Burroughs

Reference Manual

B 20 Systems Multiplan™

(Relative to Release Level 2.3)

Priced Item
Printed in U.S.A.
July 1983

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Preface

Multiplan is a computer tool that will help you analyze data. As an aid for both business and personal needs, Multiplan is one of the most powerful modeling and planning tools ever invented. With Multiplan you can do the capital budgeting for a small company; you can make major sales force decisions or analyze product planning; you can plan your personal investments and put together a budget for your family... and much more!

Multiplan is easy to learn to use, and its versatility is enhanced by the skill of its user. As you become more familiar with Multiplan, and more capable in the execution of its powers, you'll be surprised at how quickly and efficiently you'll accomplish various tasks.

This manual is designed as a guide reference to Multiplan. The material is divided into three parts. Part 1, "Using Multiplan," presents an overview of the features of the system in a tutorial manner. Part 2, "Exploring Multiplan," examines the features in depth. Part 3, "Reference to Multiplan," contains command, function, and message directories. Parts 1 and 2 complement one another; together, they will teach you the concepts and uses of Multiplan. In Part 3 you will find the elements of Multiplan arranged for quick and easy referral; this section of the manual will answer your most detailed questions about the system.

Multiplan design allows you to operate in as intuitive a way as possible; its dimensional capabilities allow you to accomplish a wide variety of tasks. The limitations of this powerful tool are, really, only those that you impose upon it.

Good luck! We hope you enjoy working with your powerful new accomplice: Multiplan.

Introduction

Uses of Multiplan

Multiplan frees you from the limitations of more traditional methods of calculation. It provides a fourth dimension in calculation, a glimpse into the future, a chance to ask,"What if . . .?" Test out the controls. You will soon learn how to move around, manipulate data, and obtain the answers you need.

Among Multiplan's many features, the following are perhaps the most important:

1. Multiplan offers you a length and width in your active worksheet of 255 rows and 63 columns, a broad worksheet simulator in which words, numbers, and formulas may be entered in cells. Multiplan allows you access to data in supporting, inactive sheets for use directly in the formulas on your active sheet.

2. Multiplan offers you a way to manipulate data for planning or forecasting by asking: "What if . . . ?" or, "Is it worth it to . . . ?" For example:

   What if costs rise by 10% for one item and 6.5% for another?

   What if production increases?

   What if sales of one item skyrocket?

   What if home utility bills soar?

   Is it worth it to pay express freight to get a product early?

   Is it worth it to give a discount to marginal buyers?

   Alter a critical number and watch the figures change across your worksheet; observe the effects over time of a small change here, an improvement there. You can run sensitivity analyses, do budget and resource planning, and schedule more efficiently. You'll soon agree that Multiplan is a vast improvement over "hand calculating" methods.

3. Multiplan overcomes the limitations of paper worksheets. You can instantly move, insert, or delete rows and columns of data; the remaining rows, columns, or extra space will expand or contract as necessary, thereby eliminating the costly and tiresome work of typing or hand-printing the worksheet over and over.

4. Multiplan's commands, prompts, and messages—as well as the screen and keyboard—communicate with you and with each other as directly and naturally as possible to allow you to accomplish your objectives. Multiplan even offers you proposed responses to commands.

5. Some of the other special features of Multiplan that make its use easy, exciting, and efficient are:

   A special edit area. You can make additions or changes quickly and easily.

   Multiple windows. You can look at up to eight different parts of the worksheet at once. The windows can be aligned, scrolled together, opened, and closed at will.

   Named cells and areas. You can name one cell, several cells, or entire areas, and use these names as parts of formulas and commands. Named areas may also be combined in various ways for ease of use.

   Offsheet references. Named cells and areas from inactive sheets may be used in formulas on your active sheet. This "linking" of worksheets adds yet another dimension to Multiplan. It is one of Multiplan's most powerful features.

   Relative references. A reference to a particular cell need not be in absolute terms: it may be in relation to another cell or cells. Thus, a formula containing a relative reference may be copied into other cells and will be automatically changed to reflect its new position.

   Cell and sheet design (or format). Cells or areas may be formatted to display data in various ways. The display may be changed without affecting the data stored in Multi-plan.

Protecting Data

Almost everyone who has worked with computers has experienced the loss of a few hours' or even a full day's work on the computer. A loss can be the result of many things: a power outage, for example, could suddenly shut the machine down; improper handling of a disk could make it inoperable when placed in the computer.

There are ways to protect yourself against such losses, or at least minimize them. Refer to Chapter 11, "Saved Sheets, Files, and the Operating System," to learn how to protect your valuable work.

List of Files on the Multiplan 2.3 Diskette

The Multiplan 2.3 diskette is your master copy and is write protected. *This disk should not be write enabled nor used as a working copy.*

The Multiplan 2.3 diskette contains the following files in the <B20BMP-1> directory.

Multiplan.Run
Multiplan.Pcode
Multiplan.Data
Mp.Hlp
LptConfig.sys
PtrBConfig.sys

The Multiplan 2.3 diskette contains the following files in the <Tutorial> directory.

Spencer.Mp
Expenses.Mp

In addition, various installation files are also contained in the <Sys> directory.

Install.Sub
Sys.Printers.Clust
Sys.Printers.Stand
Multiplan.user
Copy.sub

Operating System Requirements

The 2.3 release of Multiplan will run under the 1.3, 2.0, 2.2, 2.3 or 3.0 level of B20 BTOS Operating System. If you are going to use the GRAPH command to interface to Burroughs Business Graphics Package, you must be using BTOS level 2.3 or 3.0 to function correctly. See the B20 Business Graphics Package Reference Manual for details about the Operating System requirements for B.G.P.

Memory Use of Multiplan 2.3

At load time Multiplan 2.3 makes configuration decisions based on available memory. Multiplan 2.3 requires at least 90K of user memory (memory not allocated to BTOS or installed services). Multiplan 2.3 can use up to a maximum of 172K. With 384k bytes minimum memory in the B20, Multiplan provides a worksheet area of over 56000 bytes.

Multiplan 2.3 provides you with a broad worksheet area of 255 rows and 63 columns to allow flexibility in the design and layout of your models. However, it is not intended that you be able to fill every cell on a sheet. Because each cell used on a worksheet can require different amounts of memory to store, an estimate of the maximum worksheet size is not possible. Longer string and formula cells will use up more memory, and thus limit the dimensions of the worksheet. Additional memory overhead is also present. The "%Free" indicator at the bottom of MULTIPLAN's screen indicates the amount of the total worksheet memory still available.

Disk Space Used by Multiplan 2.3

The installation of Multiplan 2.3 requires approximately 365 sectors of disk space.

Multiplan 2.3 Enhancements

1. The DOLLAR formatting code now uses the "# of decimals" field in the FORMAT commands. This allows for "$" formatting, without requiring two decimal digits.

2. Multiplan 2.3 now supports a direct interface to the Burroughs Business Graphics Package. This is achieved by the use of the GRAPH command. Refer to the B20 Business Graphics User's Manual for further information.

3. Printing to a file no longer appends the ".xx" extension to the user-entered filename.

4. The character for operations requiring user confirmation has been changed from "Y" to GO. For example, if the user is saving a worksheet which has already been saved, the prompt will now be:

   "Press GO to overwrite existing file, CANCEL to cancel command"

5. Multiplan 2.3 now has a manual paper feed option to handle single sheet paper feed operation. Refer to the PRINT OPTIONS command in the Multiplan 2.3 Reference Manual for more details.

6. The GOTO command has been changed to JUMP. Refer to the JUMP command for more details.

7. You may select Data Entry Mode by pressing the f1 key. Data Entry Mode is useful for entering text. When in Data Entry Mode the f1 LED is lit, and typing any alphabetic character automatically selects the Alpha command. While in Data Entry Mode, you may select a Multiplan command by pressing the "/" or f1 keys. Pressing the f1 key toggles between Data Entry and Command Modes. To begin an alphabetic (or text cell) with a digit or the "/" character, press the space bar first.

How to Use This Manual

This manual is divided into three parts. Part 1 contains Chapters 1 through 7; Part 2, Chapters 8 through 11; Part 3, Chapters 12 through 14.

Part 1: Using Multiplan

Part 1 introduces the use of Multiplan in a tutorial manner: in simple steps with many practical examples. You'll learn to create a worksheet and to execute the many commands and functions available. Your skill will increase as you use Multiplan to make a financial analysis of a model firm—Spencer Ceramics. The tutorial presents Multiplan in a horizontal manner, showing you the system's main features as they are commonly used.

Part 2: Exploring Multiplan

Part 2 examines Multiplan in a vertical manner, describing each major feature in depth. These descriptions use many examples, which are designed specifically to demonstrate the behavior of Multiplan. "Using Multiplan" and "Exploring Multiplan" com-

plement one another: the former could be compared to a guided tour of a city; the latter, to a series of illustrated lectures on the architecture of that city.

Part 3: Reference to Multiplan

Part 3 contains three directories: one for commands, one for functions, and one for messages.

The commands directory displays Multiplan commands in alphabetical order by the key letters used to select them. Command names are listed at the beginning of each chapter to make it easy for you to locate the command that you want. Each entry contains a display of the command use and effects, one or more examples, and cross-references to related commands.

The functions directory lists all the functions (such as SUM, COS, and AVERAGE) that can be used in a Multiplan formula. Each entry describes the operation of a function, specifies its requirements for input, and gives an example.

The messages directory lists all the messages and trouble reports Multiplan might display, in alphabetical order; it shows the cause of each and what action you can take when you see a message on the screen.

The Appendices

Appendix A is a Glossary of special terms used in the two volumes of this manual. The terms appear in boldface type when they are first used in the text.

Appendix B, "Notes for the VisiCalc User," offers a comparison of Multiplan and VisiCalc. You'll find it helpful if you have previously used a similar product.

Appendix C is a table of the B 20 special keys and how to use them with Multiplan.

How to Proceed

An interactive program like Multiplan can be learned only by use. "Using Multiplan" and most of "Exploring Multiplan" are designed to be read and used at the terminal. It's important that you try, test, and experiment as you learn. You'll be surprised at how quickly it all falls together! There is no way that anything you type can damage the computer or Multiplan, so don't hesitate to experiment.

We recommend that you begin by working through Part 1, "Using Multiplan" Chapter 1, "Fundamentals," and Chapter 2, "Filling in a Worksheet." These chapters will help you become familiar with the keyboard and screen display and introduce you to Multiplan's typing aids.

"Entering Formulas" and "Formulas, Copying Cells, Naming Cells," Chapters 3 and 4, lead you further into the use of Multiplan. When you've completed these chapters you'll have met Multiplan's most important commands and features.

Chapter 5, "Windows, Copying Formulas, and Options," introduces the finer points of Multiplan's screen display. After completing it you you'll be ready to print some samples of your work. Chapter 6 will tell you how. The final chapter in the tutorial, Chapter 7, "Accessing Inactive Worksheets" takes you beyond working working with a single sheet. It will show you how to organize data on multiple sheets and to draw data from them for use on your active sheet.

As you work through Part 1, "Using Multiplan," you'll find it helpful to refer at times to Part 2, "Exploring Multiplan," and Part 3, "Reference to Multiplan."

Chapter 8, "Command Entry and Editing" explains in depth the typing aids you learned to use in Chapters 1 and 2.

Chapters 9 and 10, "Cell References" and "Formulas," will place the tutorial examples of Chapters 3 and 4 in a wider context and point the way toward experiments of your own.

Chapter 11, "Saved Sheets, Files, and the Operating System," helps you understand how the computer handles Multiplan files.

Begin applying Multiplan to simple tasks, making frequent use of the directories in the "Reference to Multiplan." As you gain experience, use Multiplan for more complex tasks, such as organizing multiple worksheets. You'll soon find that you have a firm grip on a powerful tool.

Good luck—and have fun!

Part 1
Using Multiplan

Chapter 1
Fundamentals

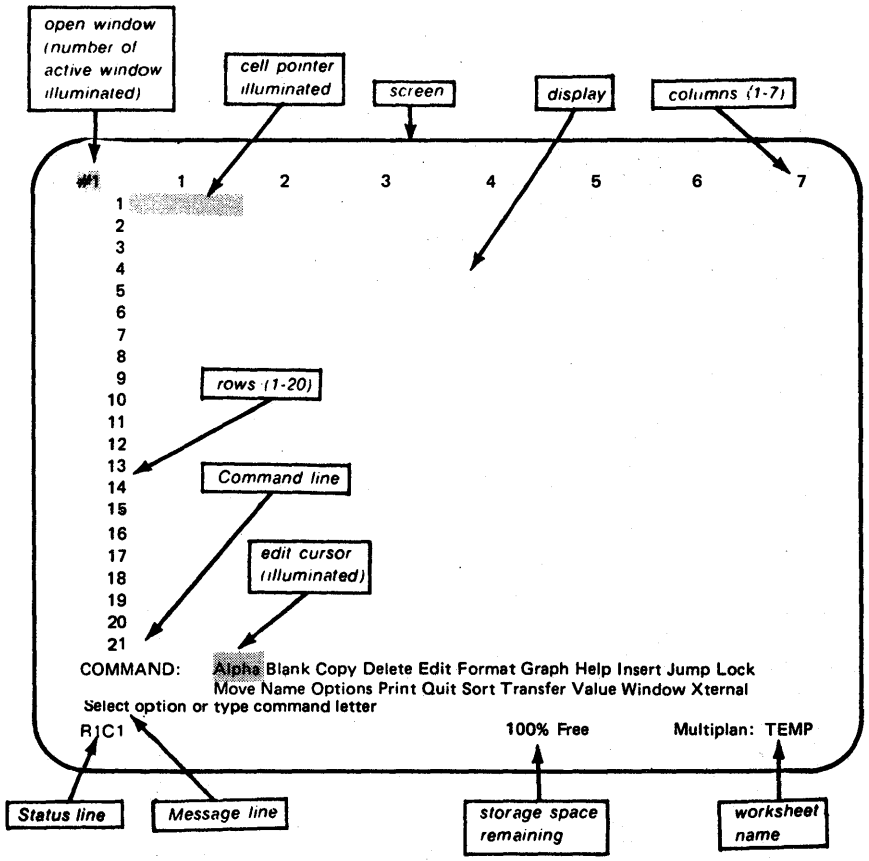
Welcome to Multiplan! As you work through the following lessons, you will become familiar with the concept of Multiplan and with the commands and keys that control its operation. Your speed and efficiency will increase greatly, and you will discover possibilities and methods of planning and computation that were unavailable to you when you used only pencil and paper.

Starting Up

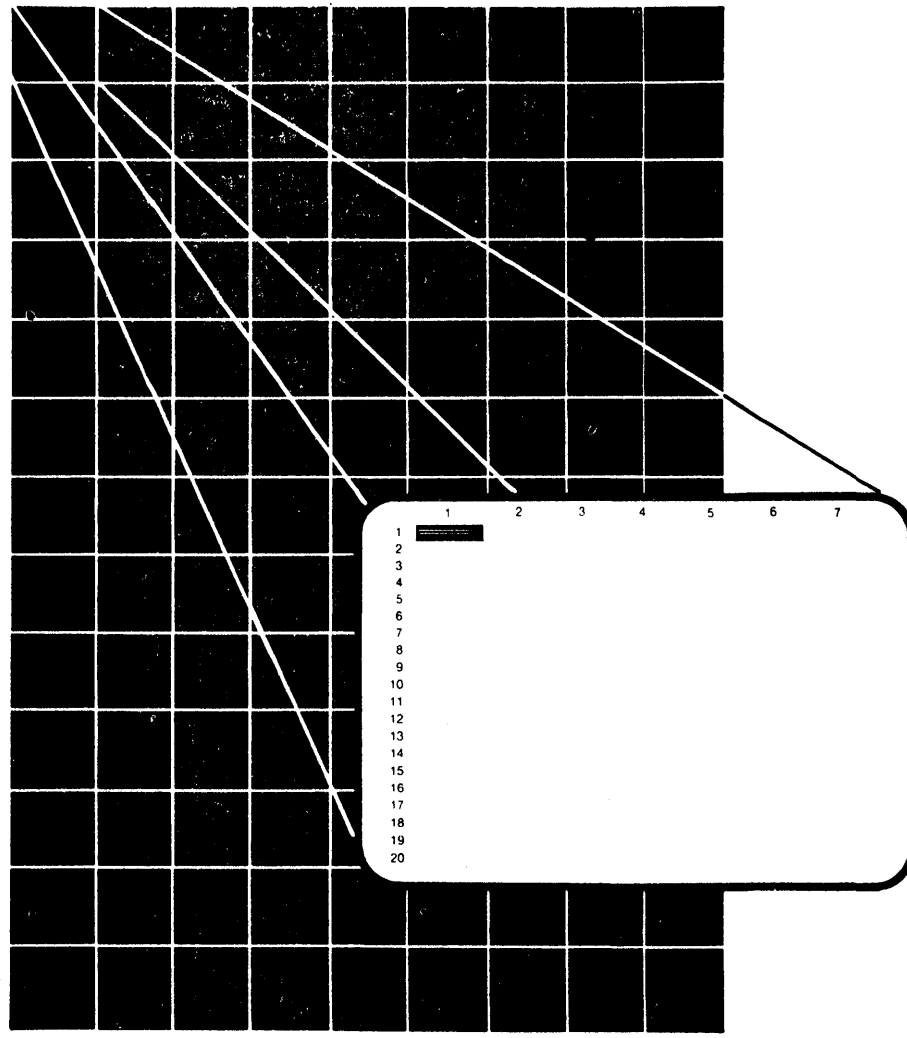
To work with Multiplan, you need the Multiplan diskette and for the tutorial (Part 1) you need a blank, formatted diskette for storing your worksheets. Use the diskette formatting procedure for your computer system to make the blank formatted diskette. Load Multiplan by following the load procedure in your reference card. You're ready to begin.

The Screen

When Multiplan is loaded and ready, your screen will show the following display:



Your screen displays about 1/115th of the actual **worksheet** available to you. You can imagine the screen as a window to your worksheet:



With Multiplan, it is possible to view the sheet through more than one window at a time to see information on different parts of the worksheet. You will learn how to do that in Chapter 10.

Columns are numbered across the top. Your screen now shows you 7 of the 63 worksheet columns.

Rows are numbered down the left side of the display. Your screen now shows you about 20 of the 255 worksheet rows.

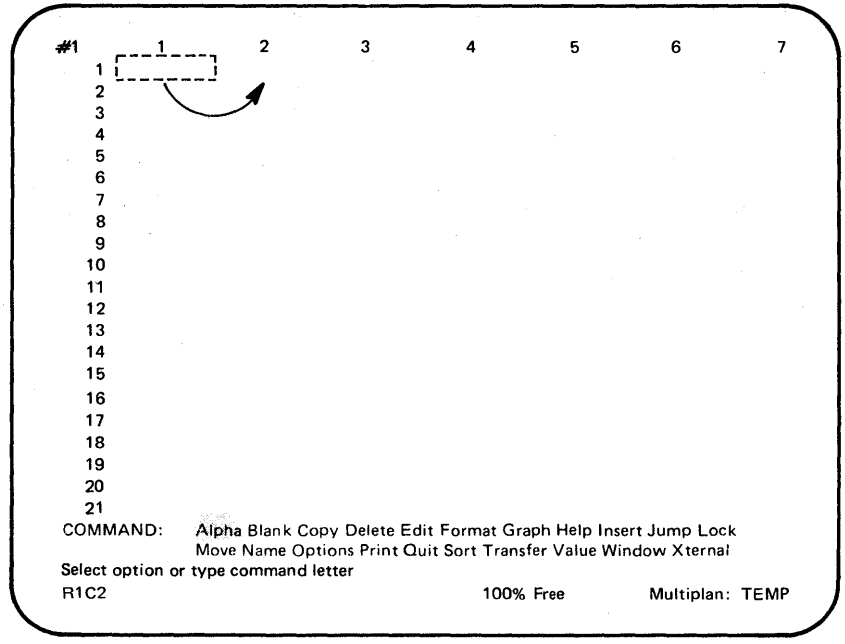
The **cell** that is available for immediate use, the **active cell,** is illuminated by the **cell pointer.** The cell pointer is now in the upper left of the display. It is in row 1, column 1. A cell is identified by its **location**; the row **number** is always given first. Cell "row 1, column 1" (R1C1) is the active cell now.

The Direction Keys

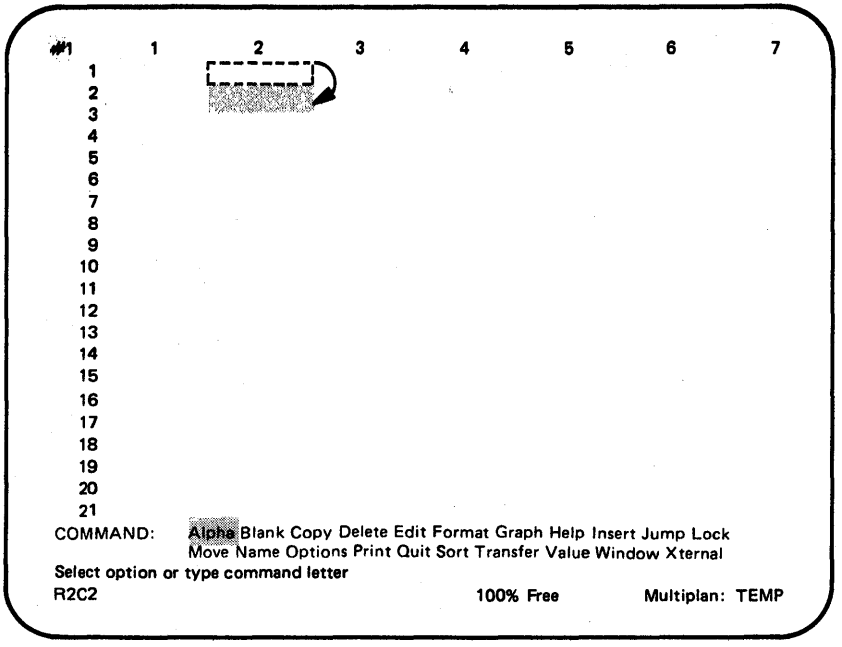
Look at your **keyboard**. There is a block of keys with numbers and arrows (on the right-hand side of the keyboard). The arrows are called the **direction keys**.

Moving the Cell Pointer

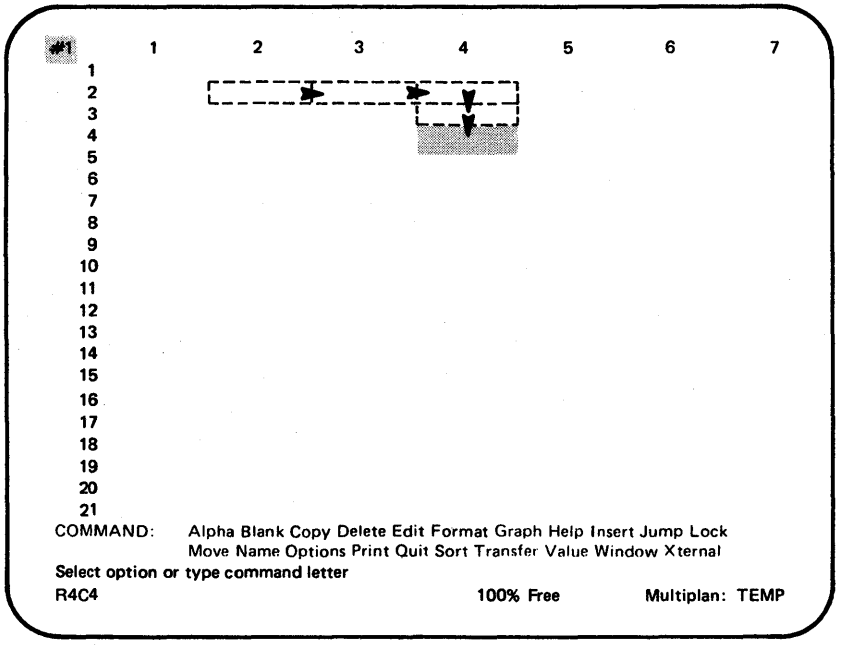
Press the right arrow key once. Now look at the cell pointer. You moved it one cell to the right, to column 2. The pointer is now in row 1, column 2 (R1C2). That cell is now the active cell.



Press the down arrow key once. The pointer has moved down a row. The active cell is now row 2, column 2 (R2C2).

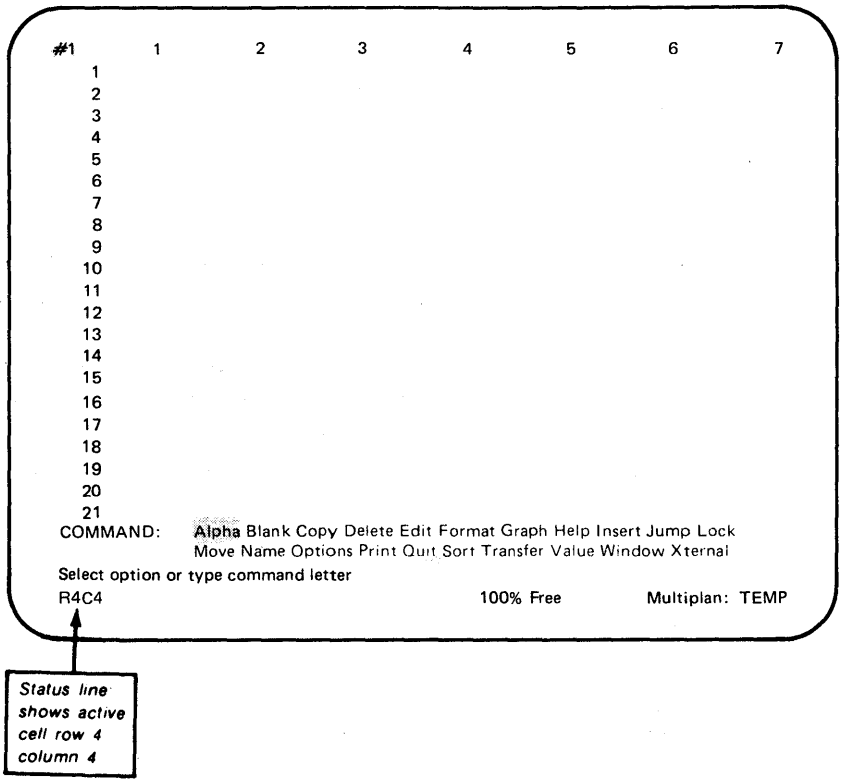


Press the right arrow twice and the down arrow twice. The pointer moved across the display to column 4, then down to row 4.

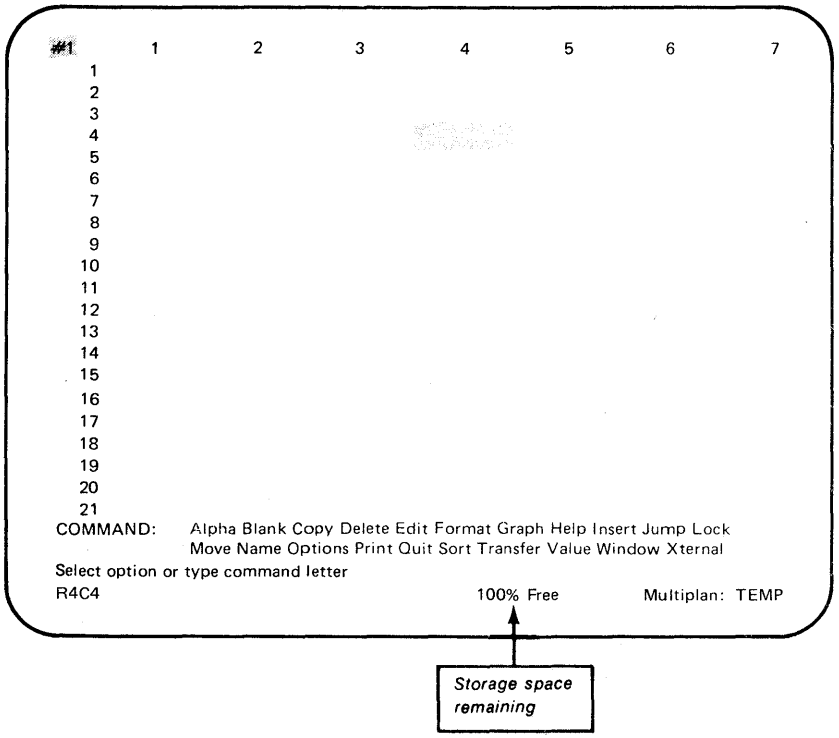


The Status Line

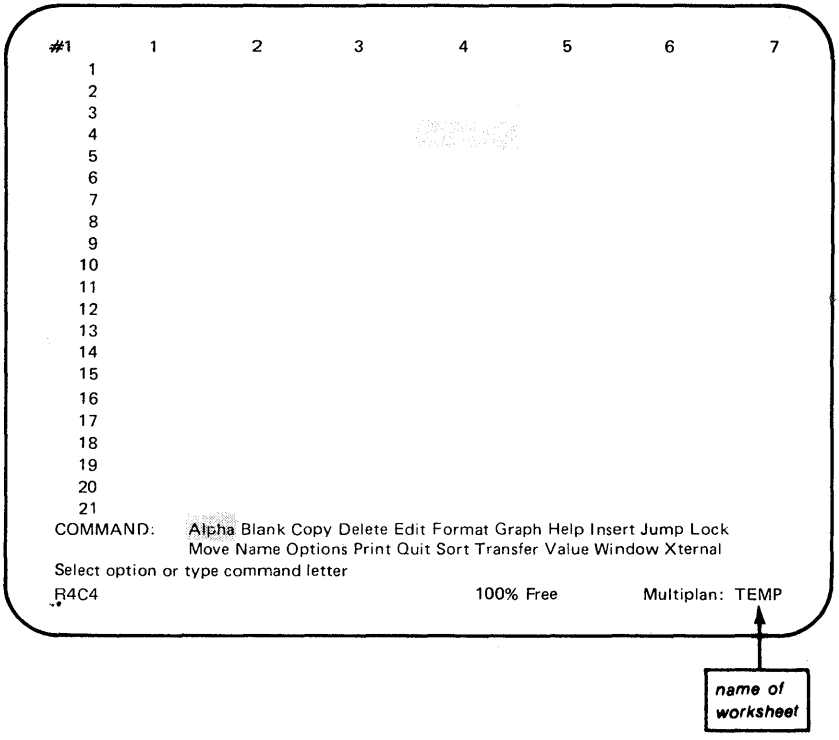
The bottom line of the screen is called the **status line**. It tells you the location of the active cell and what it contains (it is still blank). Right now the status line should read R4C4. If it contains any other number, use the direction keys to move the pointer to row 4, column 4.



Look at the number next to the cell location on the status line. It tells you how much storage space is left in your particular system.

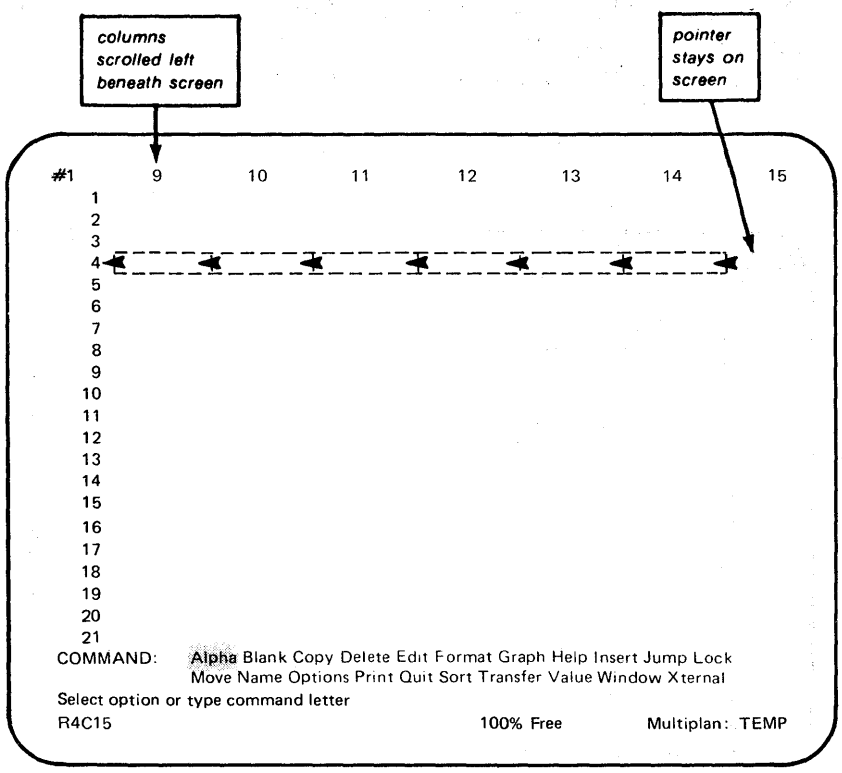


Since worksheets can be named by you for ready reference, the status line will also tell you the name of the worksheet you are currently using. You haven't given your sheet a name yet, so Multiplan calls it *TEMP* (temporary) for now.



Scrolling the Worksheet

Your screen shows you only 7 columns: what if you want to see column 15? Press the right arrow until the cell pointer reaches the right edge of the display. As you continue to press the arrow key, the pointer remains still, but the columns move to the left beneath it. This is called **scrolling**. Press the arrow key until column 15 is reached. (Columns 1 through 8 are no longer visible on the left.) You are now in row 4, column 15 (R4C15).

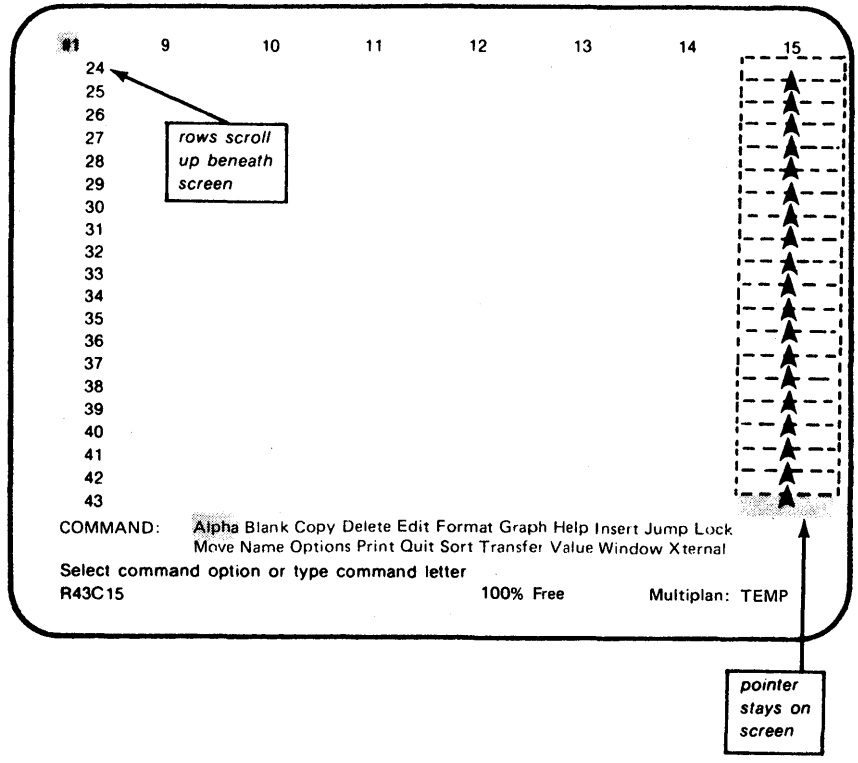


The Repeat Function

Characters or directional movements are repeated as long as you continue to press and hold a key. To stop the action, merely release the key.

The **repeat** function can be used to scroll faster through columns or rows.

