification is optional. Choose Reset to cancel all sort specifications.

Data-Range. The range whose rows (records) will be sorted.


Do not include a database's field names row in the sort Data-Range. You do include this row in a /Data Query Input range.


Be sure to include all the columns of your data records in the Data-Range. If you leave out a few columns, they won't be sorted, causing the records to be split apart, perhaps irretrievably.

Primary-Key. The column (field) by which the rows (records) are to be sorted.

When you select Go, 1-2-3 rearranges the rows so that the entries in this column are in the specified order.

1-2-3 prompts you to enter A (Ascending) or D (Descending) to specify the sort order. It offers the most recently specified choice—to reaccept it, press [ENTER] alone.

1-2-3 Sort Order

Ascending: top-to-bottom	Descending: bottom-to-top

- Blank cells.
- Label cells in ASCII order (page B-2). The label-prefixes are ignored.
- Numbers and formula values in numeric order.

Secondary-Key (optional). The field (column) that determines the order of records whose Primary-Key values are the same. Specify the Secondary-Key column and choose Ascending/Descending order in the same manner as for the Primary-Key.

Reset. Cancels all /Data Sort specifications.

Go. Performs the sort according to the current Data-Range, Primary-Key, and Secondary-Key specifications, and returns to Ready mode.

- If you have not specified a Data-Range and a Primary-Key, 1-2-3 *beeps* and returns to the Sort menu.

• The order of records whose Primary-Key and Secondary-Key values both are the same is not predictable.

• If a formula entry moves in a /Data Sort Go operation, its cell addresses are adjusted just as they would be in a /Copy operation (page 12-4): relative addresses change and absolute addresses don't. In general, this produces the desired result if formulas use relative addresses to process values within the same data record only. Avoid formulas that use values in other data records.

Quit. Returns to Ready mode without sorting the records. 1-2-3 does remember any sort specifications you entered.

Notes

1. /Data Sort is particularly useful in finding duplicate labels in a column list or duplicate records in a database.

2. With a little extra work, there is a way to restore a database to its original order once it has been sorted: When you create the database, use /Data Fill to enter an additional column (field) of consecutive serial numbers. You'll always be able to return to the original order, by using this field as the Primary-Key.

/Data Query /DQ

Locate, copy, or delete records in a database, based on simple or complex selection criteria.

Preliminaries

Before you issue this command, you must prepare several ranges:

Find, Delete operations: Input and Criterion ranges.

Extract, Unique operations: Input, Criterion, and Output ranges.

Preparing the Input Range

The Input range is the database itself. The first row contains labels that act as *field names*. No two field names should be the same. For the purposes of the /Data Query commands, uppercase and lowercase letters are equivalent in field names. Each subsequent row is one *data record*. Database entries are just the same as ordinary cell entries. (In fact, they are treated as ordinary entries in most respects. Only the /Data Query command treats them specially.)

Preparing the Criterion Range

The first row contains some or all of the field names from the Input range, in any order. One or more subsequent rows contain the criteria, the rules by which 1-2-3 will select records.

Rules for Creating Selection Criteria

Groups of Selection Criteria—AND vs. OR

During performance of a /Data Query operation, each record is tested against the selection criteria stored in the Criterion range:

A record is selected if it passes every test in at least one Criterion range row.

A record need not succeed in "running the gauntlet" of every row. It must only succeed in passing the tests in a single row. (If a row contains no criteria, all records pass.)

Think of the several criteria in a row as being connected by *AND*. If a row has three criteria, then a record "passes" through that row if it passes Criterion 1 *AND* Criterion 2 *AND* Criterion 3.

If you create a Criterion range with more than one row of criteria, think of the several rows as being connected by *OR*. If a Criterion range has three criterion rows, then a record is selected if it "passes" Criterion Row 1 *OR* Criterion Row 2 *OR* Criterion Row 3.

Individual Criteria

To test for an exact match—label entry or number entry:

Be sure the field name of the match value is in the first row of the Criterion range. Enter the match value below the field name.

Examples:

Name ← field name
Jones ← exact-match entry

Limit ← field name
500 ← exact-match entry

To test for an approximate match—label entry:

1-2-3 allows you to define approximate matches of label entries by using three special characters:

? Matches any single character. "h?t" matches "hat", "hot", and "hut", but not "huts".

* Matches all characters to the end of the label, so "cat*" matches "cat", "catsup", and "catechism", but not "cutthroat".

~ The tilde character at the beginning of a label-match entry instructs 1-2-3 to accept any label except the one following the tilde. However, empty cells are never selected by any label-match criterion.

Examples:

~Smith selects all records with a non-empty Name entry other than Smith.

S* selects all records with a non-empty Name entry that begin with the letter S.

Label-Match: [SPACE] characters always count in an exact or approximate label-match. Extra [SPACE] characters at the beginning or end of an Input range or Criterion range entry may prevent a match. However, an empty Criterion range cell defines the easiest test—all records pass.

Number-Match: The entry "0" matches any cell with a zero value. This includes empty cells and label cells. An empty entry is a test that all records pass.

To perform a numeric comparison—number entry or formula entry:

You must enter a *logical formula* in the Criterion range, not a label or number. Unlike label and number match entries, a formula need not be entered in any particular column of the Criterion range—you identify which fields are to be tested in the formula itself.

The most important rules for creating logical formulas for the Criterion range are:

1. Write the formula to test the first record (second row) of the database.
2. Use relative addresses to refer to record values.
3. Use absolute addresses to refer to values outside the database.

When you select the Query Command, 1-2-3 changes the reference to sequentially apply the cell in the same column (field) of each record in the Input range. If the value of the formula is *TRUE* (not zero), the record fits the criterion.

For example, you want to select the records in which the field in column Q has a value greater than 100. The field names in the Input range are in row 1, so the first record is in row 2. The criterion formula, in any column of the Criterion range, would be: +Q2>100. When you select the Query command, 1-2-3 will test this formula. If it is TRUE, the record would be selected. It would then check the second record by evaluating +Q3>100, and so on.

If you want to select the Input range records for which the value in column R is not equal to that in column Q, the criterion is: +R2<>Q2.

To select records for which the value in column R is less than the value in column Q of the previous record, the criterion is: +R2<Q1. The first record will be selected if the value in R2 is negative.

Preparing the Output Range

The Output range is an area of the worksheet to which 1-2-3 copies selected records in a /Data Query Extract or Unique operation. You need not define this range for Find and Delete operations.

The first row contains some or all of the field names from the Input range, in any order. These names determine which fields are to be copied from the selected records.

Each subsequent row is a slot for one (partial) record copy. If you specify an Output range that consists only of the field names row, 1-2-3 automatically extends the range down to the bottom of the worksheet (row 2048).

/Data Query Procedure

When you issue the /Data Query command, 1-2-3 displays the Query menu:

Input Criterion Output Find Extract Unique Delete Reset Quit

This is a "sticky" menu. To return to Ready mode, choose Quit. With the other choices, you enter query specifications, then the Query menu returns.

> **Note.** 1-2-3 remembers all query specifications. Thus, you may not need to re-enter one or more of the specifications the next time you want to query the same records.

When you select Input, Criterion, or Output, 1-2-3 offers to reuse the most recently specified range: It highlights the range, displaying the addresses of its upper left and lower right corner cells in the control panel.

Press [ENTER] alone to reuse the same range. You can press [BACKSPACE] to cancel this remembered range or cell and return the pointer to the current cell. Otherwise, revise the specification or enter a new one.

1. Specify an Input range.
2. Specify a Criterion range.
3. (Extract, Unique operations only) Specify an Output range.

Unless you wish to specify the most-recently specified range of that type

4. Choose a Query operation to perform. To process the database, choose Find, Extract, Unique, or Delete. To cancel the specifications made in steps 1 through 3, choose Reset. To return to Ready mode without cancelling the specifications, choose Quit.

Description of Data Query Operations

Find. 1-2-3 highlights, one by one, the records in the database that satisfy the criteria stored in the Criterion range. 1-2-3 expands the pointer to cover the first such record and places you in Find mode:

- ↓ and ↑ move the cursor to the next and previous selected record. If there are no more such records in that direction, 1-2-3 *beeps*.
- → and ← move the cursor side-to-side within the record. This is useful with databases that are too wide to fit on the display screen.

- [HOME] moves the highlight to the database's first record, whether or not it satisfies the criteria. Similarly, [END] moves the highlight to the last record in the database.
- Press [ENTER] or [ESC] to end the Find operation. The Query menu returns.

Extract.

The Output range, except for its first row, is erased. 1-2-3 copies from the selected records those fields whose names are specified in the Output range. Formula entries: Only the values are copied, not the formulas themselves.

If more records satisfy the criteria than there are "slots" in the Output range, 1-2-3 *beeps* and displays the error message "Output range full". You can avoid this problem by specifying a one-row Output range, which 1-2-3 automatically extends down to the bottom of the worksheet (row 2048).

Unique. An extract in which 1-2-3 makes sure that no two Output range copies are identical. This is especially useful when you are copying only certain fields from the selected records. In such cases, Extract can produce identical Output range copies from different Input range data records.

Delete. The data records that satisfy the criteria are removed, and the Input range definition is shortened accordingly. As a safety precaution, 1-2-3 prompts you to confirm the deletion order (Delete), or to rescind it (Cancel).

Reset. The range specifications for the Input, Criterion and Output ranges are cancelled.

Quit. 1-2-3 returns to Ready Mode, but remembers the Query range specifications you've made.

Notes

1. Use /Data Query to find all records in a database meeting certain conditions, to create a new database containing a subset of the fields and/or records in another database, or to eliminate unwanted records from a database.

2. It is often convenient to use *Split Screen* (/Worksheet Window) when performing a /Data Query. Display the Criterion range in one window and either the Input range or the Output range in the other window.

3. It is often convenient to "freeze" the field names on the screen (/Worksheet Titles) when scrolling through a database.

4. You can use /Range Name Labels Down to provide range names for the fields in the first record (second row) of a database. Do not thereafter issue the same command for the Criterion or Output range. You can't make the same range name apply to more than one location. Naming these cells makes it easier to write numeric comparison formulas that refer to the cells.

5. The database statistical functions (@DCOUNT, @DSUM, @DAVG, @DMIN, @DMAX, @DVAR, @DSTD) generate statistics on records selected from a database. These functions require an Input range and Criterion range, just as the /Data Query commands do. See page 17-15 for details.

/Data Distribution /DD

Analyze a range of numbers or formulas by counting how many values fall into a group of specified intervals.

Procedure

Before issuing this command, you must prepare a Bin range. This range must be a single column, containing numbers or formulas whose values increase from top to bottom. Be sure that:

A. There is an empty column to the right of the Bin range; This is the results column, in which 1-2-3 will record the "counts" that make up the frequency distribution.

B. The cell below the results column is empty.

Procedure

1. Specify a Values range, wherein the values to be analyzed are stored.

2. Specify the Bin range you've constructed.

Note. 1-2-3 remembers the most recently entered Value and Bin ranges. Thus, you may not need to re-enter these specifications the next time you want to calculate a frequency distribution.

When prompting you to specify these ranges, 1-2-3 offers to reuse the most recently entered specification: It highlights the range, displaying the addresses of its upper left and lower right corner cells in the control panel.

Press [ENTER] alone to reuse the same specification. You can press [BACKSPACE] to cancel this remembered range or cell and return the pointer to the current cell. Otherwise, revise the specification or enter a new one.

Results

1-2-3 counts how many values in the Values range fall into each interval defined by the Bin range. The counts are put into the results column to the right of the Bin range:

- The first cell in the results column contains the count of the number of values in the Values range less than or equal to the first value in the Bin range.
- Each successive cell in the results column contains the count of values greater than the previous bin value, and less than or equal to the bin value to its left.
- The last cell, in the row below the end of the Bin range, contains the count of values greater than the last (and greatest) value in the Bin range.


The previous contents of the results range and the cell below it are lost.

Notes

1. To produce a histogram corresponding to the frequency distribution, create a Bar graph with the frequency counts as the A-range. To label the bars, make the Bin range the X-range of the graph.

2. If the entries in the Value or Bin range are changed, the frequency count is not updated automatically. To do so, issue the /Data Distribution command again, using the same ranges: /DD[ENTER] [ENTER].

3. /Data Fill provides a convenient facility for creating Bin ranges with equal intervals.

4. The @MAX and @MIN functions can help you to determine appropriate upper and lower limits for the Bin range.

5. Empty cells and label cells in the Value range are equivalent to "0" number entries.

18. Quit Command

The /Quit command ends a 1-2-3 work session. Ending a 1-2-3 session is not like ending a session with certain other computer programs:

1-2-3 does not automatically save your work when you end a session.

That means it is entirely possible for you to work diligently for hours, then have it all disappear with a few careless keystrokes. 1-2-3 tries to prevent this from happening—it requires you to confirm the /Quit command at this menu:

No Yes

- Selecting No cancels the /Quit command and returns you to Ready mode.
- Selecting Yes ends the session without further delay. Control returns to the Lotus Access System or to the computer's operating system, whichever you were using when you started the 1-2-3 session.

What to Do Before Ending a Session

There are several ways in which you can save your work at any time during a 1-2-3 session. In fact, we strongly suggest that you save your work often (for instance, every 15 minutes) to soften the effects of such disasters as an erroneous command that could destroy your work.

In any event, if you have any work to save, be sure to perform one or more of these data-storage procedures before issuing a /Quit command:

/File Save command. This command stores your entire worksheet, exactly as it currently stands, in a *worksheet file*.

/File Xtract command. This command stores any range you specify, exactly as it currently stands, in a worksheet file. Only the range you specify will be saved. The rest of the worksheet is not saved.

These two commands, and only these two commands, allow you to continue using a worksheet at a later time, picking it up exactly as you left it. The /File Retrieve command pulls a stored worksheet out of its worksheet file and restores it to the display screen.

(See Chapter 14, "File Commands", for additional details regarding these commands.)

/Print commands. In certain situations, you may not want to preserve your work as a 1-2-3 worksheet file. Perhaps you just want to compose a quick memo. Or you may be preparing data for use by another program, or for printing at a later date. In such cases, you may find a /Print command satisfies your needs. The /Print Printer command sends a "snapshot" of any specified range directly to your computer's printer. The /Print File command performs the same function, but stores its output in a *print file* instead of sending it to the printer.

@ Functions

19. 1-2-3 Function Reference

This chapter is a reference to 1-2-3's @ **functions**. Think of these functions as "built-in" formulas. Like a formula, a function has a numeric or logical value (or *ERR* or *NA*). This value usually depends on its **arguments**: numbers, cell or range references, or even other functions.

Use functions by typing the function name, followed by its arguments. The function name always begins with an "@"; the rest of the name can be typed using any combination of uppercase and lowercase letters. The arguments follow the function name, separated by commas and enclosed in parentheses:

@functionname(arg1,arg2,..,argN)
arguments

Spaces are not allowed in a function, except within a range name.

Depending on the function, an argument can be either a single value or a range:

- Where a function requires a single value argument, you may use any of the following:

  number
  cell address
  function
  range name that names a single cell
  formula

- Where a function requires a range argument, you may use any of the following:

  cell address..cell address (separate with one or more periods)
  range name (in some cases, a multiple-cell range is required)

For a function to work, there must be the correct number of arguments, in the correct order, and of the correct type—single value or a range.

You can specify cell and range references either by pointing or by typing.

Note. Some functions, such as @ERR, do not take an argument. With these functions, don't use any parentheses at all—e.g., @ERR() is not valid. Other functions may take a variety of arguments, as indicated below.

In this reference, some functions are shown with the argument *list*. In this case, the argument can be a single cell, a range, or a list of cells and ranges, with the entries separated by commas. Blank cells in a range argument are ignored.

See the "@ Functions" section (page 8-22) for an introduction to using 1-2-3's @ functions.

Labels and Empty Cells

1-2-3's @ functions treat cells with label entries as if they had an entry of zero. An empty cell counts as a zero if specified individually (e.g., B14). An empty cell is ignored altogether if specified as part of a range (e.g., B14..B21).

Function Summary

In this section, we list the @ functions by category. Detailed descriptions appear in the following section.

Mathematical Functions

Argument requirements: *x*, *y*, and *n* must be single values

@ABS(*x*)	absolute value
@ACOS(*x*)	arc cosine
@ASIN(*x*)	arc sine
@ATAN(*x*)	2-quadrant arc tangent
@ATAN2(*x*,*y*)	4-quadrant arc tangent of *y*/*x*
@COS(*x*)	cosine
@EXP(*x*)	exponential
@INT(*x*)	integer part
@LN(*x*)	log base e
@LOG(*x*)	log base 10
@MOD(*x*,*y*)	*x* modulo *y*
@PI	the number π = 3.14159...
@RAND	random number between 0 and 1
@ROUND(*x*,*n*)	round a number to *n* digits
@SIN(*x*)	sine
@SQRT(*x*)	square root
@TAN(*x*)	tangent

Logical Functions

Argument requirements: *x*, *true-value*, *false-value*, and *cond* must be single values

@FALSE	the value 0 (*FALSE*)
@TRUE	the value 1 (*TRUE*)
@ISNA(*x*)	the value 1 (*TRUE*) if expression *x* has the value *NA*
@ISERR(*x*)	the value 1 (*TRUE*) if expression *x* has the value *ERR*
@IF(*cond*,*true-value*,*false-value*)	true-value if cond is *TRUE*; *false-value* if cond is *FALSE*

Special Functions

Argument requirements:

x, *row#*, col#, v0, v1, v2, . . . must be single values
range must be a multiple-cell range

@NA	the value *NA* (not available)
@ERR	the value *ERR* (error)
@CHOOSE(*x,v0,v1,..vn*)	select argument value
@HLOOKUP(*x,range,row#*)	horizontal table lookup
@VLOOKUP(*x,range,column#*)	vertical table lookup

Financial Functions

Argument requirements:

x, *pmt*, *int*, *term*, *prn*, and *guess* must be single values
range must be a multiple-cell range

@IRR(*guess,range*)	internal rate of return
@NPV(*x,range*)	net present value
@FV(*pmt,int,term*)	future value
@PV(*pmt,int,term*)	present value
@PMT(*prn,int,term*)	loan payment

Date Functions

Argument requirements:

year, *month*, and *day* must be single values
serial # must be a single value

@DATE(*year,month,day*)	serial number of date 1 = 01-Jan-1900 to 73049 = 31-Dec-2099
@TODAY	today's date
@DAY(*serial #*)	day number
@MONTH(*serial #*)	month number
@YEAR(*serial #*)	year number

Statistical Functions

Argument requirements: Any number of arguments, of any type, may be included in the list.