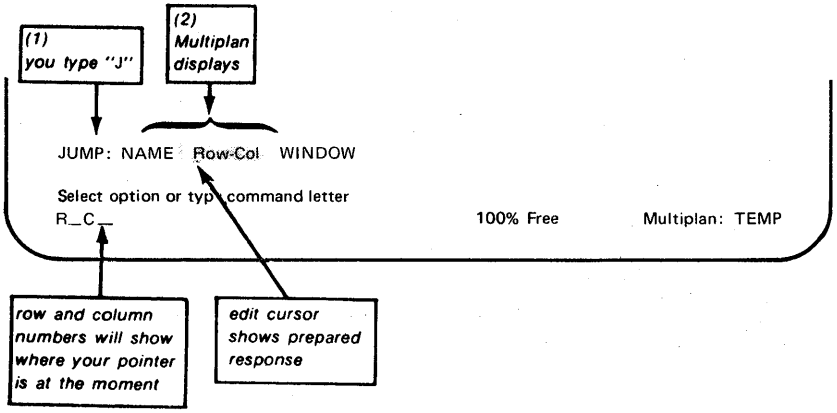
Press and hold the down arrow key. Once the pointer reaches the bottom of the display, look at the left side of the screen. You will see the rows scrolling past your pointer.



To stop scrolling, release the direction keys.

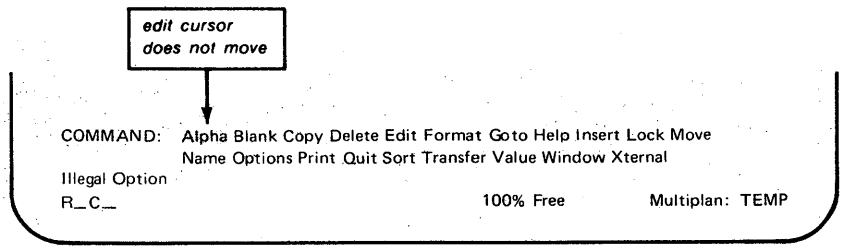
The Jump (J) Command

There is a faster way to reach a cell on a different part of the worksheet. Press the key *J*. At the bottom of the screen, above the status line and **message line**, you should see, on the **command line** the command:



Look at the highlighted box on the command line. It is called the edit cursor. It shows you where you are working at the moment.

Note If you pressed a key that does not work as a command (an invalid command), such as the letter *K*, the command line will not change, but you will see the **message** "Illegal Option."



Just press *J* again and you will see the Jump Command.

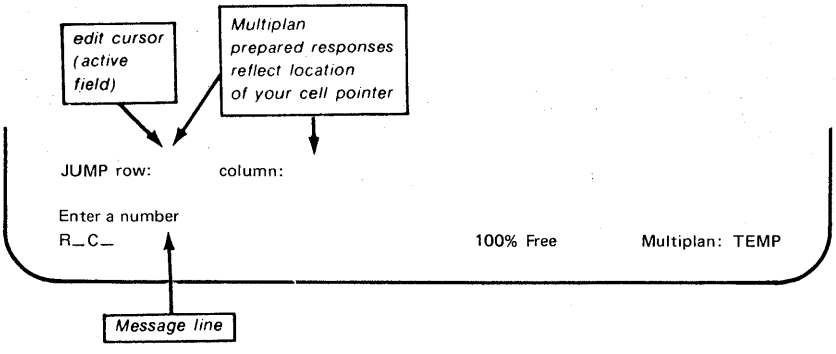
If you have pressed other keys while you were moving the pointer, find the CANCEL key on your keyboard, and press it to clear the command line. Then press *J*.

The Structure of Commands

You can see that the Jump command now offers you a choice of three subcommands: Name, Row-col, or Window (Names will be discussed in Chapter 4.) All Multiplan commands are prepared in this way: you first select the initial letter of the command you want, then you choose one of several versions of the command (subcommands) with another letter.

Multiplan Prepared Responses

To save you time, Multiplan has tried to anticipate your **choice** of subcommands and has preselected the choice you would be most likely to make. In this case the choice is **Name,** which is displayed in the edit cursor box. If you agree with Multiplan's selection, merely press the RETURN key on your keyboard; the command line will change to display the chosen subcommand. (You can, of course, type the *N* yourself.) Press *R*. You will see:



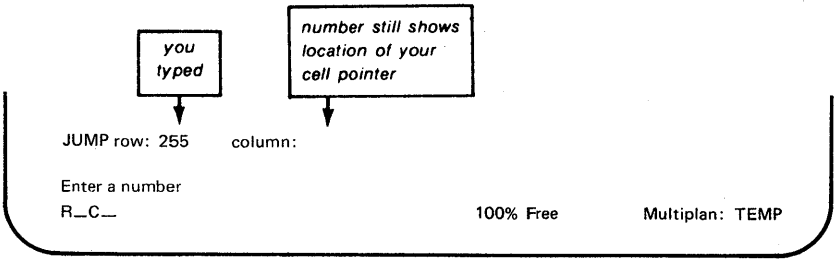
Multiplan has again tried to anticipate your choice by guessing what you will want to do and displaying a number in each of the two **fields** (spaces) in the command line, one by "row" and one by "column." Since Multiplan did not know what to choose, it listed the current position of the cell pointer.

Fields: Moving the Edit Cursor between Fields: The TAB Key

The command line is divided into as many fields as there are choices to be made. The edit cursor shows you which field is **active** (available for immediate use).

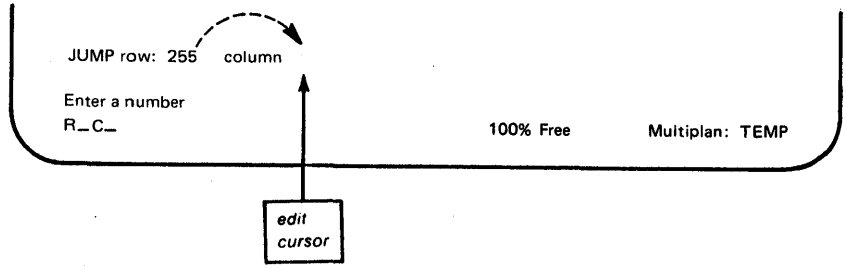
The cursor is moved from field to field by the TAB key, and will return to the first field after the last field has been reached. Look at the message line below the command line. It reads,"Enter a number." The edit cursor is in the first field by "row." Multiplan is asking you to choose a row number if you don't like the one it guessed. Respond with the last row on the worksheet, row 255, like this: type *255*.

The command line should now look like this:

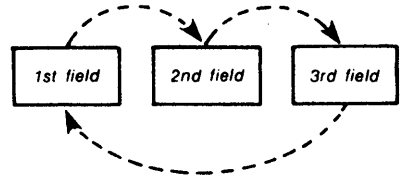


Note There may be two sets of numbers on your keyboard. If there are, use the numbers across the top of the keyboard rather than those set off to the right.

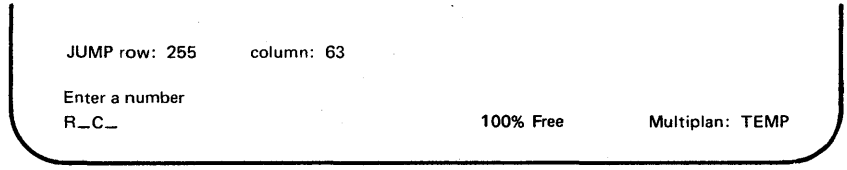
The edit cursor after the 255 is now an illuminated box. It is waiting to see if you are finished in the first field. Press TAB to move the cursor to the second field in the command line.



Press TAB a few times to see how the cursor moves between fields. In commands with more than two fields, the TAB key moves the cursor like this:



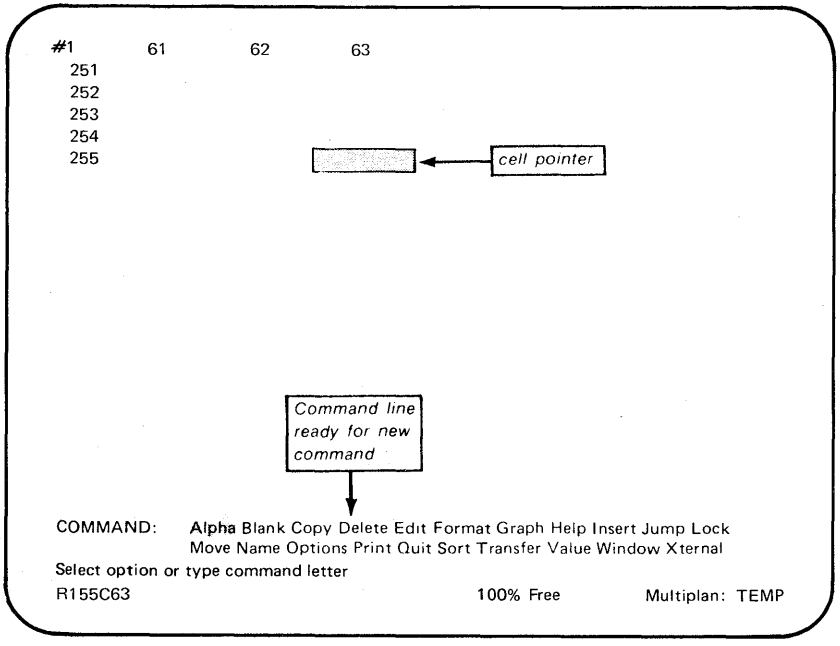
With the cursor in the second field (column), pick the last column on the worksheet, column 63, by typing *63*. The command line looks like this:



Carrying Out a Command: The RETURN Key

You have now selected the cell (by its row and column numbers) to which you want the cell pointer to go. Multiplan is not sure you are ready to carry out the command until you tell it to do so. Find the RETURN key on your keyboard. The RETURN key is used to carry out commands. Press RETURN.

Your screen should look something like this:



Your command has been carried out—the cell at the 255th row and the 63rd column (R255C63) is visible in the window—and the command line is waiting for a new command from you.

You have focused the screen on a different part of the worksheet by using the Jump command. Use this command to move quickly to and from any part of the worksheet.

What if you changed your mind? Suppose you decided you wanted row 155 instead of row 255. Press *J* for Jump, and *R* for Row-column. The edit cursor is in the first field for row number.

Simply type *155.* (If your mistake was in the last field for column number, use the TAB key to move the edit cursor to that field and type in the correct answer.) Press RETURN to carry out the command. The cell pointer is now on row 155, column 63.

The Jump (J) Command (Review)

Use the Jump command again to get back to the beginning of the worksheet.

Type *J*.

```
JUMP: Row-col Name

Select option or type command letter
R155C63                          100% Free          Multiplan: TEMP
```

Press *R* to select Row-column.

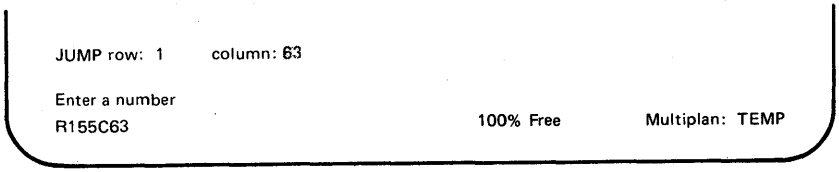
```
JUMP row: 155      column: 63

Enter a number
R155C63                          100% Free          Multiplan: TEMP
```

Now type a number *1* in the field by "row".

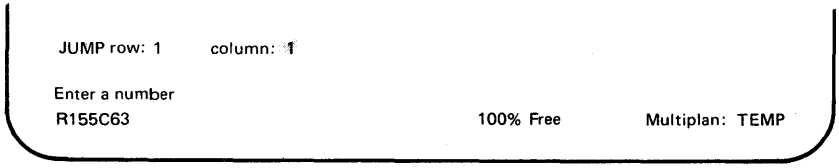
Note **Be sure not to confuse Multiplan by using the lowercase letter l for the number 1.**

```
JUMP row: 1      column: 63

Enter a number
R155C63                          100% Free          Multiplan: TEMP
```

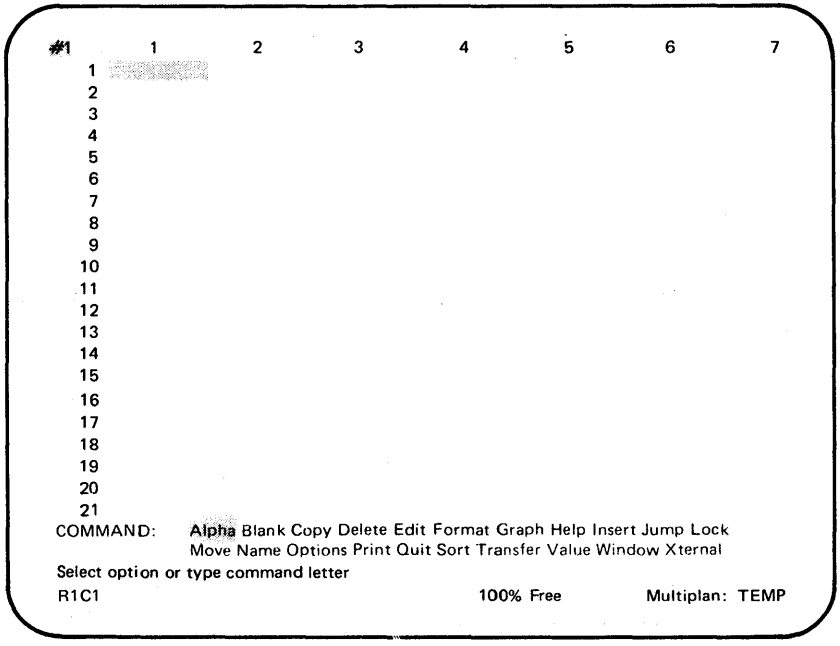
TAB to the next field (columns).



Type number *1* in that field.



Press RETURN. The screen should now show you the cell pointer on active cell R1C1 (row 1, column 1).



The Quit (Q) Command

In your next Multiplan lesson, you will learn how to write in the cells. To leave Multiplan now, however, use the Quit command. Press *Q*. Your screen will show:

```
QUIT:

Enter GO to confirm
R1C1                          100% Free          Multiplan: TEMP
```

The command line asks you to confirm your decision to erase the screen by pressing GO. Press GO to end your Multiplan session.

Note Later you will learn how to **save** any work you have done before you use the **Quit** command.

Summary

In this session you learned:

What the different parts of the screen look like and what they mean.

Where the direction keys are located on a typical keyboard, and what they do.

How to move the cell pointer using the direction keys.

Where the status line is located, and what it tells you.

How to scroll the worksheet by using the direction keys.

How to scroll by using the repeat function.

How to get to another cell quickly by using the Jump (J) command.

How commands are structured.

How Multiplan helps you by presenting prepared responses.

How to move the edit cursor between fields by using the TAB key.

How to carry out a command by using the RETURN key.

How to leave Multiplan by using the Quit (Q) command.

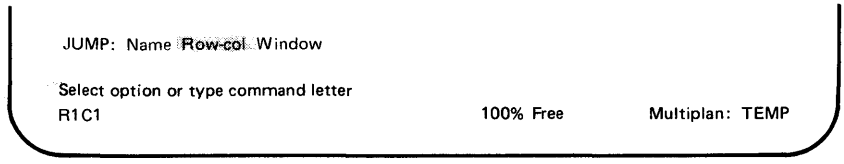
Chapter 2
Filling in a Worksheet

In Chapter 1 you learned how to start Multiplan and how the rows and columns are used to identify the cells of the worksheet.

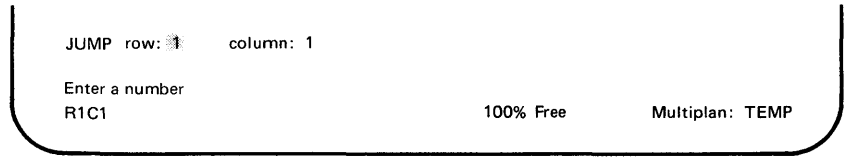
You also learned how to move the cell pointer to different parts of the worksheet by using the direction keys, and how to move the pointer quickly by using the Jump command.

The Jump (J) Command (Review)

1. Press *J*. The system responds:



2. Press *R* to select a desired response. The system responds:



3. Type the row and column numbers desired (using TAB to move from field to field).

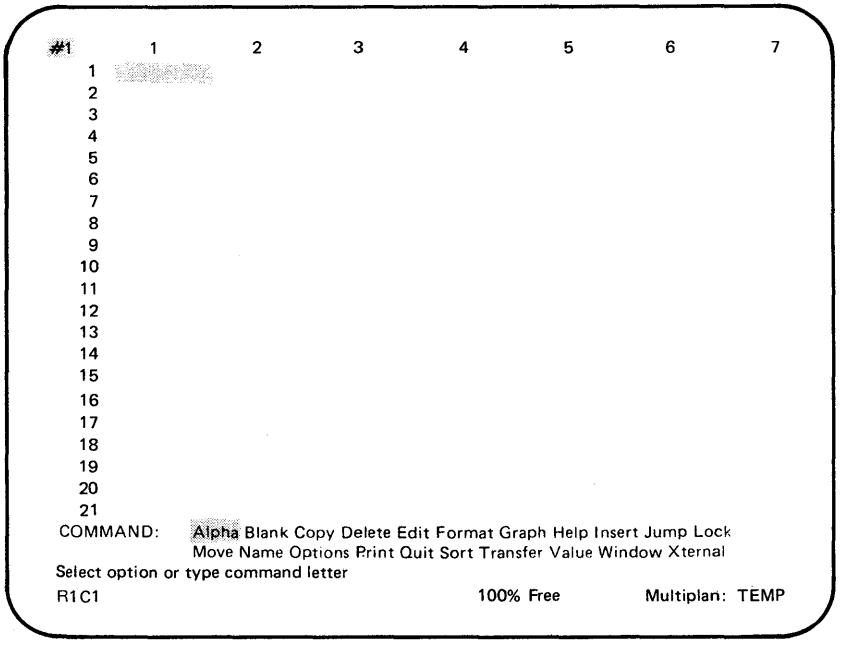
4. Press RETURN to carry out your command.

In this session you will begin to write on the worksheet. You will learn how to change cell entries and correct mistakes as you go along. You will also begin work on a financial analysis for a model company—Spencer Ceramics. A large industrial firm is considering buying Spencer Ceramics and has requested a projected

income statement; the firm has asked for a summary operating budget showing projected sales, costs, and gross profits. If, on the basis of this information, Spencer Ceramics looks like a good investment, the firm will send in its own accountants to do a more detailed survey.

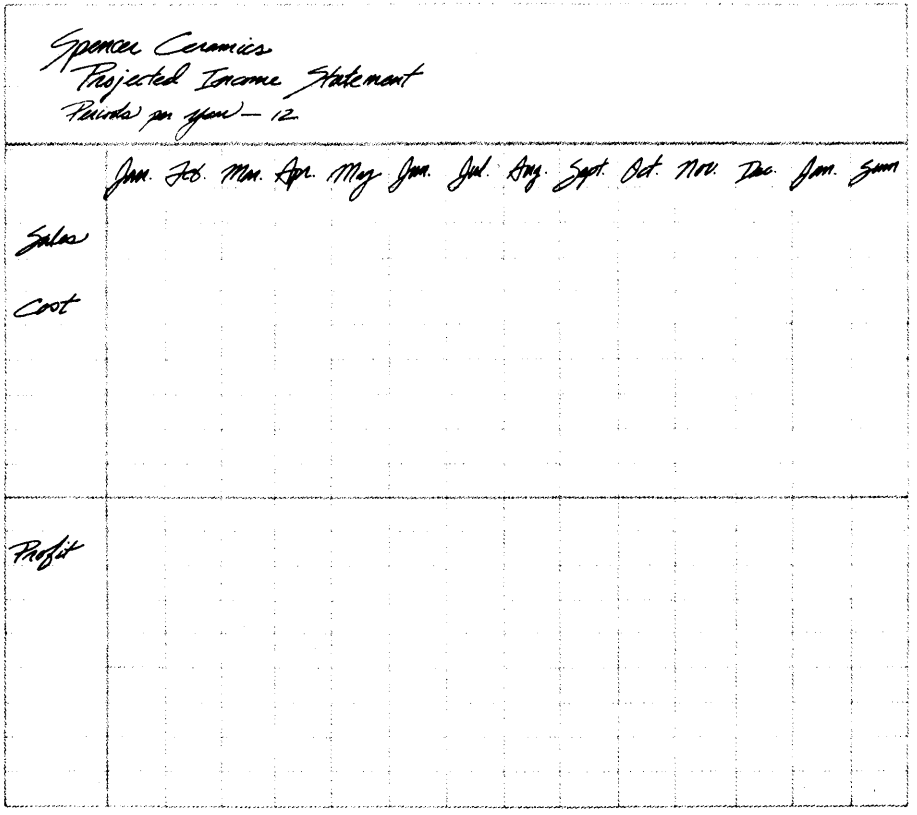
The Worksheet Number Grid

Load the Multiplan diskette according to the instructions given in your reference card, then insert your worksheet diskette. In a moment you will see the row and column numbers, as well as the command, message, and status lines appear on the screen.



The row and column numbers are merely guides for entering the forecast **data**. The information on the bottom of the screen is there only to help you enter the figures on the worksheet and will not appear on the final printed form.

To plan what needs to be done in your analysis of Spencer Ceramics, sketch a brief outline with pencil and paper, showing how the table will be set up.



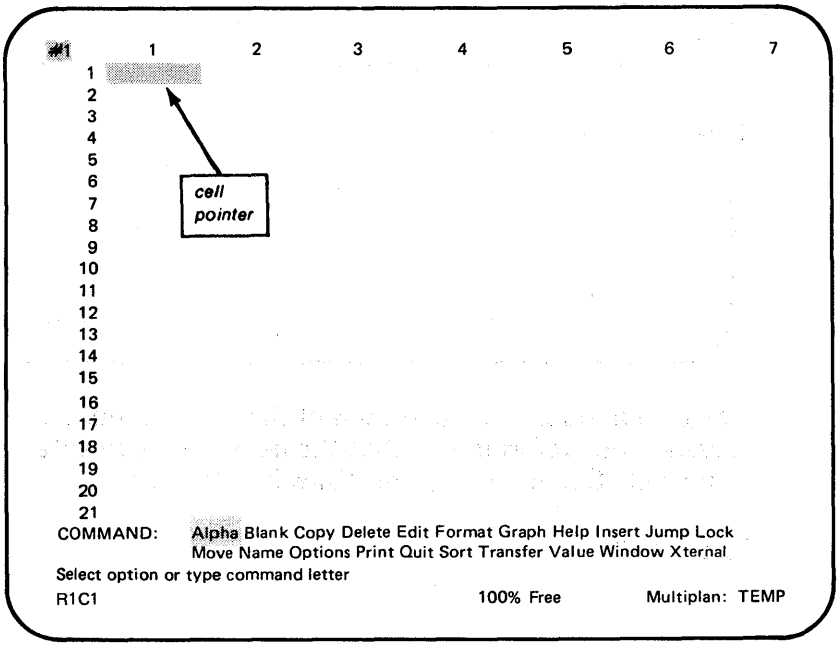
With Multiplan, it is easy to expand the table later to add more items, to insert rows or columns of space, or to delete unwanted items. It is even easy to change a figure, such as January sales; Multiplan will recalculate the entire table automatically.

Entering Words: The Alpha (A) Command

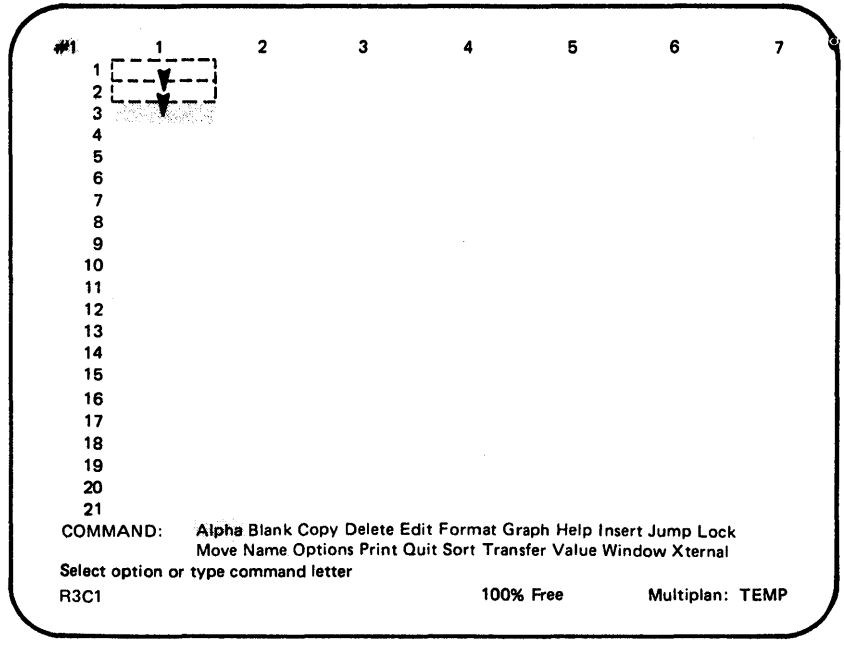
To prepare the table for the figures on Spencer Ceramics, begin by entering the headings for the rows and columns. You can add a title to the sheet later.

Words and numbers are entered in different manners. Since Multiplan is designed to deal primarily with numbers and formulas, it automatically recognizes numbers as soon as they are typed. Therefore, if you want to enter a word or a title, you must specifically tell Multiplan that you want to enter a word, and not a number or a formula, into the cell. You do this by using the Alpha (A) command.

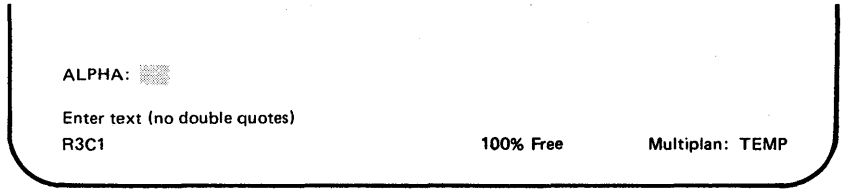
Before you begin, look at the cell pointer on your screen. It should be in row 1, column 1 (R1C1); if it is not, use the direction keys to place it there.



Since you will later need some room at the top of your table for the names of the months, move the cell pointer down two rows by pressing the down arrow twice. The pointer is now in row 3, column 1 (R3C1).



Now press *A*. You will see:



The command line indicates use of the Alpha command, and the message line informs you that the next step is to enter the text you want. Begin by entering *Sales* in column 1.

Type *Sales*.

Note Use the SHIFT key to get a capital letter, just as on a typewriter.

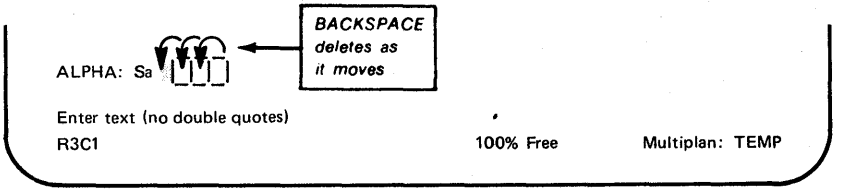
Now you see:

```
ALPHA: Sales

Enter text (no double quotes)
R3C1                          100% Free          Multiplan: TEMP
```

Editing

The BACKSPACE Key

The edit cursor is located immediately after the word you have typed. Before you press RETURN to enter the command in the cell, try **editing** the word *Sales* by using the BACKSPACE key. Press BACKSPACE three times. You will see that the edit cursor deletes the character to its left as it moves. You now have:



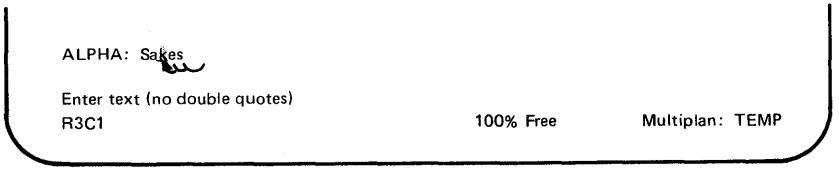
This time type the word incorrectly. Finish typing *Sakes*. You have:

```
ALPHA: Sakes

Enter text (no double quotes)
R3C1                          100% Free          Multiplan: TEMP
```

The BACKWARD and FORWARD Character Keys

Now try a different way to move the edit cursor. You can move it without deleting characters by pressing the BACKWARD **character key** (f9) as many times as necessary to move the cursor back to where you want it.

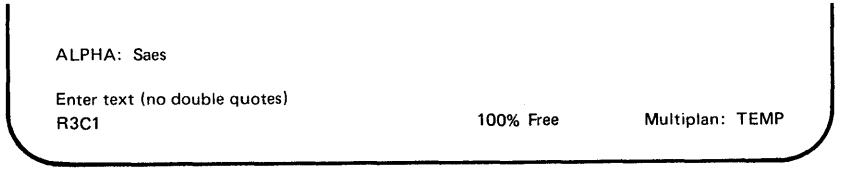
Press the BACKWARD character key (f9) three times to move the cursor back to the *k*.



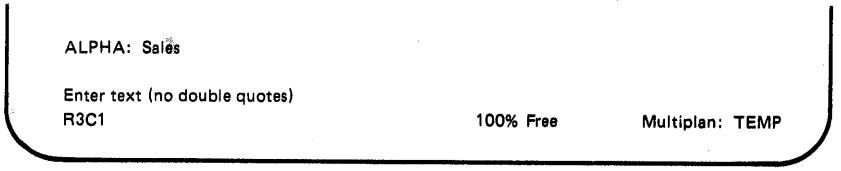
You can move the cursor forward by pressing the FORWARD character key (f10). Practice moving the cursor back and forth by using the BACKWARD character (f9) and FORWARD character keys (f10).

The DELETE Key

When the cursor is on the mistake, find the DELETE key on your keyboard. Press DELETE. You will see:



Notice that when the *k* was deleted, the word closed up to fill the space. The edit cursor remained where it was. To add the letter you need (the *l*), just type *l*.



The letter you typed was inserted before the edit cursor. The word was automatically expanded to make room for the new letter.

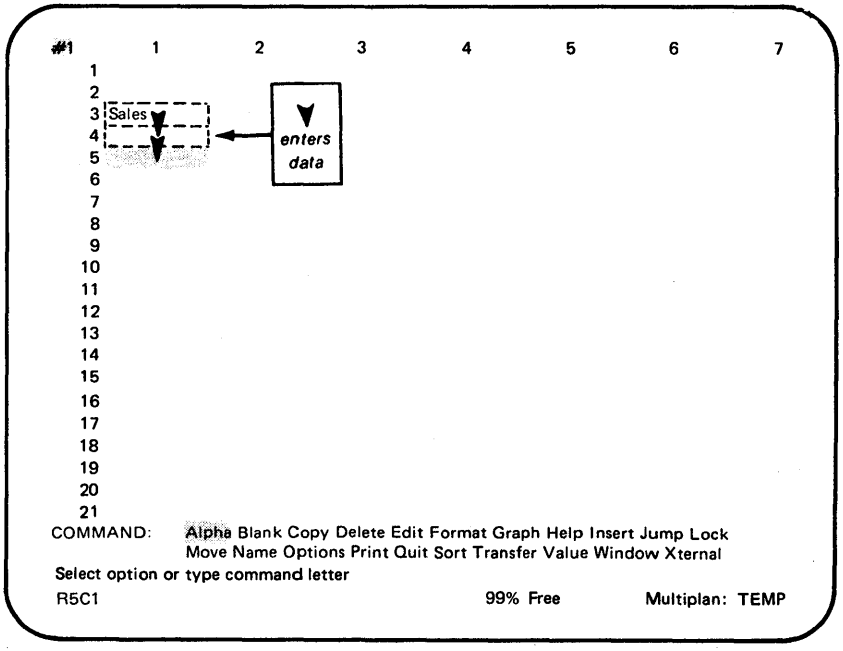
Entering Data with the Direction Keys

Now that the word *Sales* is correct, you can enter it into the cell in two ways:

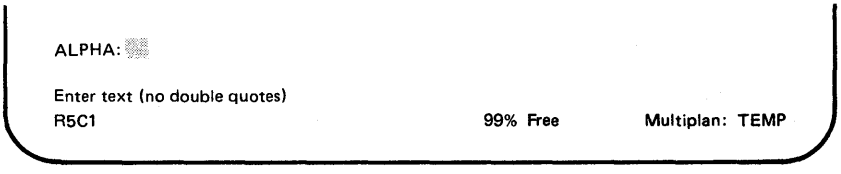
1. You could first press RETURN, and the word *Sales* would appear in the cell R3C1. You would then need to press the down arrow to move the pointer to the next cell.

2. A faster way to enter the word would be to press the down arrow, moving the pointer to the next cell in which you want to work. *Sales* will automatically be entered. (You may, of course, use any direction key; your choice will depend on the cell you want to use next.) This feature will save you many steps as you continue to work with Multiplan.

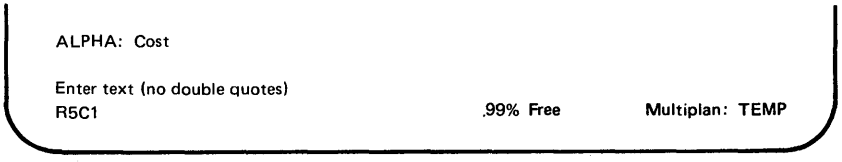
To enter *Cost,* move down a couple of spaces in column 1. Press the down arrow twice. Your pointer should now be in row 5, column 1 (R5C1).



The command line is waiting for your next instruction. Tell it that you want to enter another word by typing *A* for Alpha.



When the message reads, "Enter text," type *Cost*.



Correcting Mistakes (Review)

To correct mistakes, BACKSPACE, deleting as you go, to the mistake. Retype from that point forward. Or you may follow this procedure:

1. To correct a wrong character:

   Press the BACKWARD character key (f9) to move the edit cursor backward (or the FORWARD character key (f10) to move the cursor forward) until it is on the mistake.

   Press DELETE to remove the mistake.

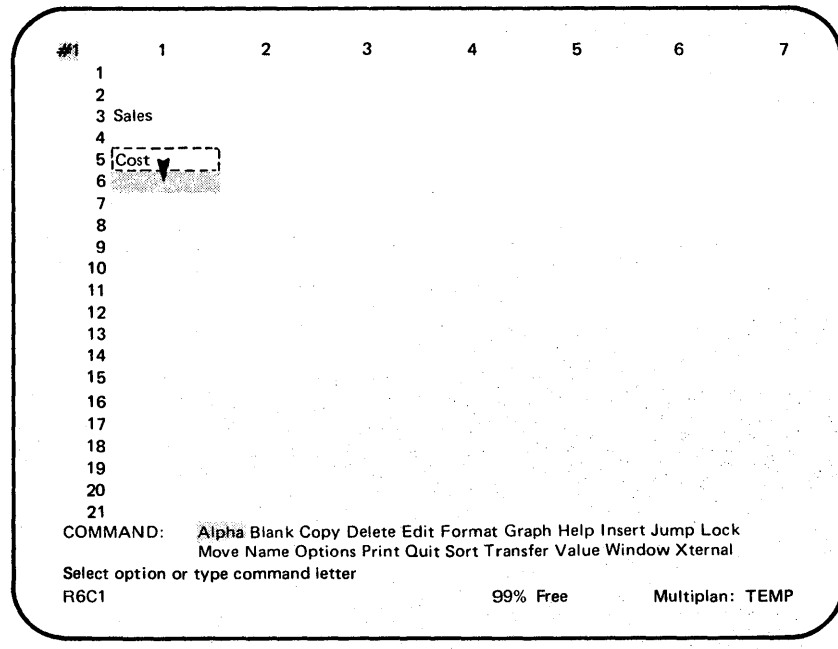
   Insert the correct character by typing it in (it will be entered to the left of the cursor).

2. To insert a missing character:

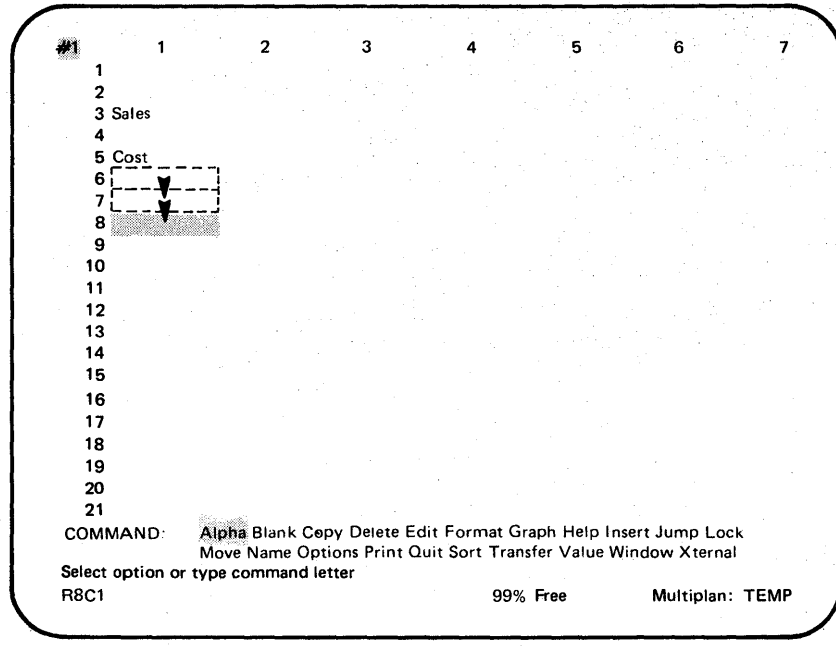
   Press the BACKWARD character (f9) or FORWARD character (f10) key to move the edit cursor until it is on the character to the right of the missing letter.

   Type the letter required (it will be entered to the left of the edit cursor).

When you are ready to enter *Cost* in row 5, column 1 (R5C1), press the down arrow. Now the screen looks like this:



Move the cell pointer down two rows to row 8.



Type *A* again (to enter another word).

```
ALPHA:

Enter text (no double quotes)
R8C1                                99% Free          Multiplan: TEMP
```

Type *Gross Profits.*

```
ALPHA: Gross Profits

Enter text (no double quotes )
R8C1                                99% Free          Multiplan: TEMP
```

Press the right arrow once.

```
#1      1         2         3         4         5         6         7
  1
  2
  3 Sales
  4
  5 Cost
  6
  7
  8 Gross Prof ►
  9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
COMMAND:  Alpha Blank Copy Delete Edit Format Graph Help Insert Jump Lock
          Move Name Options Print Quit Sort Transfer Value Window Xternal
Select option or type command letter
R8C2                                99% Free          Multiplan: TEMP
```

column too narrow

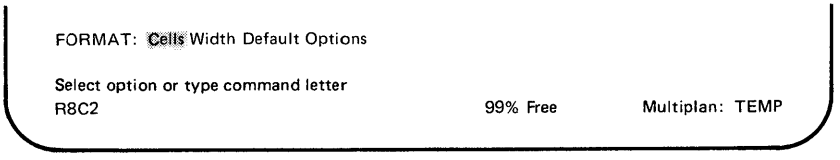
Column Width

Look at row 8, column 1. You can see that the column was not wide enough to accommodate all the characters in *Gross Profits*. Multiplan has not lost any of the information you have entered. It displays as much of it as it can in the space it has. If you give it more space, it will display the remainder of the characters.

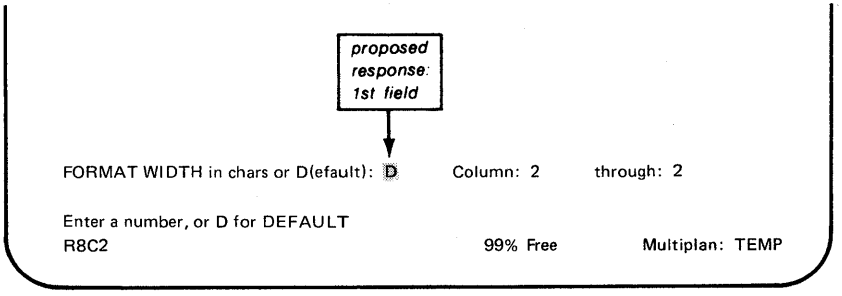
When you loaded Multiplan, it began with a column width of 10 characters. Column width is easily changed using the Format Width command.

The Format Width Command

Press *F*. On the command line you will see:



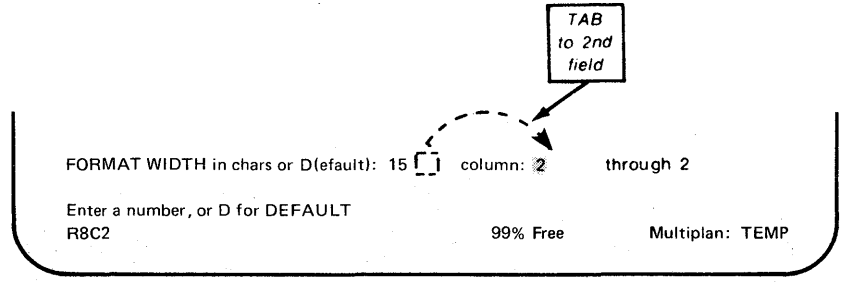
At this point you need only the Format Width subcommand. The other subcommands will be explained later and will become clear as you use them. For now, however, press *W*. You will see:



In the first field, Multiplan has prepared Default as the **proposed response**, but you may also specify the number of characters of width you want. Since the prepared width of 10 characters (which is what you now have) is not wide enough to show your heading completely, choose the width you will need. *Gross Profits* has 13 characters (12 letters and 1 space). Select 15 characters of width to give yourself enough room. Type *15*. Now you see:

```
FORMAT WIDTH in chars or D(efault): 15    column: 2      through: 2

Enter a number, or D for DEFAULT
R8C2                                  99% Free          Multiplan: TEMP
```

Multiplan now lets you select just the columns you want to widen. TAB to the second field:

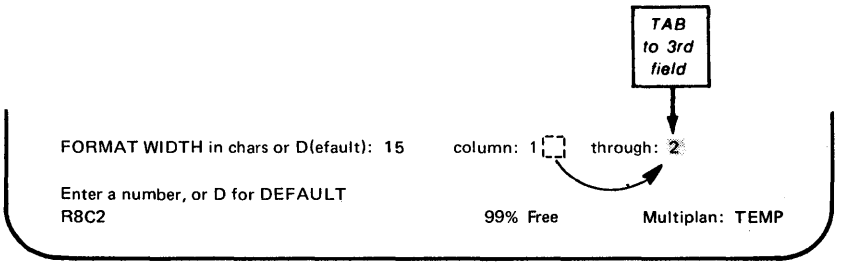


On the pencil and paper sketch you made earlier, you used a total of 14 columns: 1 for the headings, 12 for the monthly figures, and 1 for the sum. You may want to add a column or two later for some other purpose, perhaps just for space to make the table easier to read.

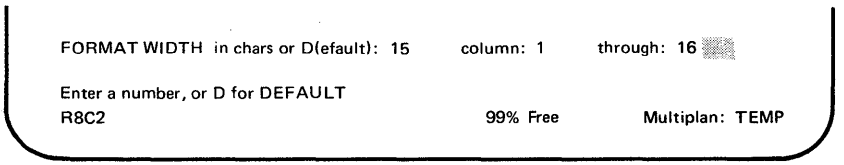
Widen columns 1 through 16. In the second field where your edit cursor is now, type *1*.

```
FORMAT WIDTH in chars or D(efault): 15    column: 1      through: 2

Enter a number, or D for DEFAULT
R8C2                                  99% Free          Multiplan: TEMP
```

TAB to the third field.



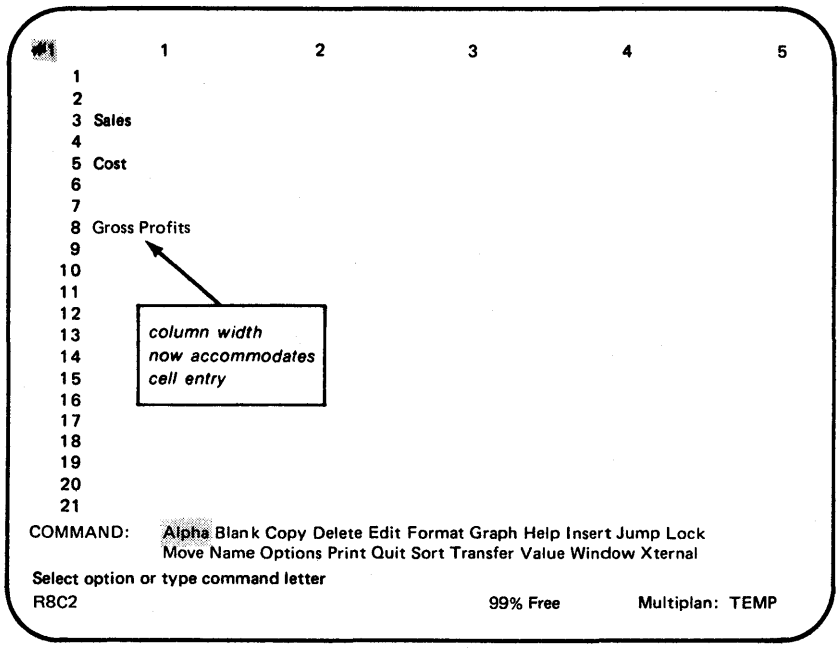
Type *16*.



Carrying Out Commands: The RETURN Key

Press RETURN.

Note In this case you must press RETURN to carry out your command. The direction keys may only be used to end a command when you are entering numbers or words in cells.

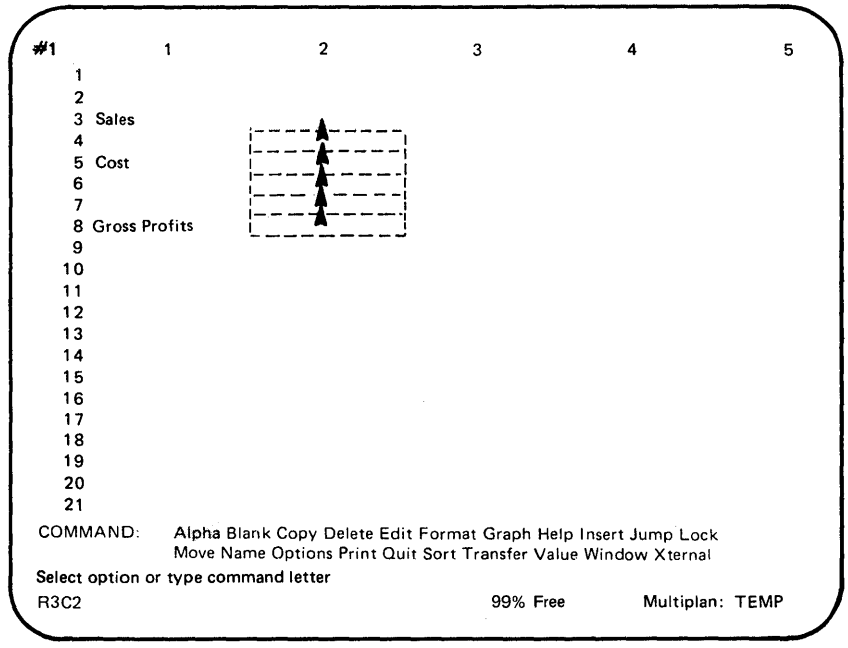


Gross Profits may now be fully seen in column 1. Notice that there are fewer columns on the screen, but that each column has been widened. Your table is now ready for the first numbers.

Entering Numbers

The sales figures for Spencer Ceramics show that the average amount of monthly sales last year was $20,000.

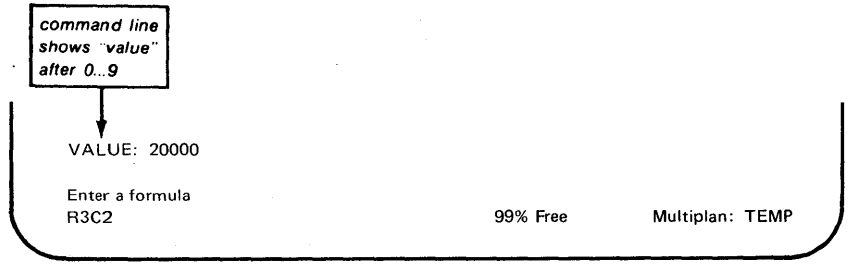
Move the cell pointer to row 3, column 2 (R3C2) opposite *Sales.* (Press the up arrow five times.)



Type *20000.* (Use the numbers at the top of the keyboard.)

Note Multiplan does not use commas (20,000) or spaces (20 000) in numbers. You also do not have to tell Multiplan that you want to enter a number, as you do for words (to enter words, you must use the Alpha command). As soon as you type a digit from 0 to 9, Multiplan treats it as a value.

Look at the command line.



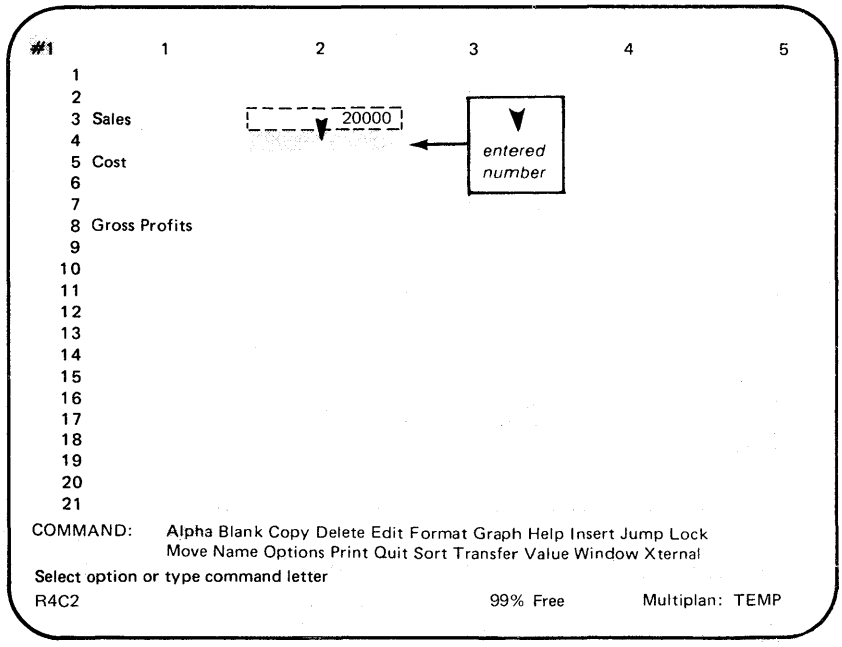
Do not type the $ now. Fill in all the figures first. You'll learn how to change them to dollars later.

Note If you typed $ from habit ($20,000) or put in a comma (20,000), clear the command line by pressing CANCEL:

```
COMMAND:   Alpha Blank Copy Delete Edit Format Graph Help Insert Jump Lock
           Move Name Options Print Quit Sort Transfer Value Window Xternal
Select option or type command letter
R3C2                                  99% Free          Multiplan: TEMP
```

Now start fresh and type *20000*.

Press the down arrow. Now you have:



Spencer Ceramics' costs were $15,000 per month. Enter *15000* in row 5, column 2, like this:

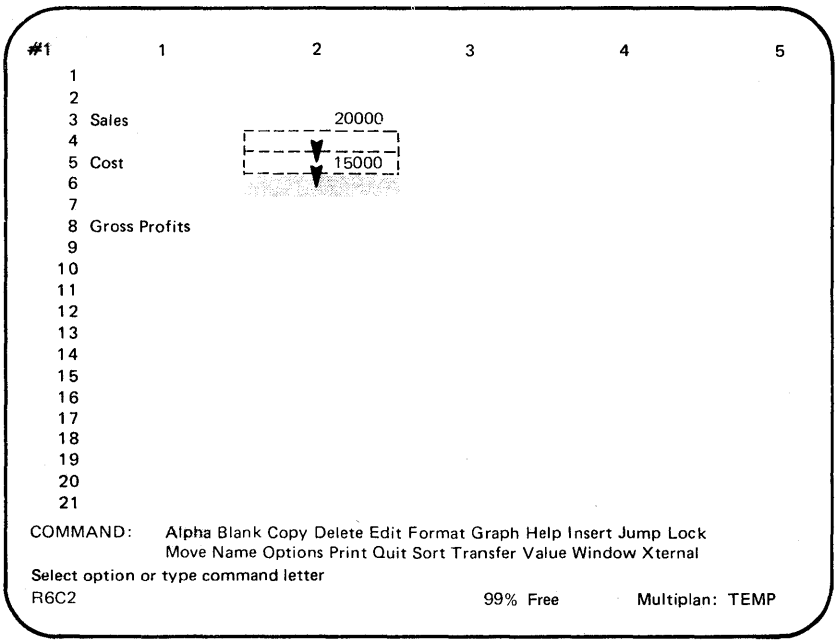
1. Move the pointer to the desired cell (row 5, column 2), using the direction keys.

2. Type the number 15000 in the command line, making any corrections needed.

3. Use a direction key (any one of them) to enter the number in the cell.

Note The RETURN key will also enter numbers in cells, but use direction keys whenever possible: they save time.

Now your screen should look like this:

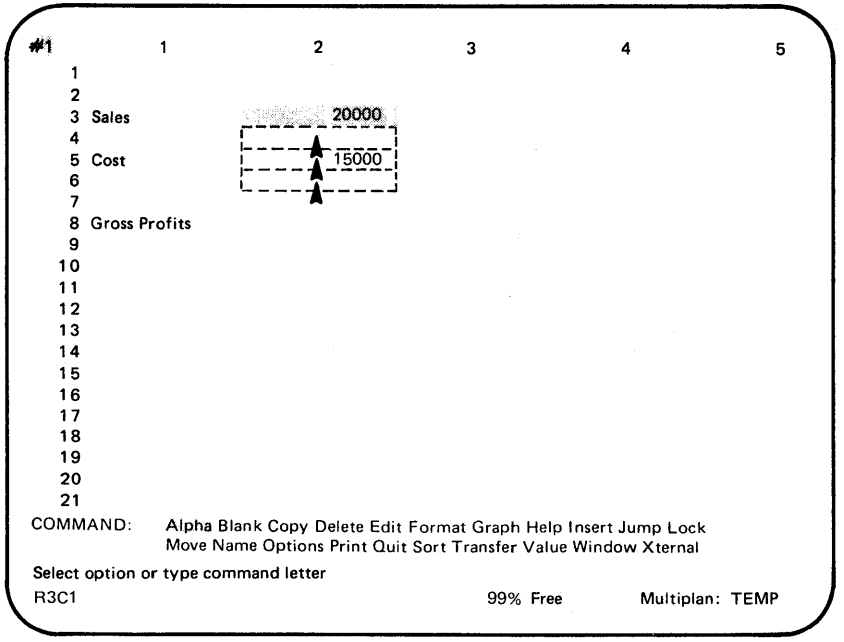


Since all the figures you are working with on this project have to do with finances, you may decide that it would be better to have all the numbers entered as dollars. It's easy to make the change.

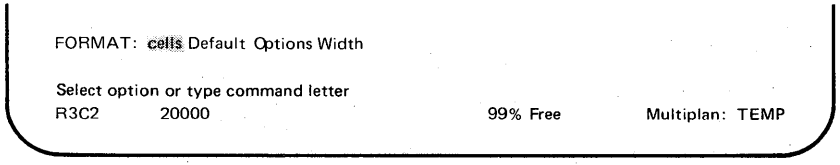
The Format Cell Command

Multiplan offers a wide selection of **formats** in which cell entries may be displayed. The command used for this particular purpose is Format.

First, place your cell pointer on the cell (or on the first cell in the group of cells) you wish to change. Move the cell pointer up to row 3, column 2 (press the up arrow three times).



Now type *F*. You will see:



This time you want to format a group of cells, so choose the proposed response (Cells) by pressing RETURN. The command line reads:

```
FORMAT cells: R3C2                    alignment: [Def] CTR GEN Left Right –
        format code: (DEF) CONT Exp Fix Gen Int $ * % -      #of decimals: 0
Enter a reference to cell or a group of cells
R3C2        20000                          99% Free          Multiplan: TEMP
```

Ranges: The Colon

The edit cursor in the first field highlights the active cell (row 3, column 2). You would like to format all the cells in column 2 beginning with row 3 and extending through row 8. With Multiplan, it is possible to format a range of cells by using the symbol for range, a colon.

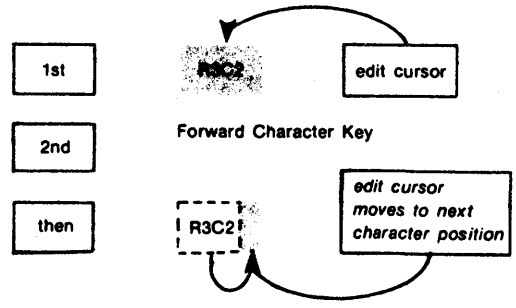
Note Rows 3 through 8 in column 2 could be written, for example, as

R3:8C2

or

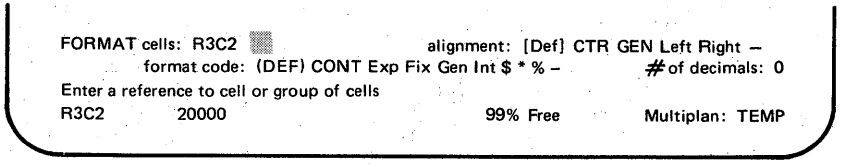
R3C2:R8C2

To enter the colon, use the FORWARD character key (f10) to move the edit cursor to the character position after R3C2. You will see the edit cursor change like this:

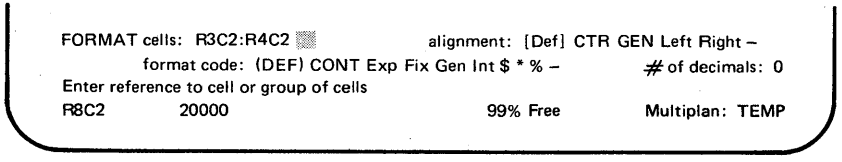


Note If you use any other keys, Multiplan will think you want to replace the entire prepared cell coordinate and it will remove the R3C2 completely. You will then have to type in the coordinate yourself.

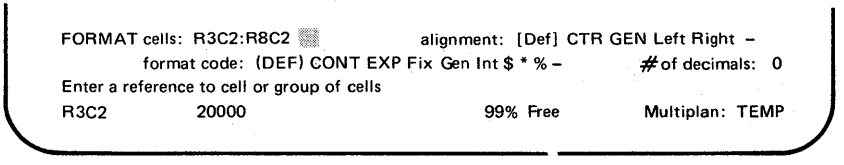
Locate the colon (:) and type it.



Now is the time to let Multiplan work for you. Instead of typing in the coordinates of the cells you want included in the **range** of cells to be formatted, let the cell pointer do the work. Press the down arrow once and look at the first field. It now shows you:

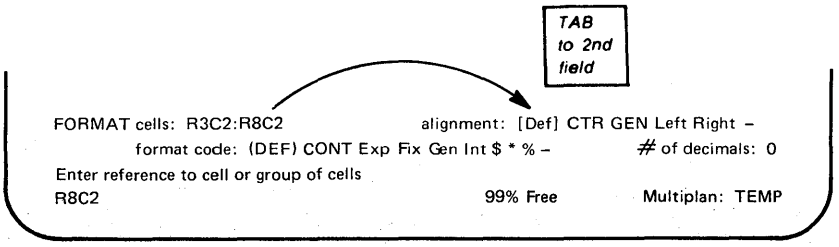


Press the down arrow four more times and watch the number change:



As you can see, making changes with Multiplan is easy. All you have to do is point to what you want and Multiplan will put the correct **references** into place.

Now TAB to the second field to choose the alignment.



Note The cell pointer jumps back to the position it was in when you started working with this field, its "home" position.

Alignment

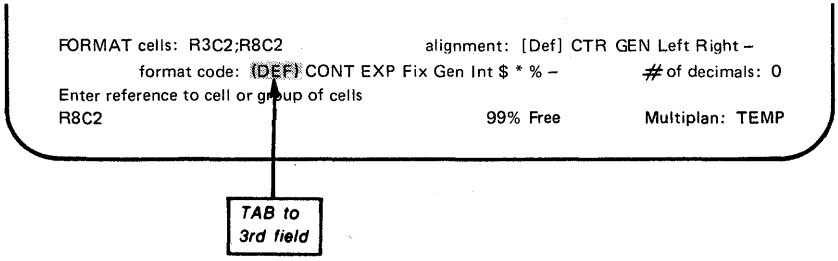
The alignment code offers you several choices.

Code	Format	Comments
Def	Default	Aligns as specified in the Format Default command.
Gen	General	Aligns text left, numbers right; centers error values.
Left	Left	Aligns cell entries to the left.
Right	Right	Aligns cell entries to the right.
Ctr	Center	Centers cell entries.
-		Do not change alignment.

Alignment Examples

Left	$1000.25 $50.25
Right	$1000.25 $50.25
Centered	$1000.25 $50.25

Any alignment choice that sets the numbers to the right would be acceptable, since you want the decimal points to be in line with each other. Therefore, you could choose Default, Standard, or Right, with the same effect on the numbers. (However, if you had included column 1 in your range of cells, all of your text, or words, would be moved to the right, too.) Since the prepared response (Default) is acceptable, press TAB to the next field to choose the format of the display.

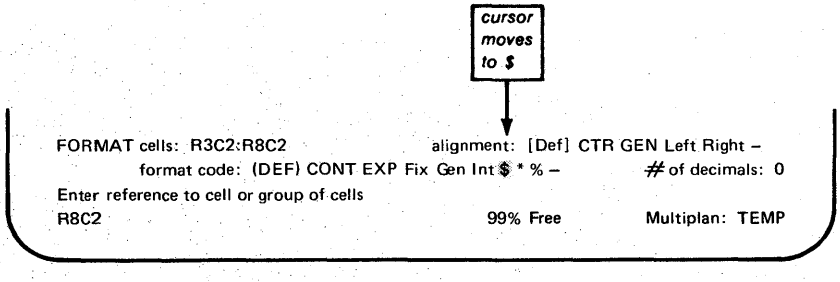


Formats

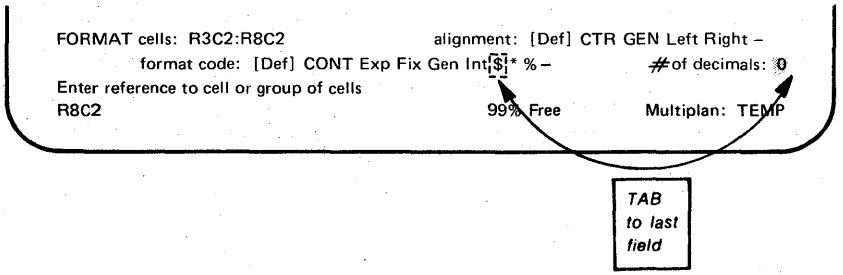
The third field contains several choices for the type of display. At this point, you know you want the format code for dollars. Some of the other choices are quite specialized. The following chart gives a brief summary of these formats; they are thoroughly explained in Part 3, "Reference to Multiplan."

Code	Format	Comments
Def	Default	Format as specified in the Format Default command.
Gen	General	Cuts off text according to the width of the cell: displays numbers in their scientific notation (e.g.,2.001E03 for 2001), if necessary, to fit the width of the cell.
$	Money Amounts	Sets numbers with leading dollar sign and 0 or 2 decimal places. (Negative numbers are enclosed in parentheses.)
Int	Integer	Rounds decimals to whole numbers.
Fix	Fixed Point	Fixes the number of decimals to be displayed by "# of decimals."
Exp	Scientific Notation	Displays numbers as a decimal times the power of ten (sets maximum decimal places to be displayed by "# of decimals" field).
Cont	Continuous	Continues long text across column borders, as long as adjoining cells are empty and formatted for "Cont."
*	Bar Graph	Rounds numbers to whole numbers, and sets an asterisk for each unit in the active cell's value.
-		Do not change format.
%	Percent	Displays numbers as a percentage.

Choose dollars instead of the prepared response by typing a dollar sign ($).

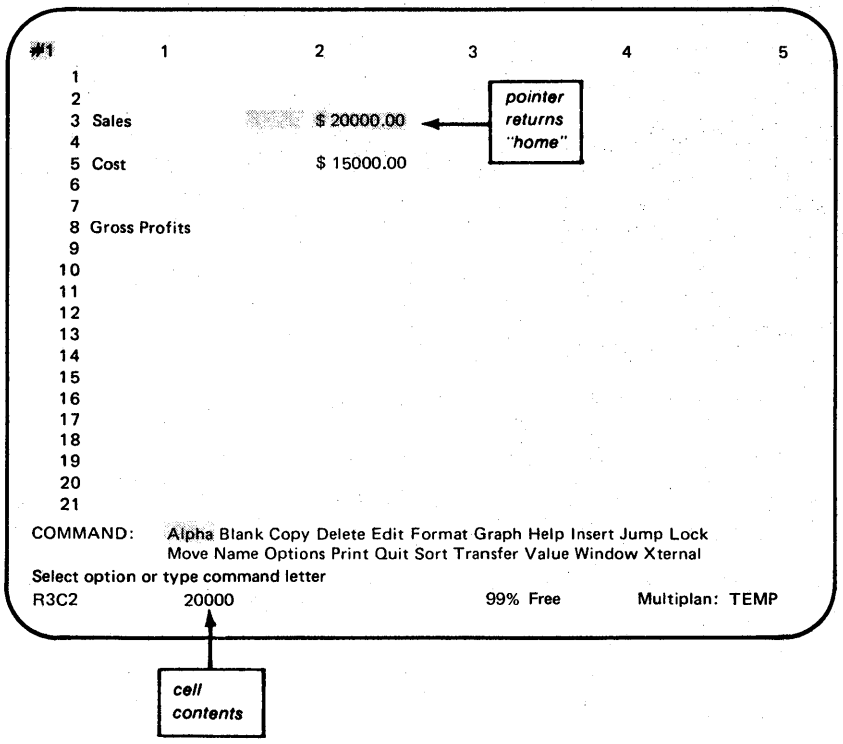


Now TAB to the last field, the number of decimals.



The dollar symbol will automatically give you no decimal places, so you need to specify a number 2 here.

As soon as you have made certain that all your choices are correct, press RETURN to carry out your choices.



You have made four choices in the Format command:

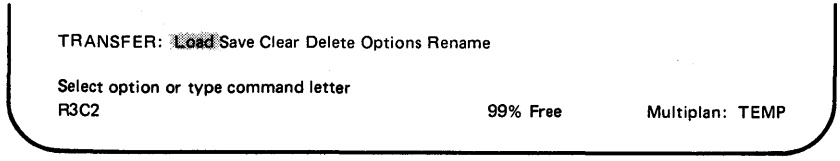
1. You chose to format cells (and you specified which cells).
2. You chose to align the material in the cells to the right.
3. You chose to format for dollars ($).
4. You chose to have two decimal places.

Note You can change the way numbers are displayed any time you like without changing their values. For example, you could show the same value as "1000," "1E3," or "$1000.00."

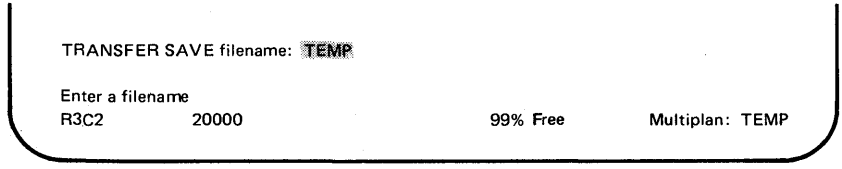
You have learned a lot about formatting in this session, but you will learn more later. In the next chapter, you will use a more detailed breakdown of costs to make a more comprehensive forecast for Spencer Ceramics.

Saving Work: The Transfer Save Command

Save your worksheet so you won't have to start all over next time. To do this, use the Transfer Save command. Type *T.* The command line now reads:



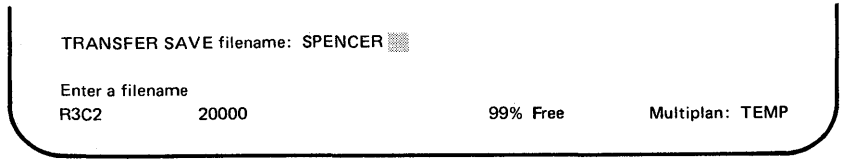
To save your work, choose Save by pressing the space bar and then RETURN.



Give your worksheet a logical **filename,** so that it will be easy to remember when you load the sheet in the next session.

A good **name** for this worksheet would be *SPENCER.*

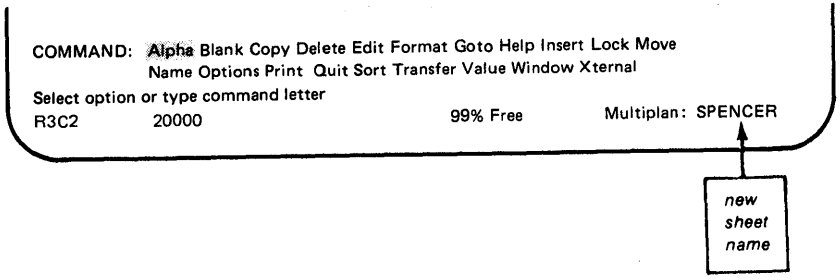
Type *SPENCER.*



You have replaced the name *TEMP*, which Multiplan had given the sheet in the absence of another name. From now on, you must ask for this **file** by its exact name when you want to load it, or Multiplan will not be able to find it.

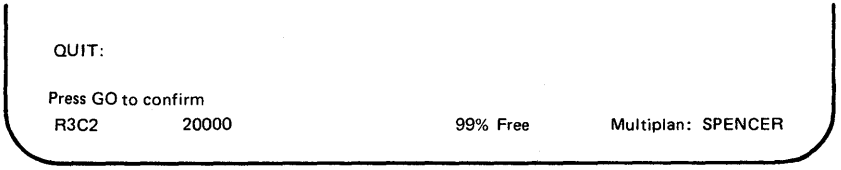
Press RETURN to now save our worksheet as "SPENCER".

Note that the sheet name on the status line is now changed to reflect the new sheet name.



The Quit (Q) Command

To leave Multiplan, press *Q* for Quit, as you did at the end of the last session:



Be sure you have saved your work with the Transfer Save command before you press GO.

Press GO. The screen should now be blank.

When you begin the next session, you will use the Transfer Load command to pick up where you left off.

Summary

In this session you learned:

How to use the Jump (J) Row-column command (review).

How to use the worksheet number grid: the purpose of row and column numbers and of the command, message, and status lines on the screen.

How to use the Alpha (A) command to enter words.

How to use BACKSPACE to edit words by deleting characters.

How to use BACKWARD and FORWARD character keys to move the cursor without deleting characters.

How to use DELETE to remove characters.

How to enter data using the direction keys.

How to correct mistakes (review).

How to change the width of columns using the Format Width command.

How to carry out commands using the RETURN key.

How to enter numbers in cells.

How to change cells to the dollar format using the Format Cell command.

How to specify ranges using a colon.

What alignment choices are available.

What formats are available.

How to save your work using the Transfer Save command.

Chapter 3
Entering Formulas

In the last session you learned to put words (using the Alpha command) and numbers in cells by pointing to them with the cell pointer, writing the information in the command line, and then entering it in the cell by pressing either RETURN or one of the direction keys.

You also learned to use the Format command to display the numbers in dollar format.

At the end of the session you saved your worksheet in a file that you named *SPENCER*.

In this session you will get more practice in entering words and numbers and in formatting cells. Most important, you will learn to enter formulas.