@COUNT(*list*)	number of items in list
@SUM(*list*)	sum of all items in list
@AVG(*list*)	average of all items in list
@MIN(*list*)	minimum of all items in list
@MAX(*list*)	maximum of all items in list
@STD(*list*)	standard deviation of all items in list
@VAR(*list*)	variance of all items in list

Database Statistical Functions

These functions operate on the values in particular fields of records selected from a database.

Argument requirements:

input must be a valid Input range (/Data Query Input)

criterion must be a valid Criterion range (/Data Query Criterion)

offset must be a single value

@DCOUNT(*input,offset,criterion*)	number of items in field
@DSUM(*input,offset,criterion*)	sum of items in field
@DAVG(*input,offset,criterion*)	average of items in field
@DMIN(*input,offset,criterion*)	minimum of items in field
@DMAX(*input,offset,criterion*)	maximum of items in field
@DSTD(*input,offset,criterion*)	standard deviation of items in field
@DVAR(*input,offset,criterion*)	variance of items in field

Alphabetical Function Reference

@ABS(*x*) — Absolute value of *x*

@ABS(1.258) → 1.258

@ABS(−6.2) → 6.2

@ABS(DIFF_FACTOR) → absolute value of the value DIFF_FACTOR (valid only if the range name is assigned to a single cell).

@ACOS(*x*) — (Arc cosine) The angle, in radians, whose cosine is *x*

@ASIN(*x*) — (Arc sine) The angle, in radians, whose sine is *x*

If the value *x* is not between −1 and +1, the value is *ERR*. The @ACOS value is always between 0 and π. The @ASIN value is always between −π/2 and +π/2.

@ACOS(−.3) → 1.8754889 (radians)

@ASIN(.5)*180/@PI = 30 (additional calculations convert to degrees)

@ACOS(B1) → ERR if B1 contains 4.5.

@ATAN(*x*) — (Arc tangent) The angle, in radians, whose tangent is *x*

There is no restriction on the value of *x*. The function value is always between −π/2 and +π/2.

@ATAN(1) → 0.7853 (radians)

@ATAN(B1) → angle whose tangent is the value in cell B1.

@ATAN2(*x*,*y*) (Arc tangent) The angle, in radians, whose tangent is the value y/x

This function differs from @ATAN(*x*) in that its result can be any value between $-\pi$ and $+\pi$:

Value of *x*	Value of *y*	Value of @ATAN2(*x*,*y*)
positive	positive	between 0 and $\pi/2$
negative	positive	between $\pi/2$ and π
negative	negative	between $-\pi$ and $-\pi/2$
positive	negative	between $-\pi/2$ and 0

If $x = 0$ and $y = 0$, the value is *ERR*.

x	*y*	Value of @ATAN2(*x*,*y*)
1.5	2	0.9273
-1.5	2	2.2143
-1.5	-2	-2.2143
1.5	-2	-0.9273

@AVG(*list*) Average of all cell values in the list

If there are no values to be averaged, the result is *ERR*. For instance, @AVG(B10..F29) → *ERR* if the range B10..F29 contains only empty cells.

Note. @AVG(*list*) → @SUM(*list*)/@COUNT(*list*)

@AVG(2,7,4,22) → 8.75

@AVG(B1,4,B5..B75,OTHER_RANGE) → average of a single cell, a number, and the values in two ranges. OTHER_RANGE may name a single cell or a multiple-cell range.

@CHOOSE(*x*,*v0*,*v1*,..,*vn*) Use the value *x* to select one of the values *v0*, *v1*, *v2*, . . . , *vn*

If the selector value, *x*, is not a whole number, 1-2-3 ignores its fractional part, using just its integer part. The value *x* selects one value from the list *v0*, *v1*, *v2*, . . . as follows:

- If $x = 0$, then @CHOOSE → *v0*.
- If $x = 1$, then @CHOOSE → *v1*.
- If $x = 2$, then @CHOOSE → *v2*.
- If $x < 0$ or $x > n$, then @CHOOSE → *ERR*.

  (That is, an error occurs if the selector value is less than 0 or is larger than the number of items to be selected.)

@CHOOSE(H20,12,B1,LAST__VALUE)

The result is 12 if H20 contains 0.
The result is the value in cell B1 if H20 contains 1.3.
The result is the value in the cell named LAST__VALUE if H20 contains 2.95.

Note. You may use @CHOOSE as an alternative to creating an @HLOOKUP (or @VLOOKUP) table whose lookup row (or column) has the entries 0,1,2,3,. . . .

Since *FALSE* = 0 and *TRUE* = 1, these two functions have virtually the same meaning:

@CHOOSE(*x,false-value,true-value*)
@IF(*x,true-value,false-value*)

@COS(*x*) — Cosine of *x* (*x* in radians)

To convert the value *x*, in degrees, to radians, use this formula:

x*@PI/180

@COS(@PI) → −1
@COS(60*@PI/180) → 0.5

@COUNT(*list*) — Number of cell entries in a list

A *single value* (number, cell address, one-cell range name, etc.) on the argument list counts 1—regardless of the actual value. Note these special cases:

- @COUNT(0) → 1.
- @COUNT(@ERR) and @COUNT(@NA) → 1 (These are the only cases in which the ripple-through-the-worksheet effect of *NA* and *ERR* is halted.)
- @COUNT(H54) → 1 even if cell H54 is empty.
- If the argument list includes a range specification, then 1-2-3 counts all non-empty cells within the range. If A3 is the only blank cell in the range A1...A4, then:

@COUNT(A1..A4) → 3
@COUNT(A3) → 1

@DATE(*year,month,day*) — Serial number of a particular date

Each date has a particular serial number:

Jan 1, 1900 = 1	Dec 31, 1999 = 36525
Jan 2, 1900 = 2	Jan 1, 2000 = 36526
Jan 1, 1901 = 367	Dec 31, 2099 = 73049

The year argument must have a value between 0 (standing for 1900) and 199 (standing for 2099).

1-2-3 checks to make sure the month and day argument values are reasonable:

- @DATE(85,14,8) → *ERR*, since there is no 14th month.
- @DATE(85,4,31) → *ERR*, since April (the 4th month) has only 30 days.

In most cases, you will want to display the serial number of a date in a special Date numeric display format. (See the command summaries of the /Worksheet Global Format and /Range Format commands.)

@DATE(85,9,27) → 31317 or 27-Sep-85 (Date format).

@DATE(B3,B1,B2) → serial number of the date whose month is the value in cell B1, whose day is in B2, and whose year is in B3.

@DAY(*serial #*) — Day of the month (1-31) of a given date

The date argument must be the *serial number* of the desired date, as produced by the @DATE or @TODAY function.

@DAY(@DATE(85,3,27)) → 27

@DAY(B4) → the day (1-31) of the date whose serial number is in cell B4.

@DAVG(*input,offset,criterion*)
@DCOUNT(*input,offset,criterion*)
@DMAX(*input,offset,criterion*)
@DMIN(*input,offset,criterion*)
@DSTD(*input,offset,criterion*)
@DSUM(*input,offset,criterion*)
@DVAR(*input,offset,criterion*)

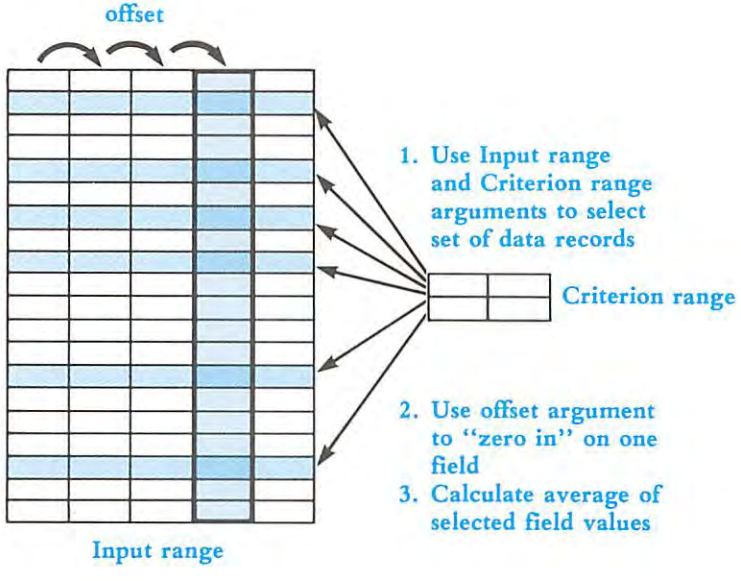
These functions are database counterparts to the statistical functions @AVG, @COUNT, etc. The @AVG operation, for instance, finds the average value of a list of arguments. The @DAVG function selects certain records from a database. Then, it "zeroes in" on one field (column) of the selected records and calculates the average value.

All the database statistical functions work in this same way:

1. 1-2-3 uses the criteria stored in a Criterion range (*criterion* argument) to select certain records from a database (*input* argument). In specifying these ranges as arguments to the function, you type cell addresses or range names just as you would in a /Data Query command.

2. Using the *offset* argument, 1-2-3 focuses its attention on a certain field (column) of the selected records. If *offset* = 0, 1-2-3 uses the leftmost column; if *offset* = 1, it uses the second column; etc.

3. 1-2-3 performs the statistical operation (average, sum, maximum, etc.) on the single column of selected values. For details on these statistical operations, consult the descriptions of @AVG, @COUNT, @MAX, etc., in this chapter.



	A	B	C	D	E	F
1	Item	Quantity	Type		Type	Item
2	1001	2	nut		nut	+A2>1001
3	1002	4	bolt			
4	1003	0	nut			
5	1004	17	bolt			

- @DAVG(DATAB,0,CRIT__1) → @AVG(1001,1003) → 1002.

  The label-match criterion "nut" causes the records in rows 2 and 4 to be selected. The average of the values in column 0 ("Item" field) of the selected records is 1002.

- @DAVG(DATAB,1,CRIT__1) → @AVG(2,0) → 1.

  The same records are selected. The average of the "Quantity" field items is 1.

- @DMAX(DATAB,1,CRIT__2) → @MAX(4,0,17) → 17.

  The formula criterion in cell F2 causes the records in rows 3 through 5 to be selected. In these records, the largest "Quantity" field value is 17.

@ERR — The value *ERR* (error)

Use this function to force 1-2-3 to display *ERR* in the worksheet. All cells whose values depend on an *ERR* cell also become *ERR* cells. Exception: See @COUNT.

@IF(B14>3.2,@ERR,B14)

If the value in cell B14 exceeds 3.2, *ERR* is displayed in the cell.

@EXP(*x*) — The number e raised to the *x* power

If the argument *x* is very large (approximately 230), the value is *ERR*.

@EXP(1.258) → 3.5183776

@FALSE — The value 0

1-2-3 regards the value 0 to be equivalent to the logical condition *FALSE*. You can use a *FALSE* value as a selector with an @CHOOSE or @IF function.

@IF(B50,75,99.50)

If cell B50 contains @FALSE, then the value of this @IF function is 99.50.

@FV(*pmt,int,term*) — Future value of an annuity

Yields the future value of an ordinary annuity (series of payments). It uses *pmt* as the per-period payment, *int* as the per-period interest rate, and *term* as the number of periods. 1-2-3 assumes a single payment is made at the end of each period. (With an "annuity due", payments are made at the beginnings of periods.)

The formula used is:

$$\text{@FV result} = \text{pmt} * \frac{(1 + \text{int})^{\text{term}} - 1}{\text{int}}$$

@FV(1000,14.5%,5) → 6675.9352

Yields the value at the end of five years of a series of five yearly $1000 investments. The yearly interest rate is 14.5%, compounded yearly for 5 years.

Note that the number of payments and the compounding period are assumed to be the same.

@HLOOKUP(*x,range,row#*) — Horizontal table lookup

Arguments:

x (selector value) During a lookup, 1-2-3 compares this value with those in the lookup row. This process selects a particular column of the table. There need not be an exact match, however. See "How 1-2-3 Does a Lookup" below.

range (lookup-range) A range specification that identifies the lookup table itself. The first row 0 of the table is the **lookup row**, the set of values with which 1-2-3 compares the selector value. These values must be in ascending order, with no repeats. Subsequent rows contain the potential results of a lookup operation.

row# Indicates which value in the selected column is the final result of the @HLOOKUP function.

How 1-2-3 Does a Lookup

1. 1-2-3 locates the first value in the lookup row that exceeds the selector value, *x*. Then, it backs up to the previous column. If the selector value is greater than all entries in the lookup row, the last column is selected.

2. 1-2-3 uses the *row#* argument to count down the selected column: the lookup row is 0, the next row is 1, etc. The numeric value of the cell reached in this way is the result of the @HLOOKUP function.

Errors. If the first cell in the lookup row exceeds the selector value, the result is *ERR*. If *row#* is negative or exceeds the number of rows in the lookup range, the result is *ERR*.

Examples:

"TAX_TABLE"

		Income	Status	Tax		
		$6,089	2	$381		
	Over	$6,000	$6,050	$6,100	$6,150	$6,200
1	Single	599	618	617	626	634
2	Joint	373	381	389	397	405
3	Separate	709	719	730	740	750
4	Head	547	555	563	571	579

@HLOOKUP(INCOME,TAX_TABLE,STATUS) → 381 if INCOME = 6089 and STATUS = 2 (as shown above).

@HLOOKUP(INCOME,TAX_TABLE,STATUS) → 709 if INCOME = 6011 and STATUS = 3 (as shown above).

@HLOOKUP(INCOME,TAX_TABLE,STATUS) → *ERR* if INCOME < 6000.

@IF(*x,true-value,false-value*) Use a "truth-test" to choose between two values

---

The truth-test is performed on the argument *x*. If *x* is non-zero (*TRUE*), then the result is the *true-value* argument. If *x* is 0 (*FALSE*), then the result is the *false-value* argument.

@IF(B1 > B2,1000, – 55)

1-2-3 evaluates the logical formula B1 > B2 to *TRUE* (i.e., 1) or *FALSE* (i.e., 0), depending on whether the value in cell B1 exceeds that in cell B2. If the condition is *TRUE*, then the result of the @IF function is 1000. If the condition is *FALSE*, then the result of the @IF function is – 55.

@INT(*x*) — Integer part of *x*

@INT(1.258) → 1
@INT(−1.258) → −1
@INT(H5/100) → The number of "hundreds" contained in the value stored in cell H5

@IRR(*guess,range*) — Internal rate of return

Yields an approximate internal rate of return for a series of cash payments made at regular intervals. You must "prime the pump" with a guess at the correct answer.

Internal rate of return is defined as the interest rate that makes the net present value of the series of cash flows equal to 0. 1-2-3 uses an iterative scheme to calculate the internal rate of return.

The result is *ERR* if 1-2-3 cannot approximate the answer to within .0000001 after 20 iterations.

In some cases, 1-2-3's calculation scheme produces different results with different guesses. In most cases, you should choose a guess value between 0 and 1.

@IRR(14%,A2..A6) → .102212 if the range A2..A6 contains the values −1000, 500, 400, 200, and 100.

If the "400" cash flow were changed to "−200", using @IRR would result in a negative number showing that you are losing money.

@ISERR(*x*) — Tests whether or not a cell has the value *ERR*

@ISERR yields *TRUE* (i.e., 1) if the argument *x* is @ERR or refers to a formula whose current value is *ERR*. Otherwise, the result is *FALSE* (i.e., 0).

@ISERR(B1) → TRUE (1) if the formula in cell B1 currently is displayed as *ERR*.

@ISNA(*x*) — Tests whether or not a cell has the value *NA*

Yields *TRUE* (i.e., 1) if the argument *x* is @NA or refers to a formula whose current value is *NA*. Otherwise, the result is *FALSE* (i.e., 0).

@ISNA(B1) → TRUE (1) if the formula in cell B1 currently is displayed as *NA*.

@LN(*x*)	Natural logarithm (base e) of *x*
@LOG(*x*)	Common logarithm (base 10) of *x*

If *x* is 0 or negative, the result is *ERR*.

@LN(1.258) → 0.2295236
@LOG(1.258) → 0.09968064
@LN(@EXP(J7)) → the value in cell J7; @LN and @EXP are inverse functions.

@MAX(*list*)	Maximum of the values in a list
@MIN(*list*)	Minimum of the values in a list

If there are no entries in the list, the function returns the result *ERR*. If a range is included in the list, empty cells in the range are ignored.

With these cell entries: H1: 56 H2: 14 H3: empty H4: – 20

@MAX(H1..H4) → 56
@MIN(H1..H4) → – 20
@MIN(H1..H3) → 14 (not 0)
@MIN(H1..H2, H3) → 0

@MOD(*x*,*y*)	Integer remainder when *x* is divided by *y*

1-2-3 calculates this as: $x-(y*@INT(x/y))$. If $y = 0$, the result is *ERR*.

@MOD(15,7) → 1

@MONTH(*serial #*)	Month of the year (1-12) of a given date

The date argument must be the *serial number* of the desired date, as produced by the @DATE or @TODAY function.

@MONTH(@TODAY) → 9 in September.
@MONTH(@TODAY + 90) → The month in which the due date falls for today's purchase, assuming 90-day terms.

@NA	The value *NA* (not available)

@IF(B14 > 3.2,@NA,B14)

This formula "filters" a cell value. If B14's value exceeds the cutoff point, 3.2, then the current cell and all others depending on it will be displayed as *NA*.

Exception: See @COUNT.

@NPV(*x,range*) Net present value

Yields the net present value of a series of future cash flows. The first cash flow is assumed to be made at the end of the first period. Subsequent cash flows occur at the end of the 2nd, 3rd, 4th, . . . periods. 1-2-3 uses *x* as the per-period interest rate. The *range* must be in a single column or single row.

If $V_1 \ldots V_n$ are the values in the range, then: $NPV = \sum_{i=1}^{n} \frac{V_i}{(1+x)^i}$

Here's how to find the net present value of an initial flow, occurring now, followed by a series of future flows, starting one period from now:

If: INITIAL = single cash flow now
SERIES = range of future flows (receipts or payments)
RATE = per-period interest rate

Then: The net present value of the entire set of cash flows is:

INITIAL + @NPV(RATE,SERIES)

Example: An initial payment of $1000 is followed by four annual receipts of $400 each. At 10.5% annual interest, the four positive flows yield a @NPV value of $1254.343. Balancing this result with the initial $1000 payment, the overall net present value is $254.343.

@PI The value π (3.141592653589794)

Note that @PI does not take an argument. Use @PI to convert a value, *x*, in degrees to radians for use with @COS, @SIN, and @TAN:

*x**@PI/180

@PI → 3.141592. . .
@SIN(30*@PI/180) → 0.5 (the sine of 30 degrees is 0.5)

@PMT(*prn,int,term*) Per-period loan payment

Yields the loan payment for a given principal (*prn*), per-payment interest rate (*int*), and number of payments (*term*). The formula used is:

$$@PMT\ result = prn * \frac{int}{1 - (1 + int)^{-term}}$$

@PMT(50000,14.5%/12,25*12) → 621.0815

This is the payment on a $50,000 25-year mortgage, with a 14.5% annual interest rate. Note the use of "/12" to produce the per-payment interest rate and "*12" to convert years to the number of payments.

@PV(*pmt,int,term*) — Present value

Yields the present value of an ordinary annuity (series of payments). 1-2-3 uses *pmt* as the per-period payment, *int* as the per-period interest rate, and *term* as the number of periods. 1-2-3 assumes a single payment is made at the *end* of each period. (With an annuity due, payments are made at the beginnings of periods.)

The formula used is:

$$\text{@PV result} = \text{pmt} * \frac{1 - (1 + \text{int})^{-\text{term}}}{\text{int}}$$

@PV(1000,14.5%,5) → 3392.225

Yields the present value of a series of $1000 payments, invested at 14.5% and compounded yearly for 5 years.

@RAND — Random number between 0 and 1

Note that @RAND does not take an argument. Each time 1-2-3 recalculates the worksheet, the value of this function changes. If you want to generate a set of random numbers just once, convert the formulas to values. (Use the [F9/CALC] key or a /File Xtract-/File Combine routine.)

50*@RAND → a random number between 0 and 50

@ROUND(*x,n*) — The value *x* rounded to *n* digits

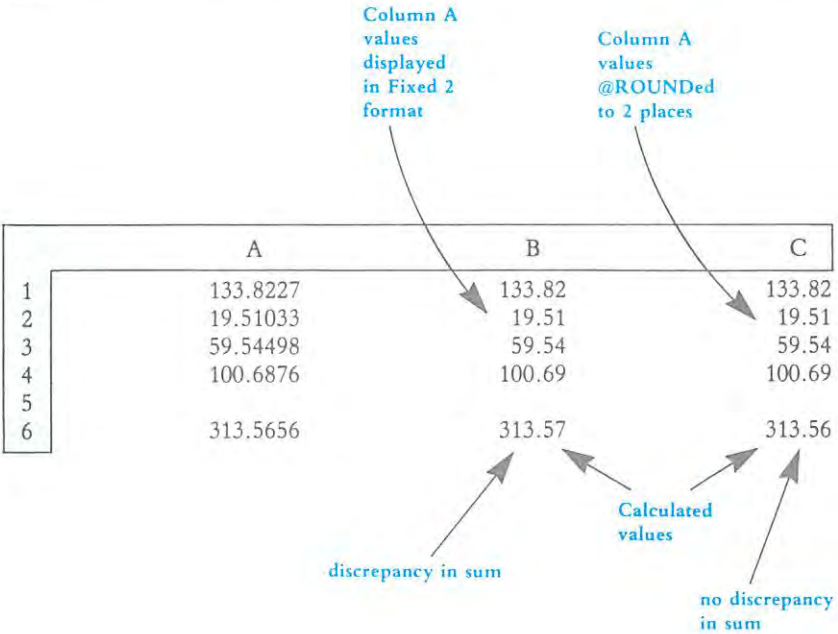
1-2-3 rounds the value *x* to the number of digits specified by *n*. (*n* is truncated to an integer and must be in the range from −15 to +15, inclusive.)

If *n* is 0, then *x* is rounded to an integer. If *n* is positive, then *x* is rounded to a number of decimal places. If n is negative, then *x* is rounded to the nearest 10, or the nearest 100, or the nearest 1000, etc.

@ROUND(7145.258,H12)

Value in Cell H12	Value of @ROUND(7145.258,H12)
−3	7000
−2	7100
−1	7150
0	7145
1	145.3
2	7145.26
3	7145.258

Use the @ROUND function to ensure accurate currency calculations. A typical worksheet calculates currency amounts that include fractions of a penny (or dollar or millions of dollars). When a column of such numbers is totaled and formatted without fractional amounts (e.g., *Currency, 2* format), discrepancies may appear. Solve this problem by using @ROUND to round off the fractional values before totaling them.



@SIN(*x*)	The sine of *x* (*x* in radians)

To convert a value *x*, in degrees, to radians, use this formula:

x*@PI/180

@SIN(1.258) → .95147680
@SIN(90*@PI/180) → 1 (the sine of 90 degrees is 1)

@SQRT(*x*)	Square root of *x*

If *x* is negative, the result is *ERR*.

@SQRT(2) → 1.4142

@STD(*list*) — Standard deviation of a list of values

1-2-3 calculates the *population standard deviation* value ("unbiased") by taking the square root of the population variance (@VAR value—page 19-16). If @COUNT(*list*) is 0, the result is *ERR*. Empty cells in the range are ignored. Label cells count as zeros.

To use the *sample* standard deviation, you need to do a bit more calculating:

If cell G10 contains @COUNT(B1..C20) and G11 contains @STD(B1..C20), then this formula calculates the sample standard deviation:

@SQRT(G10/(G10 – 1))*G11

@STD(A1..A4) → 6.159076 if the range A1..A4 contains the values 45.60, 33.01, 41.00, and 49.57.

@SUM(*list*) — Sum of a list of values

Label cells count as zeros. Empty cells are ignored.

@SUM(17,A10,A20,B1..C50) → the sum of 102 cell values and the number 17.

@TAN(*x*) — Tangent of *x* (*x* in radians)

If $x = \pi/2 + \pi * n$ (n = any integer), the result is *ERR*. These "forbidden" numbers are the radian equivalents of 90°, 270°, 450°, etc.

@TAN(45*@PI/180) → 1

@TODAY — The *serial number* of today's date

"Today" is the day you enter at MS-DOS's prompt when you start the computer. Always be sure to enter the proper date and time.

The serial number may be used with the @YEAR, @MONTH, and @DAY functions. You may also perform operations with serial numbers as you would with any other integers. Assign cells with serial number entries one of the three Date numeric display formats (page 8-25).

@TODAY → 31081 on February 3, 1985.

@TRUE — The Value 1

1-2-3 regards the value 1 to be equivalent to the logical condition *TRUE*. You can use a *TRUE* value as a selector with an @CHOOSE or @IF function.

@IF(B50,75,99.50)

If cell B50 contains @TRUE, the value of this @IF function is 75.

@VAR(*list*) — Variance of a list of values

1-2-3 calculates the population variance value ("unbiased"). If @COUNT(*list*) is 0, the result is *ERR*. Empty cells in the range are ignored.

To use the sample variance, you need to do a bit more calculating:

If cell G10 contains @COUNT(B1..C20) and G11 contains @VAR(B1..C20), then this formula calculates the sample variance:

+G10/(G10 – 1)*G11

@VAR(A1..A4) → 37.93422 if the range A1..A4 contains the values 45.60, 33.01, 41.00, and 49.57.

@VLOOKUP(*x,range,col#*) — Vertical table lookup

Arguments:

x (selector value) During a lookup, 1-2-3 compares this value with those in the lookup column. This process selects a particular row of the table. There need not be an exact match, however. See "How 1-2-3 Does a Lookup" below.

range (lookup-range) A range specification that identifies the lookup table itself. The first column of the table is the *lookup column*, the set of values with which 1-2-3 compares the selector value. These values must be in ascending order, with no repeats. Subsequent columns contain the potential results of a lookup operation.

col# Indicates which value in the selected row is the final result of the @VLOOKUP function.

How 1-2-3 Does a Lookup

1. 1-2-3 locates the first value in the lookup column that exceeds the selector value, *x*. Then, it backs up to the previous row. If the selector value is greater than all entries in the lookup columns, the last row is selected.

2. 1-2-3 uses the *col#* argument to count across the selected row: the lookup column is 0, the next column is 1, etc. The numeric value of the cell reached in this way is the result of the @VLOOKUP function.

Errors. If the first cell in the lookup column exceeds the selector value, the result is *ERR*. If *col#* is negative or exceeds the number of columns in the lookup range, the result is *ERR*.

Examples:

	Income	Status	Tax
	$6,089	2	$381

"TAX_TABLE"

Over \	1 Single	2 Joint	3 Sep.	4 Head
$6,000	599	373	709	547
$6,050	618	381	719	555
$6,100	617	389	730	563
$6,150	626	397	740	571
$6,200	634	405	750	579

@HLOOKUP(INCOME,TAX_TABLE,STATUS) → 381 if INCOME = 6089 and STATUS = 2 (as shown above).

@HLOOKUP(INCOME,TAX_TABLE,STATUS) → 709 if INCOME = 6011 and STATUS = 3 (as shown above).

@HLOOKUP(INCOME,TAX_TABLE,STATUS) → *ERR* if INCOME < 6000.

@YEAR(*serial #*) — Year (0-199) of a given date

The *date* argument must be the serial number of the desired date, as produced by the @DATE or @TODAY function.

The following chart shows how 1-2-3 handles year numbers:

Year Argument to @DATE or @TODAY	Corresponding Calendar Year	Displayed in Date Numeric Format
0	1900	01-Jan-00
1	1901	01-Jan-01
2	1902	01-Jan-02
99	1999	01-Jan-99
100	2000	01-Jan-2000
101	2001	01-Jan-2001
199	2099	01-Jan-2099

@YEAR(@TODAY) → The current year

@YEAR(@TODAY + 365) → Next year (unless it is currently January 1 of a leap year)

PrintGraph

20. Printing 1-2-3 Graphs

PrintGraph is the program that allows you to print or plot graphs saved as picture files using the 1-2-3 command /Graph Save. PrintGraph allows you to control the way your graphs are printed. Graphing parameters such as colors used in the graphing, fonts (character styles), and orientation (position on the paper) may be adjusted to fit the needs of the graph(s) you want to print. PrintGraph also allows you to queue graphs to be printed. That is, you can select a series of graphs and PrintGraph will print them in the order you define. And, as with 1-2-3, help is never more than a keystroke away. Pressing the [F1/HELP] key gives you a Help screen appropriate to your current action.

Like 1-2-3, PrintGraph needs to know what graphics device is connected to your computer. Often you will be using the same printer to reproduce both worksheets and graphs, but you will still need to give PrintGraph that information. Chances are, though, that you'll only need to specify that information to PrintGraph once—when you first "configure" PrintGraph. After that PrintGraph will remember the configuration of your system (see Save option, page 20-5).

This chapter will show you how to configure PrintGraph for your system, and how to use PrintGraph to print the graphs produced by 1-2-3.

Note. Not all printers can be used to create 1-2-3 graphs. If in doubt, consult your dealer.

How to Start PrintGraph

Because PrintGraph is supplied on its own program disk, you will need to put the PrintGraph Disk in Drive A before you can start PrintGraph. If you are already in MS-DOS, then put the PrintGraph Disk in Drive A, type "GRAPH", press [ENTER], and the PrintGraph menu will appear.

If you are in 1-2-3, you must exit the worksheet using the /Quit Yes command. Remember to /File Save your current worksheet and /Graph Save your graphs before quitting. You will now see the Lotus Access System menu or the MS-DOS prompt (see page 21-2). Select PrintGraph from the Access System menu by pointing to "PrintGraph" and pressing [ENTER], or type the letter "P". You will then be prompted to change disks. Remove the 1-2-3 System Disk from Drive A, insert the PrintGraph Disk, and press [ENTER]. The PrintGraph menu will appear.

Option	Meaning
Select	Select a graph or series of graph files for printing.
Options	Select printing options (colors, orientation, fonts).
Go	Print the selected graphs.
Configure	Change the default PrintGraph configuration.
Align	Set the current page position as "top of page".
Page	Advance the printer paper to the top of the next page.
Quit	Quit PrintGraph.

Each of these options will be described in greater detail in the following sections.

Changing PrintGraph's Default Configuration

PrintGraph's current configuration is always displayed in the main area of the screen, below the control panel. As you make changes to PrintGraph, the display will be updated to reflect the changes.

Just as with 1-2-3 configuration, PrintGraph initially assumes that you have certain hardware connected to your system (the *default configuration*). The first time you start PrintGraph, the default configuration will be:

DIRECTORIES
Pictures: B:\
Fonts: A:\

GRAPHICS DEVICE
DMP-2100 Med.

INTERFACE
Parallel

PAGE SIZE
Length: 11.000
Width: 8.000

PrintGraph assumes that your graph files are stored in the root directory of the disk in Drive B, that your typeface styles (fonts) are stored on Drive A (the PrintGraph Disk), that you are using a DMP-2100 in medium-resolution mode as your graphics device (printer), that the printer is connected to a parallel connector, and that your page size will be 8 in. × 11 in. If this default configuration is correct, then you will not need to change anything. If your system is different, read on.

PrintGraph Configuration Options

Since we are immediately concerned with changing PrintGraph's default configuration, you should select Configure from the PrintGraph menu. As with all 1-2-3 menus, options are selected by pointing to the option name with the menu pointer using the ← or → arrow keys and pressing [ENTER], or by typing the first letter of the option. As you select each option, a list of configuration choices will appear under the command line.

Files Option

Selecting this option allows you to specify which directory or directories will be searched for graph and font files when you are selecting graphs to be printed, and when you issue the Go command to print the graph files.

Choice	Meaning
Pictures	Select directory containing graph files.
Fonts	Select directory containing fonts.
Quit	Return to the Configure menu.

Initially, Pictures is set in the root directory of B:\ (typically, a data disk containing picture files would be in Drive B) and Fonts is set in the root directory of A:\. For either option, you will be prompted to enter the name of the directory in which the respective files are stored. For example, if you want to tell PrintGraph that your graph files are stored in the root directory of Drive A, select Pictures and type "A:\" in response to the prompt. Selecting Quit will return you to the Configure menu. Notice, as always, that the status area of the screen has been updated to reflect your choice.

Device Option

Graphics devices and their associated parameters (called *device drivers*) are stored in a special disk file, called a *device library*. When you select Configure Device, a list of device drivers currently available in the device library is displayed on the status area of the screen. The currently selected device is marked with #.

As Lotus adds graphics devices to the device library, new device libraries may be made available. If you receive a disk containing a new device library, you need only copy the new device library onto your PrintGraph Disk. When you use Configure Device, the new devices will be added to the device list. A partial device list is shown below. Note that the DMP-2100 medium-resolution (the default graphics device) is marked with # to show that it is currently selected.

Type of Graphic Output
Low-resolution DMP-200 Printer
Medium-resolution DMP-200 Printer
High-resolution DMP-200 Printer
Low-resolution DMP-420 Printer

Medium-resolution DMP-420 Printer
High-resolution DMP-420 Printer
Low-resolution DMP-500 Printer
Medium-resolution DMP-500 Printer
High-resolution DMP-500 Printer
#Medium-resolution DMP-2100 Printer
High-resolution DMP-2100 Printer
CGP-220 Color Graphics Printer
FP-215 Plotter
HP 7470A Plotter
HP 7475A Plotter

To choose a device, use the ↑ or ↓ keys to move the highlighted pointer to the device and press [SPACE]. The # marker will appear next to that device. Pressing [ENTER] records the new device and you will be returned to the Configure menu. The status screen will have been updated to display the new device. Pressing [ESC] returns you immediately to the Configure menu, but the original device choice is retained.

Notice that some of the printer names on the list are described as low-, medium-, or high-resolution. These descriptions indicate the relative resolution of the dot matrix for the printers so listed. For example, choosing High-resolution DMP-2100 will cause the graph to be printed with greater resolution than would be possible with the Medium-resolution DMP-2100 selection. However, the printer will take twice the time to print the graph in the high-resolution mode. The DMP-420 and DMP-500 printers can handle graphics in low-, medium-, and high-resolution modes. The DMP-2100 printer can handle graphics in either medium- or high-resolution modes.

If you are still confused by the printer designations, you might want to ask your dealer for advice. Your dealer or the manual that accompanied your printer are the best sources of information.

Page Option

This option is not available in this release.

Interface Option

To connect a printer to a computer, some type of interface card and cable are required. Computers communicate with printers using two different means: parallel or serial. You must tell the computer what kind of interface is connected or it will not communicate correctly with the printer.

To change the printer interface type, select Interface from the menu. You can choose one of four interface types:

Choice	Meaning
1	Parallel. The parallel interface connector located at the back of the main unit.
2	Serial. The serial (RS232-compatible) interface connector located at the back of the main unit. Baud rate must also be specified (see below).
3	Second Parallel. An optional second parallel interface.
4	Second Serial. An optional second serial interface.