Loading Your File: The Transfer Load Command

When you load your Multiplan program, you will see that the row and column numbers appear on the screen, but not the table. You have to load the file before the table will appear. Type *T* for Transfer. The command line will show:

```
TRANSFER: Load Save Clear Delete Options Rename

Select option or type command letter
R1C1                              100% Free        Multiplan: TEMP
```

Multiplan has selected Load as its prepared response. Since you want to load your file into Multiplan, merely type *L*. The command line will read:

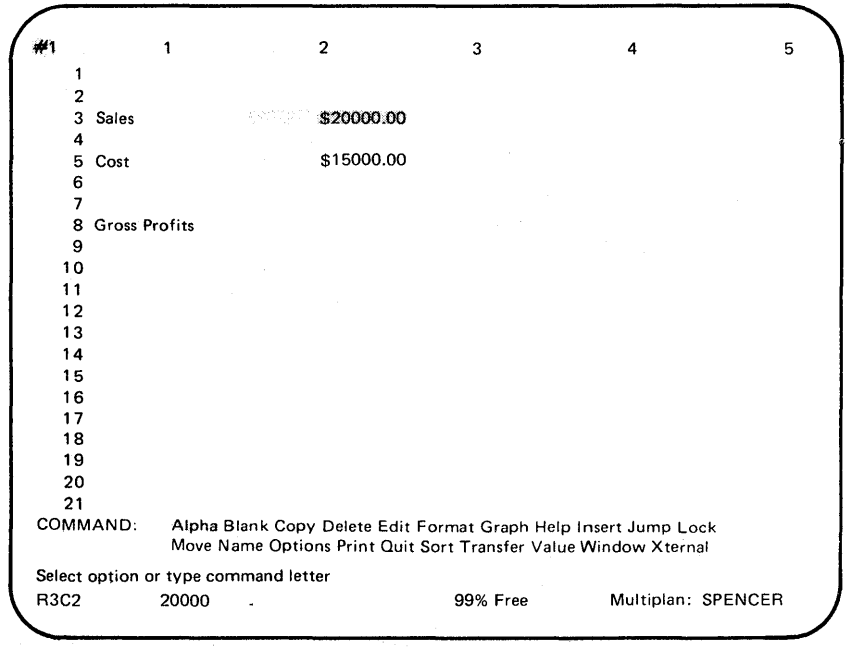
```
TRANSFER LOAD filename:

Enter a filename or use direction keys to view directory
R1C1                              100% Free        Multiplan: TEMP
```

Looking through the Filemane Directory

Look at the message line; it says that you can use the arrows (direction keys) to look through the directory of saved files. Multiplan only shows you the list of sheets; it does not show you any other non-Multiplan files.

Press any of the direction keys. Multiplan displays the list of sheets which are in your directory. Use the cursor keys until **SPENCER** is highlighted.

SPENCER is the only name in your directory right now. To load it, press RETURN. Your file looks like this when it is loaded:



The Insert Command

Look at the following breakdown of Spencer Ceramics' monthly costs:

Material	=	$ 4,000.00
Labor	=	$ 7,000.00
Overhead	=	$ 4,000.00
Total Costs	=	$15,000.00

Your table must be expanded to make room for the new information. You will need space for *Material, Labor,* and *Overhead,* as well as the sum of costs, *Total Costs.* To insert either rows of space or empty columns, use the Insert command. Type *I.*

```
INSERT: Row Column

Select option or type command letter
R3C2          20000                    99% Free          Multiplan: SPENCER
```

The prepared response, Row *(R)* is what you want. (You need to add some extra rows of space.) Press RETURN to select *R*.

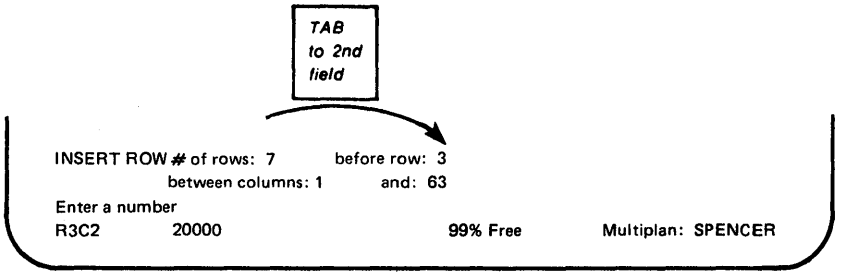
```
INSERT ROW # of rows: 1              before row: 3
          between columns: 1 and: 63
Enter a number
R3C2          20000                    99% Free          Multiplan: SPENCER
```

Note Multiplan prepares responses according to its best guess of what you want to do. In this case, since your cell pointer is on row 3, Multiplan proposes the insertion of 1 row of space before row 3, to extend between columns 1 and 63, or, in other words, across the whole worksheet.

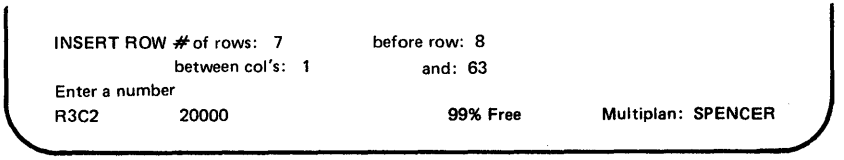
The new figures will require at least 5 rows (4 for figures and 1 for the total costs). Allow yourself enough room. Plan to add 7 rows. In the first field, type 7.

```
INSERT ROW # of rows: 7              before row: 3
          between columns: 1 and :63
Enter a number
R3C2                                   99% Free          Multiplan: SPENCER
```

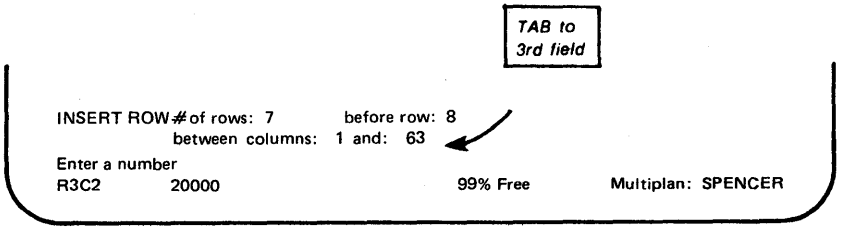
TAB to the second field.



Multiplan asks where to insert the new space by asking which row the space should go in front of. You want to put it before row 8, since that is where you need the space. Type *8*.

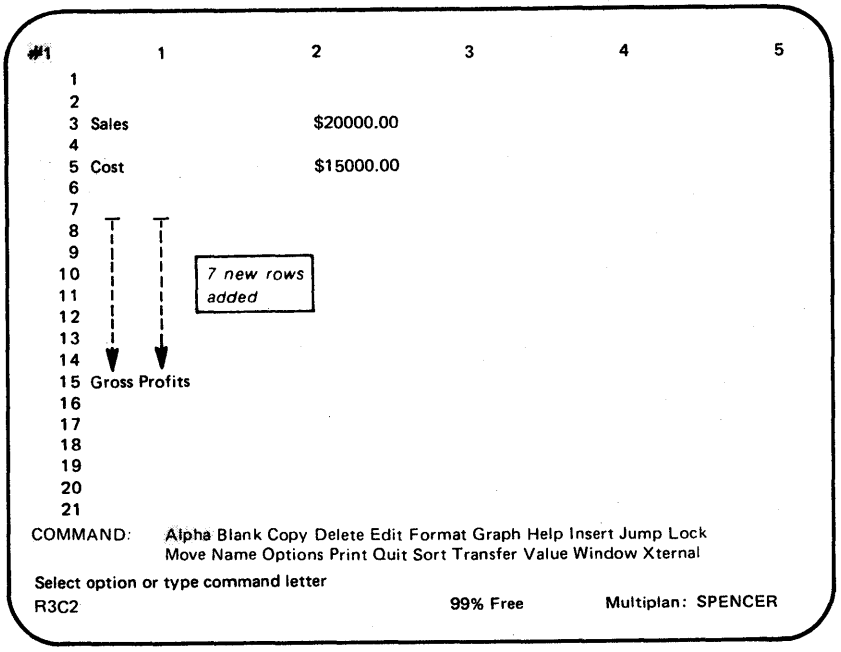


TAB to the third field.



Multiplan has proposed that you insert the new rows of space across all of the columns by saying, ". . . between columns 1 and 63." Since you want the space to extend at least across all 14 columns in your table, you do not need to type any numbers in either the third or fourth fields. Just press RETURN to carry out the command as it stands.

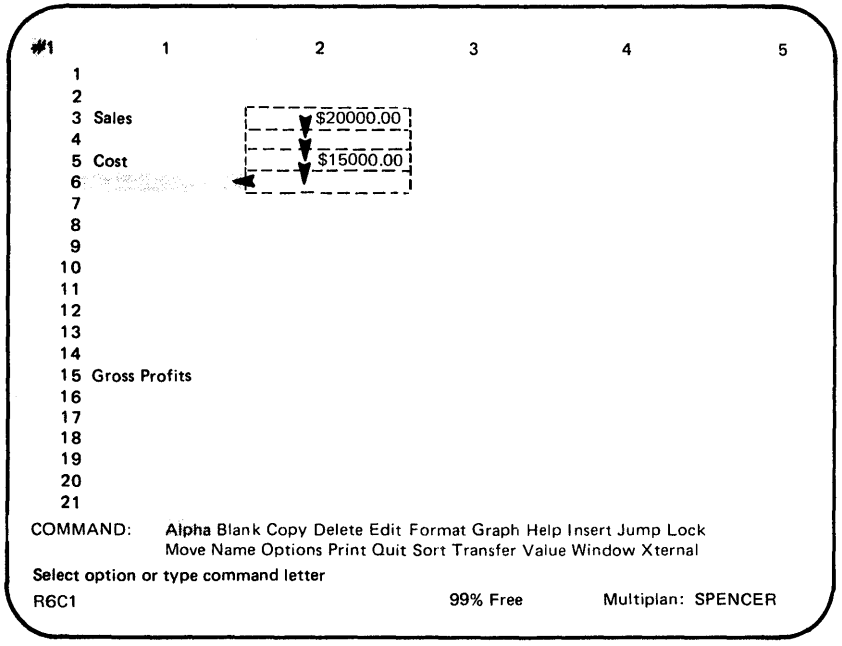
Now you see:



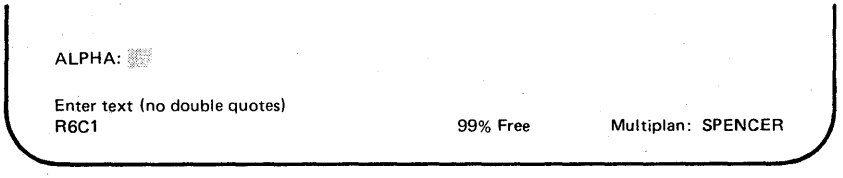
Entering Additional Words

You will be able to add the new information in the space you have created. Under *Cost* (row 5), you will add the subcategories of *Material* in row 6, *Labor* in row 7, and *Overhead* in row 8. Leave a row of space between *Overhead* and *Total Costs* for drawing a line, and add *Total Costs* in row 10. Follow the procedure given below to make these changes.

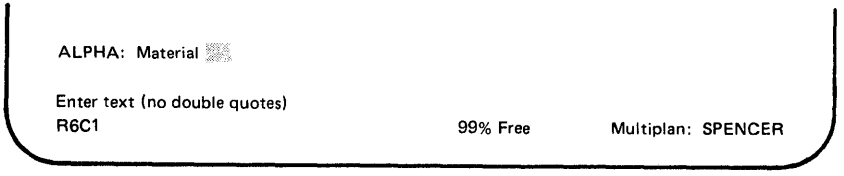
Move the cell pointer to row 6, column 1 (using either the direction keys or the Goto command).



To enter a word, use the Alpha command. Type *A*. The command line now reads:



Type *Material*.



If you make a mistake in entering a word, BACKSPACE and type over the mistake, or follow this procedure:

1. To correct a wrong character:

   Use the BACKWARD (f9) or FORWARD (f10) character key to move cursor to the mistake.

   DELETE the wrong character.

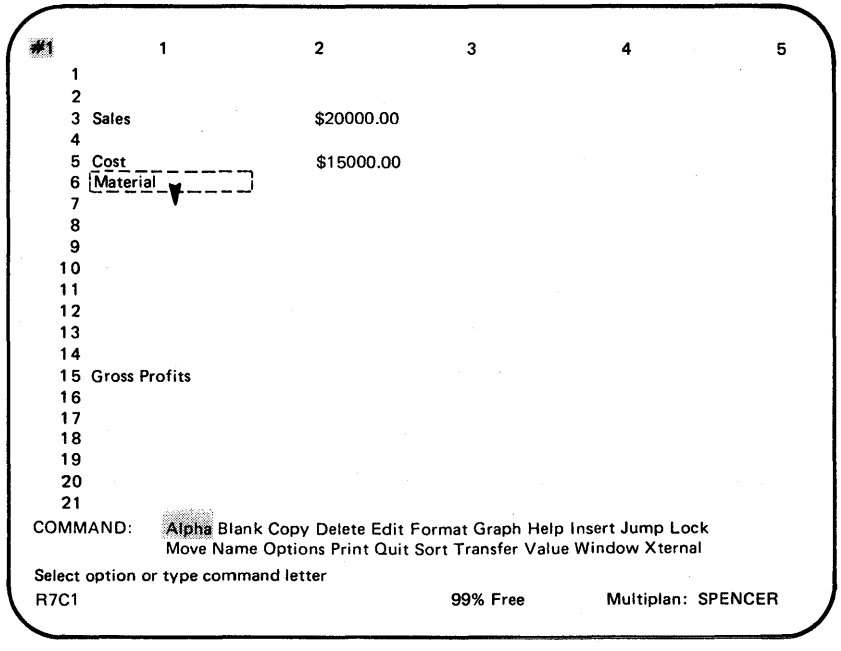
   Type in the correct character. (It inserts to the left of the cursor.)

2. To add a missing character:

   Use the BACKWARD (f9) or FORWARD (f10) character key to move edit cursor to the right of the missing character.

   Type in the character.

Press the down arrow to enter *Material.* Your screen now looks like this:



Enter *Labor* in row 7 and *Overhead* in row 8 like this:

Press A for Alpha.

Type in the word Labor

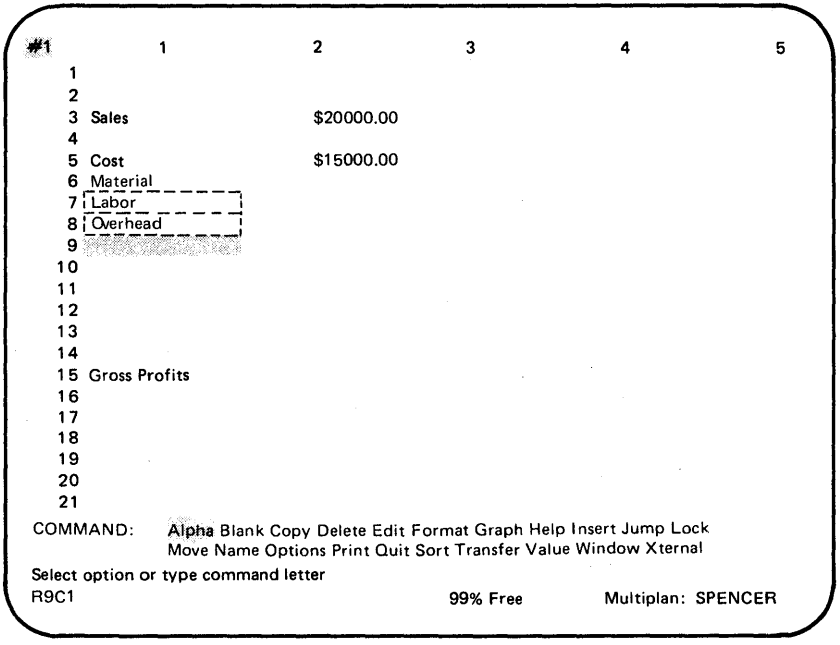
Press the down arrow to enter the word.

Press A for Alpha.

Type in the word Overhead.

Press the down arrow to enter the word.

Now you have:

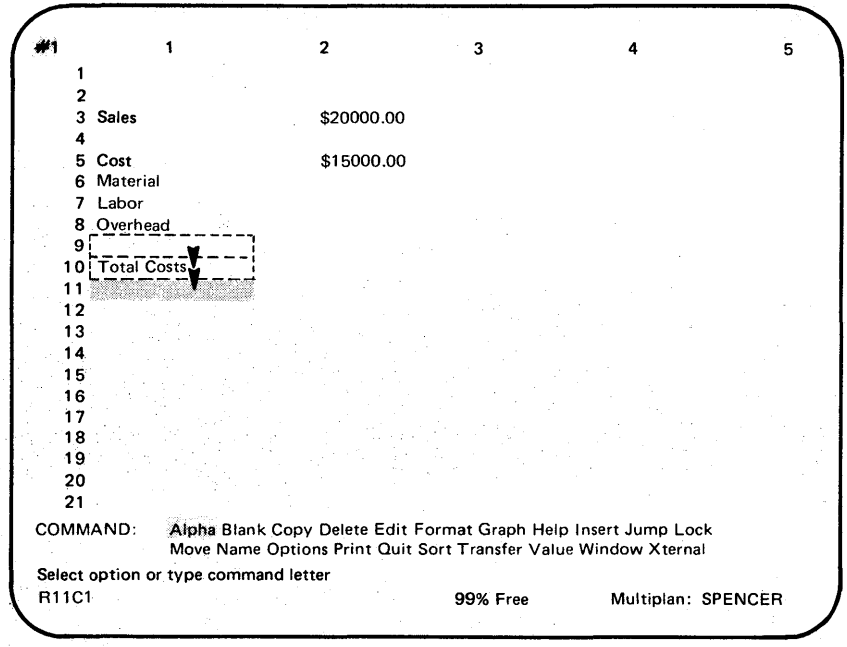


Leave row 9 empty for now, and move the pointer to row 10. Enter *Total Costs* like this:

Press *A*.

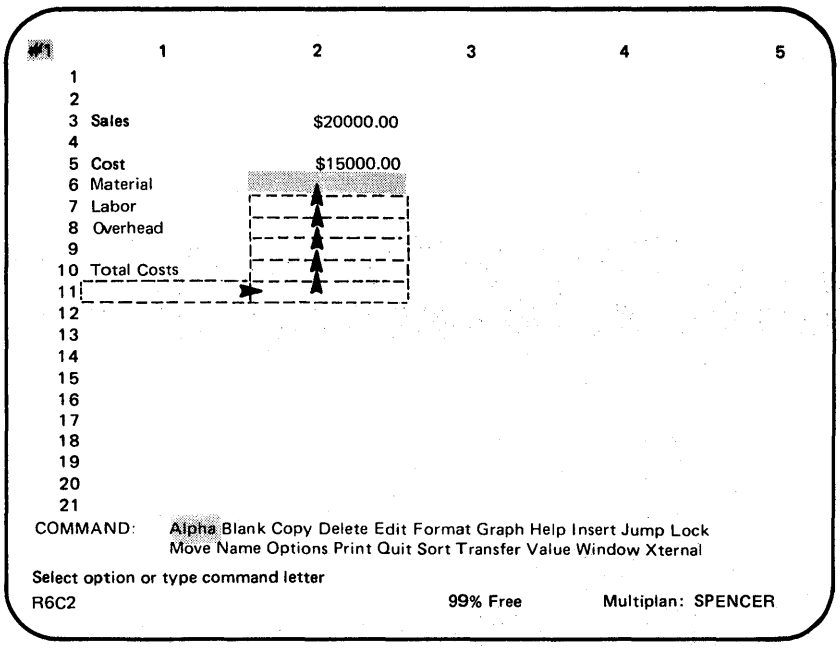
Type *Total Costs*.

Press the down arrow.



Entering Additional Numbers

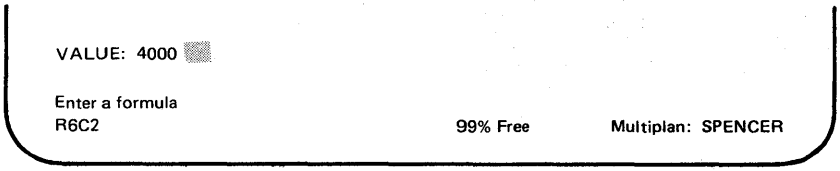
Now you are ready to enter the numbers. Move the cell pointer right once to column 2, and up five times to row 6 (or use the Jump command).



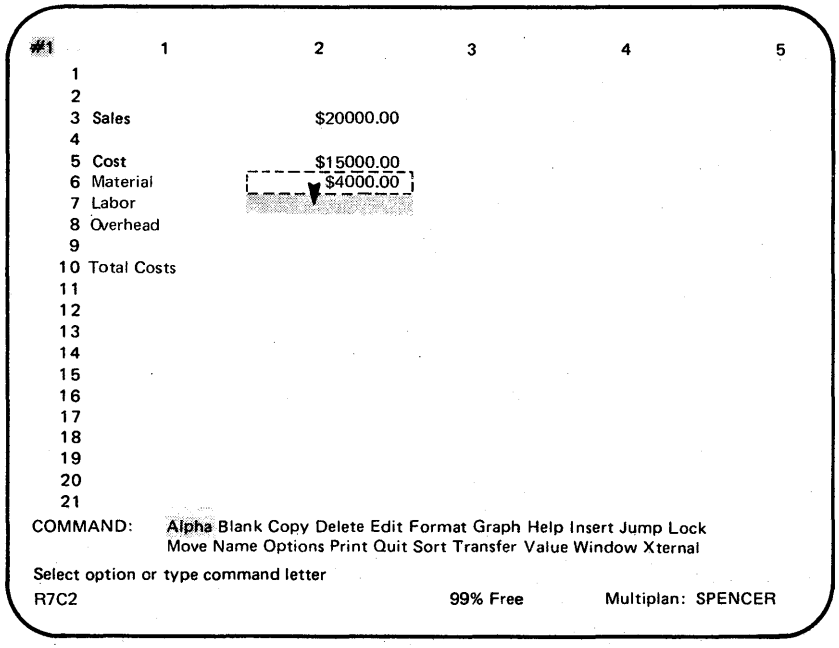
Type *4000.*

Note Remember, you don't have to tell Multiplan that you want to enter a number by any special command. When you type the first digit, the command line will automatically show:

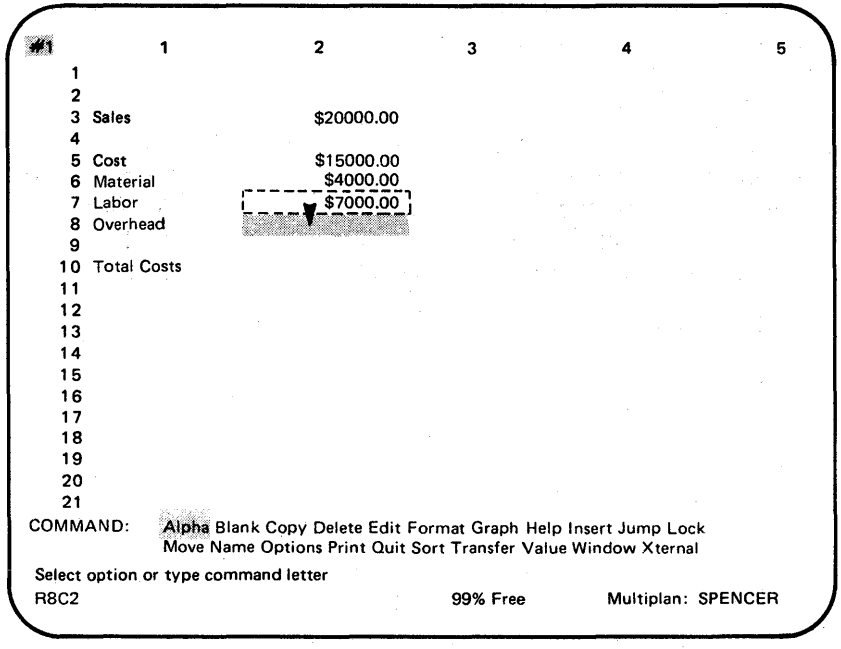
VALUE: <first digit>



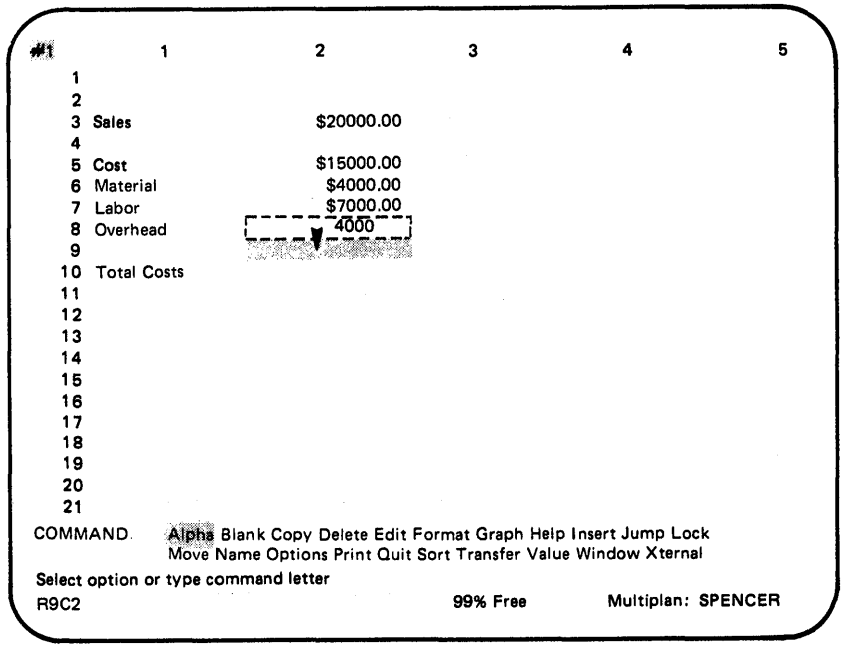
Press the down arrow. Now you have:



Type *7000* and press the down arrow.

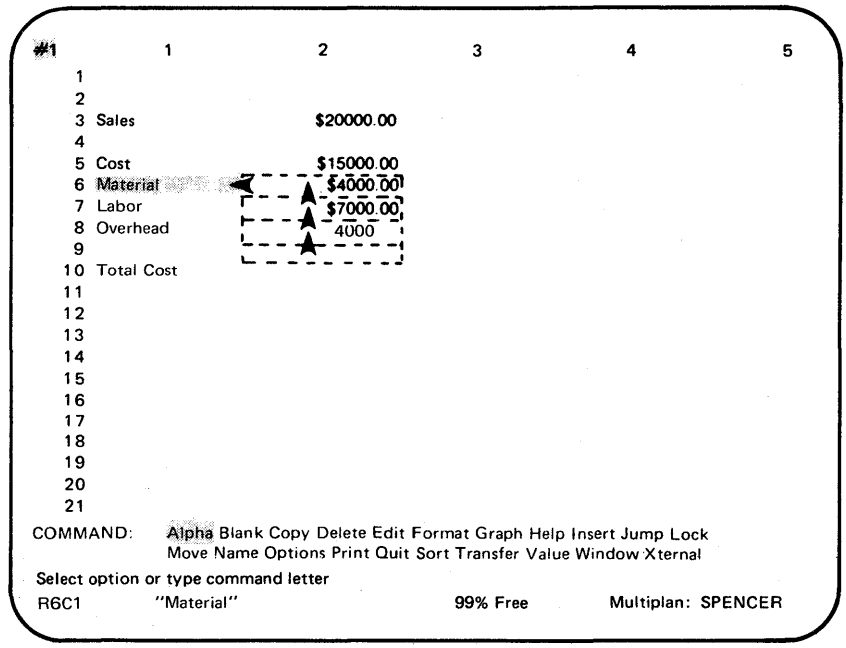


For the last number (by *Overhead),* type *4000* and press the down arrow. You will see:

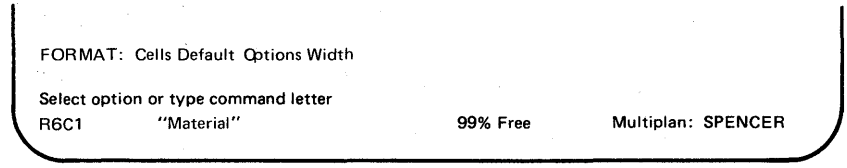


Aligning Cell Contents

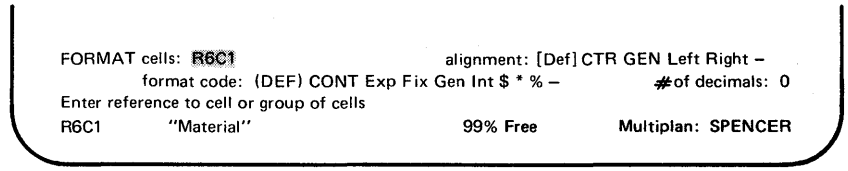
To make it clear that the four entries under *Cost (Material, Labor, Overhead,* and *Total Costs),* are subcategories, you will want to align them to the right side of column 1. First, position the pointer on the first cell to be aligned. (Move it up 3 rows to row 6, column 2, and left one cell to row 6, column 1.)



To align cells, use the Format command. Type *F*. From the command line choices:



choose *C*, the proposed response, by pressing RETURN. The command line now reads:

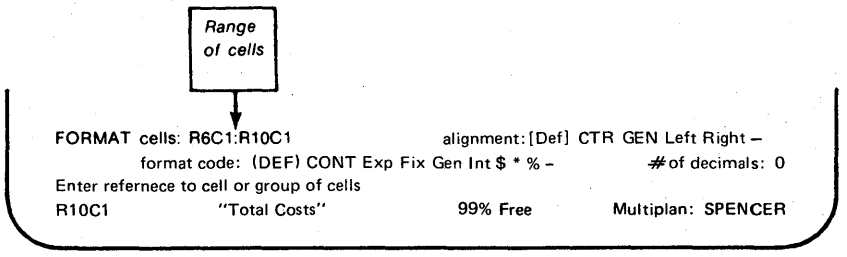


In the first field (where the edit cursor is located), enter the range of cells you want to format. You want to align rows 6 through 10 in column 1 to the right. Do this by using the symbol for range just as you did in the last session:

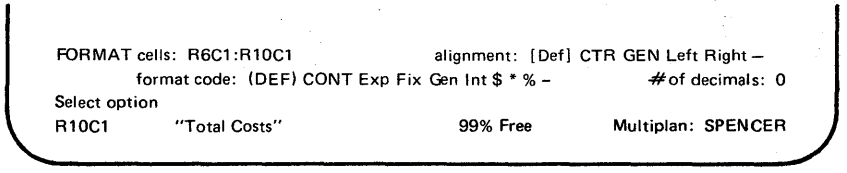
1. Press the FORWARD character key (f10) to move the cursor to the end of R6C1.

2. Type a colon (:).

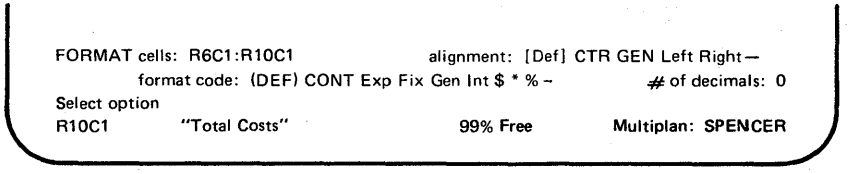
3. Move the pointer down to row 10. The first field now shows the range of cells you want.



TAB to the second field.

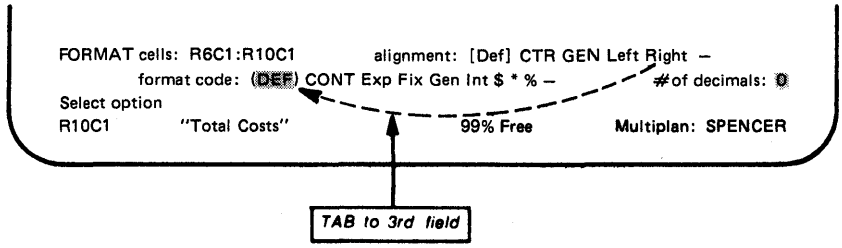


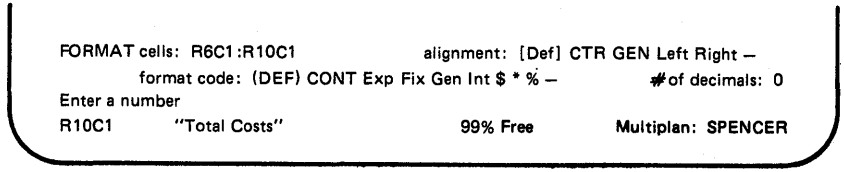
In the second field, you want to change the proposed response from Default (Def), (which currently aligns words to the left) to Right. Type *R*.



Now TAB to the third field.

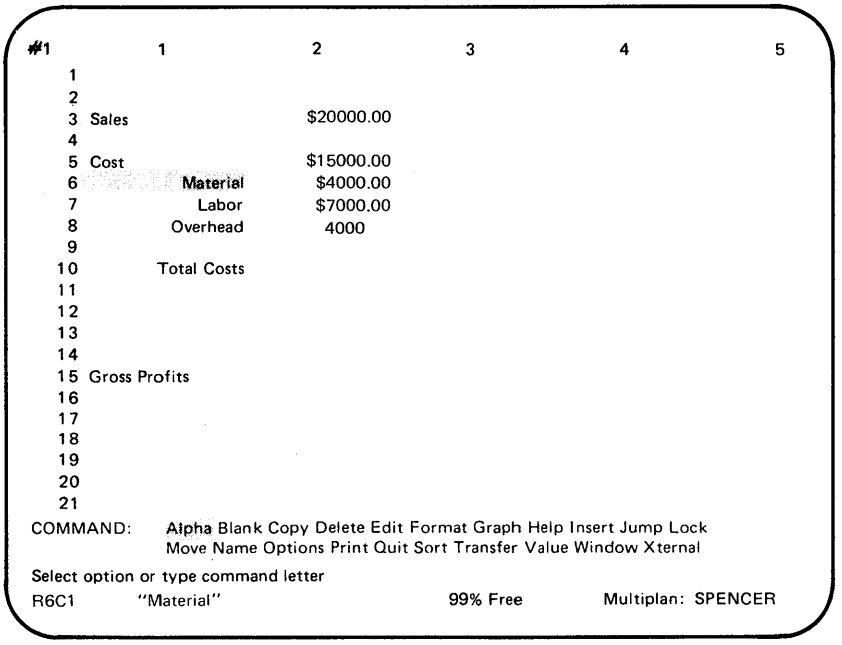
Either the prepared response, Default, or the General format would work because the cells to be formatted are words, not numbers.





There is no need to select a decimal number for words, so press RETURN.

Your screen should now show you the new alignment for rows 6 through 10 in column 1:

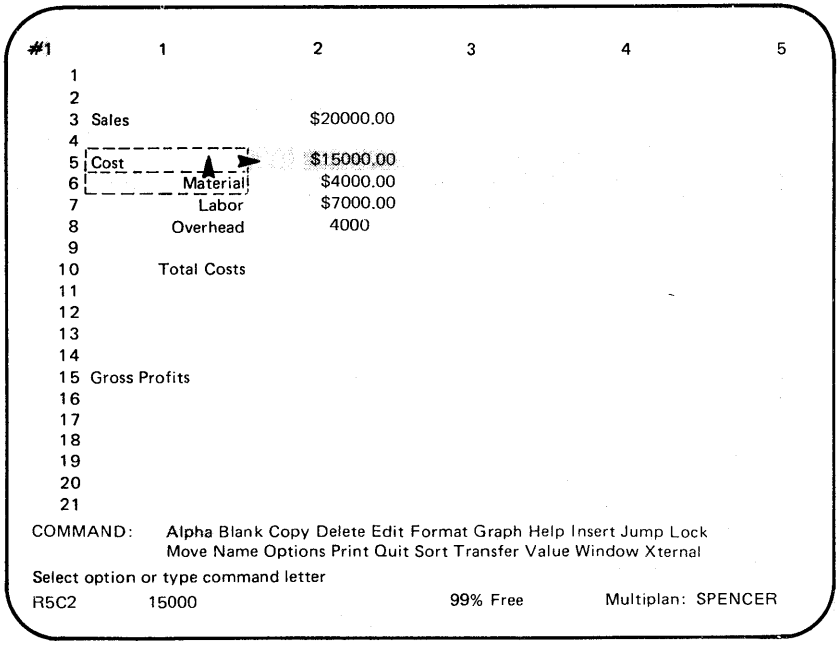


The Blank Command

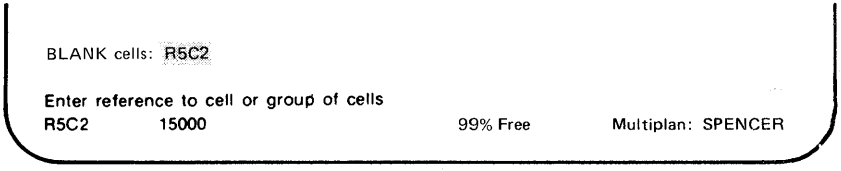
Now you are ready to enter *Total Costs* in row 10.