Selections from the interface list are made by pointing to the choice, then pressing [ENTER]. Once the choice is made, PrintGraph returns to the Configure menu. The status screen will be updated to reflect the change.

Note: Second Parallel and Second Serial hardware interfaces are not currently available for the Model 2000.

Serial interfaces require the additional specification of a *baud rate* (the speed in characters per second with which the interface will send data). When you select the serial option, one of the following baud rates should also be selected (they are listed in order of increasing speed):

Choice	Baud Rate	Choice	Baud Rate
1	110	6	2400
2	150	7	4800
3	300	8	9600
4	600	9	19200
5	1200		

To determine the correct baud rate setting, check the manual that accompanied your printer, or ask your dealer for advice. Most printers and plotters seem to operate best at 1200 baud, but you should select the fastest available baud rate that will correctly transmit data without losing it.

You may obtain a cable for your Radio Shack printer or plotter at any Radio Shack Computer Center. If you do not use a Radio Shack printer or plotter, consult with your dealer to find a compatible cable.

PrintGraph supports devices which are Model 2000-compatible and 1-2-3-compatible. Check with your dealer or consult the device literature to be sure that the device you have selected is compatible.

Save Option

Be sure to remove the write-protect tab from the PrintGraph Disk before selecting this option. If you made any changes in the configuration they will immediately take effect (as reflected on the status screen). However, these changes will be forgotten at the end of the current PrintGraph session unless you Save them to disk. PrintGraph will then use the new configuration in subsequent PrintGraph sessions.

Choice	Meaning
Cancel	Cancels the Save and returns you to the configuration menu.
Replace	Causes the current configuration to be written to disk.

Reset Option

This menu selection allows you to cancel a PrintGraph configuration that was altered during the current session. Once Reset has been selected, all newly entered PrintGraph configuration options will be reset: (1) to the configuration that was read from disk when PrintGraph was started, or (2) to a configuration that was last Saved during the current session.

Quit Option

Selecting Quit allows you to exit the Configure menu and return to the main PrintGraph menu. If you have changed PrintGraph's configuration and want to save that change, you should select Save before selecting Quit.

Using PrintGraph to Output Graphs

PrintGraph's main function, of course, is to print graphs generated with 1-2-3 on a printer or other graphics device. To do this, PrintGraph reads a 1-2-3 graph file (a .PIC or picture file) and formats it according to various options which you specify. PrintGraph then outputs this graph to the graphics device.

You can select the various format options from the PrintGraph menu just as you would select an option from any 1-2-3 menu. Because PrintGraph allows you to queue a list of graph files for printing, you may also select from lists of graph files on your storage diskette. Selections from lists are made by pressing [SPACE]. An example of this type of selection appears below.

The PrintGraph menu options which affect the formatting and printing of graph files are:

Option	Meaning
Select	Select a graph or series of graphs for printing.
Options	Select graphics printing options (colors, orientation, fonts) before printing.
Go	Print the selected graphs.
Align	Set the current paper position as "top of page".
Page	Advance the printer paper to the top of the next page.
Quit	Quit PrintGraph.

The following sections will describe each of the major PrintGraph formatting commands in greater detail.

Selecting Pictures for Printing

The first option on the PrintGraph menu, Select, allows you to specify the graph files you want to print. When you choose Select, a list of graphs is retrieved from the directory specified in the PrintGraph configuration (see above) and displayed on the status area of the screen. Note also that the list is displayed in alphabetical (descending) order, along with the date, time, and size (in bytes) for each graph.

Use the ↑ and ↓ keys to move through the list of graphs. When you want to choose a graph, press [SPACE] and the graph name will be marked (selected) with the symbol #. For example, suppose your data disk contained the following .PIC files: EXPENSE, INCOME, MONTHLY, and YEARLY. You want to choose MONTHLY as your first graph to be printed, so you use the ↑ and ↓ keys to move the pointer down the graph list to MONTHLY and press [SPACE]. The # indicator will appear next to MONTHLY to show that it is selected:

PICTURE	DATE	TIME	SIZE
EXPENSE	11-03-85	15:02	8832
INCOME	11-26-85	15:40	15488
#MONTHLY	11-26-85	14:20	13568
YEARLY	12-10-85	14:23	33920

Any graphs that were selected during the current PrintGraph session, but prior to the current Select, will also be marked with the # indicator. While in the selection list, you may press the [F10/GRAPH] key at any time and the graph on which the pointer is resting will be displayed on the graphics monitor, allowing you to preview graphs before printing them.

Note. Do not be surprised if a previewed graph appears to have more detail than the graph as originally displayed in 1-2-3. In fact, the smaller lines of text in a previewed graph may appear to be unreadable. This is because the picture file (.PIC file) generated by 1-2-3 actually contains more detail than can be displayed by 1-2-3's /Graph View command. However, PrintGraph is capable of printing this detail, and the hard copy will be similar to the graph that was displayed in 1-2-3, except more precise.

Other selections can be made from the graph list in the same way. If you want to remove a graph from the currently selected list, move the pointer to the graph name, press [SPACE] once again, and the indicator mark will be removed.

Pressing [ESC] cancels the graph list and any new selections that were made from it (selections made prior to the current selections are kept), and returns you to the PrintGraph menu. Pressing [ENTER] selects the currently highlighted graph and causes the currently selected list of graphs to be saved. Do not confuse this with PrintGraph configuration—picture selections are kept only for the duration of the current PrintGraph session. You are returned to the main PrintGraph menu and the list of selected graphs is displayed on the status screen in the order in which you selected them.

Choosing Other PrintGraph Formatting Options

Selecting Options from the main PrintGraph menu allows you to set or change various aspects of a graph or series of graphs before printing. Remember that Options apply to the entire set of selected graphs, so that if you intend to change options between graphs, you should Select only those graphs to which the options will apply. When you select Options, you are offered the following choices:

Color Font Size Pause Eject Quit

Color Option

The Color option allows you to assign colors to various parts of the graph. PrintGraph displays a menu of colors appropriate to the graphics device currently selected. Their possible uses are shown below. Note that the default color for the grid and the data ranges is black.

Uses: Grid (grid, axes, scale), A-range, B-range, C-range, D-range, E-range, F-range

Color selections are made by first selecting the appropriate menu item (Grid, A, B, C, D, E, or F) and then selecting a color for that item from the list displayed in the control panel. The list of colors displayed in the status area of the screen will be continuously updated to reflect changes. The color option has no effect unless you are using a color graphics device (e.g., CGP-220 printer or FP-215 plotter).

Font Option

This option allows the selection of fonts to be used in printing the text portions of the graph. Font 1 is only used for the first line of the graph title. Font 2 will be used for the rest of the graph. If no selection is made for Font 2, then Font 1 will be used for the entire graph.

Font selections are made in the same way as graph selections (see above) from the list of fonts displayed in the status area of the screen, except that only the font name and size (in bytes) are displayed.

Font Name	Size	Font Name	Size
BLOCK1	3597	ROMAN1	4744
BLOCK2	6593	ROMAN2	9117
ITALIC1	6507	SCRIPT1	5831
ITALIC2	9076	SCRIPT2	7726

Figure 20-1 shows these fonts in their printed form.

The numbers after each font indicate how bold (dark) the font is. For example, Script2 is bolder than Script1. The current selections for Font 1 and Font 2 are displayed on the status area of the screen at all times. The bold font produces high quality graphs only with high resolution printers and plotters.

Size Option

The Size option allows you to choose the size and orientation of the graph on the paper. Each choice controls the values for margin, graph height, width, and rotation.

Choice	Meaning
Full	The graph will occupy a full page with normal margins. All variables are automatically adjusted. An indicator will appear on the screen.
Half	The graph will occupy half of a page. All variables are automatically adjusted.
Manual	Each variable of graph placement can be adjusted manually (see below).

Selecting Manual from the Size options menu allows you to select each of the aspects of graph placement.

Choice	Meaning
Height	Adjusts height of the graph (vertical page length) in inches.
Width	Adjusts the width of the graph (horizontal page width) in inches.
Left	Adjusts the size of the left margin in inches.
Top	Adjusts the size of the top margin in inches.
Rotation	Adjusts the number of counterclockwise degrees of rotation. Zero degrees of rotation will orient the X axis along the width of the page. Ninety degrees of rotation will orient the X axis along the height of the page. Rotation changes the orientation of the axis and rotates the entire graph. If the Full size option is selected for a pie chart, and you select zero degrees of rotation, the pie chart will be eliptical rather than round.

Do not be alarmed if what you type for a value is not exactly what appears on the status screen (PrintGraph uses the correct value, but displays a "rounded" value).

Block 1

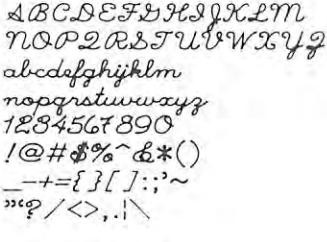
Block 2

Roman 1

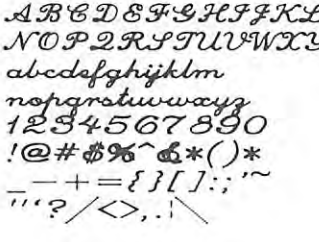
Roman 2

Italic 1

Italic 2



Script 1



Script 2

Figure 20-1. Graph Fonts

A Technical Note. A graph will be stretched or compressed to exactly fit the specified height and width after rotation of the graph. The degree of distortion depends on the relationship between the graph's X axis and Y axis scale values (called the aspect ratio). All 1-2-3 graphs are produced with an aspect ratio of approximately 1.385 to 1. Therefore, the ratio of height to width should be maintained at the same aspect ratio.

Pause Option

Selecting the Pause option causes PrintGraph to pause between printing graphs. A pause might be required to change paper or switch settings on a printer, or to change pens on a plotter (in addition to the automatic pause to change pens provided for all plotters).

Choice	Meaning
Yes	Pause between the printing of each graph. PrintGraph will signal the pause with a continuous *beeping*. Pressing [SPACE] causes PrintGraph to continue.
No	PrintGraph will not pause between printing graphs. As always, the current setting of Pause is displayed on the status area of the screen.

Eject Option

Selecting Eject allows you to control whether PrintGraph will automatically advance the paper to the next page between printing graphs.

Choice	Meaning
Yes	Advance (eject) the paper between printing of graphs. On a printer (a continuous paper-feed device), the paper will be advanced to the top of a new page before printing resumes. On a plotter, you will be prompted to put a new sheet of paper on the plotter before printing will resume.
No	No paper will be advanced between printing of graphs, unless PrintGraph determines that the next graph to be printed is too "long" for the current page, in which case the paper will be advanced to the top of the next page automatically. Otherwise, you will have to use the printer's controls to advance paper.

The current setting of Eject is displayed on the status area of the screen.

Readying the Printer

Before PrintGraph does any printing, you should be sure that your printer is ready for printing. Two PrintGraph options allow you to position the paper correctly:

Option	Meaning
Align	Sets the current paper position to be the "top of page".
Page	Advances the printer paper one page.

The printer's controls can be used to advance the paper until the print head is located at the top of a new page. You should then select Align, to tell PrintGraph that the current paper position is the top of the form. Once the paper is Aligned, all subsequent Pages will cause the printer to advance exactly one page (to the top of form on the subsequent page). If you need to advance the paper to Align it, use the printer's controls.

Printing the Graph

Now you are ready to print your graph(s). Select Go from the PrintGraph menu. PrintGraph will then use the options you have selected to format and print the graph(s) on your printer or plotter. As PrintGraph works, it will display messages in the status area of the screen letting you know what it is currently doing. During the printing process, your printer may stop for a few seconds. Don't be alarmed; this is normal. When all graphs have been printed, you will be returned to the PrintGraph menu.

Interrupting Graph Printing

To stop PrintGraph while a graph is being printed, hold down [CTRL] and press [BREAK]. Your printer may continue until it completes the current line. Then, control returns to the PrintGraph menu.

Leaving PrintGraph

When you are finished using PrintGraph, select Quit from the PrintGraph menu. You will be prompted to confirm your Quit by selecting Yes or No. Selecting No will return you to the PrintGraph menu. If you started PrintGraph from the Access System menu, selecting Yes will return you to the Access System. You will be prompted to remove the PrintGraph Disk and reinsert your 1-2-3 System Disk if you select 1-2-3. If you started PrintGraph from MS-DOS, selecting Yes will return you to MS-DOS.

A Sample PrintGraph Session: Printing Two Graphs

Suppose that you have two graphs that you want to print, "PROJECT" and "EXPENSE", which are stored on a data disk in Drive B. You normally use your DMP-2100 printer as the graphics printer, but today you want to use an FP-215 plotter. What do you do next? Follow through this sample session with PrintGraph.

First, you want to get PrintGraph running. If you're still in 1-2-3, you need to save the current worksheet and graph(s) if you haven't already done so (using the /File Save and /Graph Save commands) and then exit 1-2-3 (using /Quit Yes). You are now in the Access System menu. Select PrintGraph from the menu, at which time you will be prompted to remove the 1-2-3 System Disk from Drive A and insert the PrintGraph Disk into the same drive. The PrintGraph menu and status screen will be displayed, showing the current PrintGraph configuration.

(If the MS-DOS prompt **A>** had been displayed on the screen, you would have put the PrintGraph Disk in Drive A and typed:

GRAPH **[ENTER]**

The PrintGraph menu and status screen would have been displayed after a few seconds.

The first thing you do is tell PrintGraph where the pictures and fonts you want to use are stored. Notice that the status screen gives us the current configuration:

DIRECTORIES
Pictures: B:\
Fonts: A:\

Is that correct? The data disk is located in the root directory of Drive B, so you don't need to change Pictures. Usually fonts are located on the PrintGraph disk in the root directory of Drive A, so that won't need to be changed either. If that weren't the case, you could:

1. Select Configure Files Pictures or Configure Files Fonts from the menu.

2. When prompted, you would type the name of the directory where pictures or fonts are stored. In either case, press **[ENTER]** following the entry.

The status screen would immediately show the new configuration. If you wanted to make the directory change permanent, you would also have to select Configure Save Replace to record the change in PrintGraph. Remember, you can always change the configuration at any time.

What about the printer? A quick check of the status screen tells us that the current GRAPHICS DEVICE is a Medium-resolution DMP-2100, which is set to use the Parallel INTERFACE. Since you want to use an FP-215 plotter, you need to change the graphics device.

Select Configure Device from the menu, and the list of available graphics devices will be displayed on the screen. Now you can choose the FP-215 plotter by moving the pointer with the ↑ and ↓ keys. To make the choice, press **[SPACE]**. The status screen will be updated accordingly, and you will be returned to the Configure menu. Since the FP-215 will be attached at the same printer connector, you don't need to change the Interface option.

Should you Save the new printer configuration? Probably not, since the FP-215 is temporary. The next time you start the PrintGraph program, it will read the startup configuration stored on the PrintGraph disk, and the default printer will again be the Medium-resolution DMP-2100.

Now select the graphs you want to print from the files stored on the data disk. When you choose Select from the PrintGraph menu, the available picture files on the data disk will be displayed in the status area of the screen:

PICTURE	DATE	TIME	SIZE
EXPENSE	11-03-85	15:02	8832
MONTHLY	11-26-85	14:20	13568
NEWCHART	11-26-85	15:40	15488
PROJECT	02-15-85	10:56	3072
YEARLY	12-10-85	14:23	33920

The graphs you want to print are "PROJECT" and "EXPENSE". Select these graphs from the list of pictures by using the ↑ and ↓ keys to move the the pointer to the pictures you want. When you reach "PROJECT" and "EXPENSE", press **[SPACE]** to select the pictures. The # indicator will appear next to the selected pictures, like this:

PICTURE	DATE	TIME	SIZE
#EXPENSE	11-03-85	15:02	8832
MONTHLY	11-26-85	14:20	13568
NEWCHART	11-26-85	15:40	15488
#PROJECT	02-15-85	10:56	3072
YEARLY	12-10-85	14:23	33920

The **[SPACE]** key acts as both a selector and a "deselector" for pictures (it's also called a "toggle", because it switches back and forth between two choices). So if you make a mistake, you can deselect, or select, a picture as many times as you want.

While the highlighted pointer is on each name, you can press the **[F10/GRAPH]** key to produce a rough sketch of the graph on the screen. This allows you to verify graph choices—"EXPENSE" and "PROJECT". When you've finished selecting pictures, press **[ENTER]**, and the status screen will be redisplayed with the selected pictures listed at the left in the exact order in which you selected them. The selection order will also be the order in which the pictures are printed.

There are a few more options that you could specify. You could select different colors and fonts to be used in printing the graphs. You could also change the size and alignment of the graphs on the page, and choose whether PrintGraph pauses between printing graphs, and whether each graph should be printed on a new page. As always, PrintGraph's status screen shows the currently selected fonts and colors, and the current size and alignment settings for the soon-to-be-printed graphs. Checking the status screen, you find that the currently displayed colors for the graph are:

COLORS

Grid:	Black
A Range:	Cyan
B Range:	Magenta
C Range:	Black
D Range:	Black
E Range:	Black
F Range:	Black

Since your plotter has four available pen colors, you could keep the current color assignment, but say that you decide to print the graphs entirely in black. "EXPENSE" and "PROJECT" each involve only two data ranges, so here's how you would specify the colors for those data ranges:

1. Select Options Color A. The prompt line displays a list of color choices for data range A with the pointer resting over Black. Press [ENTER] and Black will be selected. The status screen will be updated to reflect the change.

2. Now, since you haven't left the Color menu, choose B and press [ENTER]. The color for the B Range will also be changed to black. Again, the status screen will reflect this.

3. To exit the Color menu, select Quit. Another Quit will put you back in the PrintGraph menu.

Finally, you have decided to print the graphs using the ROMAN2 font. You select Options Font from the PrintGraph menu, and a list of available fonts will be displayed on the status screen. Selections from this list are made in exactly the same way as selections from the Pictures list. You're allowed to pick one font each time. The first font selected will become Font 1 and will be used on graph titles. The second choice will become Font 2 and will be used on graph legends. If you don't make a separate selection for Font 2, the font you selected for Font 1 will be used for the whole graph. After a font is selected, you are returned to the Options menu.

Now, check to see that the printer is properly set at the beginning of a new page. If it is, select Align from the PrintGraph menu. It appears that nothing has happened, but PrintGraph will "know" where the top of the paper is. If the paper isn't at the top of the page, use the printer's controls to advance the paper until it is.

To print the graphs, you should select Go from the PrintGraph menu. As PrintGraph processes the graphs and prints them, it will inform you of its progress by displaying these messages:

Loading Font A: ROMAN2

Loading Picture B: PROJECT

Generating Picture B: PROJECT

Loading Picture B: EXPENSE

Generating Picture B: EXPENSE

The message *WAIT* will also be displayed in the upper right corner of the control panel.

The two graphs are printed the way you wanted them. You can now fine tune the graphs by altering some of the other PrintGraph parameters. That's the best thing about PrintGraph: if you don't exactly like the way things look, you can electronically change them until they're just right.

Access System

21. Lotus Access System

To keep things running smoothly for you, a number of additional programs are included on your 1-2-3 disks.

Lotus has gathered the essential programs needed to support 1-2-3 usage under a single, easy-to-use umbrella: the **Lotus Access System**. Think of the Access System as a "switchboard", through which you can invoke any of the programs provided by Lotus. When you finish using a program, control automatically returns to the central switchboard.

Using the Access System is like using 1-2-3 itself in several ways:

- You select tasks to perform from a series of menus that both present all your options and provide a short explanation of each one.
- Every step of the way, you can press the [F1/HELP] key to get more detailed explanations.
- Procedures that erase data are protected with confirmation steps, to minimize the likelihood of accidentally doing something you'll later regret.

The biggest payoff is that learning 1-2-3 skills also makes the rest of the Access System easy to learn.

Access System Functions

Here is an outline of the essential functions you can perform using the Lotus Access System:

- Start a 1-2-3 session.
- Print the graph files created with 1-2-3.
- Translate files created by other programs into a form that 1-2-3 can use.
- Translate files created by 1-2-3 into a form other programs can use.
- Perform file-maintenance functions: copying, renaming, and erasing individual files; displaying lists of filenames sorted by name, by creation date, etc.

Starting Your Computer with the System Disk

When you reset the computer with the 1-2-3 System Disk (or its backup) in Drive A (the drive on the bottom), the computer automatically passes control to the Lotus Access System. First, though, it prompts you to enter the current date and time. If you have any trouble with these entries, see the "Transferring 1-2-3 Files to a Hard Disk" section in "Getting Started".

If you have already started your computer and are at the MS-DOS A> prompt, you can re-enter the Access System by typing the following MS-DOS command:

LOTUS [ENTER]

(Uppercase and lowercase letters are equivalent to the MS-DOS command processor.)

The Access System menu screen appears (Figure 21-1).

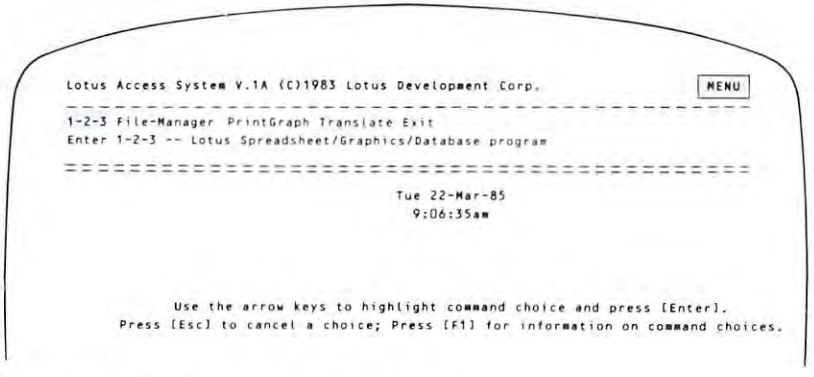


Figure 21-1. Lotus Access System Menu

Note. The automatic startup procedure for the Lotus Access System is stored on the 1-2-3 System Disk in a file named "AUTOEXEC.BAT". Don't alter or erase this file unless you wish to change the startup procedure. (See the "AUTOEXEC.BAT File" section in the MS-DOS Manual.)

It is possible to bypass date and time entry, but we urge you to be conscientious in entering them each time the computer prompts you to do so. These entries allow MS-DOS to timestamp all the data you store, a very valuable service.

There are two ways to reset the computer—get it to "start again from scratch"—without turning the power off and on. First, locate the black Reset Switch, which is under the red Power Switch. Press the Reset Switch in. The other method is to hold down both the [CTRL] and [ALT] keys together, then press [DELETE]. In both cases, you must wait a few seconds for the system to self-test.

Using Access System Menus

Using the menus in the Access System is just like using 1-2-3 command menus (page 6-8). There are two ways to select a menu choice:

1. Use the pointer-movement keys on the right side of the keyboard to highlight your choice, then press [ENTER].

2. Type the first letter of the menu choice.

Getting Help

Whenever you're at an Access System menu, you can press the [F1/HELP] key to interrupt the session and view a Help screen. To return to using the Access System, press [ESC]. In some cases, selecting a menu choice takes you to another menu. You can return to a higher menu level by selecting the Quit choice or by pressing [ESC]. (For details, see Chapter 6, "Using 1-2-3 Commands".)

Switching Disks

When you select a function from the Access System menu, the program may prompt you to switch disks. A typical prompt might look like this:

Put 1-2-3 System Disk in Drive A and press any key.

When you're switching disks, always be sure to replace the outgoing disk in its protective sleeve. We won't mention the details of disk-switching any further in this chapter, trusting that you'll find the Access System instructions easy to follow.

In the following sections, we describe each program that you reach through the Access System switchboard. For the Tandy-supplied programs, we will not attempt to duplicate the documentation provided in the MS-DOS Manual. Instead, we'll refer you to the appropriate section in that manual.

1-2-3 — Start a 1-2-3 session

The 1-2-3 startup screen appears at the beginning of a session. Press any key to erase the startup screen to begin using the program. Once 1-2-3 is active, do not remove the 1-2-3 System Disk from Drive A unless you are specifically instructed to do so.

Automatic Loading of Worksheets. When 1-2-3 begins execution, it automatically searches the current directory for a worksheet named "AUTO123". If such a file exists, 1-2-3 automatically /File Retrieves it. Which directory is to be current when 1-2-3 starts execution is determined by the setting in the 1-2-3 configuration file, 123.CNF (/Worksheet Global Default Directory command).

Ending 1-2-3. To end a 1-2-3 session, issue the /Quit command. Be sure to save your work first, using the /File Save command. 1-2-3 does not automatically save data when you end a session.

PrintGraph — Start a PrintGraph session

The PrintGraph program provides a convenient way to print the graphs you've defined using 1-2-3. For a description of PrintGraph program usage, see Chapter 20.

Ending the PrintGraph Program. To end a PrintGraph session, issue the Quit command and confirm by selecting Yes.

Translate — Translate files for data import/export

Translate allows you to exchange data between 1-2-3 and other programs that run on the Model 2000. You can even exchange data with other computers—all you need is an appropriate data-communications program.

Translate can perform several types of file conversion:

Source	Filename Extension	Destination	Filename Extension
VisiCalc spreadsheet	.VC	1-2-3 worksheet	.WKS
DIF (Data Interchange Format)	.DIF	1-2-3	.WKS
dBASE-II	.DBF	1-2-3	.WKS
1-2-3	.WKS	DIF	.DIF
1-2-3	.WKS	dBASE-II	.DBF

Ending Translate. To return to the Access System main menu, select Quit and confirm by selecting Yes.

Translate Functions

Before performing any file translations, be sure that each file to be translated has the proper filename extension, as indicated in the table above. Use the Lotus Access System File Manager or the MS-DOS RENAME command to do the job.

Procedure

1. When you select Translate, the following menu appears:

   VC to WKS DIF to WKS WKS to DIF DBF to WKS WKS to DBF Quit

Select a Translate function by moving the menu pointer and pressing [ENTER] or Quit to the Access System main menu.

2. Specify the *source directory*—the one with the files you wish to translate.
3. Translate displays a list of files of the appropriate type, for example:

   ACCTS1.DBF
   ACCTS2.DBF
   PHONELST.DBF
   PROSPECT.DBF

Select one file only, using the pointer-movement keys, [SPACE], and [ENTER]. (For details, see "Selecting Files" on page 21-9.)

4. Specify the *target directory*—the directory on which the translated file is to be stored.

5. Confirm the Translate request by selecting Yes. Selecting No allows you to choose another file to translate. Selecting Quit returns you to the Translate menu.

VC to WKS: The VisiCalc functions @@CHOOSE, @@NOT, or @@OR, and @@AND will not be translated as formulas. When Translate encounters one of these functions, it displays a "Formula error" message, reports the cell address, and translates the text of the VisiCalc formula as a label entry.

DIF to WKS: Select by-row or by-column translation. If you make the same choice here that was made to create the DIF file, the data is preserved in its original form. If you make the opposite choice, the data's rows and columns are switched.

WKS to DIF: Use only worksheet files created with the /File Save command.

DBF to WKS: Deleted records in the dBASE-II file are not written to the worksheet file.

WKS to DBF: To restrict the translation to a particular range of the worksheet, enter a *range name*. If you specify a range that is only one row deep (i.e., a row of field names), Translate will process succeeding rows until it reaches a blank row. To process the entire worksheet, press [ENTER] alone. The first row of the partial or complete worksheet must be the database's top row (i.e., the row of field names).

File-Manager — Start a File-Manager session

The File-Manager menu appears (Figure 21-2). This program provides an easy-to-use way to handle individual files and groups of files on your data disks. When you select the File-Manager, it asks you to choose a disk drive to use as a source for processing. (Don't worry—you can change in midstream.) Then, the File-Manager menu appears above a list of all the files in the current directory of the source disk.

Ending File-Manager. To return to the Access System main menu, select Quit and confirm by selecting Yes.

Descriptions of the File-Manager functions follow:

Disk-Drive

Specify the disk drive that contains the disk with the files to be processed. Use this function whenever you switch disks in any disk drive. Only the directory of the source disk is processed by the File-Manager.

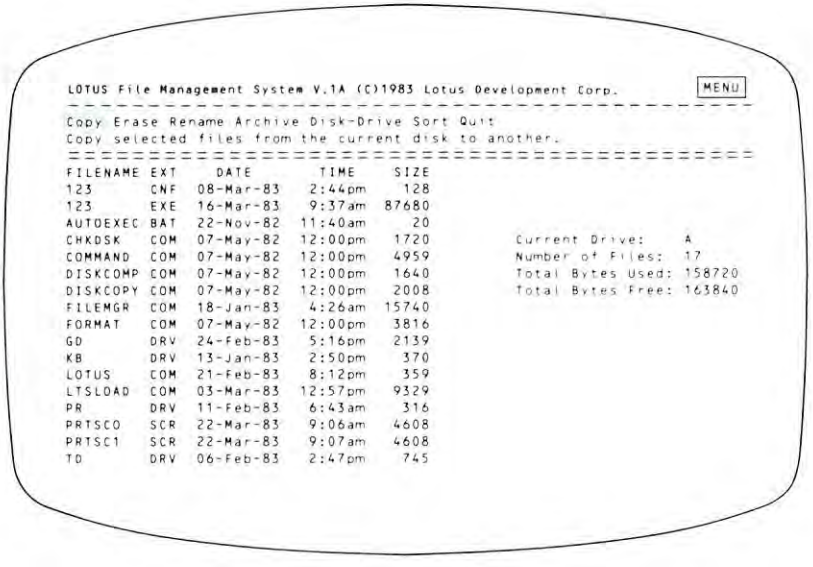


Figure 21-2. File-Manager Menu

Procedure

1. Before selecting Disk-Drive, place the disk containing the files you wish to process in the desired drive.

2. Select Disk-Drive and indicate the letter of the chosen drive.

A list of files in the current directory of the chosen disk appears, sorted according to the current sort settings (Figure 21-3).

Whenever you are not in the midst of a File-Manager function, you can switch disks and/or respecify the Disk-Drive setting.

Copy

Copy files from the current directory of the source disk to the current directory of another disk. (If your system has only two disk drives, then there will be no choice as to the files' destination.) The newly created files always have the same names as the originals.

Procedure

1. Select a set of files. (See "Selecting Files" below.)

2. Make sure the proper disk is in the destination drive. Then confirm the Copy request by selecting Yes. Selecting No returns you to Step 1. Selecting Quit returns you to the File-Manager menu.

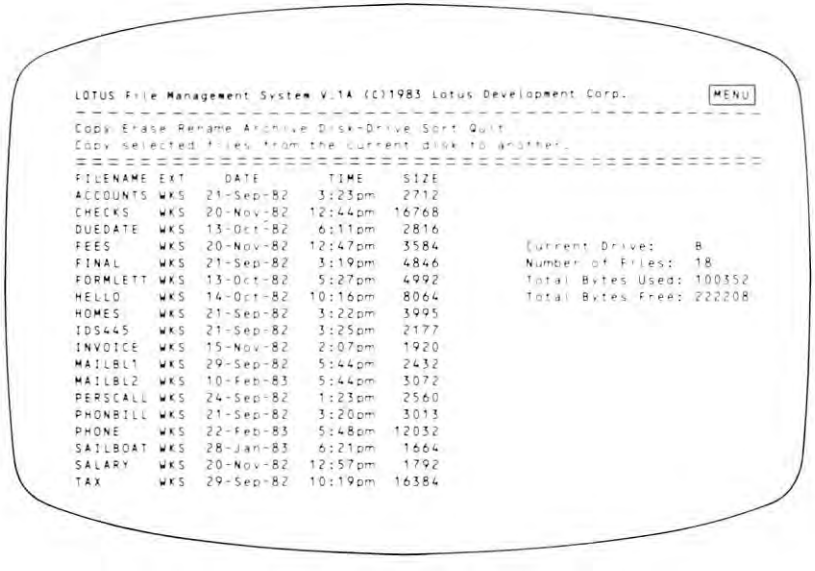


Figure 21-3. Filename Listing

Erase

Erase one or more files in the current directory of the source disk.

Procedure

1. Select a set of files. (See "Selecting Files" below.)

2. Confirm the Erase request by selecting Yes. Selecting No returns you to Step 1. Selecting Quit returns you to the File-Manager.

The File-Manager highlights each filename as it erases the file. You can press **[BREAK]** to interrupt a multiple-file erasure.

Rename

Assign a new name to one or more files in the current directory of the source disk.

Procedure

1. Select a set of files. (See "Selecting Files" below.)

2. Confirm the Rename function by selecting Yes. Selecting No returns you to Step 1. Selecting Quit returns you to the File-Manager menu.

3. One at a time, type new filenames (you must include filename extensions) as the File-Manager prompts you. The renaming takes place as you type each name. To quit in the middle of this process, press **[BREAK]**.

Archive

Create a second copy of one or more files in the current directory of the source disk. Each new copy must have a name different from the original.

Procedure

1. Select a set of files. (See "Selecting Files" below.)

2. Confirm the *Archive* function by selecting Yes. Selecting No returns you to Step 1. Selecting Quit returns you to the File-Manager menu.

3. One at a time, type new filenames (you must include filename extensions) as the File-Manager prompts you. The copying takes place as you type each name. To quit in the middle of this process, press **[BREAK]**.

Sort

Rearrange the displayed list of filenames.

The files themselves are not affected. The Sort function is similar to 1-2-3's /Data Sort command (page 17-4). You can sort the lines of filenames, in Ascending or Descending order, according to the data in any one or two of the four columns.

Procedure

1. A sort menu appears:

   Primary-Key Secondary-Key Reset Go Quit

2. (Optional) If you wish to cancel existing sort specifications, choose Reset.

3. Select Primary-Key to display this list of choices:

   Name Extension Date/Time Size

Move the highlight to indicate the column to be used as the primary basis for the reordering.

4. (Optional) Select Secondary-Key to redisplay the same list of choices. Select the column to be used to break ties in case two files have the same Primary-Key entry.

5. Select Ascending (A-Z) or Descending (Z-A) sort order.

6. Select Go to perform the sort. The File-Manager menu returns.

You can re-sort the filename list as many times, in as many ways, as you wish. Do not switch disks in the midst of a sort operation.

Selecting Files

The Copy, Erase, Rename, and Archive functions all process a set of one or more files stored in the current directory of the source disk. The process of selecting sets of files is something unique to the File-Manager: 1-2-3 itself never processes more than one file at a time. You indicate the files to be processed as follows:

1. Select a Command: Copy, Erase, Rename, or Archive. An indicator will appear in the upper right corner to remind you which command you are using.

2. Select the File(s). Use these keys to move the highlight among the filenames:

Key	Function
↑	Up one name
↓	Down one name
[PG UP]	Up one page of names
[PG DN]	Down one page of names
[HOME]	First filename
[END]	Last filename

Whenever a filename is highlighted, you can press [SPACE] to select the file (Figure 21-4). File-Manager marks the filename with the character #. Pressing [SPACE] at a filename that is already marked removes the mark and "deselects" the file.

3. When you are finished marking filenames, press [ENTER] to proceed to the next step. To cancel your work, press [ESC]. This removes all the marks from the list and returns you to the File- Manager menu.

Special case. If you wish to select a single file, you may skip step 2. Just move the pointer to the file you desire and press [ENTER].

Figure 21-4. Selecting Files with [SPACE]

Exit — Return to MS-DOS

End the Access System session and return control of the computer to MS-DOS. Confirm the request by selecting Yes. Selecting No leaves you in the Access System.

Appendices

Contents

A. Configuring 1-2-3

Now that you have 1-2-3, what do you need in the way of hardware to get it up and running, and how do you tell 1-2-3 what your computer system looks like? This appendix covers both of these questions.