When you do so, you will have two rows showing total costs. You started with *Costs* in row 5, and now you have another row for *Total Costs.* You will want to blank out the number *$15000.00* in row 5, column 2. The table will be clearer if *Cost* is left in as a major category heading in column 1, but you don't want the number to appear there.

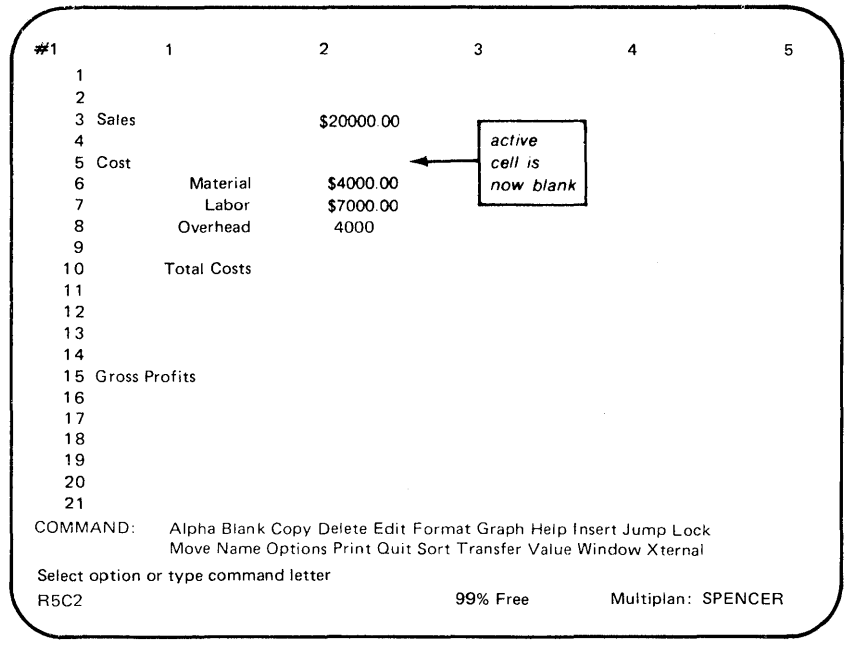
Use the Blank command to blank out the *$15000.00*. First move the pointer to row 5, column 2.



Type *B*. The command line reads:



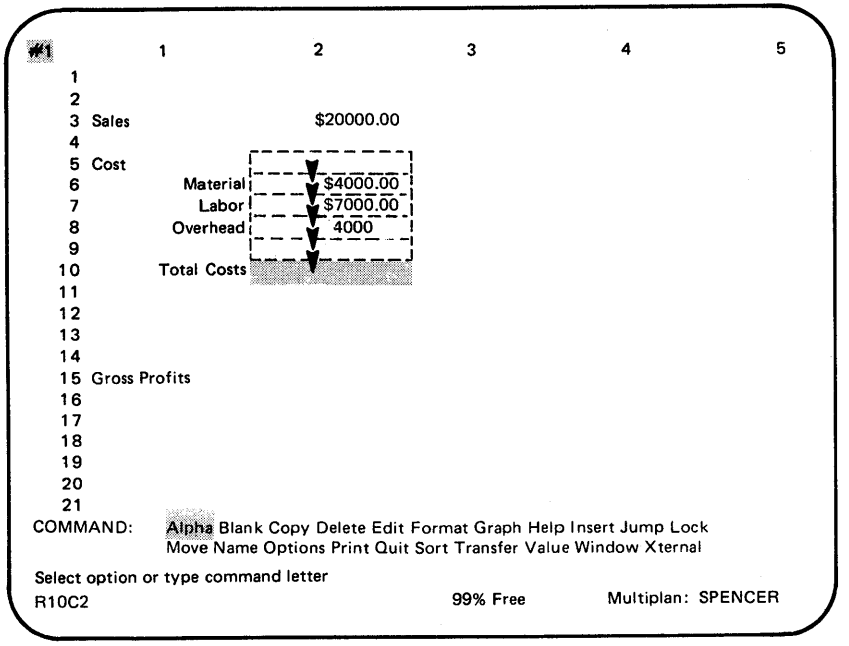
Look at the cell number shown by the edit cursor. It shows you that the cell pointer is in row 5, column 2. All you have to do is press RETURN, and the number in the cell will be removed. Watch R5C2 and press RETURN.



You may also use the command to blank out a group of cells. You can first press *B* for Blank, and then specify a cell or several cells. Follow by pressing RETURN, and all the specified cells will be blanked out.

Formulas

Now you are ready to enter a **formula** for *Total Costs.* The total costs in row 10 will be figured by adding the three items above it. Move the pointer down to *Total Costs,* row 10, column 2.

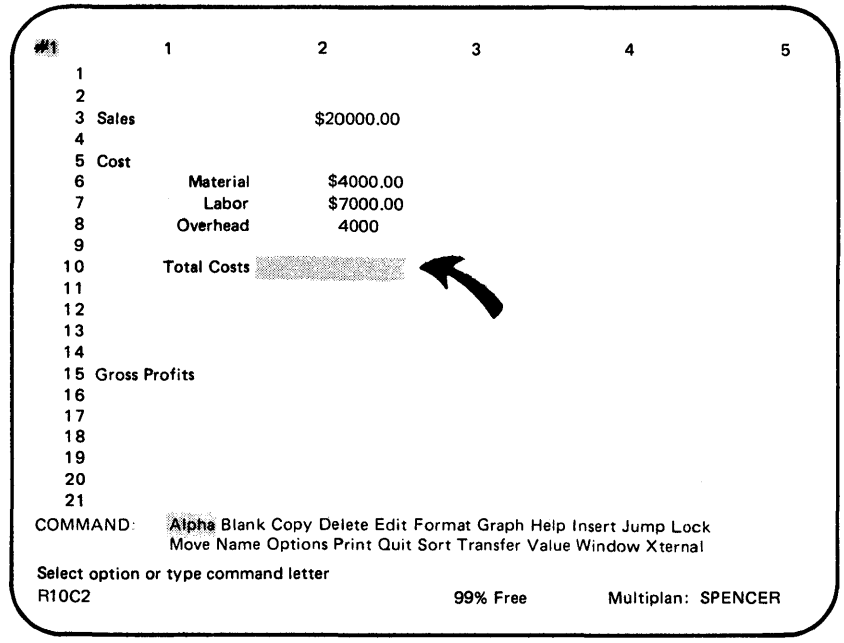


The Sum Function

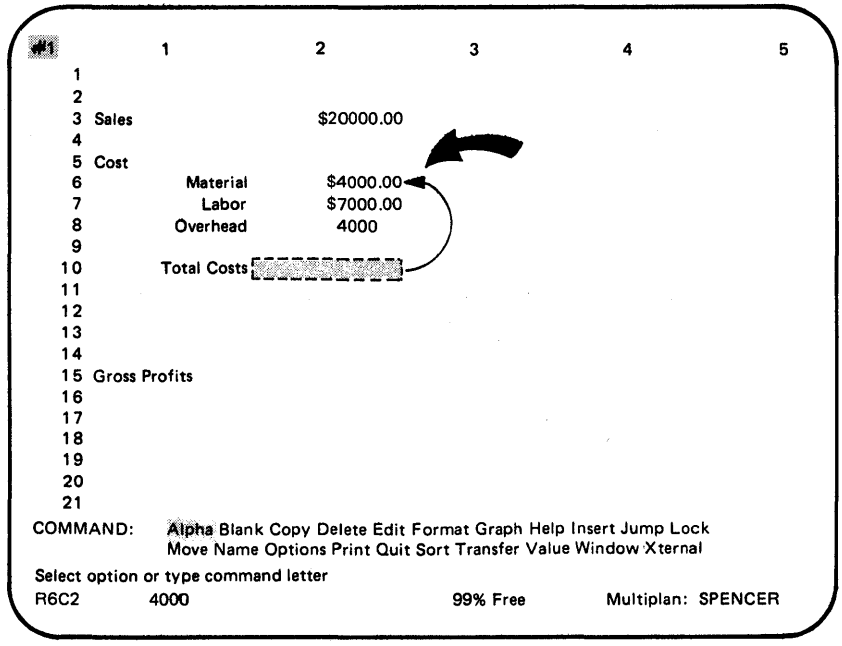
You might be tempted not to bother with a formula. You could just enter $15000.00, since you already know that that is the number that belongs there. You need a formula, however, because costs may change; you need something that will work for other months, too.

Without touching any keys for a moment, think about what you will be doing. Point with your fingers to row 10, column 2 *(Total Costs)* on your display screen.

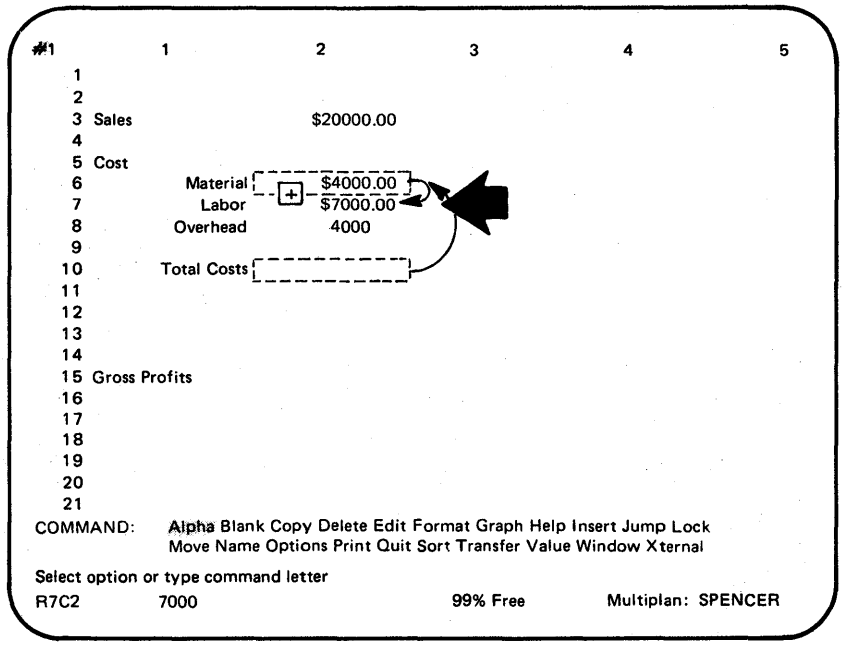
Think: "Total Costs (row 10,column 2). . .



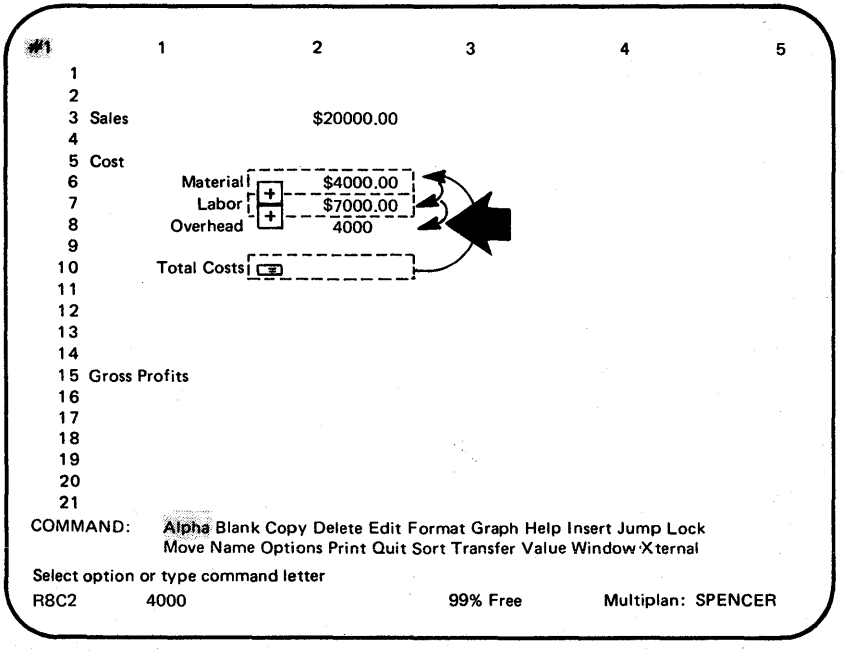
"will be the sum of (now point to row 6, column 2) *Material*. . .



"plus (now point to row 7, column 2) *Labor* . . .

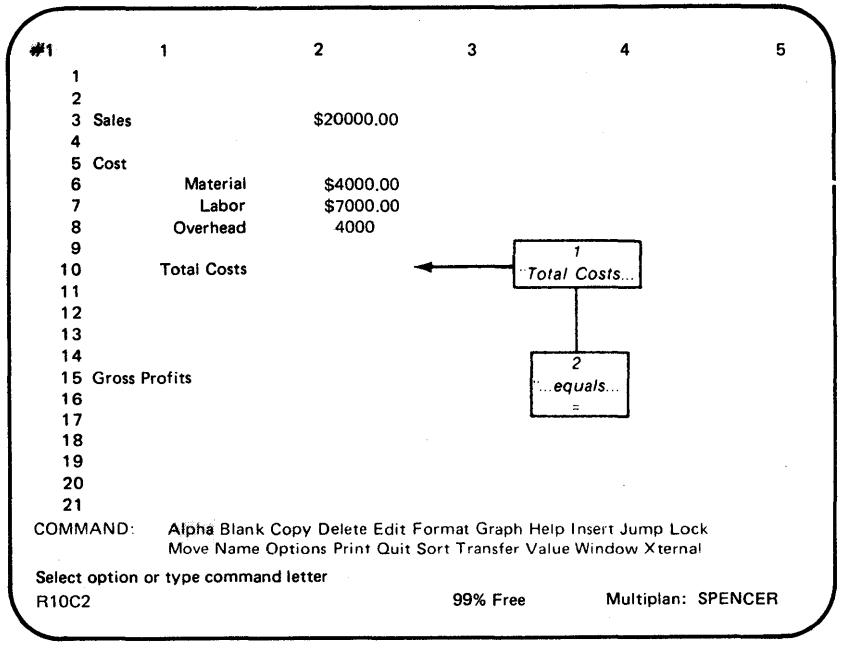


"plus (now point to row 8, column 2) *Overhead.*"

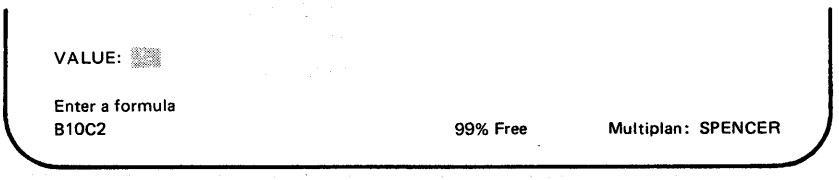


You will follow the same procedure using your cell pointer. Multiplan can express the formula faster than you can summarize it, though: "Total Costs equals the sum of rows 6 through 8 in column 2." Multiplan can also do the work of figuring out the formula faster than you can—so let it! All you need to do is follow this procedure:

Say to yourself:	**Do this:**
"Total Costs . . .	1. Place the cell pointer on the cell where the sum of *Total Costs* will be located (row 10, column 2).



"equals . . .	2. Press =. (To begin a formula in Multiplan, use either = or +). Look at the command line.

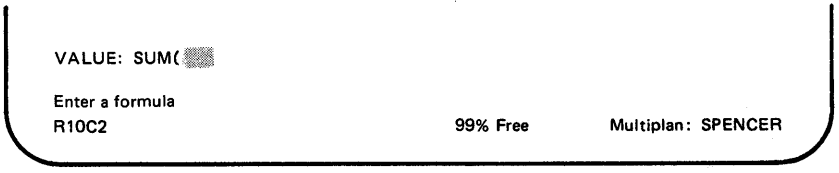


"the SUM of . . .

3. Type SUM(. Look at the command line.

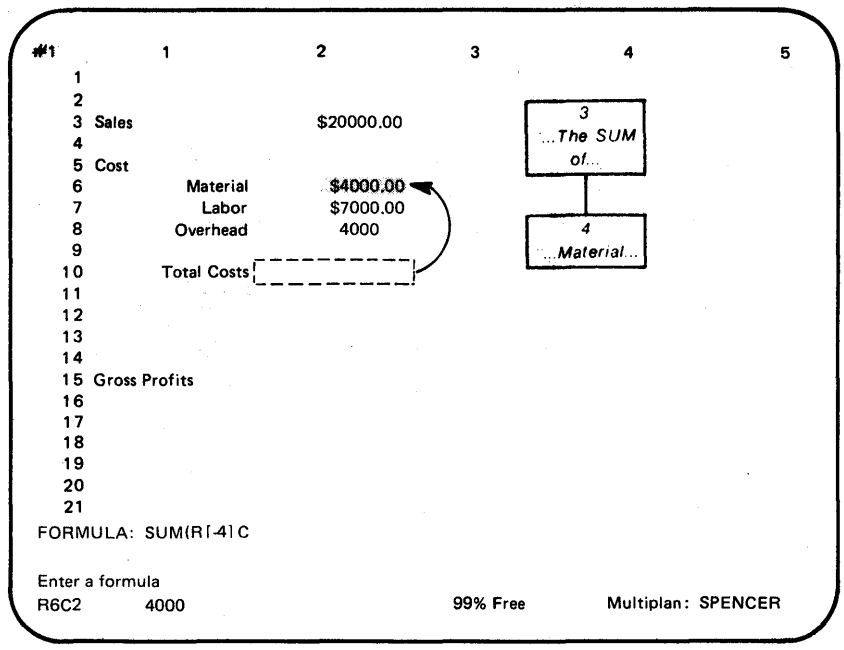
Note Type SUM and do not put a space between SUM and the left parenthesis (the opening parenthesis of your formula). If you do, your answer will show #NAME?.

There are many other **functions** available in Multiplan. They include: AVERAGE, MAX (maximum), MIN (minimum), etc. See Part 3, The "Reference to Multiplan" for a detailed discussion of these functions.



"row 6 (*Material*) . . .

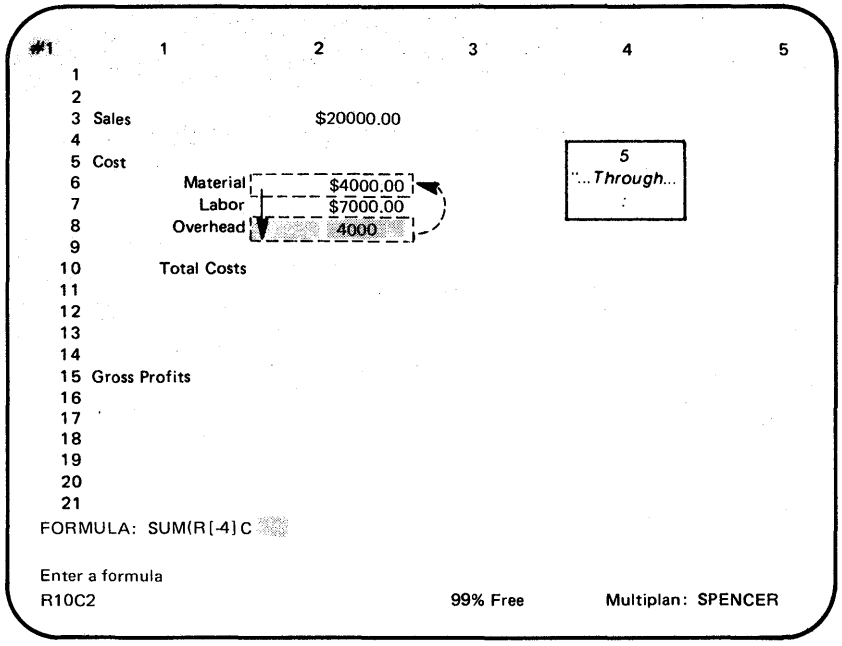
4. Move the cell pointer up 4 rows to row 6. (Watch the formula being built on the command line).



"through . . .

5. Type : to get the range. Look at the command line. You can see the first part of your formula.

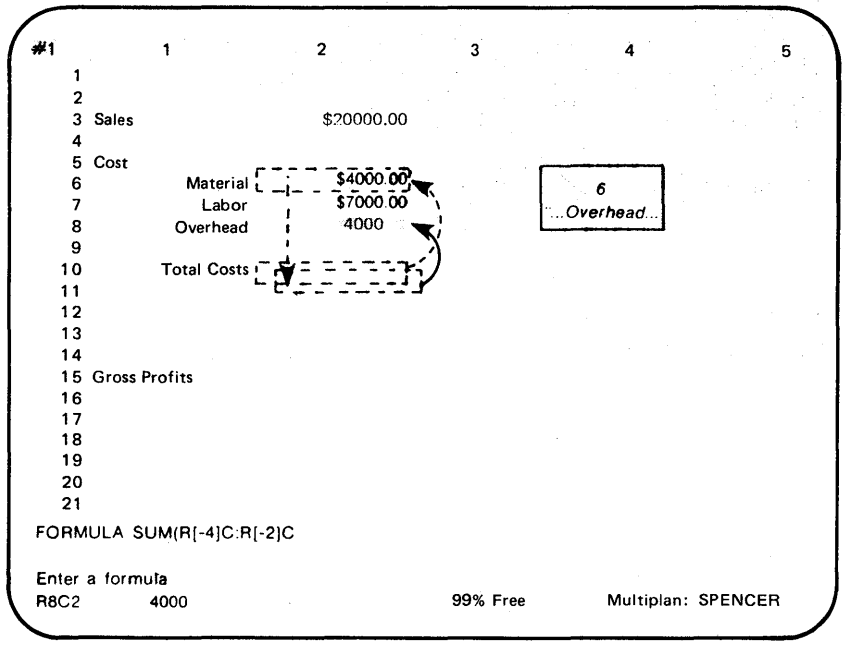
Note The cell pointer automatically moves back to its "home" position as soon as you type a symbol like :, +, or -.



"row 8 (*Overhead*)."

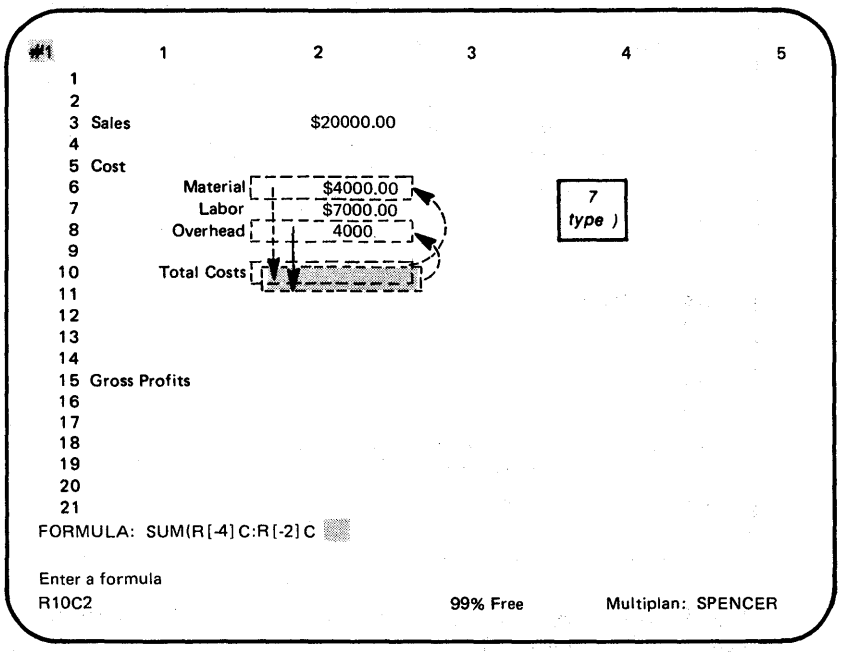
6. Move the cell pointer up 2 places to *Overhead.*

Note Your pointer is already in column 2, so you do not need to specify the column.

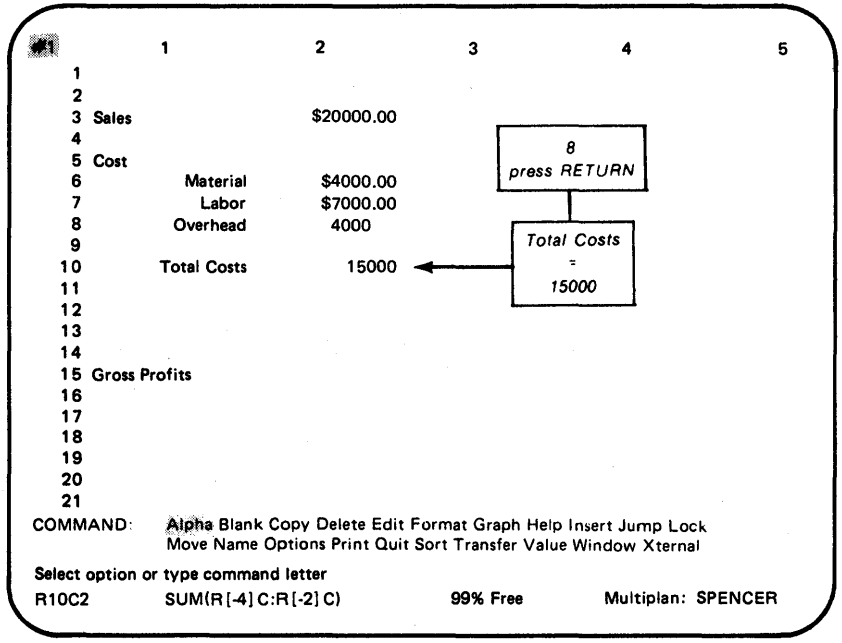


7. Type the closing parenthesis of your formula.

Note The pointer has moved back to the *Total Costs* cell again, and the status line shows the second part of your formula.



8. Press RETURN. You will see *Total Costs* now as *15000.* Look at the status line to see the formula from which it was derived.



The formula you see on the status line is Multiplan's way of saying exactly what you said as you built the formula. Multiplan says:

1	2	3	4	5	6	7
R10C2	*SUM*	*(R[-4]*	*C*	*:*	*R[-2]*	*C)*

1. "This cell is the active cell. It contains . . .
2. the sum of . . .
3. the row 4 rows up from here (or 'this row minus 4') . . .
4. in this column . . .
5. through (:) . . .
6. the row 2 rows up from here (or 'this row minus 2') . . .
7. in this column."

Note When a formula in Multiplan does not give a row or column number, it is saying "this" row or "this" column. It does not give the number because the cell pointer is on the cell to which it is referring. For example, RC would mean the cell in this row, in this column, and would mean the cell illuminated by the pointer.

Reviewing and/or Changing a Formula

If at some later time you forget exactly how you arrived at the figure in a particular cell, you can see its contents by moving the cell pointer to it and looking at the status line.

If you wish to CHANGE the formula, place the cell pointer on that cell and use the Edit command (type *E*) to bring the formula onto the command line. Then use the FORWARD (f10) or BACKWARD (f9) character keys with the DELETE or BACKSPACE keys to make the changes you want.

The Format Default Command

Notice that *15000* is not formatted to show dollars. When you used the Format Cells command earlier, you changed the format for only a few cells to dollars, Multiplan offers you a way to format the entire worksheet at one time using the Format Default command. Since all the entries in this worksheet will most likely be dollar amounts, use the Format Default command now. Press F.

```
FORMAT: Cells Default Options Width

Select command option or type command letter
R10C2        SUM(R[-4]C:R[-2]C)          98% Free        Multiplan: SPENCER
```

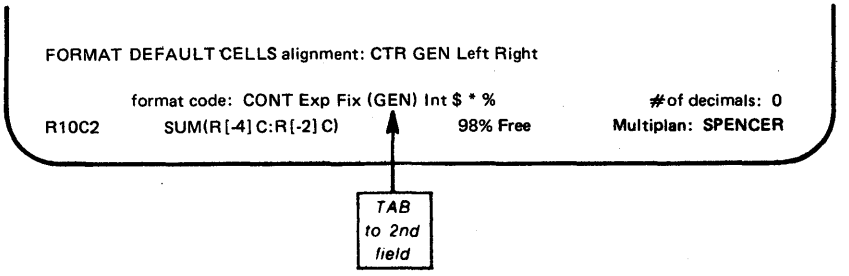
Choose Default by pressing *D*. You will see:

```
FORMAT DEFAULT: Cells Width

Select command option or type command letter
R10C2        SUM(R[-4]C:R[-2]C)          98% Free        Multiplan: SPENCER
```

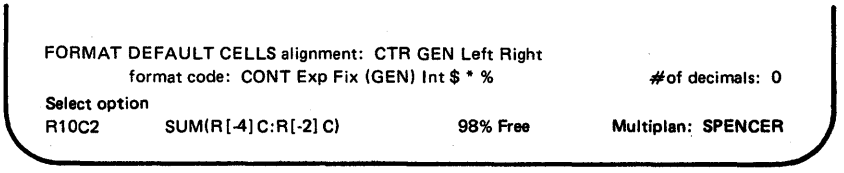
You would like to format all the cells on the entire worksheet, so choose the proposed subcommand Cells by pressing RETURN. Now you will see:

```
FORMAT DEFAULT CELLS alignment: CTR GEN Left Right
        format code: CONT Exp Fix (GEN) Int $ * %          # of decimals: 0
Select option
R10C2        SUM(R[-4]C:R[-2]C)          98% Free        Multiplan: SPENCER
```

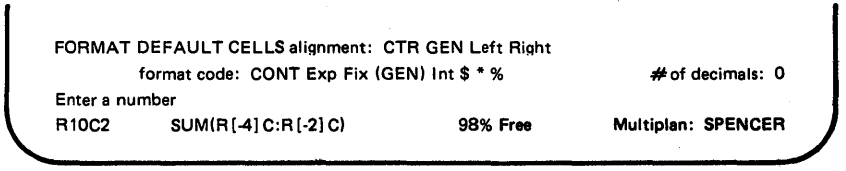
In the first field, Multiplan proposes general alignment. The alignment lines up words (text) to left and numbers to the right. Since that is what you want, TAB to the second field.



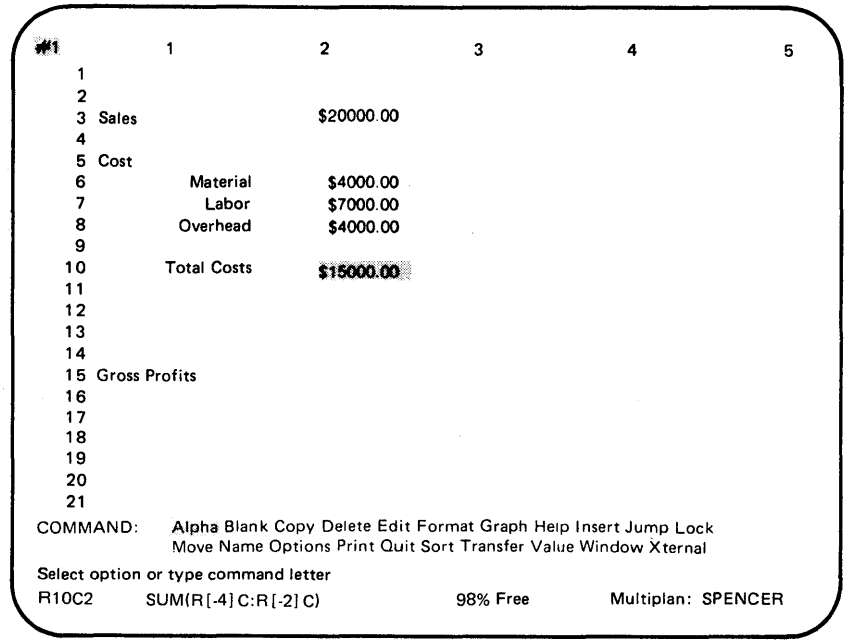
In the second field, Multiplan proposes a general format. Since you want dollars, press the dollar sign ($).



Now TAB to the last field, number of decimals.



The format automatically gives you no decimal places, so press 2, then RETURN to carry out your command.



The *4000* in row 8, column 2 and the *15000* in row 10, column 2 have been changed to dollar format ($4000.00; $15000.00). Any numbers you enter from now on will appear in dollars unless you specifically change them with another Format command.

Drawing Lines

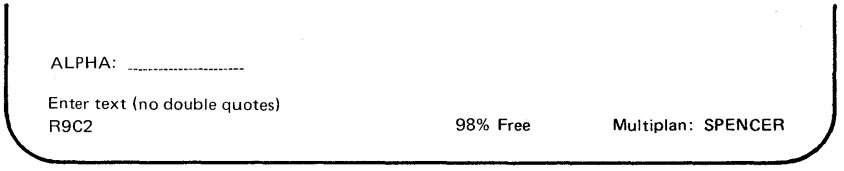
In order to make the table easier to read, draw a line using dashes in row 9, column 2 to separate the subcategories from *Total Costs.* Follow this procedure:

1. Move the pointer up one row to row 9.

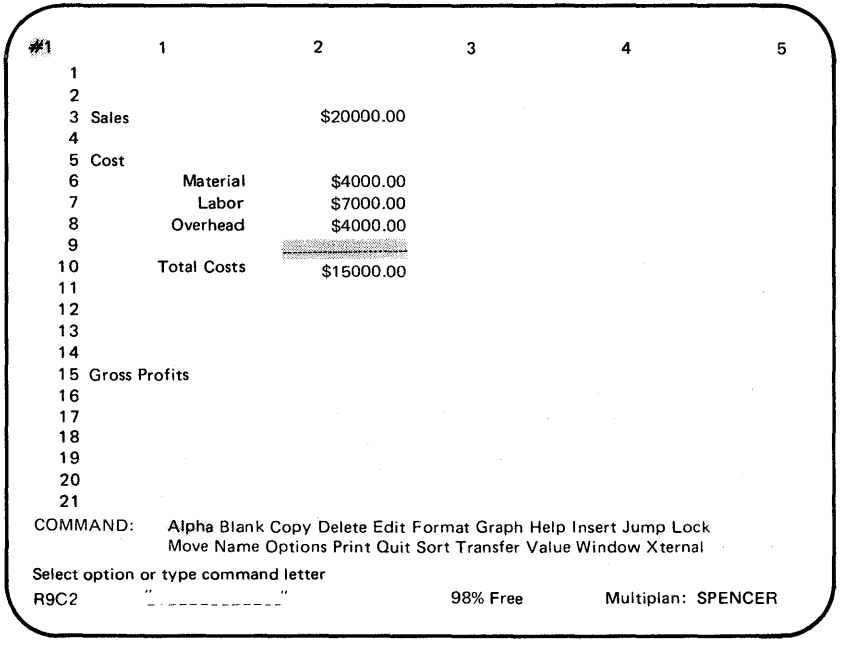
2. Press *A* for Alpha.

Note If you use the dash or hyphen without the Alpha command, the command line will show VALUE. Then when you try to enter the line in the cell, you will get only a beep and a message saying "Error in formula."

3. Type the dash 15 times to fill the character spaces in the cell:



4. Press RETURN. You now see:

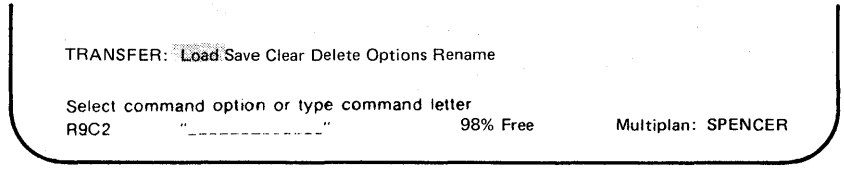


You will learn later how to extend this line across the entire worksheet, or across as many columns as you wish. You will also get more practice in entering formulas using the cell pointer at a later time. With practice, it will become easier and more natural to use Multiplan.