What You Need to Run 1-2-3

Your dealer should have provided you with an explanation of the minimum hardware needed to run 1-2-3, but if he or she didn't, here are the facts.

Required Hardware

1. A Tandy TRS-80 Model 2000, with at least 256K of main memory.

2. A pair of double-sided, double-density diskette drives or one double-sided diskette drive and a hard disk.

3. A Tandy VM-1 Monochrome Monitor or a Tandy CM-1 Color Monitor with graphic options.

Optional Hardware

1. Additional memory up to a total of 768K. 1-2-3 can use all additional memory that you install.

2. Printer and interface.

3. Plotter or graphics printer, along with the appropriate interface card.

See Chapter 20, "Printing 1-2-3 Graphs", for a partial list of graphics printers and plotters compatible with 1-2-3.

Note: You need a high resolution Monochrome Graphics board and a VM-1 Monochrome Monitor to display high resolution monochrome graphics. You need a High Resolution Monochrome Graphics board with a High Resolution Color Graphics Chip Kit installed and a CM-1 Color Monitor to display graphs in color.

1-2-3's Default Configuration

Every time you start 1-2-3, it reads a startup configuration file, 123.CNF, from the 1-2-3 System Disk. Stored in this file are procedures that 1-2-3 uses during a work session—unless you override them. These procedures are collectively called the **default configuration**. This is the "factory-installed' or default configuration:

Data transfer to the printer (/Print commands)

- Printer interface: Parallel connector
- Page length: 66 lines (11 inch paper printed at 6 lines per inch)

- Print margins: Two empty lines at the top and bottom of a page; four-column left margin (start printing in column 5); right margin at column 76.
- Printer setup string: None
- Auto Line-Feed setting: The printer does not automatically advance the paper after each line is ended. This means that 1-2-3 will include linefeed characters in print output.
- End-of-page procedure: Do not wait for manual intervention at the end of each print page.

Data transfer to/from disk storage (used by several commands)

- Unless a filename is preceded by a *pathname*, store and retrieve information on diskettes using the root directory of the disk in Drive B (on the top).

If these procedures are the ones you wish 1-2-3 to use, then you will not want to change 1-2-3's default configuration.

Changing 1-2-3's Default Configuration

There are two ways to change the default configuration:

1. Use the /Worksheet Global Default commands (described below).

This establishes new default procedures for the current 1-2-3 session and, optionally, alters the configuration file, 123.CNF. At the start of subsequent sessions, 1-2-3 will read the new default configuration. In that sense, you might want to think of the default configuration as being permanent. But you can alter it as many times as you like, using /Worksheet Global Default.

2. Use /Print Options and /File Directory commands.

While using 1-2-3, you can override the default printer settings. These overrides are stored in the *worksheet files* in which you store worksheets. This makes it easy to define a special print format for each worksheet.

You can also override the default directory setting that determines the directory for storing and retrieving data.

You can also cancel the override—return to the default printer settings using /Print Printer Options Clear.

Note. While we recommend always leaving the 1-2-3 System Disk in Drive A, the other configuration options can be changed to suit the requirements of your system or your personal taste.

The /Worksheet Global Default command allows you to control the default configuration through the following menu structure:

Printer Directory Status Update Quit

↓

Interface Auto-LF Left Right Top Bottom Page-Length Wait Setup Quit

The default configuration supplied by Lotus includes these settings:

Printer

Interface: Parallel
Auto Line-Feed: No
Left margin: 4
Right margin: 76
Top margin: 2
Bottom margin: 2
Page length: 66
Pause at end of page: No
Setup string: <none>

Current Directory at Startup: B:\

This listing is an illustration of the default configuration status screen (see "Status" below).

Top-Level Menu

Printer. Specify printer and printer characteristics.

Directory. Specify the *current directory*—the standard directory to be used for data storage and retrieval.

Status. Display the default configuration settings.

Update. Store the configuration settings in file 123.CNF on the 1-2-3 System Disk.

Quit. Return to Ready mode.

Choose options on this menu by moving the pointer with ←, →, [HOME], and [END], then pressing [ENTER], or by typing the first letter of the option.

Printer Options

Interface Option **Lotus-supplied: 1 (Parallel)**

To connect a printer to a computer, some type of interface card and cable are required. Computers communicate with printers using two different means: parallel or serial. You must tell the computer what kind of interface is connected or it will not communicate correctly with the printer.

1 Parallel. The standard parallel interface connector supplied with the Model 2000 at the back of the main unit.

2 Serial. The serial (RS232-compatible) interface connector at the back of the main unit. Baud rate must also be specified (see below).

3 Second Parallel. An optional second parallel interface.

4 Second Serial. An optional second serial interface. Baud rate must also be specified (see below).

With choice 2, you must also specify the interface's *baud rate*—the speed at which data will be sent to the printer:

110 150 300 600 1200 2400 4800 9600 19200

To determine the correct baud rate setting, check the manual that accompanied your printer, or ask your dealer for advice. Most printers and plotters seem to operate best at 1200 baud, but you should select the fastest available baud rate that will correctly transmit data without losing it. Be sure that your printer is compatible with the Model 2000 and 1-2-3.

Note: Second Parallel and Second Serial hardware interfaces are not currently available for the Model 2000.

Auto-LF **Lotus-supplied: No**

Many printers do not automatically advance the paper a line. They must be sent a *linefeed* character (Control J—ASCII code 10 decimal) after every carriage return character (Control M—ASCII code 13 decimal). 1-2-3 indicates this condition with an Auto-LF setting of No in the default configuration.

(With some printers, auto-advance is a switch-selectable option.)

If your printer automatically advances the paper after a carriage return, change this configuration setting to Yes.

Here's an easy test to determine whether this setting should be changed: Print a few rows of the worksheet using the /Print Printer command.

- If the printout is double-spaced, change the Auto-LF setting from No to Yes.
- If the printout is spaced correctly, don't change the Auto-LF setting.
- If the printer does not advance the paper at all, then change the Auto-LF setting from *Yes* to *No*.

You can also check your printer's User Manual or consult your dealer.

Right, Top, Left, and Bottom Margin

Possible settings: 0-240 for Left and Right; 0-10 for Top and Bottom
Lotus-supplied: Left = 4, Right = 76, Top = 2, Bottom = 2

If you Update the configuration file (see below), 1-2-3 will use these margin settings unless you override them with /Print Options Margins commands (page 15-12). Margin settings may also be overridden when you /File Retrieve a worksheet.

- If your printer has a wide carriage or you select compressed printing with a setup string (see below) you will probably want to increase the right margin.
- If your printer is set to automatically skip over the paper perforations, set the top and bottom margins to zero.

Page-Length **Possible settings: 20-100 Lotus-supplied: 66**

If you Update the configuration file (see below), 1-2-3 will use this setting unless you override it with a /Print Options Page-Length command (page 15-15). The page-length setting may also be overridden when you /File Retrieve a worksheet.

- If your printer is set to automatically skip over the paper perforations, you must reduce the page length. This may require some experimentation, but a value of 60 is typical.

Wait **Lotus-supplied: No**

This setting allows you to configure printers that use either continuous, fan-fold paper or single sheets.

Yes. 1-2-3 will pause between each page of printed output. At this point, you should load a new sheet of paper, then press any key to continue printing.

No. 1-2-3 will not pause between pages, but will print continuously.

Setup **Lotus-supplied: none**

Your printer may require 1-2-3 to send it a sequence of control characters (*setup string*) before it can begin printing, or to set printer options. The default setup string you specify here will be sent to the printer every time you issue the /Print Go command, unless you override it with a /Print Options Setup command (page 15-14). A setup string reinstated when you /File Retrieve a worksheet also overrides the default setting.

See page 15-14 for a description of how to enter a setup string.

Directory Options **Lotus-supplied: B:**

At the beginning of a 1-2-3 session, one disk drive becomes the *current directory*. Whenever 1-2-3 uses a file to save or retrieve data, you must supply it with a filename. If you don't use a *pathname* with this filename (e.g., C:FILE_34), 1-2-3 uses a file in the current directory.

Your entry here determines which directory becomes current at the beginning of a 1-2-3 session. During the session, you can change the setting with the /File Directory command.

An empty entry (no characters) specifies that 1-2-3 should store data in the directory in which the 1-2-3 program resides.

Status

Temporarily erases the worksheet and displays the current configuration settings. Press any key to return the worksheet to the screen. Pressing this key has no other effect.

Update

Before issuing this command, be sure to remove the write-protect tab from the 1-2-3 System Disk, and that the disk is loaded in its drive. Replace this tab when the Update operation is finished.

If you have changed the default configuration and want to make those changes permanent, choose Update. This records the new configuration in the file 123.CNF. 1-2-3 will use the new configuration the next time it starts. Then select Quit to return to Ready mode.

Quit

If you have not changed the default configuration, or if you do not wish to change the contents of the configuration file, choose Quit without Updating. You return to Ready mode.

B. Printer Control Codes

Printers often require special characters, ASCII *control codes*, to be sent to them in order to accomplish particular tasks. Control codes usually aren't required for regular printing, but if your printer is capable of special functions (using compressed type sizes, printing in color, etc.), then it requires control codes.

Each printer recognizes its own set of control codes, and only its own. Be sure to consult your printer's user manual for a list of control codes.

1-2-3 allows you to send any character or characters to your printer as a **setup string**. You can define a standard (*default*) setup string using the /Worksheet Global Default Printer Setup command (page A-5). The default setup string can be overridden with the /Print Options Setup command (page 15-14).

In 1-2-3, the first 32 ASCII codes represent control characters. With some programs, you enter these characters by holding down the [CTRL] key and typing a character. In a setup string, control characters must be entered in the form:

nnn

(*nnn* represents the character's three-digit *decimal* ASCII code)

The rest of the codes may be entered either as a typed character (e.g., F) or in *nnn* form (the code for **F** is \070).

Example 1. With a DMP-2100 printer, these three characters turn on both compressed print and italics:

Control-O Escape 4

With 1-2-3, this setup string would be entered as:

\015\0274

Example 2. With an CGP-220 printer, these three characters select the magenta color on a process ribbon:

Escape T 5

With 1-2-3, this setup string could be entered as:

\027 T 5

or

\027\084\053

or any number of similar combinations.

The table on the next page shows the standard ASCII codes in \nnn form, along with their character equivalents.

Setup String Representation	Character	Setup String Representation	Character
\000	Control @	\044	, *(comma)*
\001	Control A	\045	-
\002	Control B	\046	. *(period)*
\003	Control C	\047	/
\004	Control D	\048	0
\005	Control E	\049	1
\006	Control F	\050	2
\007	Control G *(bell)*	\051	3
\008	Control H	\052	4
\009	Control I *(tab)*	\053	5
\010	Control J *(line feed)*	\054	6
\011	Control K	\055	7
\012	Control L *(form feed)*	\056	8
\013	Control M *(carriage return)*	\057	9
\014	Control N	\058	:
\015	Control O	\059	;
\016	Control P	\060	<
\017	Control Q	\061	=
\018	Control R	\062	>
\019	Control S	\063	?
\020	Control T	\064	@
\021	Control U	\065	A
\022	Control V	\066	B
\023	Control W	\067	C
\024	Control X	\068	D
\025	Control Y	\069	E
\026	Control Z	\070	F
\027	[ESC]	\071	G
\028	FS	\072	H
\029	GS	\073	I
\030	RS	\074	J
\031	US	\075	K
\032	[SPACE]	\076	L
\033	!	\077	M
\034	"	\078	N
\035	#	\079	O
\036	$	\080	P
\037	%	\081	Q
\038	&	\082	R
\039	' *(apostrophe)*	\083	S
\040	(	\084	T
\041	)	\085	U
\042	*	\086	V
\043	+	\087	W

Setup String Representation	Character
\088	X
\089	Y
\090	Z
\091	[
\092	\
\093	]
\094	^ *(caret)*
\095	_
\096	` *(grave)*
\097	a
\098	b
\099	c
\100	d
\101	e
\102	f
\103	g
\104	h
\105	i
\106	j
\107	k
\108	l
\109	m
\110	n
\111	o
\112	p
\113	q
\114	r
\115	s
\116	t
\117	u
\118	v
\119	w
\120	x
\121	y
\122	z
\123	{
\124	|
\125	}
\126	~
\127	DEL

C. Error Messages

There are some things that 1-2-3 cannot do. When you ask for the impossible, it usually *beeps*, shows an *error message* at the bottom of the screen, and changes the mode indicator to *ERROR*. The message is a brief explanation of what is wrong.

To continue working with 1-2-3, press [ESC] or [ENTER]. Until you do this, 1-2-3 won't let you perform any other action. It just *beeps* with each keystroke. After you press [ESC] or [ENTER], you are back in 1-2-3 in Ready mode. No data will have been lost. Sometimes the worksheet will have changed, such as when you run out of memory; the command will stop when the memory is filled.

Before trying the same command again, correct whatever caused the error. This section contains suggestions of what to do.

Cannot create file. This error message means you are trying to store too many files on your disk.

Cannot delete file. This error means you are trying to erase a file that does not exist, the file is in the wrong directory, or you have entered an incorrect path.

Cannot read help file. An error has occurred while trying to read the Help file.

Directory does not exist. /File Directory or /Worksheet Global Default Directory command: There is no directory with the name you entered. (1-2-3 does record the new directory name in its internal memory. It will save this name in 123.CNF when you issue a /Worksheet Global Default Update command.)

Disk drive not ready. You have tried to access a disk that is not ready; the disk drive door is probably open, or there is no disk in the drive.

Disk error. 1-2-3 has tried to read or write on a disk and an error occurred. 1-2-3 will try again automatically. If it gets the error again, it gives you this message. Probably, the disk is damaged, or sometimes the drive is at fault.

Disk full. The available disk space is exhausted. Try another diskette. You can find out how much space is left on a disk with the /File List command. To save a worksheet that is too large to fit on one disk, you must use /File Xtract to save portions of the worksheet.

Disk is write protected. You have tried to write (/File Save or Xtract, /Print File, /Graph Save or /Worksheet Global Default Update) on a write protected disk or diskette (one with a tab covering the notch). Check the disk and try again.

File close error. This error should never occur; if it does, something may be wrong with your computer or system disk.

File does not exist. The requested input file does not exist. You can find out what files are on the current disk with the /File List command.

Formula computation error. You should never get this error message. If you do, something may be wrong with your computer or system disk.

Formula too long. The formula entered is too long or contains too many levels of nested parentheses. Break the formula down into two or more components, writing each one into a separate cell.

Illegal cell or range address. You have given 1-2-3 a set of cell coordinates or a range name which it cannot interpret. This is usually a typing error; legal coordinates are A1 through IV2048. It can also happen if you have deleted an endpoint of a named range, which sets the named range to *ERR*.

Illegal character in filename. You can only use letters, numbers and the underscore (_) in filenames.

Illegal disk name. You have tried to use a disk prefix letter not in range A..P; this is probably a typing error.

Illegal file format. The file you attempted to /File Retrieve or /File Combine is not a valid worksheet file. Only files created with /File Save or /File Xtract can be brought into the worksheet using /File Retrieve or /File Combine. If one of these files causes this error, the disk has been damaged.

Illegal formula. While recalculating formulas, 1-2-3 found an invalid formula. When you clear the error condition, the cell pointer is positioned to the first invalid formula.

Illegal menu. Using the /XM Menu command (used only in keyboard macros), you have specified more than eight items, or all your prompts, taken together, have too many characters, or you have failed to specify any items.

Illegal "*nnn*" code in setup string. The *nnn* code is the decimal representation of the ASCII code. All three characters must be digits, and the number they represent cannot exceed 255. (See Appendix B, "Printer Control Codes".)

Illegal number input. You provided an invalid number in response to a command prompt. This could be a typing error, or a number larger or smaller than the command can accept (Chapter 5, "Creating Cell Entries"). Type the number again.

Illegal /X command in macro. In a keyboard macro, the command "/X" is not followed by a legal character. The legal /X commands are: /XC, /XG, /XI, /XL, /XM, /XN, /XQ, /XR.

Input line too long. You have tried to /File Import a text file with a line longer than 240 characters. Since 1-2-3 expects lines to end with a carriage return, this can happen when importing files from a program that doesn't use carriage returns at the end of each line.

Justify range is full or line too long. In /Range Justify, there's not enough room in the specified range for the labels after justification. After pressing [ESC], 1-2-3 will show what justification it can do. Make more room for the labels and try again.

Key column is outside of sort range. While using /Data Sort, you specified as a key a column outside the range of cells being sorted. Respecify the key column and try again.

Macro return without macro call. In a keyboard macro, an /XR (return) command was issued without an /XC (call) command.

Memory full. The worksheet storage space is full. You can sometimes save some space by /File Saving the file on a disk and then /File Retrieving it; this is particularly effective if you have been inserting and deleting columns and/or rows.

The biggest factor in memory usage under your control is the position of the non-blank cells farthest to the right and toward the bottom of the worksheet. By pressing [END] followed by [HOME], you can see the lower right corner of the active area of the worksheet. The best way to save memory is to rearrange your worksheet so that it can be contained in the smallest possible rectangle, the top left corner of which is cell A1.

Missing or illegal configuration file. 1-2-3 could not find the file named 123.CNF that has your configuration data. After you press [ESC], 1-2-3 will continue to operate with default choices. Use /Worksheet Global Default to specify your equipment and Update the configuration file.

Named range not found in worksheet file. You have attempted to /File Combine a named range that was not in the worksheet file you specified. Respecify the file or the named range; if it still doesn't work, /File Save your present file, /File Retrieve the file from which you wanted a copy of the range, and check the range names.

No files of specified type on disk. You have tried to /File List files on a disk on which there are no files of the type you requested.

No unprotected cells in range. You selected /Range Input, but the range does not contain any unprotected cells.

Not a valid worksheet file. The file you attempted to /File Retrieve or /File Combine is not a valid worksheet file. Only files created with /File Save or /File Xtract can be brought into the worksheet using /File Retrieve and /File Combine. If one of these files causes this error, the disk has been damaged.