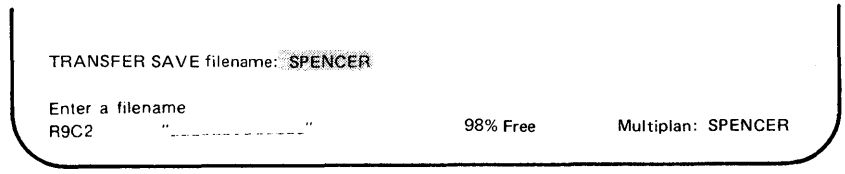
The Transfer Save Command (Review)

Save your work by using the Transfer Save command like this:

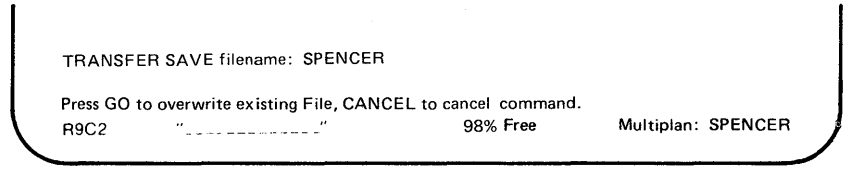
Type *T*. The command line shows:



Choose Save by pressing *S*. Now the command line reads:

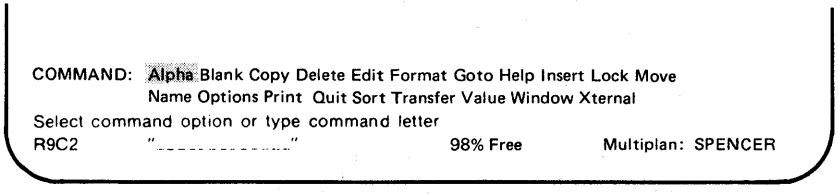


Multiplan's prepared response is the last filename used. Since that is what you want, press RETURN.



Any time you save a file under a filename previously listed, the new file will take the place of the old file. Any information in the old file that has been changed on your new worksheet will be automatically erased.

Multiplan is asking you now if you want to do that. Since you do want your new work saved, press GO. The command line will now return to:



Your worksheet has been saved. Leave Multiplan for this session by typing *Q* (Quit) and GO to confirm.

Summary

In this session you learned:

How to load your file.

How to find out what files have been saved.

How to create more space by inserting empty rows or columns using the Insert (I) command.

How to enter additional words using the Alpha command with the direction keys.

How to enter additional numbers.

How to align the contents of specific cells.

How to remove the contents of specific cells using the Blank (B) command.

How to build formulas using the cell pointer and one of Multiplan's functions (SUM), and how to read (or decipher) what the formula on the status line says.

How to use the cell pointer and the status line to review a formula, and how to use the pointer and the Edit command (E) to change a formula.

How to use the Format Default command to set the format of the entire worksheet.

How to draw a line using the dash (-).

How to save your new work with the Transfer Save command (writing over an old file).

Chapter 4

Formulas, Copying Cells, Naming Cells

In the last session, you entered cost figures into the worksheet. You then built a formula for *Total Costs* using the function called SUM.

In this session you will get more practice in building formulas. You will also learn how to copy cells and how to name them.

The Transfer Load Command (Review)

Load Multiplan and load your file. To review:

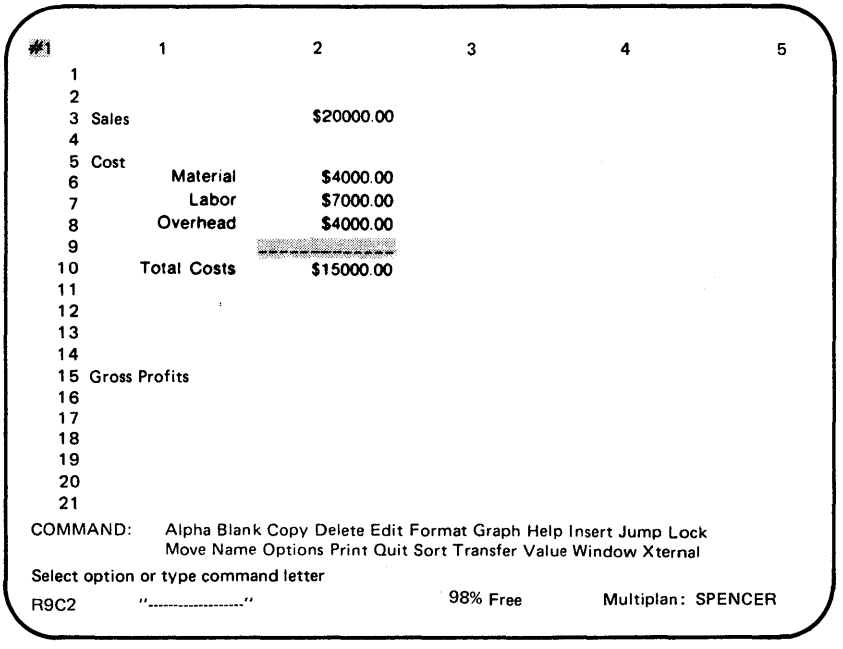
Press *T* (Transfer).

Press *L* (to select Load).

Type SPENCER.

Press RETURN.

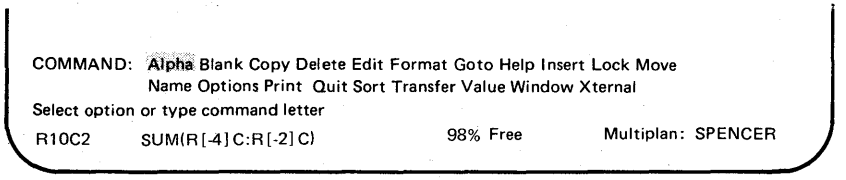
Your screen should show:



The Status Line: Cell Contents

Do not be confused by the numbers and letters displayed on the status line. With practice, you will find it easy to understand the formulas and other information.

Move the pointer down to row 10, column 2. The status line should show:



The status line shows what is actually contained in the active cell. While the active cell displays the number $15000.00, the status line tells us what formula governs that cell. The various cost figures displayed in the cell may change, but the formula will remain constant. If, for example, the cost of materials were $5000 instead of $4000, the figure displayed in the *Total Cost* cell would change to $16000.00. The status line would still show the same formula.

Formulas (Review)

The formula on the status line can be read in the same manner in which it would be said aloud. The only difference is this: Multiplan does not show a number for the active row and column.

The pointer is now on the cell for *Total Costs* in row 10, column 2. In the status line, Multiplan is saying that

1. the active cell (R10C2)

2. is the sum (SUM in capital letters, followed by parentheses enclosing the references of the cells to be summed)

3. of the row 4 places *above* "this" row (i.e., the active row minus 4 rows, or R[-4])

4. in "this" column (i.e., the active column, or C)

5. through (colon, meaning a range)

6. the row 2 rows *above* "this" row (i.e., the active row minus 2 rows, or R[-2]).

7. in "this column (i.e., the active column, or C).

Most of the work of formula building was done by Multiplan. The steps you followed were:

1. You positioned your cell pointer on the cell for *Total Costs* and pressed = to start the formula process.

2. You typed SUM and an opening parenthesis.

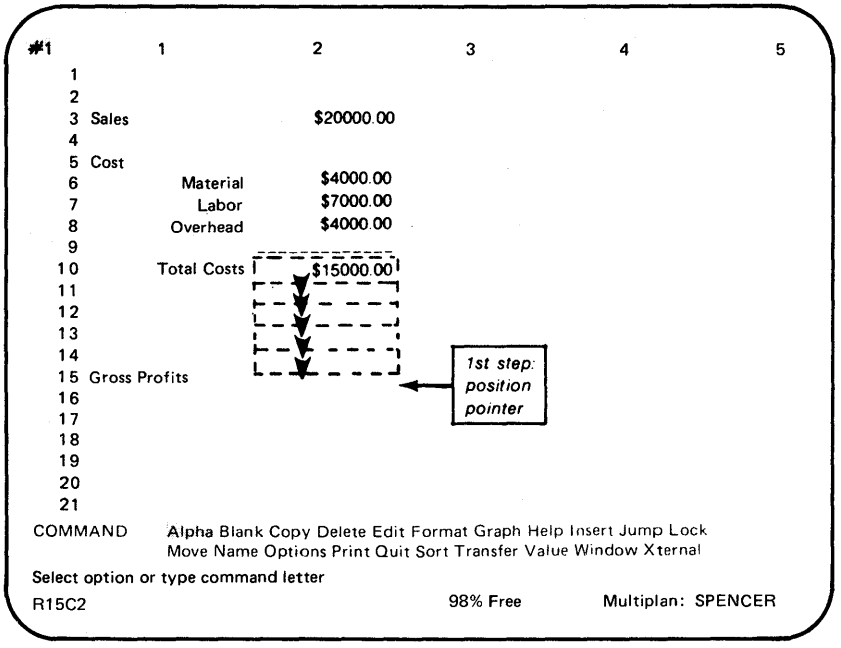
3. You pointed to the cells that made up the range you wanted (using the colon to indicate range).

4. You typed the closing parenthesis.

5. You pressed RETURN.

Multiplan's references will become easier to use as you get more practice in formula building, so move the cell pointer down to row 15, *Gross Profits.*

Note The "home" cell for the duration of this command will be the cell that is illuminated by the pointer at the time you press = for "formula." Be sure to place your pointer *before* beginning to build your formula.

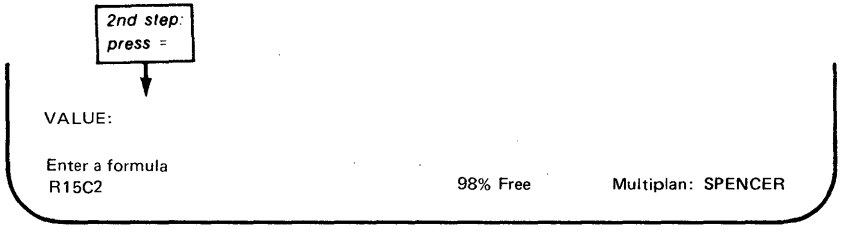


Gross Profits will be *Sales* minus *Total Cost.*

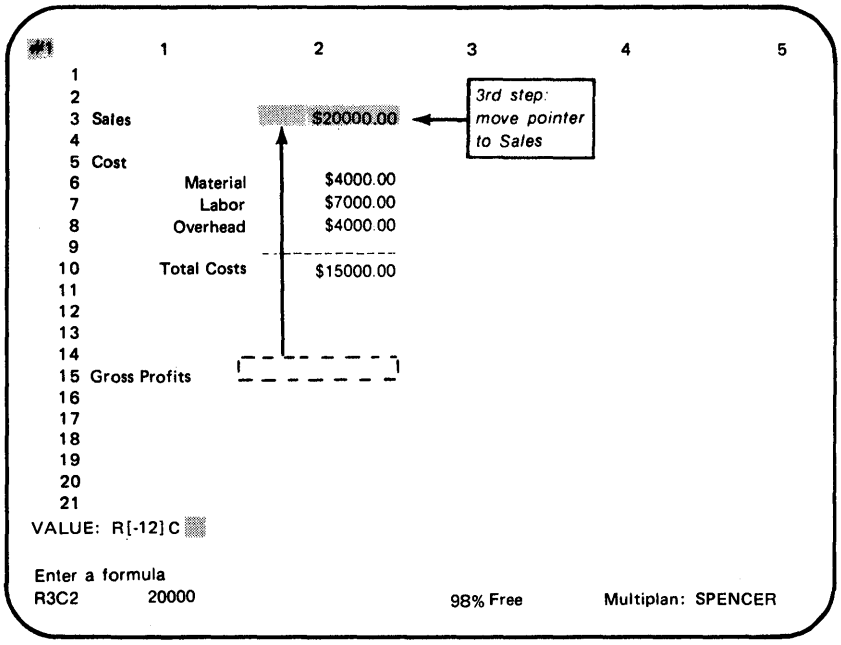
Gross profits = Sales - Cost

R15C2 = R3C2 - R10C2

Press =.

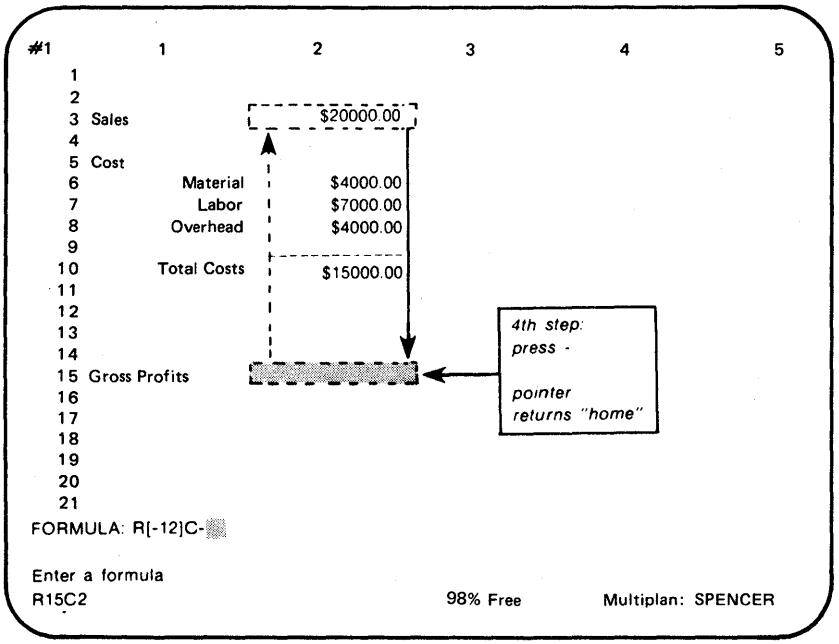


Move the pointer up to row 3, column 2, next to *Sales*.

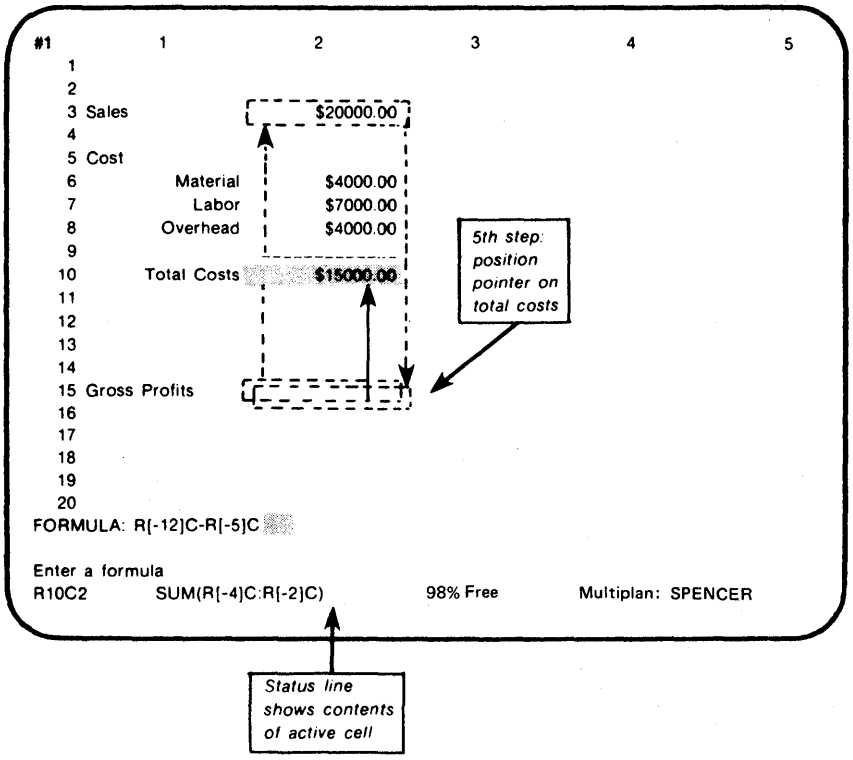


Press the minus sign (-).

Note It is not always necessary to use one of Multiplan's functions (such as SUM) to build a formula. This formula, for instance, uses only a minus sign.

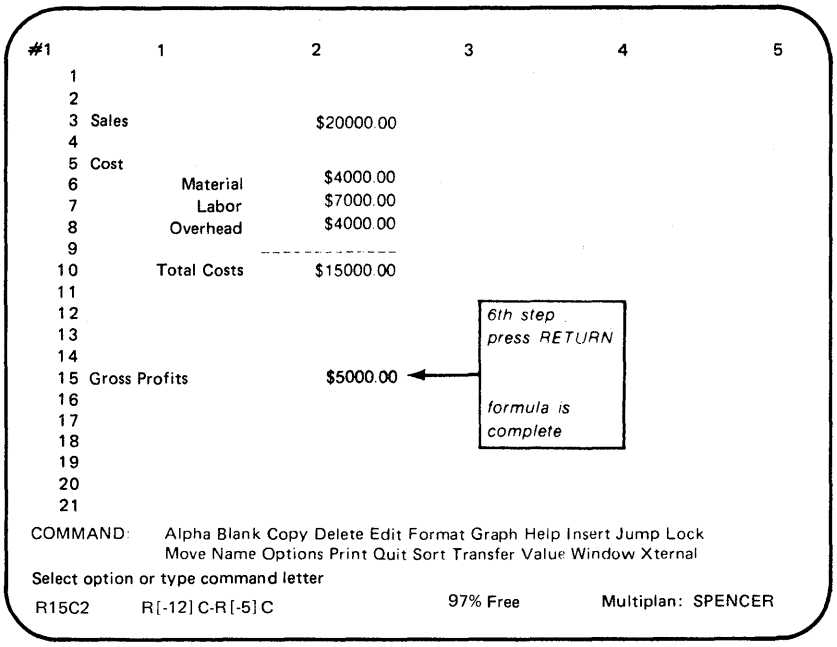


Now move the pointer up to row 10, column 2, for the *Total Costs* figure.



Note The status line now shows the formula in row 10, column 2.

Press RETURN.

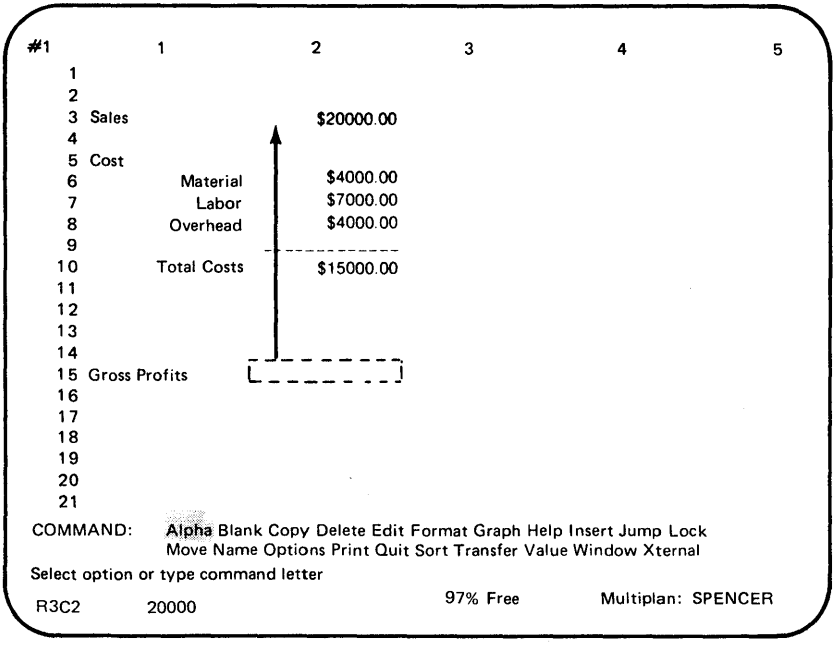


Look at the cell for *Gross Profits* (row 15, column 2). When you pressed RETURN, Multiplan calculated your formula and placed the results in the cell. *Gross Profits* now shows $5000.00, the command line has returned, and the status line displays the *Gross Profits* formula.

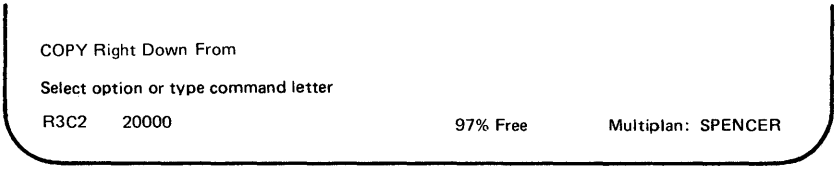
The Copy Right Command

The figures you entered for Spencer Ceramics were for only one month. You will also want to show the rest of the year. Start by copying the figures you have for this one month into the remaining months of the year (the next 11 columns). You can later change some figures for costs or sales to see the effects of the changes on Spencer Ceramics' profits.

Start by copying the number for *Sales* ($20000.00) into the next eleven cells. Move your cell pointer to the number you wish to copy (row 3, column 2).



Press *C* for the Copy command. Your command line reads:



Choose the Copy Right command to copy from one cell into the cells to its right: press *R*.

The command line reads:

```
COPY RIGHT number of cells:                starting at: R3C2

Enter a number
R3C2        20000                  97% Free        Multiplan: SPENCER
```

Where the edit cursor is located, type *11*, for the number of times you want the amount of $20000.00 copied.

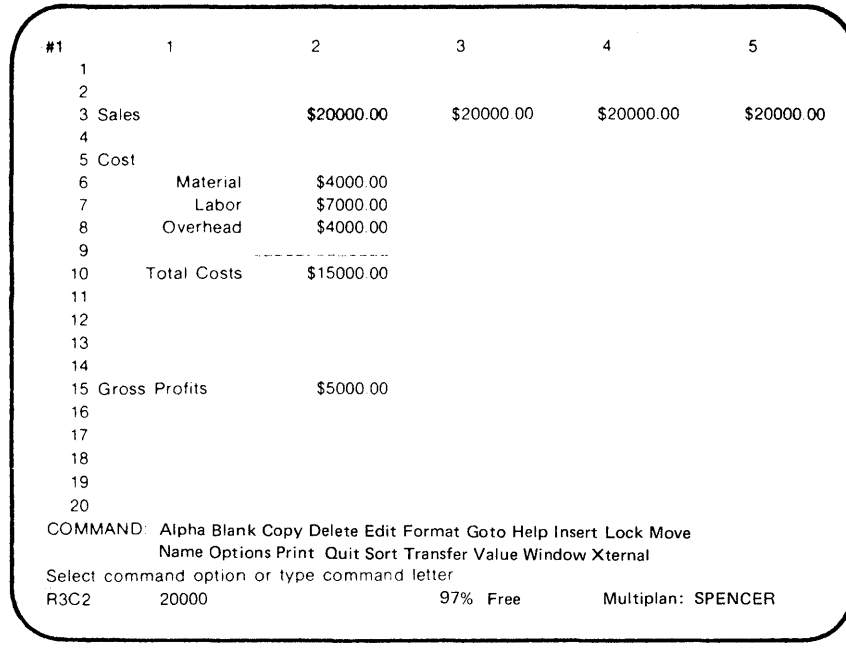
```
COPY RIGHT number of cells: 11             starting at: R3C2

Enter a number
R3C2        20000                  97% Free        Multiplan: SPENCER
```

TAB to the next field ("starting at").

```
COPY RIGHT number of cells: 11             starting at: R3C2

Enter reference to cell or group of cells
R3C2        20000                  97% Free        Multiplan: SPENCER
```

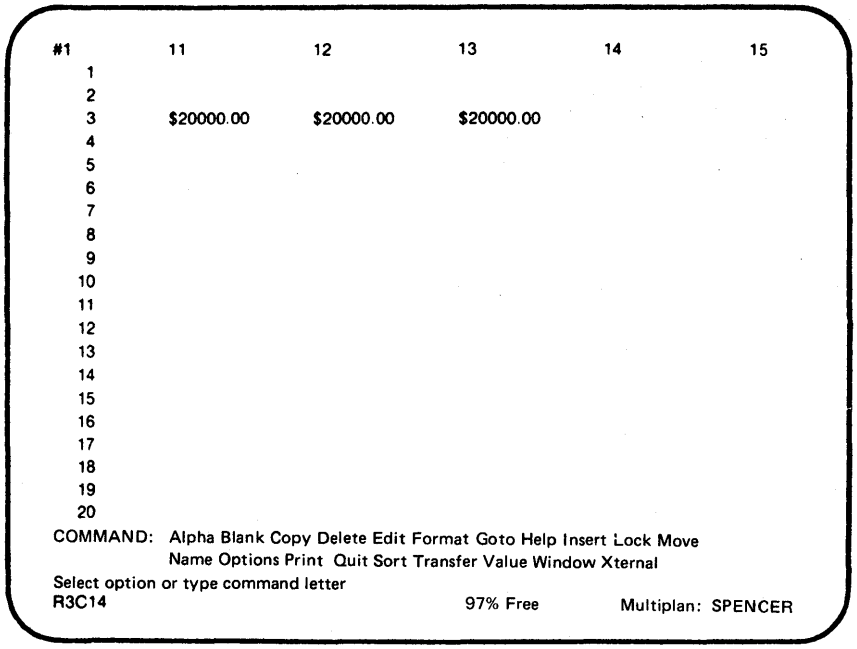
Multiplan has established the cell you want to copy as the starting point. You have already specified how many copies of that cell you want.

Press RETURN.



The screen is too small to display the whole year at one time, but you can see the rest of the year. Use the direction keys to scroll the sheet beneath the pointer. Scroll until both columns 13 and

14 are visible. The numbers stop at column 13 (the last of the twelve months of the year).



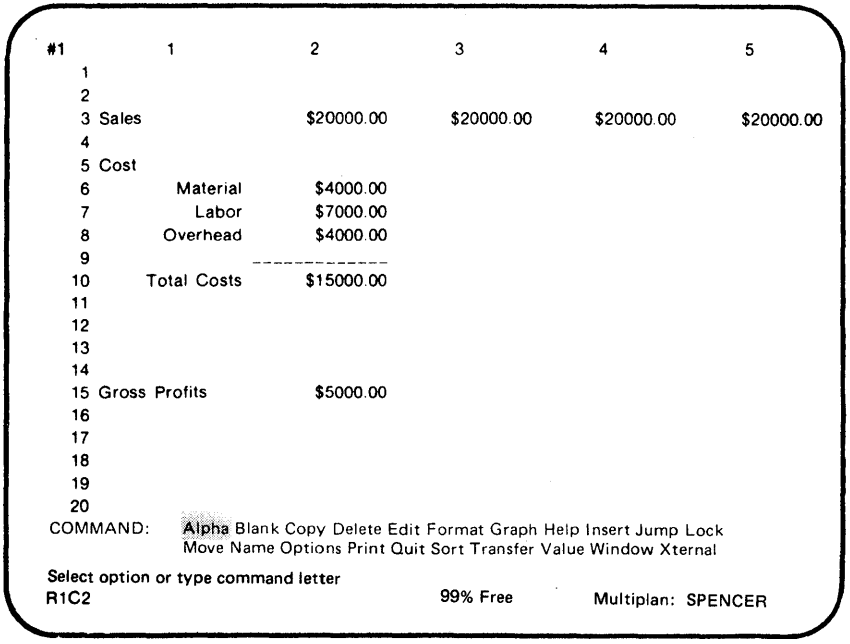
You need to be able to tell which month is which, so you will want to put the names of the months across the top of the worksheet. Use the Goto command to get back to the headings. Specify row 1, column 2. To review:

Press *G* (Goto command).

Press *R* (to select Row-column).

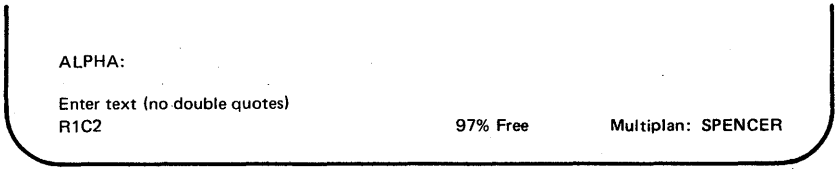
Type *1* (by Row) / TAB / Type *2* (by column).

Press RETURN.

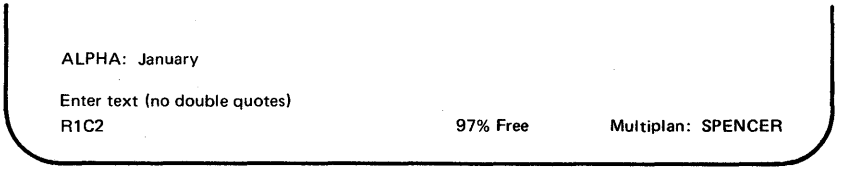


Titles

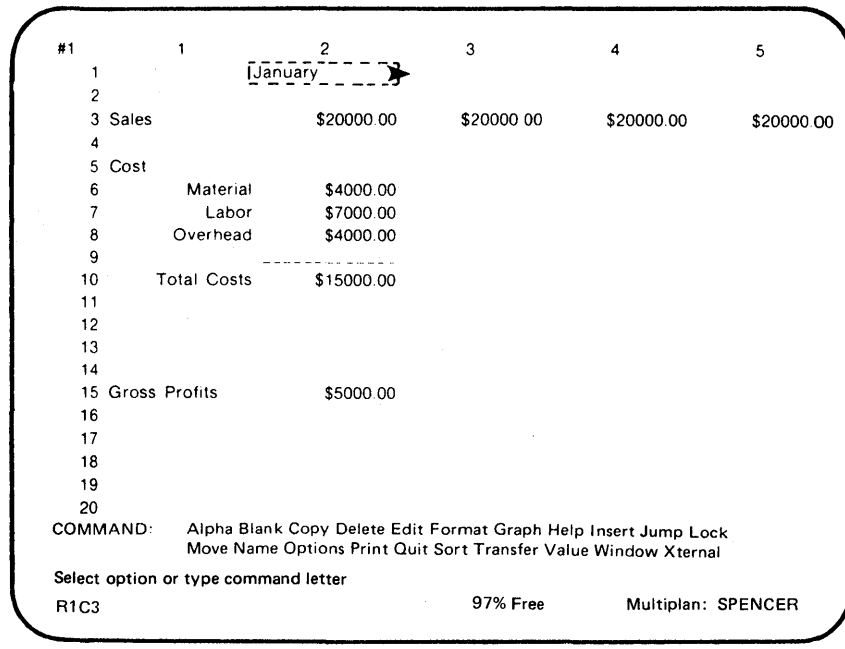
It is possible to keep the titles on the left while you scroll the sheet (by making a "window"); you will learn how to do that later. For now, enter the names of the months across the top of the table. You want to enter the months starting with January in row 1, column 2, so press *A* for the Alpha command:



Type *January*.



Move the cell pointer to the next cell, row 1, column 3. Remember that moving the cell pointer automatically enters the word; there is no need to press RETURN each time.



Follow the same procedure to enter each of the next eleven months. To review:

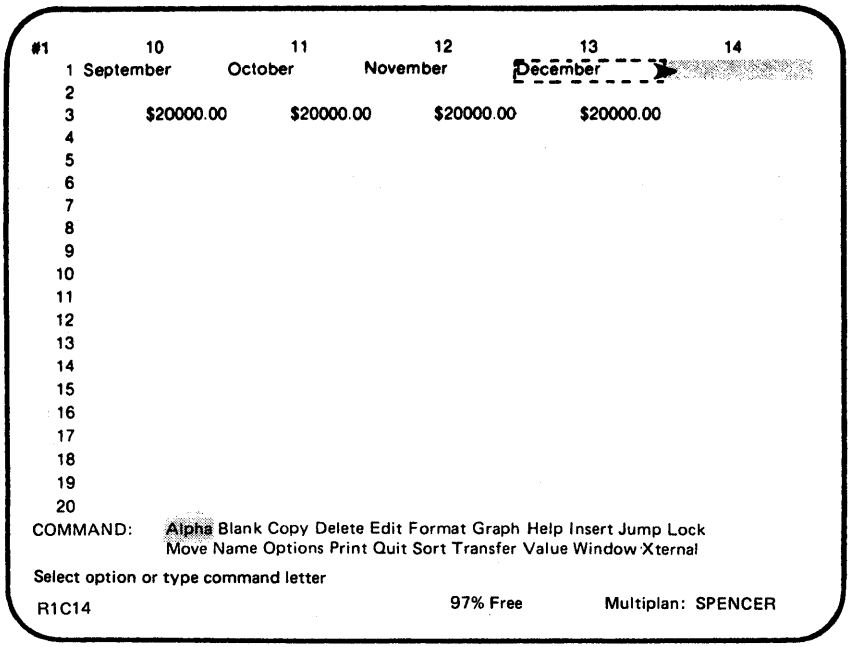
1. Move the cell pointer to the next column (same row), using the right arrow key.

2. Press *A* (Alpha command).

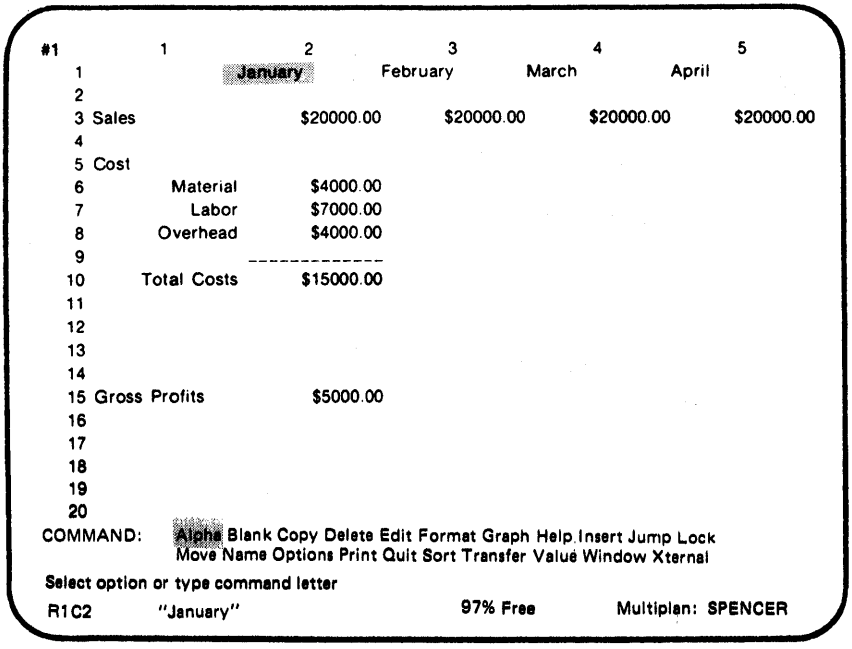
3. Type the name of the month.

4. Move the cell pointer (to start the cycle again), using the right arrow key.

Continue until you have listed all twelve months. You will automatically scroll the screen as you move the cell pointer.



Use the Jump command to move the pointer back to the beginning of the table. Jump to row 1, column 2.



Format: Align Center

The names of the months, as words, are aligned left in Multiplan's general format (the format in which your worksheet began). It would look nicer and be easier to follow if the names of the months were centered over the columns. Use the Format Cell command with the Center alignment to accomplish this.

Press *F*.

```
FORMAT: Cells Default Options Width

Select option or type command letter
R1C2        "January"                    97% Free        Multiplan: SPENCER
```

Press *C* (for Cells).

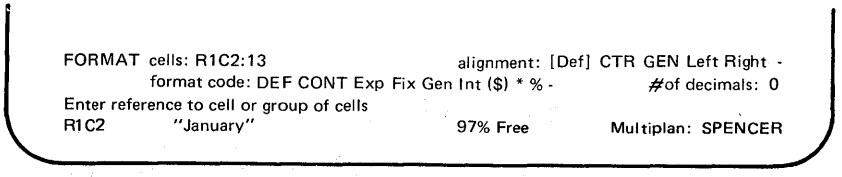
```
FORMAT cells: R1C2                       alignment: [Def] CTR GEN Left Right-
        format code: DEF CONT Exp Fix Gen Int ($) * %-        #of decimals: 0
Enter reference to cell or group of cells
R1C2        "January"                    97% Free        Multiplan: SPENCER
```

You want to format all twelve months, so you can follow basically the same procedure you used earlier to format a range of cells.

1. Press the FORWARD word key to move the edit cursor to the end of the first field (R1C2). (You earlier used the FORWARD character key.)

2. Type a colon (:).

3. Instead of pressing the right arrow key eleven times to give you the range, this time type it in yourself. Since December was in column 13, type *13*.



4. Press TAB to get to the second field. Type *C* to choose center.

5. Press RETURN now, since the format code is all right and "# of decimals" does not apply.

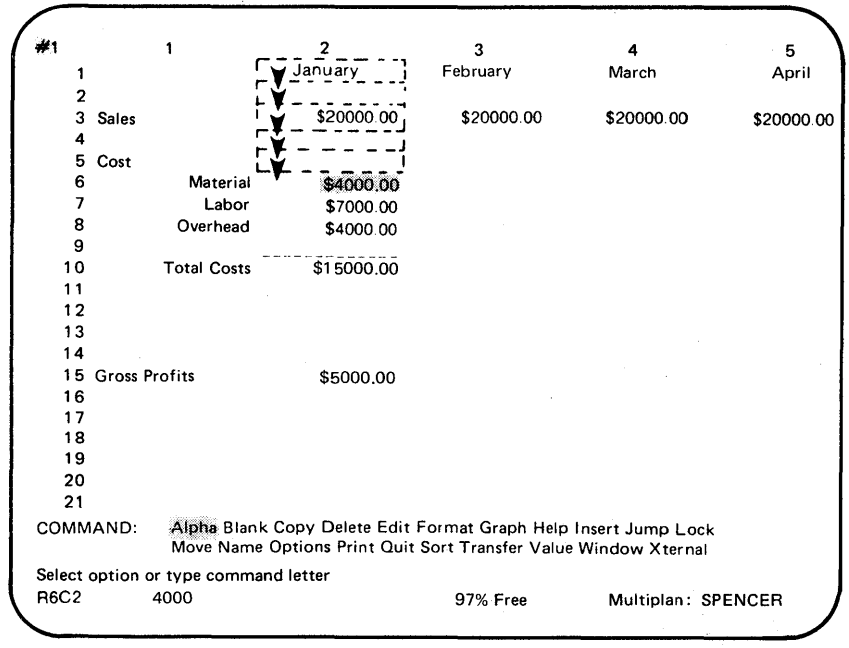
The names of the months are now aligned in the center over the columns of numbers and will be easier to read.

The Copy From Command

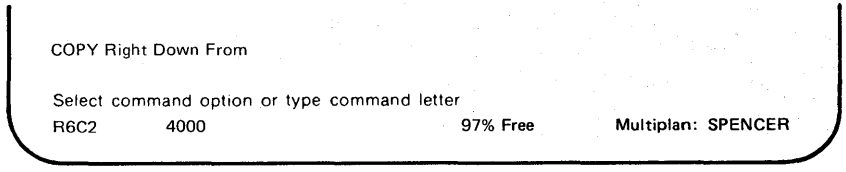
Now that the months are named, finish filling in the figures using the Copy command. Instead of copying one row at a time (as you did when you copied the $20000.00 for *Sales*), use the Copy From command to copy a group of cells.

First, move the pointer to the upper left of the area you want to copy. You want to copy the information from rows 6 through 15 in column 2, to the same rows in the remaining columns—

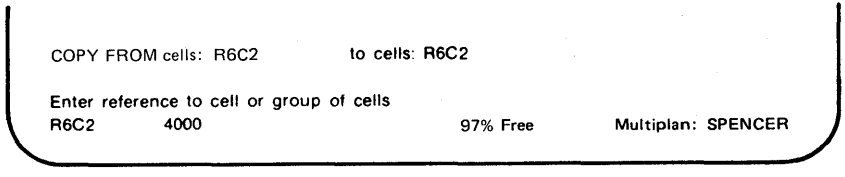
columns 3 through 13—to fill in the rest of the months. Move the pointer down to row 6 in column 2.



Press *C* for the Copy command.



Press *F* to get the proposed Copy From command.



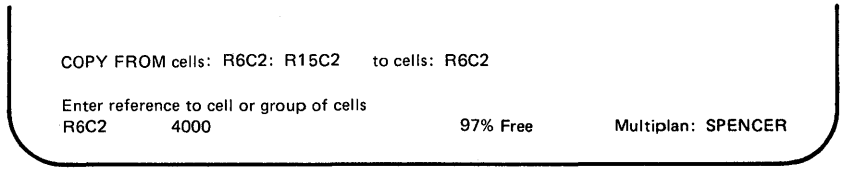
Follow these steps:

1. Use the FORWARD word key to move the cursor to the end of the first field (R6C2).

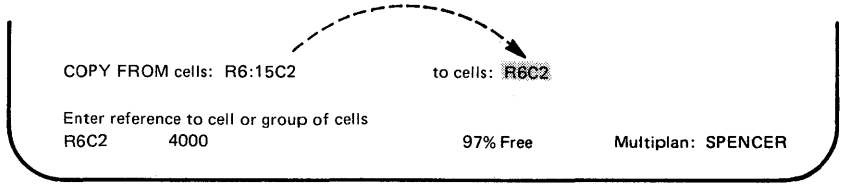
2. Type a colon (:) for a range of rows.

3. Type R15C2 to end the range at row 15.

4. Type *15* (to complete the range).

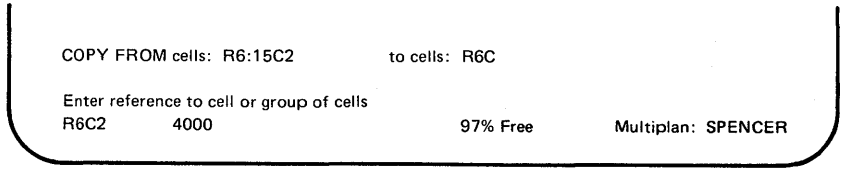


5. TAB to the second field.

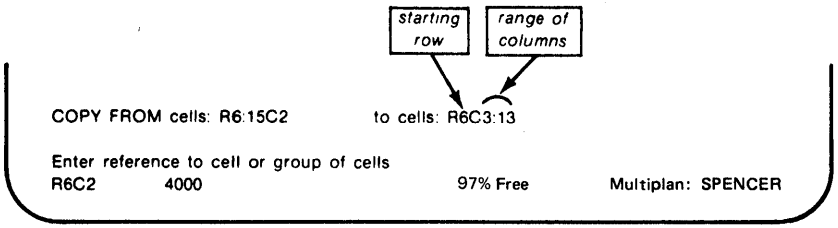


6. Use the FORWARD word key to move the edit cursor to the end of the field.

7. Use BACKSPACE to delete the 2.

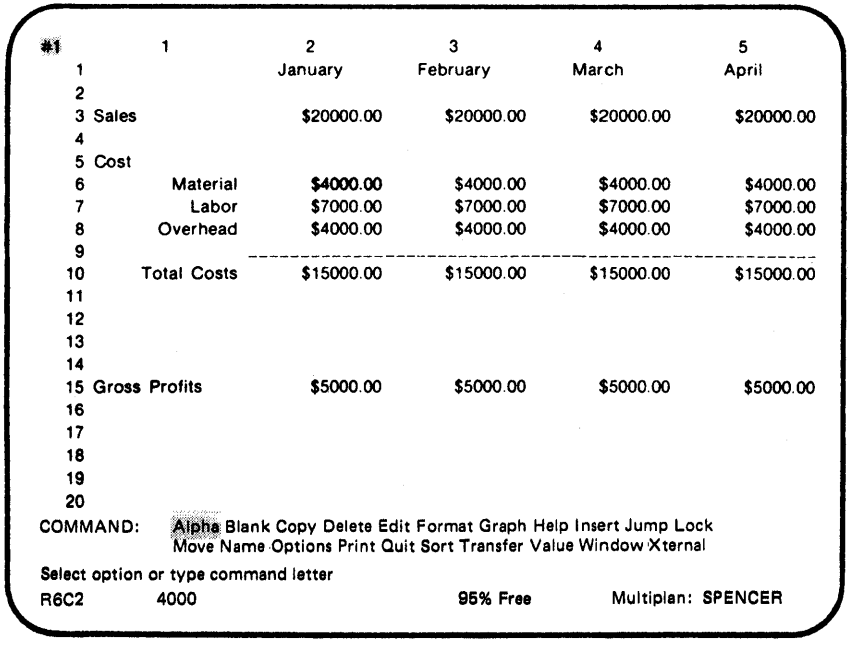


8. Type *3:13.*



Note In the second field, specify only the row number of the row where the Copy command is to start (row 6). If you specified rows 6 through 15, in columns 3 through 13 (e.g., R6:15C3:13), Multiplan would think you wanted to copy the information starting fresh with each row number. Your screen would then be full of unwanted numbers.

9. Press RETURN. You will see:



It looks like Spencer Ceramics has made a lot of money. You'll next want to see what it all adds up to. Add another column heading in column 14, row 1, for the sums. Use the Goto command to move your pointer to R1C14.

Hint Press *G*.

Press *R*.

Type *1*, TAB, *14*.

Press RETURN.

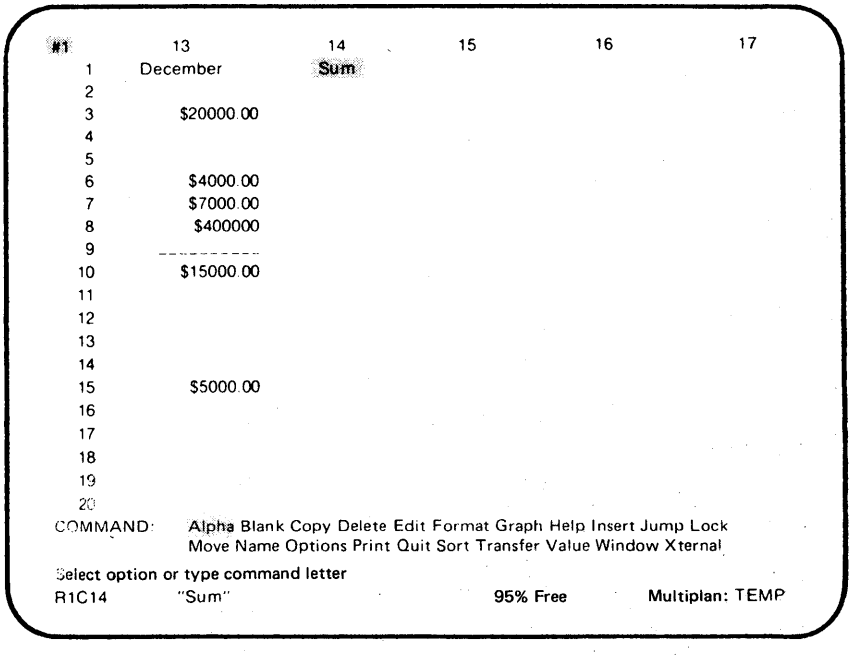
Enter the title SUM in column 14.

Press *A* (Alpha).

Type SUM.

Press RETURN.

Now your screen should show:



Center the word SUM by using the Format Cells command. To review:

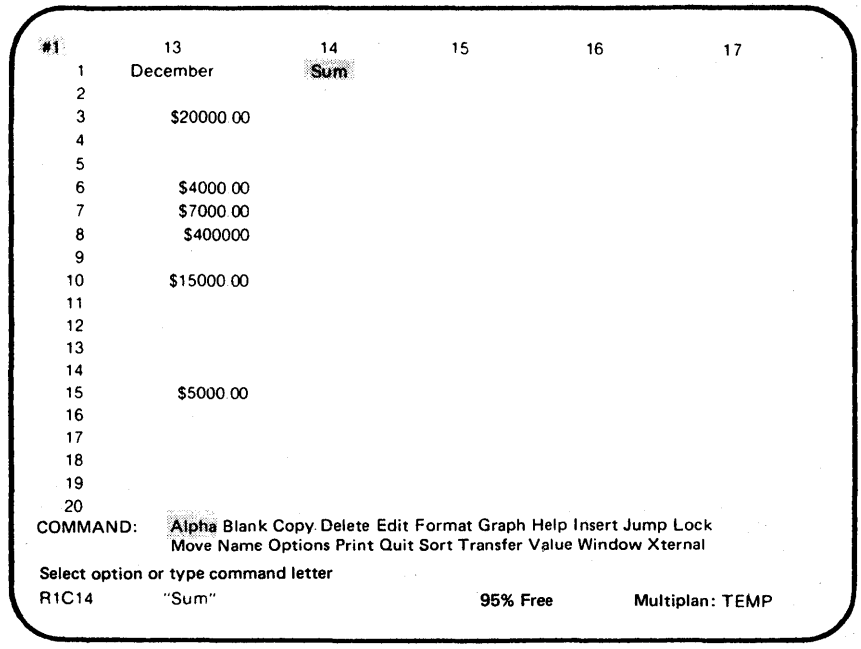
Press *F* (Format).

Press *C* (to choose Cells).

TAB to second field.

Press *C* (for Center).

Press RETURN (fields 3 and 4 are okay).



Relative References and Absolute References

Notice that, in this formula, Multiplan does not refer to the rows and columns by specific numbers. It refers to the position of rows in a relative way by saying, "the active row minus 4 rows."

Relative references are a very flexible tool. For example, you copied *Material, Labor,* and *Overhead* values, as well as the *Total Costs* formula across all twelve months. Multiplan automatically revised the formula to show the new positions relative to each column of *Total Costs.*

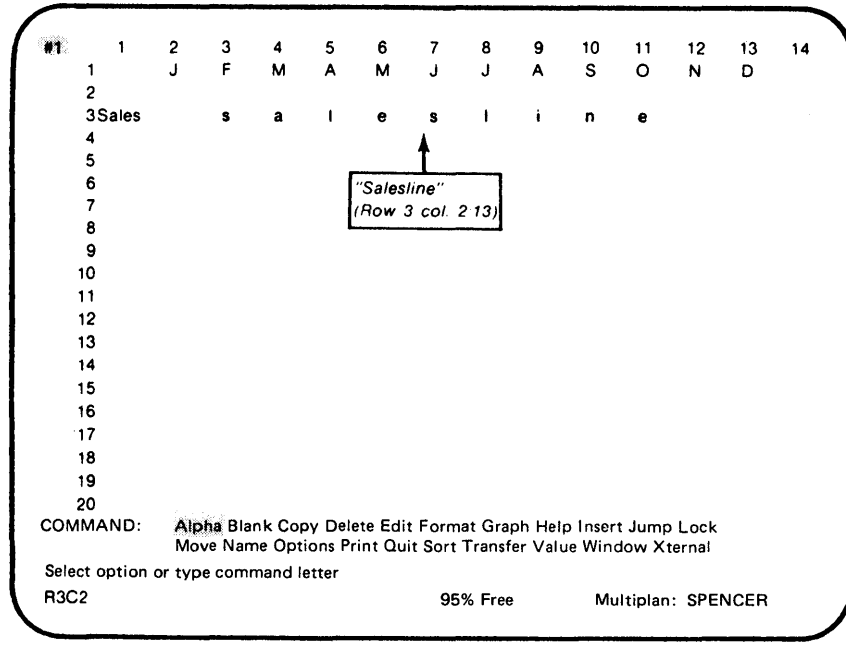
If you had specified the exact row and column number for each of these items by making an absolute reference to their position, such as SUM (R6C2:R8C2), you would have had to change each of the references for the Total Cost formula to remain correct.

Relative	**Absolute**
R10C2 = SUM(R[-4]C:R[-2]C)	R10C2 = SUM(R6C2:R8C2)

You probably are accustomed to a different kind of phrasing when you're adding: *"Materials,* plus *Labor,* plus *Overhead* equals *Total Costs,"* with the answer coming last.

Naming Cells

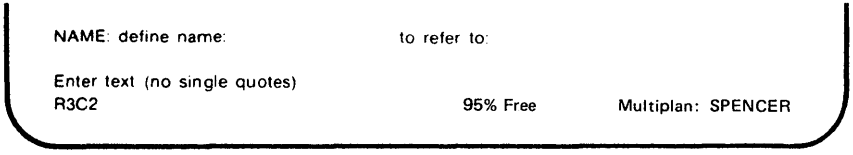
To figure out the sum of the sales in a simpler fashion, you could first name the cells, so that the names can be used in a formula. You could, for example, name a whole row, such as row 3; you could name it *salesline,* meaning the whole line of numbers showing *Sales.* If you could see your whole screen at once, you could imagine the row named *salesline.* It would look like this:



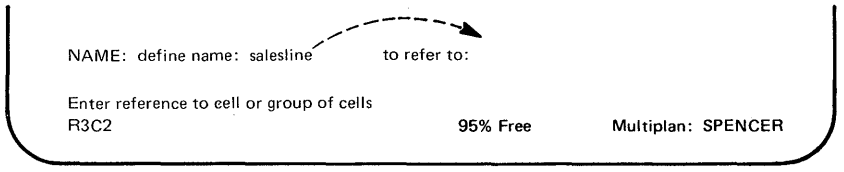
Note **When you name a cell or group of cells, make the name one long word; do not use spaces or hyphens for now. (See the discussion of the Name command in Chapter 10.**

Start first by naming row 3 *salesline*. You must use the Name command rather than Alpha (A), because you will want to locate it later by name. (When you are ready to do that, you will use the JumpTo Name command. There is no JumpTo Alpha command.)

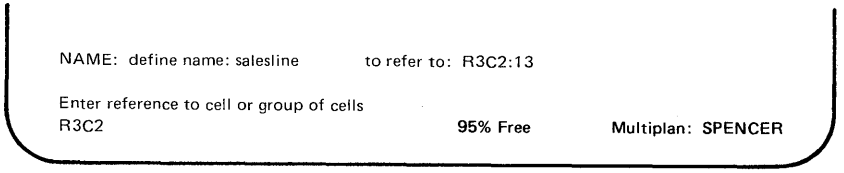
Press *N*.



In the first field, type *salesline.* TAB to the next field.



Notice that when you tabbed to the field, "to refer to," the message changed to, "enter reference to cell or group of cells." Multiplan is asking you to specify which cells this name refers to. You want it to refer to all of the cells in row 3, columns 2 through 13, so type *R3C2:13.*



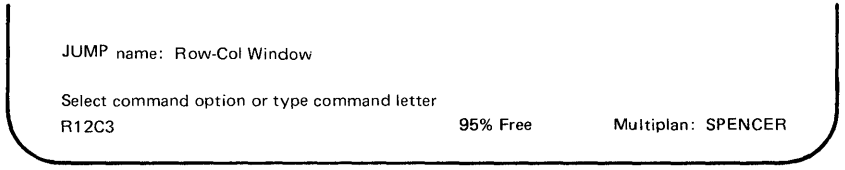
Press RETURN.

You won't be able to see the name on the screen. The name will be used later to refer to the cells in a formula. It can also be linked to cells or groups of cells on other, inactive worksheets. You'll learn more about this later.

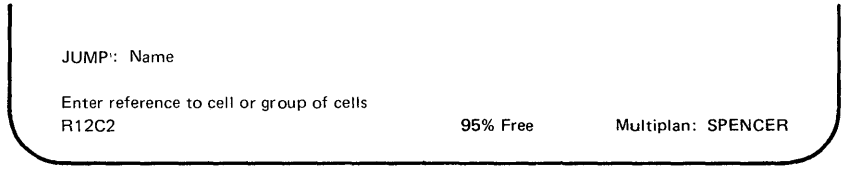
Note If you forget which cells a name refers to, you can use the Name command to find out. Press*N*, then use the right arrow to bring up the directory of names. Keep pressing the right arrow until the name you want appears. The cells it refers to will appear in the second field. If you forget which name you used, follow the same procedure until the name you are searching for appears. (Press CANCEL to return to the regular command line.)

The JumpTo Name Command

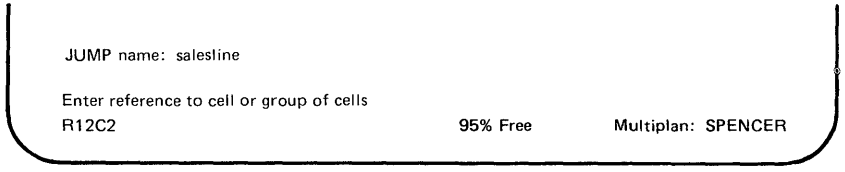
Named cells are easy to locate by using the Jump command. To see how the pointer moves, first place it on row 12, column 2. Now Press *J*.



Choose Name by typing *N*.



Type in *salesline*.



Press RETURN. Your screen now looks like this:

```
#1         1              2            3            4            5
 1                     January      February       March        April
 2
 3 Sales              $20000.00    $20000.00    $20000.00    $20000.00
 4
 5 Cost
 6          Material   $4000.00     $4000.00     $4000.00     $4000.00
 7             Labor   $7000.00     $7000.00     $7000.00     $7000.00
 8          Overhead   $4000.00     $4000.00     $4000.00     $4000.00
 9                   ------------------------------------------------------
10       Total Costs  $15000.00    $15000.00    $15000.00    $15000.00
11
12
13
14
15 Gross Profits       $5000.00$5000.00           $5000.00     $5000.00
16
17
18
19
20
COMMAND:   Alpha Blank Copy Delete Edit Format Graph Help Insert Jump Lock
           Move Name Options Print Quit Sort Transfer Value Window Xternal
Select option or type command letter
R3C2       20000                     95% Free          Multiplan: SPENCER
```

The cell pointer always goes to the first cell in the named row, or to the upper left cell of a named block of cells.

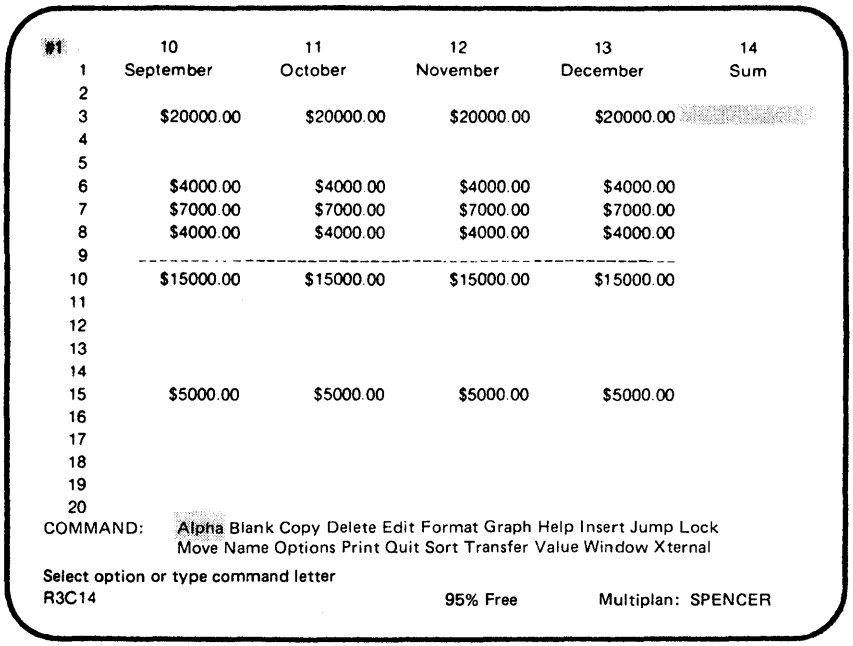
Note When you name a cell, the name will stay the same no matter what is in the cell. For example, if you name a cell *box*, you can put whatever you want in it. You can even change what is in it. The cell will still be called *box*, and you can get to it by its name (e.g., JumpTo Name, *box*.)

The only way you can remove a name is to define it as blank. For example, to remove the name *George*, simply blank out the row and column numbers to which it refers:

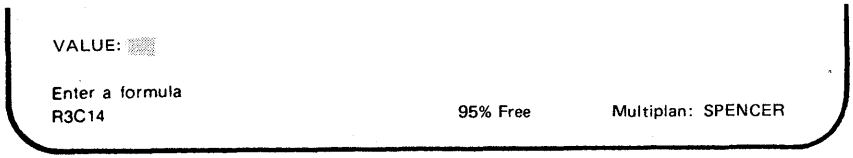
```
                                        delete cell
                                        reference
                                            |
                                            v
NAME: define name: George          to refer to:______

Enter reference to cell or group of cells
R3C2       20000                      95% Free        Multiplan: SPENCER
```

Calculating Functions: SUM

To figure out how much money Spencer Ceramics made during the twelve months, use the Multiplan function SUM (which you used before to build a formula). Begin by moving your pointer to the cell where the result will appear. Move your pointer to row 3, column 14, (use the Jump command).



Now type either + or = to begin the function. The command line will show:

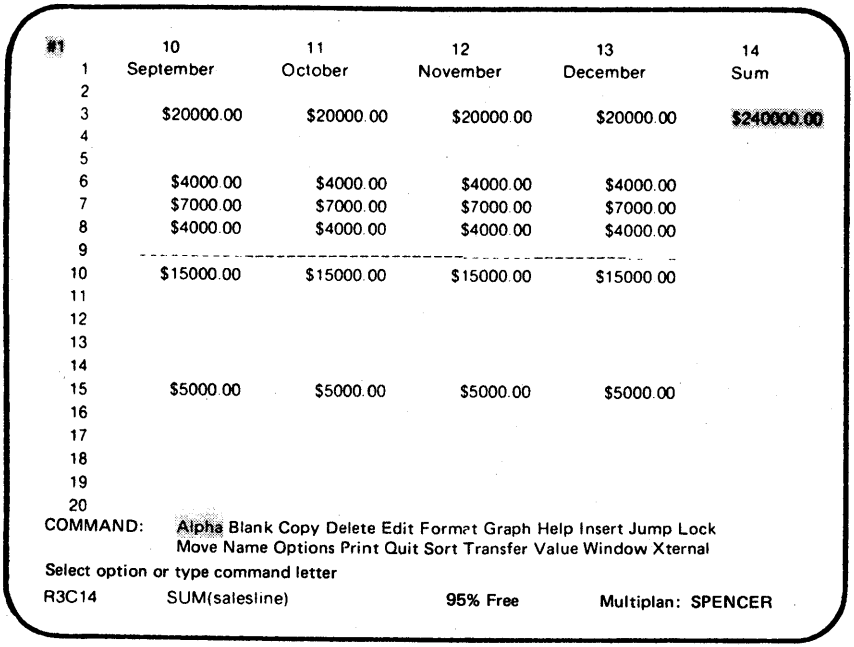


Type *SUM(salesline).*

Note Follow this procedure when using any of Multiplan's many functions: type the function in capital letters (SUM for sum, AVERAGE for average, MIN for minimum, etc.). Follow the capital letters by an opening parenthesis. Then type the name you gave the cell or group of cells, and finish it with the closing parenthesis.

Example SUM(salesline)

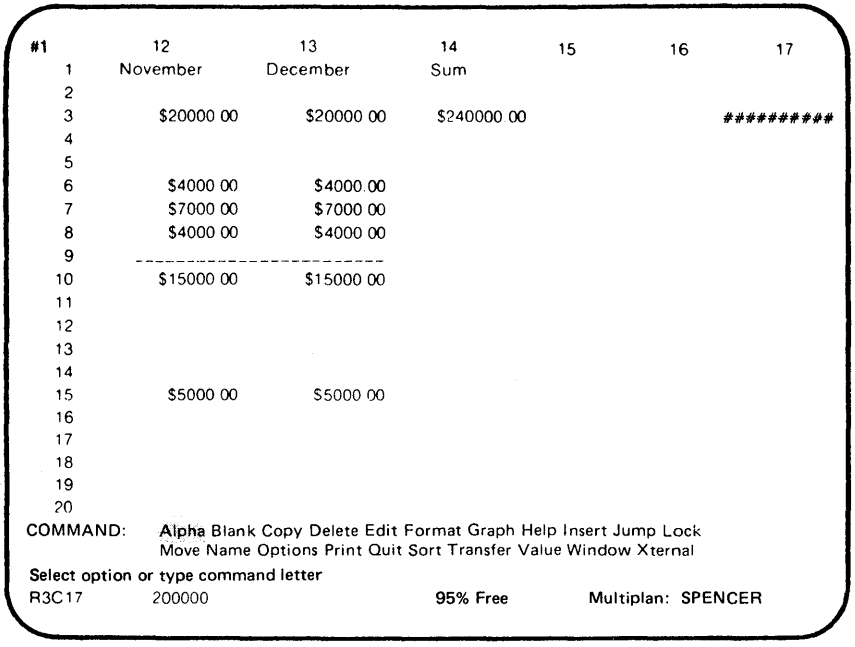
Press RETURN. You will see



Number Symbols

When numbers are too large to be shown in the current formatted column width, they are entered in number symbols (###) until the column is widened enough to accommodate the number.

Move the pointer over to column 17, which was not widened earlier. Enter the number *200000* into row 3, column 17. Type *200000.* Press RETURN. You have:



Column 17 is not wide enough to accommodate 6 numbers in the dollar format (remember: your whole sheet is formatted in dollars), because the dollar format adds a dollar sign, a decimal, and two places after the decimal point plus spaces for parentheses. (The parentheses are shown only when a number is negative.) Look at the status line. It shows that cell R3C17 contains *200,000.* You would have to widen the column in order to display the *$200000.00.* For now, use the Blank command to remove the number from the cell. (Press *B* and RETURN.)

It's time to take a break. To make it easier when you return, move the pointer back to the beginning of the table, since Multiplan always loads a worksheet exactly as it was when you saved it. Use Jump to go to Row 2, column 2.

In the next session, you will see how Spencer Ceramics' profits change as the figures that make up costs and sales change.

Save your work by the Transfer Save command. To review:

Press *T* (Transfer).

Press *S* (Save).

Press RETURN.

You will see the question:

Press GO to overwrite existing file?

Press GO (to update, or overwrite, the old file with the new information you have added).

Your work has now been saved and will be available for you when you return. Press *Q* (for Quit), and GO (to confirm).

Summary

In this session you learned:

How to use the direction keys to look through the file directory of names.

How to refer to the status line to see the actual contents of the active cell, regardless of how the data are displayed on the screen.

How to read the formula on the status line (review).

How to copy one cell to the right.

How to enter headings across the top of your worksheet.

How to center headings over columns.

How to copy one block of cells into other blocks of cells.

How relative references and absolute references differ.

How to name cells and groups of cells.

How to use the Jump command to move the cell pointer to named cells.

How to calculate the sum of a named area.

How Multiplan indicates that a number is too large to be displayed within the present width of a column by entering asterisks.

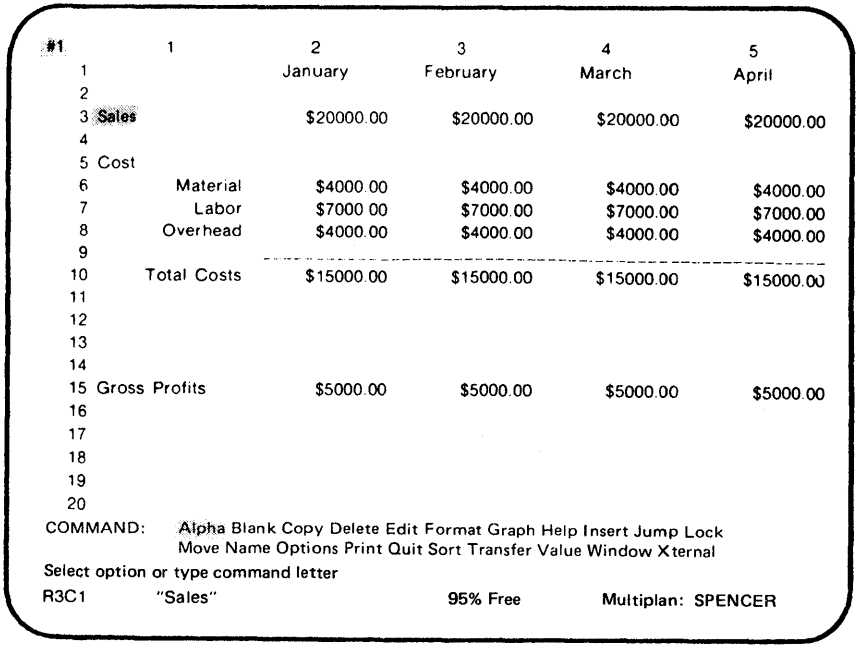
Chapter 5

Windows, Copying Formulas, and Options

In the last session you reviewed the procedure for building formulas, and you learned how to copy cells into other cells on the worksheet. You also learned how to name cells, how to use the Goto command to move the pointer to the named area and how to do a calculation using a name and a function.

In this session you will learn how to view several portions of the worksheet at once by "opening windows," as well as how to manipulate these windows quickly and easily.

Load the Multiplan disk then Transfer Load *SPENCER*. The screen should look just as it did when you left it last time:



#1	1	2	3	4	5
1		January	February	March	April
2					
3	Sales	$20000.00	$20000.00	$20000.00	$20000.00
4					
5	Cost				
6	Material	$4000.00	$4000.00	$4000.00	$4000.00
7	Labor	$7000.00	$7000.00	$7000.00	$7000.00
8	Overhead	$4000.00	$4000.00	$4000.00	$4000.00
9					
10	Total Costs	$15000.00	$15000.00	$15000.00	$15000.00
11					
12					
13					
14					
15	Gross Profits	$5000.00	$5000.00	$5000.00	$5000.00
16					
17					
18					
19					
20					

COMMAND: Alpha Blank Copy Delete Edit Format Graph Help Insert Jump Lock
Move Name Options Print Quit Sort Transfer Value Window Xternal
Select option or type command letter
R3C1 "Sales" 95% Free Multiplan: SPENCER

Fixing Titles: The Window Split Title Command

It is possible to keep the headings for *Sales, Cost,* etc., in view while you look at the last half of the year. It can be difficult to tell what numbers you are looking at when you get past April if you can't see the headings.

You can "fix" the titles in place, so that they will remain visible as you scroll the columns by using the Window Split command.

Press *W.*

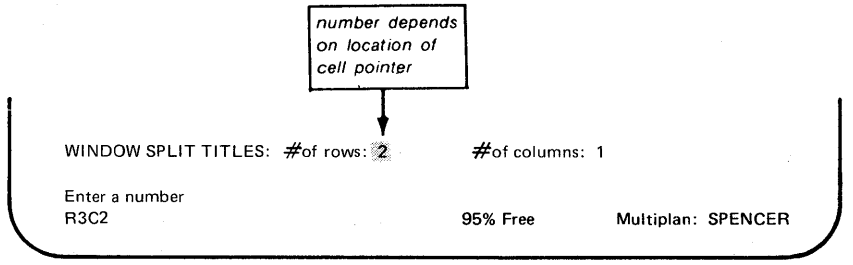
```
WINDOW: Split Border Close Link

Select command option or type command letter
R3C2        "Sales"                    95% Free        Multiplan: SPENCER
```

There are several subcommands to choose from, but for now choose Split by pressing *S.*

```
WINDOW SPLIT: Horizontal Vertical Titles

Select command option or type command letter
R3C2        "Sales"                    95% Free        Multiplan: SPENCER
```

Of the sub-subcommands you see, pick Title, because you want to fix the titles (or headings) in place down column 1 and row 1.