Number stack full. You should never get this error message; if you do, please contact the Radio Shack Customer Support Group. See Radio Shack Customer Support at the front of the manual.

Part of combine file lost. You issued a /File Combine command that caused data from the incoming worksheet to "spill over" the right edge or bottom edge of the worksheet. The surplus data is lost, but all other data from the Combine file are entered into the worksheet.

Part of file is missing. A file being read has been truncated. This error should be rare since any partial file is deleted when you get a "Disk Full" error. If it does happen, probably as a result of physical damage to your disk, you must rebuild the file. This error can also appear if the end-of-file character (Control-Z) is missing from an Imported file.

Printer error. There are problems with your printer. This may be as simple as being out of paper or having a loose cable.

Protected cell. You tried to change the contents of a protected cell while protection was enabled. You can /Range Unprotect the cell or /Worksheet Global Protection Disable for the entire worksheet.

Range name does not exist. You have specified a named range that does not exist.

System error. 1-2-3 has detected an internal inconsistency in the operating system. Restart the system immediately.

Too many fields. In /Data Query, you have specified a criterion or output range greater than the maximum of 32 fields.

Too many menu items or items too long. Using the /XM command (in a keyboard macro), you have specified more than eight items, or all your prompts, taken together, have too many characters.

Too many nesting levels in macro calls. In a keyboard macro, you have issued too many consecutive /XC (call) commands without an /XR (return) command. The nesting limit is 16.

Too many records for output range. In /Data Query Retrieve, the output range did not contain enough rows for the number of records that fit the criteria. Therefore, the output range does not contain all the selected records.

Unrecognized key name {...}. In a keyboard macro, you have typed a name in {braces} that is not the name of a key. This is usually a typing mistake.

Worksheet full. You have tried to shift non-blank cells off the right or bottom edges of the worksheet. This frequently happens when trying to /Worksheet Insert a Row in a full column or a Column into a full row. It may also happen during a /Copy or /Move where part of the target range falls off the end of the worksheet.

Glossary/ Indexes

Glossary

Boldface type *indicates words and phrases that also have Glossary entries. The page reference accompanying each entry indicates the principal location in the manual where the entry is explained.*

Absolute Cell Address. (p. 8-6) An address whose column and row labels are preceded by dollar signs (e.g., A4, BK210). An absolute cell address in a formula does not change when the formula is copied to another cell.

[F4/ABS] Key. (p. 8-8) In Point mode, changes a cell address between **relative**, **absolute**, and **mixed**. Use this key only when entering a formula—it has no useful effect during execution of a 1-2-3 command.

Access System. (p. 21-1) See **Lotus Access System**.

Address. (p. 8-2) The location of a particular cell in the worksheet, labeled by its column and row, e.g., A10, BK201.

[ALT] Key. (p. 9-5) Invokes a **keyboard macro**.

Anchor Cell. (p. 7-7) When the cell pointer is expanded to cover an entire range, the cell diagonally opposite the free cell is the anchor cell. The control panel shows this information:

B25..F60 ← **free cell**

↑ **anchor cell**

Pressing [ESC] at this point shrinks the pointer down to just the anchor cell, removing the anchor.

Argument. (p. 8-22) A numeric value provided to an @ function. Arguments, separated by commas, are placed within parentheses following the function name. 1-2-3 allows arguments that are numbers (e.g., @SIN(-.456)), references to single cells (e.g., @SUM(14,H45,H50)), and range references (e.g., @SUM(100,H23..J50)). You may also use another @ function as a single-value argument.

[BACKSPACE] Key. (p. 5-8) **Value, Label, Edit modes:** When you're typing an entry on line 2 of the control panel, [BACKSPACE] erases the character preceding the cursor. **Point mode:** Cancels the current range specification, returning the pointer to the current cell.

[SHIFT]-[TAB] Key (Backward Tab—Hold down [SHIFT] and press [TAB]). (p. 4-4) Move the pointer or cursor to the left. **Ready, Point modes:** Move pointer one page to the left. **Value, Label modes:** Complete current entry and move pointer one page to the left. **Edit mode:** Move cursor 5 characters to left. (Equivalent: [CTRL]-←.)

Border. (p. 1-9) (1) The area of the 1-2-3 screen display that contains the column letters and row numbers. The **Titles** facility effectively makes rows and/or columns part of this border. (2) Rows and/or columns to be printed along with each Print Range (/Print Options Borders command).

[BREAK]. (p. 5-9) (1) Cancels the current command, entry, or keyboard macro. (2) Interrupts a 1-2-3 or PrintGraph printing operation.

[F9/CALC] Key. (p. 8-12) **Ready mode:** Recalculates all formulas in the worksheet. **Value, Edit modes:** Replaces a numeric entry (on line 2 of the control panel) with its current value.

Cell. (p. 1-5) A single location in the worksheet, specified by its column-row address (e.g., cell G199).

Cell Entry. (p. 5-1) A number, formula, or label stored in a cell of the worksheet.

Cell Pointer. (p. 1-5) The reverse video or color bar that always highlights a cell or range of cells. The location of the pointer when you begin a command or entry is called the **current cell**. While you are entering a command or formula, you often can move the pointer to another **pointer location**.

Clear. (p. 15-5) Erases a previously specified print setting.

Column. (p. 1-5) The worksheet has 256 columns, labeled A-Z, AA-AZ, BA-BZ, . . .IV.

Column-Width. (p. 1-8) A column may be displayed at any width between 1 and 72 characters. No matter what the display width, each cell in a column can store up to 240 characters. The initial column-width (9 characters) can be changed for an individual column (/Worksheet Column-Width), or for all columns not individually set (/Worksheet Global Column-Width).

Command. (p. 6-1) An instruction to 1-2-3 to perform a task. To begin a 1-2-3 command, type / (slash). Examples: /Copy, /File Save, /Range Format.

Command Menu. (p. 6-2) A list of command keywords from which you can select a keyword by: (1) Moving the pointer with **pointer-movement keys**, then pressing [ENTER], or (2) Typing the first letter of the keyword.

Configuration. (p. A-1) 1-2-3's standard procedures for transferring information between the worksheet and printers/disks. (Example: "Use the root directory of Drive B to store data, unless instructed otherwise".) These procedures are stored on the 1-2-3 System Disk in a file named 123.CNF. The PrintGraph program also has a configuration file, GRAPH.CNF.

Control Panel. (p. 1-10) The first three lines of 1-2-3's screen display. It shows: (1) Information about the **pointer location** and the current mode; (2) Cell entries and command responses as you type or edit them; (3) Menus and menu choice explanations; (4) Command prompts and your replies to those prompts.

/Copy Command. (p. 12-1) Copies a cell or range of cells to another location in the worksheet. The effect of copying upon cell addresses in formulas depends on whether they are **absolute**, **relative**, or **mixed** addresses.

Criterion. (p. 17-7) A "test condition" used in /Data Query commands and by the database statistical functions. You must identify a *Criterion range* containing criteria to be applied to the *Input range* before executing a /Data Query operation.

Current Cell. (p. 4-1) The location of the cell pointer when you begin to type a cell or entry or begin to issue a 1-2-3 command. As you proceed with an entry or command, you often can move the pointer to another **pointer location**.

Current Directory. (p. 14-5) The file directory that 1-2-3 will use to transfer data between the worksheet and disk storage, unless otherwise directed. To specify a source or destination other than the current directory, use a disk prefix along with the filename you type (e.g., C:ACCTS means the current directory of Disk C, file ACCTS).

Current Worksheet. (p. 1-5) The 1-2-3 worksheet displayed on the screen. All entries, calculations, and commands are performed on the current worksheet.

Cursor. (p. 5-1) **Value, Label, Edit modes:** The cursor, an underscore or rectangle, indicates where the next insertion or deletion will take place. **Point mode:** The cursor indicates the (expanded) cell pointer's **free corner**.

Database. (p. 17-1) A section of the worksheet that contains data records. 1-2-3's /Data commands and database statistical functions operate on a database.

Database Statistical Function. (p. 17-15) An @ function that performs a statistical analysis on one field of records selected from a **database** (@DCOUNT, @DSUM, @DAVG, @DMIN, @DMAX, @DSTD, @DVAR).

/Data Commands. (p. 17-1) Manipulate data in tabular form, such as a **database**.

Data Disk. (p. 1-11) A disk used to store data files. Each worksheet or print job is stored in a **file** with its own name.

Data-Labels. (p. 16-11) A range of cell entries to be placed on a graph at the value locations (/Graph Options Data-Labels).

Date Formats. (p. 8-25) 1-2-3 records dates as serial numbers, from 1 (01-Jan-1900) to 73049 (31-Dec-2099). These date numbers can be displayed in three date formats (/Worksheet Global Format and /Range Format):

D1 (Day-month-year): 12-Nov-85
D2 (Day-month): 12-Nov
D3 (Month-year): Nov-85

Default. (p. 10-4) An initial or original value or procedure, which 1-2-3 uses unless you specify a different one.

Default Configuration. (p. A-1) The standard procedures 1-2-3 or PrintGraph uses to transfer information between the worksheet and printers/disks (1-2-3: /Worksheet Global Default command; PrintGraph: Configure command). The configuration information is stored in configuration files named 123.CNF and GRAPH.CNF on the program disks.

Disk. (p. 1-11) A permanent data storage medium for microcomputers, e.g., a floppy disk or a hard disk.

Disk Drive. (p. 1-11) The device into which diskettes are placed for use. Typically, the 1-2-3 System Disk resides in Drive A, while data files are stored on disks in Drive B. (See also **Hard Disk**.)

Disk Prefix. (p. 14-6) Two characters placed at the beginning of a filename (e.g., C:). The disk prefix tells 1-2-3 to use a particular disk to store or retrieve data, instead of the **current directory**. Example: "C:REFER" specifies file REFER in the current directory of disk C.

Display Format. (p. 10-3) See **Numeric Display Format**.

Display Screen. (p. 1-5) The "TV" screen of your computer; also called a CRT screen or VDT.

[F2/EDIT] Key. (p. 5-9) **Ready, Value, Label modes:** Switches 1-2-3 to Edit mode. **Edit mode**: Returns to Value or Label mode.

Edit Mode. (p. 5-9) A mode in which the pointer-movement keys position the cursor on line 2 of the control panel, so that you may make character-by-character corrections to an entry. If 1-2-3 detects an error in an entry or formula, it automatically shifts into Edit mode.

[END]. (p. 4-6) **Ready, Point modes:** (10 Pressing the [END] key followed by an arrow key causes the pointer to move in the direction of the arrow to the beginning or end of a block of non-blank cells. (2) Pressing [END] followed by [HOME] moves the pointer to the lower right corner of the **active area**. **Edit mode:** Moves the cursor to the end of the entry on line 2 of the control panel. **Menu, Help modes:** Moves the menu pointer to the last menu item. **Find mode:** Moves to the last record in the database, whether it satisfies the criteria or not.

[ENTER] Key. (p. 1-4) **Value, Label, Edit modes:** Signals the end of a cell entry or command response. **Menu mode:** Selects the currently-highlighted menu item.

Entry. (p. 5-1) A **cell entry** or a response to a 1-2-3 command prompt.

Error Message. (p. 1-4) A short message that 1-2-3 displays in the lower left corner of the screen, accompanied by a *beep*. This signals that you have violated one of 1-2-3's "rules". Press [ESC] or [ENTER] to clear an error message and return to Ready mode.

[ESC] Key. (p. 5-9) This is the "undo-it" key. **While you're issuing a command:** Returns you to the previous command step. **Value, Label modes:** Cancels the entry and returns you to Ready mode. **Edit mode:** Blanks the current entry and leaves you in Edit mode. **Point mode:** (1) Unexpands the cell pointer, leaving it at the **anchor cell**; (2) Returns you to the previous command step; (3) Removes a single-cell address from a formula.

Field. (p. 17-3) A column in a 1-2-3 **database**. Example: The first field (column) of a database might contain *Name* entries and the second column might contain *Address* entries.

Field Name. (p. 17-3) A label entry in the first row of a **database** (Input range). Field names in the Criterion and Output ranges must match field names in the Input range.

File. (p. 14-1) A collection of information stored on **disk**. Worksheets, print jobs, graph images, and programs are all stored as files.

Filename. (p. 14-1) The name under which a worksheet, print job, or graph image is stored. 1-2-3 data filenames may be up to eight characters long, containing letters (A..Z), numbers (0..9), and the underscore character in any combination. *Note:* Spaces are not allowed. Uppercase and lowercase letters are equivalent.

Filename Extension. (p. 14-5) A three-letter suffix, which 1-2-3 automatically adds to the filename you type when a data file is created (/File Save, /File Xtract, /Graph Save, /Print File):

File Type	Extension
Worksheet file	.WKS
Graph (picture) file	.PIC
Print file	.PRN

1-2-3 recognizes only these extensions for data files. When importing a data file produced by another program, rename it to have the .PRN extension.

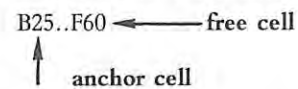
/File Commands. (p. 14-1) Store data in files and retrieve data from files.

Font. (p. 20-8) A typeface (character set) used by the PrintGraph program in printing or plotting graphs.

Format. See **Numeric Display Format**.

Formula. (p. 8-1) An instruction for 1-2-3 to calculate a number. Formulas may use the values stored in individual cells and in cell ranges. They may include arithmetic operations (addition, subtraction, etc.), logical operations (greater than, equal, etc.), and 1-2-3's built-in @ functions. Example: +B1*@SUM(A10..A20).

Free Cell. (p. 7-7) When the cell pointer is expanded to cover an entire range of cells (Point mode), the cursor in the free cell indicates which corner of the range will be affected if you press a pointer-movement key. The free cell is diagonally opposite the **anchor cell**. The control panel shows this information:



Function (@ Function). (p. 8-22) Built-in "formulas" that perform particular calculations. Example: The formula @SUM(B1..B3) performs the same calculation as the formula +B1+B2+B3. All function names begin with the "@" character. (See also **Argument**.)

Function Keys. The following function keys on the Model 2000 keyboard are assigned special 1-2-3 functions:

[F1/HELP]:	Display Help screen
[F2/EDIT]:	Switch to/from Edit mode for current entry
[F3/NAME]:	In Point mode, display menu of range names
[F4/ABS]:	In Point mode, make cell addresses "absolute"
[F5/GOTO]:	Move cell pointer to a particular cell
[F6/WINDOW]:	Move cell pointer to other side of split screen

[F7/QUERY]:	Repeat most recently specified Data Query operation
[F8/TABLE]:	Repeat most recently specified Data Table operation
[F9/CALC]:	Recalculate worksheet or single cell
[F10/GRAPH]:	Draw the most recently specified graph
[F11/END]:	Move to end of a block of cells, an entry or a menu.
[F12/SCROLL LOCK]:	Switch arrow keys between pointer- and window-movement.

Global Setting. (p. 10-2) A procedure that 1-2-3 follows, affecting the entire worksheet (/Worksheet Global). In many cases, you can use a corresponding /Range command to affect a particular cell or range of cells.

[F5/GOTO] Key. (p. 4-2) **Ready mode:** Moves the cell pointer to a particular cell (1-2-3 prompts you to specify a location).

/Graph Commands. (p. 16-1) Define and display graphs using data contained in the worksheet. Store graphs on a disk as graph (picture) files (filename extension .PIC), for later printing with the PrintGraph program.

Graph File (Picture file). (p. 16-10) A file (extension .PIC) that stores a graph image, created with the /Graph Save command. Graph images are printed with the PrintGraph program.

[F10/GRAPH] Key. (p. 16-4) (1) **Ready mode:** Pressing the [F10/GRAPH] key draws a graph using the most recently entered /Graph specifications, even if cell contents have been changed. (2) **PrintGraph program:** Previews the graph stored in the currently highlighted file.

Hard Disk. (p. iii) An alternative permanent data storage medium to the diskette, typically having many times the storage capacity of a diskette. You can use a hard disk with 1-2-3, but you must have at least a floppy diskette drive in your system.

Help Facility. (p. 3-1) 1-2-3's on-line reference manual. Pressing [F1/HELP] at virtually any time while using 1-2-3, **PrintGraph**, or the **Lotus Access System** provides instant information about the operation currently in progress. [ESC] ends the Help break and returns you where you left off in the work session.

[F1/HELP] Key. (p. 3-1) At virtually any time: Suspends the work session and invokes the **Help facility**. In 1-2-3 Help mode, pressing [ESC] returns you to the first Help screen you viewed.

[HOLD] Key. (p. 3-1) This key has no function in 1-2-3.

[HOME] Key. (p. 4-3) **Ready, Point modes:** (1) Moves the pointer (or free cell) to the upper left corner of the worksheet. (2) Pressing **[END]** followed by **[HOME]** moves the pointer to the lower right corner of the **active area**. **Edit mode:** Moves the cursor to the beginning of the entry on line 2 of the control panel. **Menu, Help modes:** Moves the menu pointer to the first menu item. **Find mode:** Moves to the first record in the database, whether it satisfies the criteria or not.

Indicator. (p. 1-10) (1) A reverse video or color word in the upper right corner that indicates 1-2-3's current **mode** of operation. (2) A reverse video or color word in the lower right corner that indicates a particular program condition (e.g. *CALC* indicates that the worksheet's formulas need to be recalculated).

Justification. (p. 11-5) Rearrangement of a column of labels to a particular width (/Range Justify).

Keyboard Macro. (p. 9-1) A sequence of keystrokes "attached" to a single letter key. The macro named "\0" is automatically executed whenever a worksheet is retrieved from disk storage. A special set of commands—the **/X commands**—can be used only in a macro.

Label. (p. 5-6) A cell entry consisting of up to 240 characters that has a non-numeric meaning. (For computational purposes, a label has a value of zero.) You can control how labels appear in their cells by using **label-prefix characters** and the commands /Worksheet Global Label-Prefix and /Range Label-Prefix.

Label-Prefix Character. (p. 5-6) A character at the beginning of an entry to indicate (1) That the entry is a label and (2) The manner in which the label is to be aligned in its cell:

Label-Prefix	Alignment	Example
'	left-aligned	LABEL
"	right-aligned	LABEL
^	centered	LABEL
\	repeating	LABELLABELLABE

Logical Operator. (p. 8-20) Used in formulas to construct statements that are *TRUE* or *FALSE*. Example: +B1>B2 is *TRUE* if the value in cell B1 is greater than that in cell B2; otherwise it is *FALSE*. The value *TRUE* is represented by the number 1. The value *FALSE* is represented by the number 0.

Long Label. (p. 11-5) A label that extends past the right edge of its cell, "borrowing" empty space from the cell(s) to its right. A label is always remembered by 1-2-3 in its entirety, even if you can't always see all of it. The complete label is displayed in the control panel when the cell pointer is moved to the label's cell.

Long Prompt. (p. 1-10) A text, displayed on line 3 of the control panel, that explains the meaning of the highlighted menu choice. 1-2-3 displays long prompts with all command menus. You can define your own long prompts for use in **/XM command** menus.

Lotus Access System. (p. 21-1) A menu-driven "switchboard" program that allows you to easily move between 1-2-3, PrintGraph, and other system functions.

Macro. See **Keyboard Macro.**

Main Memory. (p. 1-11) Your computer's temporary storage area, used for both programs and data (e.g., both 1-2-3 itself and the 1-2-3 worksheet that you are using).

Menu. (p. 6-8) A series of choices which appear in the **control panel.** Menus are used throughout 1-2-3, PrintGraph, and the **Lotus Access System.** You select menu items by moving the **menu pointer** and pressing [ENTER], or (for commands only) by typing the first letter of the choice. In Point mode, pressing [F3/NAME] displays a menu of **range names.**

Menu Pointer. (p. 6-10) A reverse-video bar (highlight) that you use to select an item from a menu. In Menu mode, the **pointer-movement** keys move the menu pointer rather than the cell pointer.

Mixed Cell Address. (p. 8-14) An address that is part-absolute and part-relative. (See **Absolute Cell Address** and **Relative Cell Address.**)

Mode Indicator. (p. 1-10) A highlighted word in the upper right corner of the screen, indicating your current mode of operation:

1-2-3 Indicator	Meaning
READY	Waiting to do your bidding
VALUE	Entering a number or formula
LABEL	Entering a label
EDIT	Editing an entry
POINT	Pointing to a cell or range
MENU	Selecting a menu item
HELP	In the Help facility
ERROR	Waiting for [ESC] or [ENTER] to clear an error condition
WAIT	1-2-3 is working and cannot process commands immediately
FIND	1-2-3 is performing a /Data Query Find operation

An additional indicator, CMD or SST (single-step), appears next to the standard indicator during execution of a keyboard macro.

/Move Command. (p. 13-1) Moves a cell or range of cells from one location on the worksheet to another. Cell addresses in formulas are preserved by /Move.

MS-DOS. (p. ii) The Microsoft Disk Operating System, supplied by Tandy.

[F3/NAME] Key. (p. 7-13) In Point mode, pressing the [F3/NAME] key produces a menu of the defined range names.

Named Range. (p. 7-11) A single cell or range of cells that have been assigned a name (/Range Name Create or /Range Name Labels). The name of a range can be substituted for its opposite-corner cell addresses. Example: The range B1..F1 is assigned the name "HEADINGS", making the formulas 45 + @COUNT(B1..F1) and 45 + @COUNT(HEADINGS) equivalent.

Number. (p. 5-4) A numeric entry in 1-2-3: (1) changes the MODE indicator from *READY* to *VALUE*; (2) may begin with a digit 0..9, +, −, ., (, @, #, or $; (3) may end with %; (4) may only have one decimal point; (5) may not be entered with a comma or space.

Numeric Display Format. (p. 10-3) The way in which a cell's numeric contents are displayed (/Worksheet Global Format, /Range Format). This may be an "edited" version of the cell's actual contents (e.g., 45.60000, $45.60, 4.56E1).

Pointer Location. (p. 4-1) The cell being highlighted by the **cell pointer**. If the pointer is expanded to highlight a range of cells, the **free cell** is the pointer location. Information regarding the pointer location always is displayed in the **control panel**.

Pointer-Movement Keys. (p. 4-2) These keys move the pointer around the worksheet in Ready and Point modes. Some of them also are active in other modes:

Key	Ready, Point	Menu, Help	Edit
←	left 1 cell	left 1 item	left 1 char
→	right 1 cell	right 1 item	right 1 char
↑	up 1 cell	up 1 item	end entry & up 1 cell
↓	down 1 cell	down 1 item	end entry & down 1 cell
[SHIFT]-[TAB] or [CTRL]-←	left 1 page	...	left 5 chars
[TAB] or [CTRL]-→	right 1 page	...	right 5 chars
[PG UP] or [CTRL]-↑	up 1 page	...	end entry & up 1 page
[PG DN] or [CTRL]-↓	down 1 page	...	end entry & down 1 page
[HOME]	upper left corner	first item	first char
[END]	end of non-blank block	last item	last char
[END]-[HOME]	lower right corner	...	...

Several other keys also accomplish pointer movement. [F5/GOTO] moves the pointer to a location you specify. [F6/WINDOW] moves the pointer between windows when you are using the Split Screen facility. [F12/SCROLL LOCK] switches the meaning of the arrow keys between moving the cell pointer and moving the window.

/Print Commands. (p. 15-1) Send an image of a cell range directly to the printer or to a **print file** on disk, for later use. /Print commands allow extensive formatting of the printed output.

Print File. (p. 15-1) (1) A file (extension .PRN) that stores a report for subsequent printing or for use by another program. 1-2-3 creates print files with the /Print File command. (2) Data to be imported from another program must be in print file format.

PrintGraph Program. (p. 20-1) A program that creates printed versions of the graphs defined with the /Graph Save command. These graph images are stored in **graph files** (extension .PIC).

Prompt. (p. 6-1) A message displayed by 1-2-3 on line 2 of the **control panel** during the execution of a command. When responding to a prompt, end your entry with [ENTER].

Protection. (p. 10-7) A 1-2-3 facility for preventing inadvertent modification of particular cells (/Worksheet Global Protection, /Range Protect, /Range Unprotect, /Range Input).

[F7/QUERY] Key. (p. 17-14) The [F7/QUERY] key repeats the recently specified /Data Query operation (Find, Extract, Unique, Delete), even if cell contents have been changed subsequently.

Quit. (p. 6-6) In a command menu, selecting Quit exits the menu and returns you to Ready mode or to a higher menu level.

/Quit Command. (p. 18-1) Ends the 1-2-3, PrintGraph, or File-Manager session. Control returns to the **Lotus Access System** or to **MS-DOS**.

Range. (page 7-1) A rectangular block of cells. (A single cell is also considered to be a range.) You may indicate a range (1) By expanding the cell pointer; (2) By typing the cell addresses of two diagonally opposite corners; (3) By typing a range name or selecting one from a menu of range names.

/Range Commands. (p. 7-1) The set of 1-2-3 commands that affect single cells or ranges of cells. In some cases, a corresponding /Worksheet command affects the entire worksheet.

Range Name. (p. 7-11) See **Named Range**.

Recalculation. (p. 10-5) The reevaluation of each formula in the worksheet, using the current cell values (/Worksheet Global Recalculation).

Relative Cell Address. (p. 8-3) A cell address that doesn't include any $ characters (e.g., C15, not C15 or C$15). It indicates the location of a value to be used *relative* to the formula cell. When you /Copy a formula with a relative address, 1-2-3 adjusts the address accordingly in the copied entry.

Scrolling. (p. 4-2) The process of "moving" the window (as defined by the reverse-video border of column and row labels) around the worksheet. It's better to think of the worksheet as stationary and the window as movable than vice versa.

[F12/SCROLL LOCK] Key. (p. 4-5) Switches the meaning of the arrow keys: ↑, ↓, ←, →. With Scroll Lock "off", these keys move the cell pointer. With Scroll Lock "on", these keys move the **window** into the worksheet.

Setup String. (p. 15-14) A sequence of special characters that perform printer functions (e.g. change print size).

Split Screen. (p. 10-10) A 1-2-3 facility in which the screen displays two separate windows into the worksheet (/Worksheet Window). You can make these windows either totally independent or *synchronized*.

[TAB] Key. (p. 4-4) Move the pointer or cursor to right. **Ready, Point modes:** Move pointer one page to right. **Value, Label modes:** Complete current entry and move pointer one page to right. **Edit mode:** Move cursor 5 characters to right. (Equivalent: [CTRL]-→.)

[F8/TABLE] Key. (p. 17-20) The [F8/TABLE] key repeats the most recently specified /Data Table operation, even if cell contents have been changed subsequently.

Titles. (p. 10-9) (1) Rows and/or columns "frozen in place" on the display screen (/Worksheet Titles). (2) Text lines to appear on a graph (/Graph Options Titles).

Tutorial. (p. x) The *1-2-3 Electronic Tutorial* on the 1-2-3 Tutorial Disk provides step-by-step lessons on how to use 1-2-3.

Typing Alternative. See **Keyboard Macros**.

Value. (p. 8-1) Any **number** or **formula**.

Window. (p. 1-6) The currently displayed portion of the worksheet (standard size: 8 columns × 20 rows). You can change the number of columns by altering column widths (/Worksheet Global Column-Width, /Worksheet Column-Width). The **Split Screen** facility allows you to split the display screen into two windows (/Worksheet Window).

[F6/WINDOW] Key. (p. 10-10) (Split Screen only). In Ready and Point modes, the **[F6/WINDOW]** key switches the cell pointer between the two windows on the worksheet.

Worksheet. (p. 1-5) 1-2-3's electronic representation of a ledger sheet, organized into columns and rows. Also called a spreadsheet.

/Worksheet Commands. (p. 10-1) Affect the current worksheet as a whole: formatting, cell protection, insertion and deletion of columns and rows, default printer/disk configuration, recalculation procedures, column-widths, Titles, Split Screen.

Worksheet File. (p. 14-1) A file that stores a complete or partial 1-2-3 worksheet (/File Save, /File Xtract). This file is in a Lotus proprietary format—it cannot be manipulated by other programs (e.g. text-editors).

/X Commands. (p. 9-9) (Usable only in **keyboard macros**) Control the processing order of keyboard macro instructions, including the creation of user-defined menus.

1-2-3 and PrintGraph Command Trees

1-2-3 Commands		Page
/Worksheet Commands		
Global	Control over-all settings	
Format	Set the display appearance of numbers	10-13
Fixed	Fixed number of decimal places 0-15 (1.23)	
Scientific	Exponential (1.2E+01)	
Currency	$ and commas ($1,000)	
, (comma)	Same as Currency, no dollar sign (1,000.546)	
General	No trailing 0's after decimal point	
+/-	Display pictograph of + + or - -	
Percent	Display as percent (56.3%)	
Date	Control display of date serial numbers	
1	Day-Month-Year	
2	Day-Month	
3	Month-Year	
Text	Show formula text (+B2*C3)	
Label-Prefix	Control label alignment in cell	10-14
Left	Label is preceded by '	
Right	Label is preceded by "	
Center	Label is preceded by ^ (a preceding \ creates repeating label)	
Column-Width	May be 1-72 characters wide	10-15
Recalculation	Control recalculation options	10-16
Natural	Recalculate formulas in dependency order	
Columnwise	Recalculate down columns, left to right	
Rowwise	Recalculate across rows, top to bottom	
Automatic	Recalculate every time worksheet is changed	
Manual	Recalculate only when [F9/CALC] key is pressed	
Iteration	Number of times recalculation occurs	
Protection	Control access to protected cells	10-17
Enable	Turn cell protection on	
Disable	Turn cell protection off	
Default	Control printer and directory settings	A-2
Printer	Control printer options	A-4
Interface	Choose serial or parallel Interface	A-4
Auto-LF	Send linefeed after carriage return	A-4
Left	Left margin	A-5
Right	Right margin (measured from left)	A-5

X A B C D E F	Remove range from current graph
Quit	Return to main Graph menu
View	Display current graph on screen 16-19
Save	Save current graph in graph file 16-19
Options	
Legend	Label each data range 16-20
Format	Set method of displaying and connecting data-points 16-21
Graph	Set format for entire graph
A B C D E F	Set format for a range
Lines	Use lines only
Symbols	Use symbols only
Both	Use both lines and symbols
Neither	Use neither lines nor symbols
Quit	Return to main Graph menu
Titles	Set title for axes and/or graph 16-22
First	Top line (large when printed)
Second	Second line (small when printed)
Y-axis	Title vertical axis
X-axis	Title horizontal axis
Grid	Display grid over graph 16-23
Horizontal	Display horizontal lines at tick marks
Vertical	Display vertical lines at tick marks
Both	Display both horizontal and vertical lines
Clear	No grid lines
Scale	Set display scale of axes 16-24
Y-axis	Not used with pie graphs
X-axis	Only relevant for XY graphs
Automatic	Include min. and max. data values
Manual	Focus in on particular area of concern
Lower	(Manual only) Set lower scale value
Upper	(Manual only) Set upper upper scale value
Format	Set format of scaling numbers
Fixed, Scientific, Currency, , (comma), General, + / −, Percent, Date, Text	
Quit	Return to options submenu
Skip	Use selected X-range entries as labels
Color	Display graph bars, lines, symbols in color 16-25
B&W	Display graph bars, lines, symbols in B&W 16-25

Functional Index

Function	Commands — Page Number
Controlling worksheet appearance	
Column widths	
Most columns	/Worksheet Global Column-Width 10-15
Specific columns	/Worksheet Column-Width 10-19
Appearance of numbers and formula values	
Most cells	/Worksheet Global Format 10-13
Cells in specific ranges	/Range Format 11-9
Alignment of labels in cells	
For labels subsequently typed	/Worksheet Global Label-Prefix 10-14
For existing labels in a range	/Range Label-Prefix 11-10
Justifying label text in a range	/Range Justify 11-16
Inserting blank columns or rows	/Worksheet Insert 10-18
Removing columns or rows	/Worksheet Delete 10-19
Moving ranges	/Move 13-1
Erasing cells in a range	/Range Erase 11-11
Erasing the entire worksheet	/Worksheet Erase 10-20
Split-screen	/Worksheet Window 10-22
Keeping row and columns headings on screen	/Worksheet Titles 10-21
Checking default settings	/Worksheet Status 10-23
Working with numbers	
Copying cells	/Copy 12-1
Naming cells and ranges	/Range Name 11-13
Filling a range with numbers	/Data Fill 17-23
Calculating a distribution of values in a range	/Data Distribution 17-33
Changing formulas to numbers	
One cell at a time	[F2/EDIT] and [F9/CALC] keys 8-11, 8-12
In a range	/File Xtract Values and File Combine Copy 14-8, 14-9
Adding and subtracting values from a worksheet file	/File Combine 14-8
Making a table of "what-if" results	/Data Table 17-23
Changing the order of recalculation	/Worksheet Global Recalculation 10-16
Choosing manual or automatic recalculation	/Worksheet Global Recalculation 10-16
Changing the number of recalculation cycles	/Worksheet Global Recalculation Iteration 10-17
Finding out about recalculation settings	/Worksheet Status 10-23
Disk files	
Telling 1-2-3 which directory to use most of the time	/Worksheet Global Default Directory A-2

Function	Commands — Page Number
Printing page numbers	/Print Printer Options Header or Footer 15-10
Printing formulas	
All cells in a range	/Print Printer Options Other Cell-Formulas 15-16
Some cells in a range	/Range Format Text 11-9
Graphing	
Choosing the type of graph	/Graph Type 16-16
Telling 1-2-3 what data to graph	/Graph X A B C D E F 16-16, 16-17
Viewing the current graph	
While in main Graph menu	/Graph View 16-19
In Ready Mode	[F10/GRAPH] Key 16-4
Giving a graph a name so it can be used later	/Graph Name 16-26
Labeling	
The entire graph	/Graph Options Titles 16-22
X and Y axes	/Graph Options Titles 16-22
Each data range (line, symbol, or shading)	/Graph Options Legend 16-20
Pie graph segments	/Graph X 16-16
X-axis scale (line and bar graphs)	/Graph X 16-16
Data points	/Graph Options Data-Labels 16-22
Choosing connecting lines and or symbols	/Graph Options Format 16-21
Choosing grid lines	/Graph Options Grid 16-23
Changing the scale	/Graph Option Scale 16-24
Choosing color output	/Graph Option Color 16-25
Choosing black and white output	Graph Option B&W 16-25
Saving a graph in a disk file	/Graph Save 16-19
Printing or plotting a graph	The PrintGraph Program 20-1
Using a database	
Highlighting selected records	/Data Query Find 17-31
Copying selected records	/Data Query Extract 17-32
Making one copy of each selected record	/Data Query Unique 17-32
Deleting selected records	/Data Query Delete 17-32
Sorting any group of rows	/Data Sort 17-26
Using form-oriented data entry	/Range Input 11-17
Miscellaneous	
Finding out how much computer memory is left	/Worksheet Status 10-23
Unprotecting or Reprotecting cells	/Range Unprotect and Range Protect 11-12
Turning protection on and off	/Worksheet Global Protection 10-17
Finding out if protection is on or off	/Worksheet Status 10-23
Restricting cell pointer to unprotected cells	/Range Input 11-17

Alphabetical Index

Note: [P] denotes a PrintGraph program command

Inserts

RADIO SHACK, A DIVISION OF TANDY CORPORATION

U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO L4M 4W5

TANDY CORPORATION

AUSTRALIA	BELGIUM	U K
91 KURRAJONG ROAD MOUNT DRUITT, N.S.W. 2770	PARC INDUSTRIEL DE NANINNE 5140 NANINNE	BILSTON ROAD WEDNESBURY WEST MIDLANDS WS10 7JN

874-9485-10/83-SP

Printed in U.S.A.

Lotus™