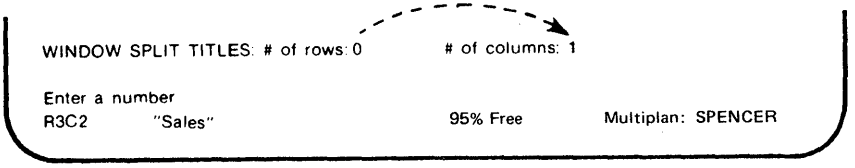
Press *T.*



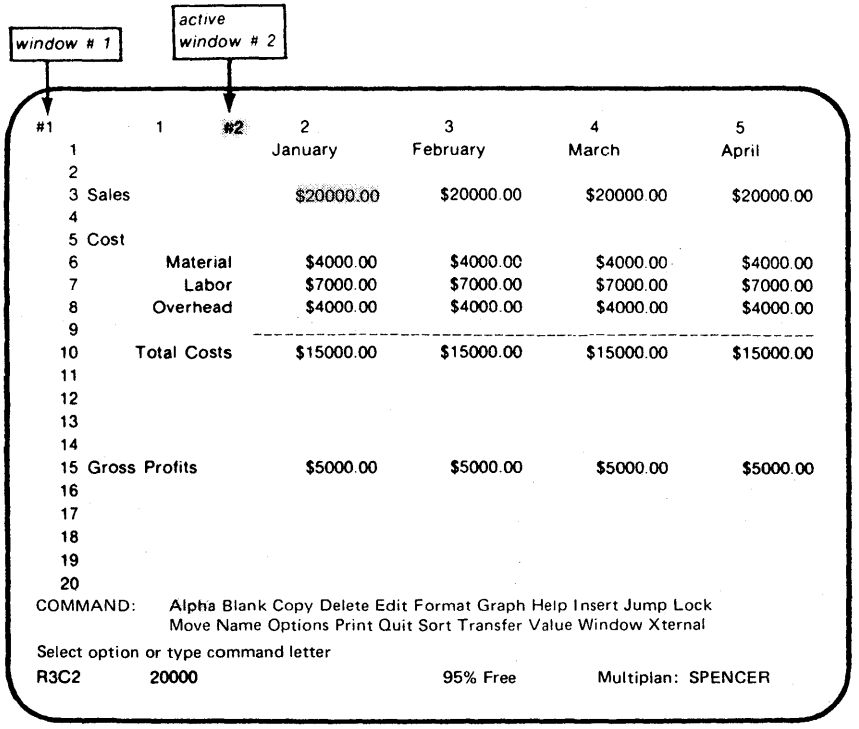
In the first field, type a zero (0) since you do not want to split the the window horizontally by rows.

Note You cannot ask Multiplan to split more columns or rows than you can see on the screen. If you do, the message, "window will not fit" will appear.

TAB to the second field.



Multiplan is asking how many columns you would like to split. You want one column for the titles. Enter 1 as the response, and merely press RETURN.



When you scroll to December, you will still be able to see the headings for *Sales*, *Cost*, and *Gross Profits*. Try pressing the right arrow six times. July will come into view with the titles still fixed to the left of the screen. Now press the left arrow six times to get back to January.

Opening a Window: The Window Split Command

You have actually opened a second window by splitting the one you were working on. Save your work at this stage by using the Transfer Save command (with Yes to overwrite the existing file).

Note It is important that you save the worksheet, as you will use the Transfer Clear command to clear your screen after you practice opening and closing windows. Transfer Clear will destroy the old sheet unless it has been saved.

Now do some experimenting with opening and closing windows by using the Window Split command.

Note Position your cell pointer *before* you start the window command like this:

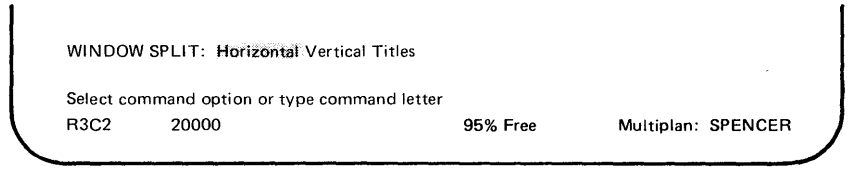
Use the Change Window key (f7) to move the pointer from window to window until it is in the window you wish to split.

Position the pointer on the row or column you want (for horizontal or vertical splits)

Now press *W*.

```
WINDOW: Split Border Close Link

Select command option or type command letter
R3C2        20000                95% Free        Multiplan: SPENCER
```

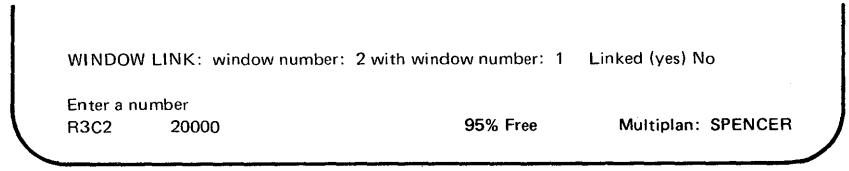
Now press *S*.



The Horizontal choice allows you to split a window across the screen at the row number you specify. The Vertical choice will let you split a window up and down at the column you choose. Press *H* or *V*.

Linking Windows for Synchronous Scrolling

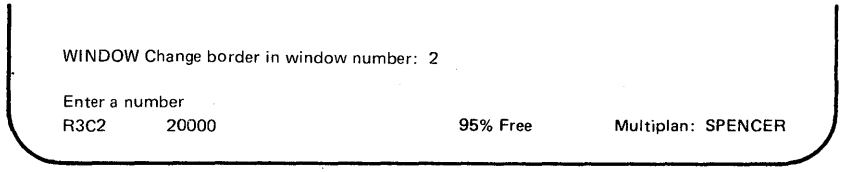
The command also asks you whether you want to link the windows for **synchronous scrolling.** Links are established between the new window and the window from which it was split. Linking allows you to scroll both windows together.



Bordering Windows

If a window is bordered, it has a line drawn around it that sets it off from the surrounding worksheet. The sheet you now have is not bordered.

Try the **bordered window** to see what it looks like. Press *W.*

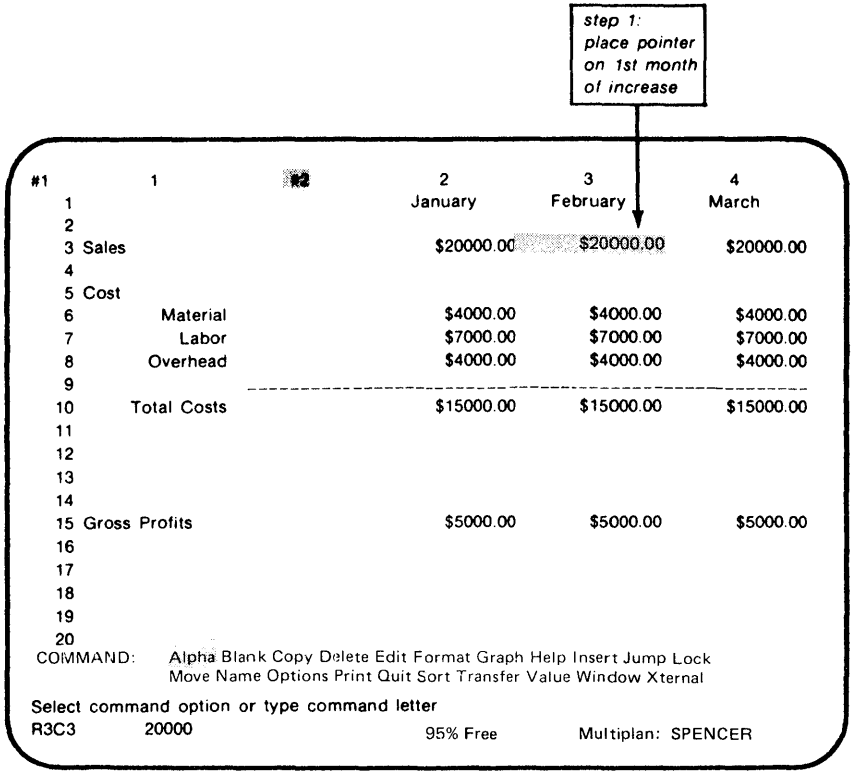


Now press RETURN.

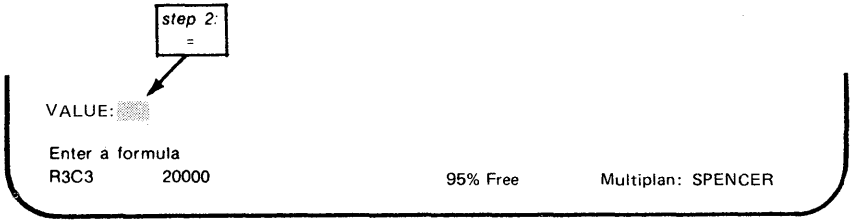
Try opening and closing windows until you become familiar with the command. When you are finished, clear the screen (Transfer Clear, Yes) and reload your worksheet (Transfer Load *SPENCER).*

A Formula Showing Increasing Sales

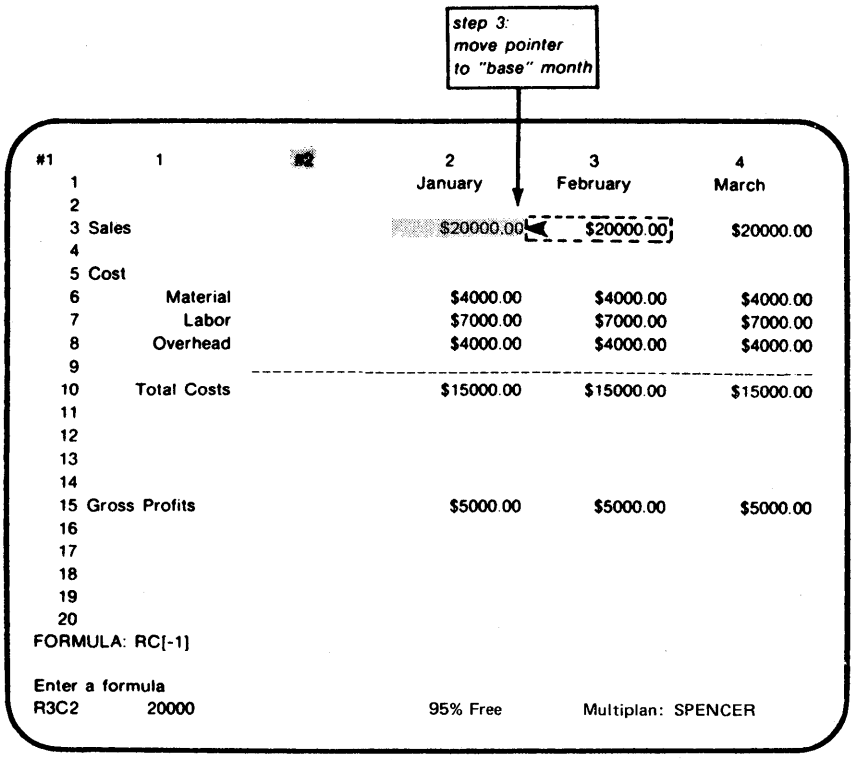
Your information on Spencer Ceramics indicates that sales have been increasing by around 10% a month. To see the effect of a 10% monthly increase in sales, first move the pointer to row 3, column 3, February, which is the first month showing an increase.



Press =. Your command line shows:

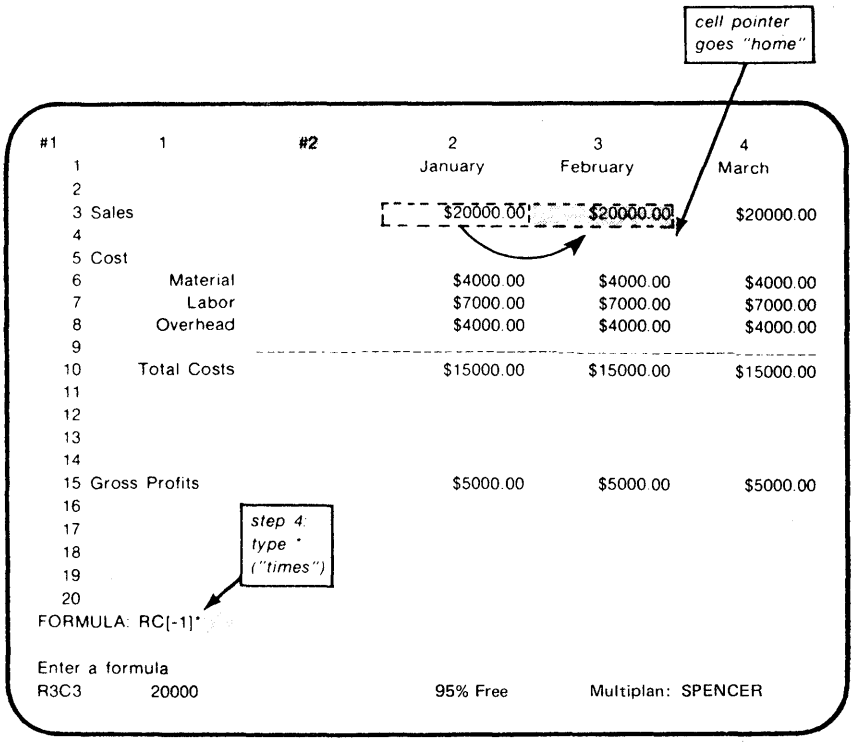


Using January sales as a base for the remaining months, type in a formula that will show each month's sales as a 10% increase over the preceding month's sales. Move the cell pointer back to January, row 3, column 2, the preceding month.

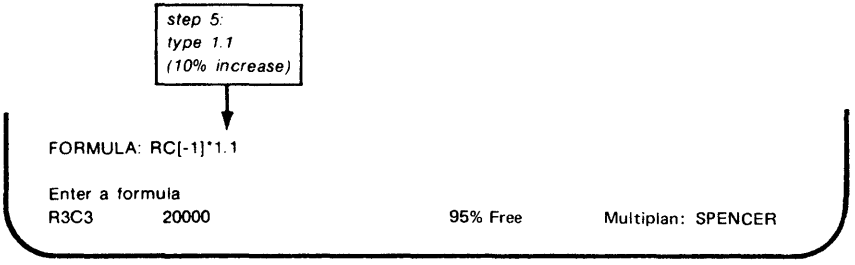


To show February's sales as a 10% increase over January's, you need to multiply January's sales by 1.1 (i.e., February sales are 110% of January's).

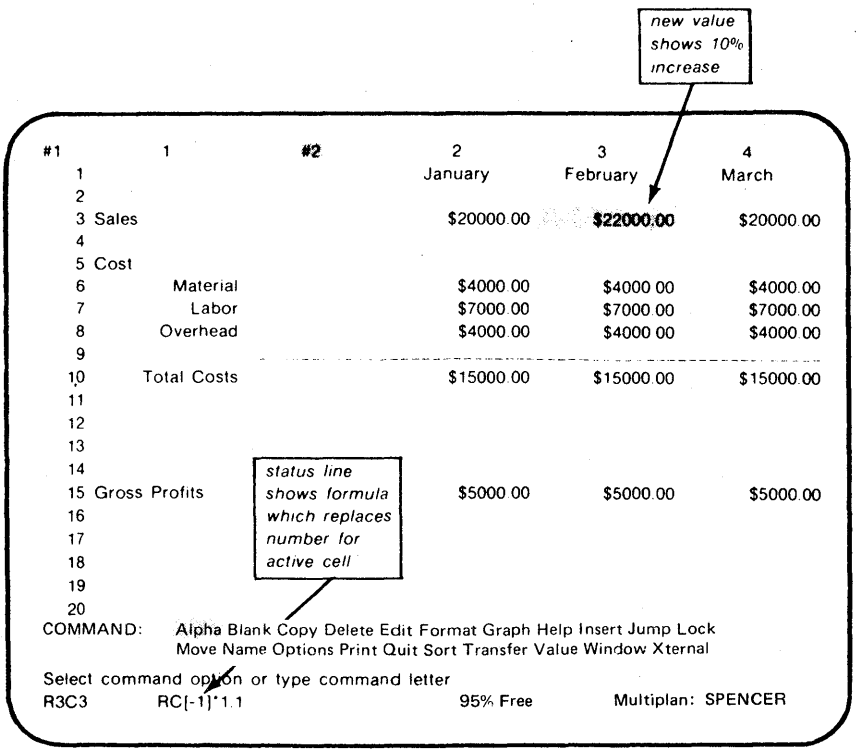
Type the sign for multiply, the asterisk (*).



Now type *1.1* (use the number *1*, not the lowercase letter *l*).

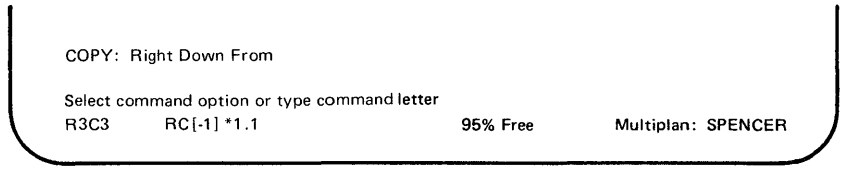


Press RETURN. You should see the new cell value for February showing a 10% increase over the previous month, January.

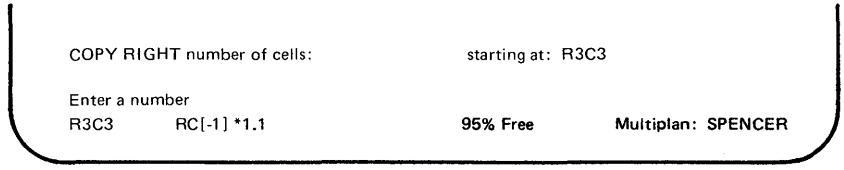


Copying a Formula to the Right: The Copy Right Command

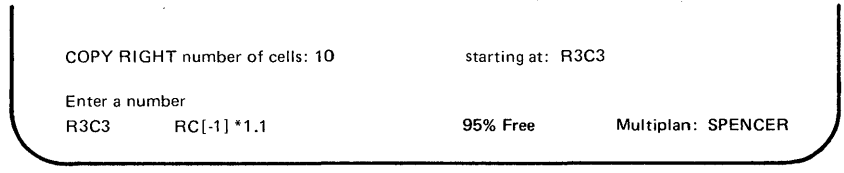
There is no formula in the cell for January, because it acts as the "base" month for the 10% increase. You will therefore be copying the formula for February into the remaining 10 months of the year. To copy this formula to the right, be sure the cell pointer is on R3C3 and press *C*.



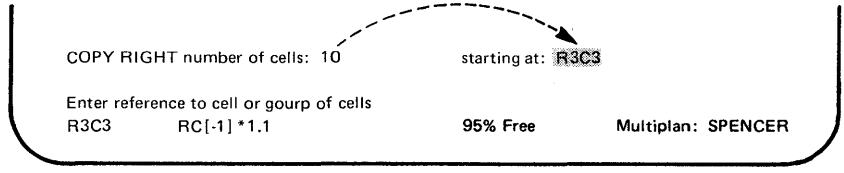
Press *R.*



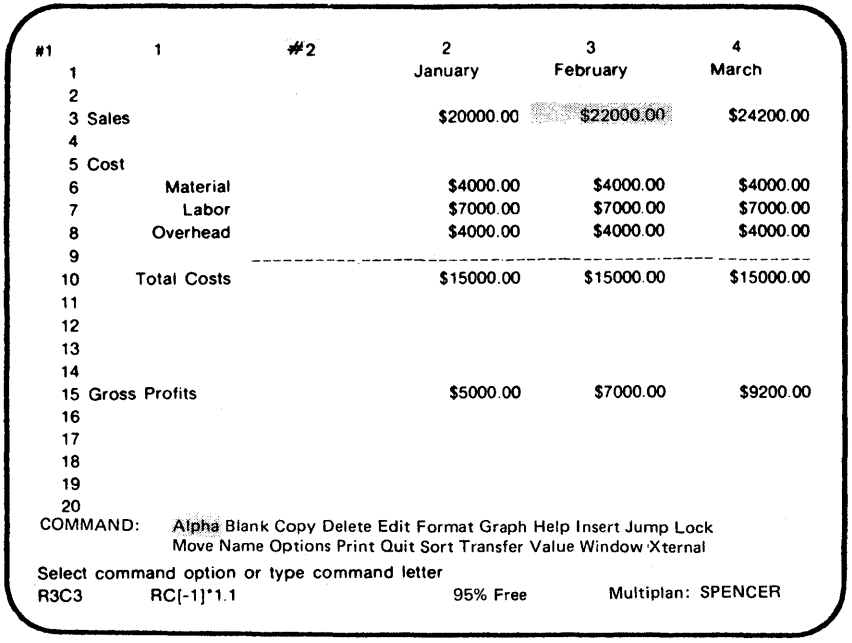
In the first field, type *10.*



TAB to the next field. You see that R3C3 (the active cell) is already given as the proposed response. That is where you want to start, because the other 10 cells are to be copies of this cell.



When you press RETURN, watch the results. Press RETURN.



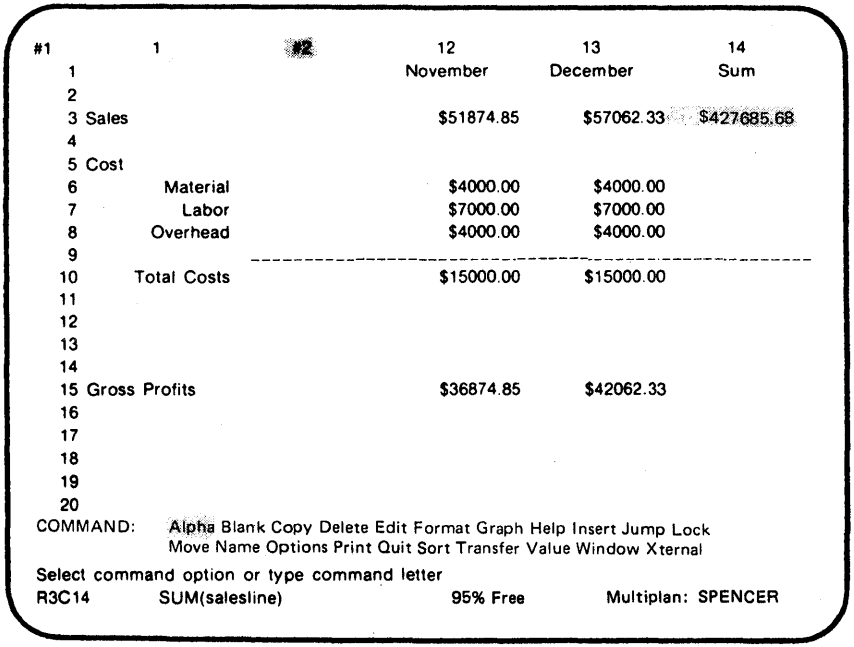
#1	1	#2	2	3	4
1			January	February	March
2					
3	Sales		$20000.00	$22000.00	$24200.00
4					
5	Cost				
6	Material		$4000.00	$4000.00	$4000.00
7	Labor		$7000.00	$7000.00	$7000.00
8	Overhead		$4000.00	$4000.00	$4000.00
9					
10	Total Costs		$15000.00	$15000.00	$15000.00
11					
12					
13					
14					
15	Gross Profits		$5000.00	$7000.00	$9200.00
16					
17					
18					
19					
20					

COMMAND: Alpha Blank Copy Delete Edit Format Graph Help Insert Jump Lock
Move Name Options Print Quit Sort Transfer Value Window Xternal

Select command option or type command letter

R3C3 RC[-1]*1.1 95% Free Multiplan: SPENCER

When you have moved your pointer to row 3, column 14, you will be able to see the sales figures resulting from a 10% monthly increase. The formula was copied to the remainder of the year, and the cells that depended on sales figures have been updated to include the new information.



#1	1	#2	12	13	14
1			November	December	Sum
2					
3	Sales		$51874.85	$57062.33	$427685.68
4					
5	Cost				
6	Material		$4000.00	$4000.00	
7	Labor		$7000.00	$7000.00	
8	Overhead		$4000.00	$4000.00	
9					
10	Total Costs		$15000.00	$15000.00	
11					
12					
13					
14					
15	Gross Profits		$36874.85	$42062.33	
16					
17					
18					
19					
20					

COMMAND: Alpha Blank Copy Delete Edit Format Graph Help Insert Jump Lock
Move Name Options Print Quit Sort Transfer Value Window Xternal

Select command option or type command letter

R3C14 SUM(salesline) 95% Free Multiplan: SPENCER

Use a formula to figure out the sums of *Total Costs* (R10C14) and *Gross Profits* (R15C14). To review:

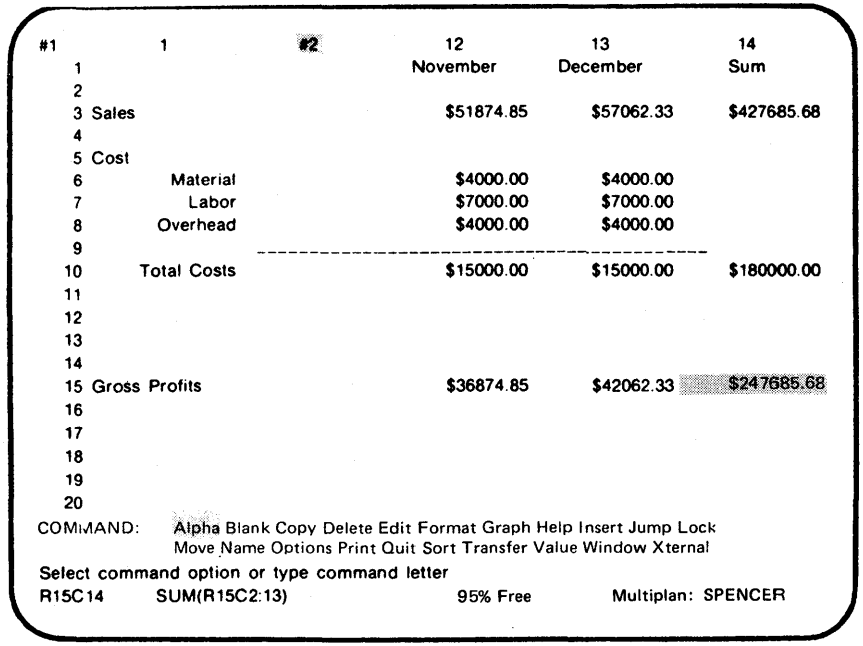
For *Total Costs:*

1. Move the pointer to row 10 column 14.
2. Press =.
3. Type SUM(R10C2:13).
4. Press RETURN.

For *Gross Profits:*

1. Move the pointer to row 15 column 14.
2. Press =.
3. Type SUM(R15C2:13).
4. Press RETURN.

You will see:

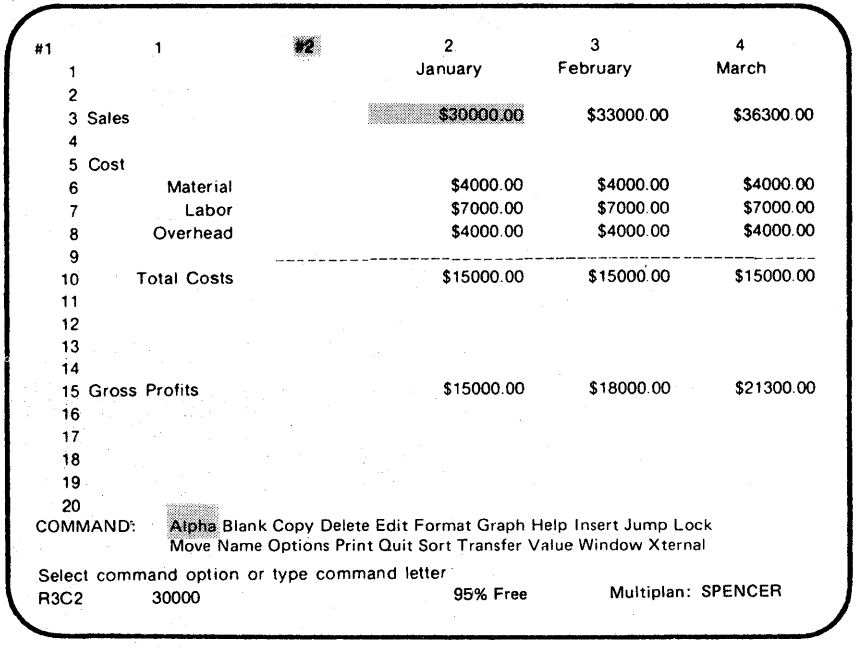


Before you go on, save your work (Transfer Save, Yes to over write).

The Options Command

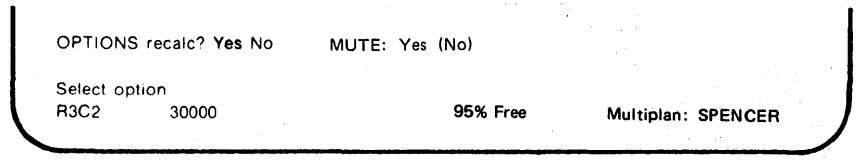
If you change the number or formula of a cell, such as January sales, Multiplan will recalculate all of the cells that depend upon that cell.

Use the Goto command to move your pointer to row 3, column 2 Change January sales by typing *30000.* Watch the remaining sales and profits figures change when you press RETURN. Press RETURN.



If you change the formula in row 3, column 3, to reflect a 20% increase (*1.20), Multiplan will automatically recalculate the entire worksheet.

It is possible to turn off the automatic recalculation option if you wish by using the Options command. Press *O.*



Select *No* by typing *N*. Press RETURN. Now change the number for January sales to 2500 and press RETURN. You will see that only the cell for January shows any change.

While the option to recalculate is turned off, you can do a one-time calculation by pressing the RECALC key (f3). Press it, and watch the screen. The entire sheet has been recalculated. *Gross Profits* (row 15) now shows losses in parentheses.

Use the Options command to change back to automatic recalculation (Option, Yes, RETURN). (Your work has been saved by Transfer Save earlier.)

Summary

In this session you learned:

How to fix row and column headings to let you scroll while viewing the headings (WST).

How to open a new window (WS).

How to link windows so that they scroll together, either by rows or by columns, or both.

How to draw a border around a window.

How to enter a formula to show an increasing sales percentage.

How to copy a formula into other cells to the right.

How to use the Option command to suspend Multiplan's automatic recalculation feature.

Chapter 6
Printing Your Work

You have by now become familiar with the basic command structure of Multiplan, using the keyboard and commands to build a worksheet that responds quickly and accurately to changes.

In this session you will learn to use the Multiplan Print Command to produce a copy of the summary operating budget that you developed to show projected sales and profits of Spencer Ceramics. You can copy your work on paper or on a disk file.

The Print Command

Start up Multiplan and load your SPENCER file. You will now use the Multiplan Print command (P) to get a paper copy of your work. Press P.

Multiplan displays the Print menu as follows:

PRINT: Printer File Margins Options

The Print Margins Command

The proposed response of Multiplan for the Print command is P for Printer. It is possible for you to press RETURN and have your worksheet printed without specifying margins. Multiplan has set margins that it will use unless you enter different margins.

If you choose not to change the margins that Multiplan has set (left 5; top 6; print width 70; print length 54; page length 66), Multiplan will print as many columns across the page as will fit within these margins. Any columns left over are printed on a second page, with row and column numbers given just as for the first page.

For now, however, establish your own margins using the Print Margins command. Press M. You will see:

Print Margins: left: 5 top: 6 print width: 70 print length: 54
page length: 66

The Left Margin

The left margin and the text width are given as a number of characters. That means that the left margin has been set at 5 characters by Multiplan and will remain so unless you change it. Five characters gives approximately a half inch margin at the left. That is reasonable, so leave it at 5 and TAB to the next field.

The Top Margin

The top margin and the length of the page are given in lines. Multiplan suggests 6 lines of space at the top of the page which gives you approximately 1 inch of space. Set it to two inches, to 12. TAB to the third field.

Print Width

The width of 8½- by 11-inch paper is approximately 85 characters. Multiplan has set the width of the printed text at 70. This is adequate so TAB to the next field.

Print Length

The length of the text has been set to 54 lines. Sheets longer than this will be printed on multiple pages each containing 54 lines. The tables for Spencer use only 20 rows, so you do not need to worry about the length of the text for this printing. TAB to the next field.

The Page Length

The page length has been set at 66 lines (the length of 8½- by 11-inch paper). Change this parameter if your paper is another size. The sum of the top margin and the print length cannot exceed the length of the page. Multiplan displays an error if you do so. The remaining space constitutes the bottom margin.

The Print Printer Command

Press RETURN. Multiplan returns to the Print command anticipating the Print Printer response. To produce a paper copy of your table, press RETURN.

Your table should now be printing on your printer. If does not do so, refer to the Printer section of Chapter 11 to determine the probable cause of the problem.

The Print File Command

The Print Printer command, which you just carried out, caused your active worksheet to be printed (in the form you specified) on the printer. It may be, however, that you wish to make a disk copy (or several copies) of the worksheet as it would appear on the printed page. You would then be able to print the worksheet again at some future time, or call it up for editing with the Word Processor. The Multiplan Print File command allows you to make such a copy for later use.

To make a disk file copy of the SPENCER worksheet, press P and F (for File). Multiplan displays:

PRINT on file:

Naming Your Disk File Copy

Multiplan maintains different types of files separately by appending a suffix to the name you assign to a file. You can therefore specify the same name for the printed copy of your sheet. Multiplan differentiates the actual file to use according to context. (i.e. if you load a sheet, Multiplan only looks for the files which has suffixes of binary files). You, however, need not worry about the suffix since it is added or stripped from the file name which you give to Multiplan.

Multiplan does not overwrite an existing file without expressly asking your permission.

Type SPENCER in response to the Multiplan prompt for a file name and press RETURN. Multiplan will produce a disk copy of your sheet. You may use it with any other programs you might have. (See Chapter 11,"Saved Sheets, Files, and the BTOS™ Operating System" for suggestions.)

The Print Options Command

Suppose you decided you did not want to show itemized costs on the printed sheet, but just wanted the column showing the sums for sales, costs, and gross profits (column 14). You may specify partial areas you want printed by using the Print Options command. Press P and O (for Options).

Multiplan responds with:

```
PRINT OPTIONS:
  area:                          Printers:
  formulas: Yes (No)   row-col numbers: (Yes) No
```

In the first field, Multiplan asks for the area. Specify column 14 as the only column to be printed. Type C14.

The second field, "Printer", allows you to select a printer name other than the default one provided. (See Chapter 11, "Saved Sheets, Files, and the BTOS Operating System" for suggestions.)

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The third field allows you to have the formulas in the cells printed instead of the values, if you wish. This option is useful when you desire to have a printed copy of your equations. For now, leave it No and TAB to the last field.

The last field allows you to include the row and column numbers to the left and at the top of the printed copy. For now, leave it Yes.

Press RETURN AND P (for Printer).

Column 14 is printed on your printer.

Summary

In this session you learned:

How to use the Print command, and what sub-commands are part of it.

How to set print margins.

How to start printing.

How to make disk copies of your printed sheet.

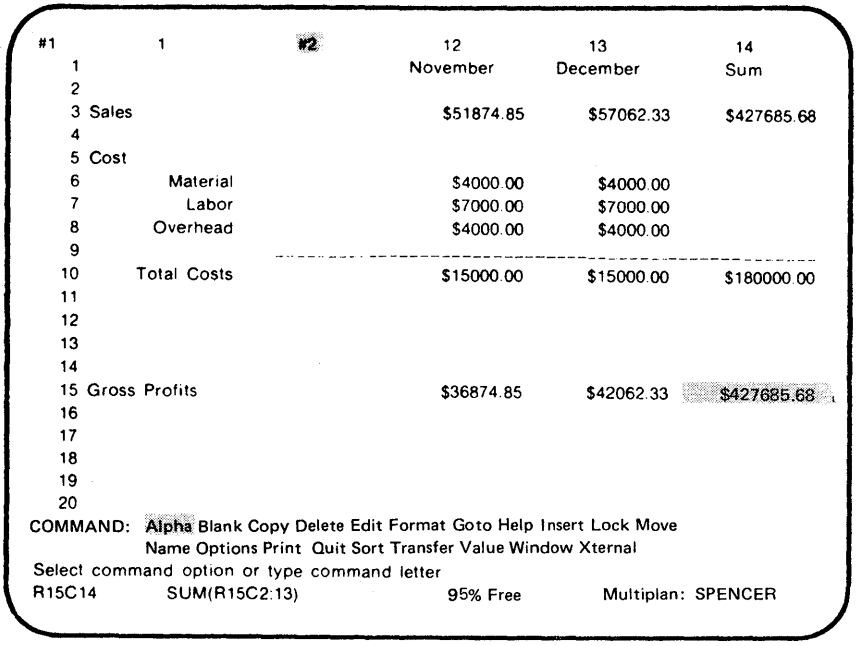
How to select a name for your disk file copy.

How to print portions of your worksheet.

Chapter 7
Accessing Inactive Worksheets

In this session you will learn to bring up information from inactive worksheets for use in entries and formulas on your active sheet.

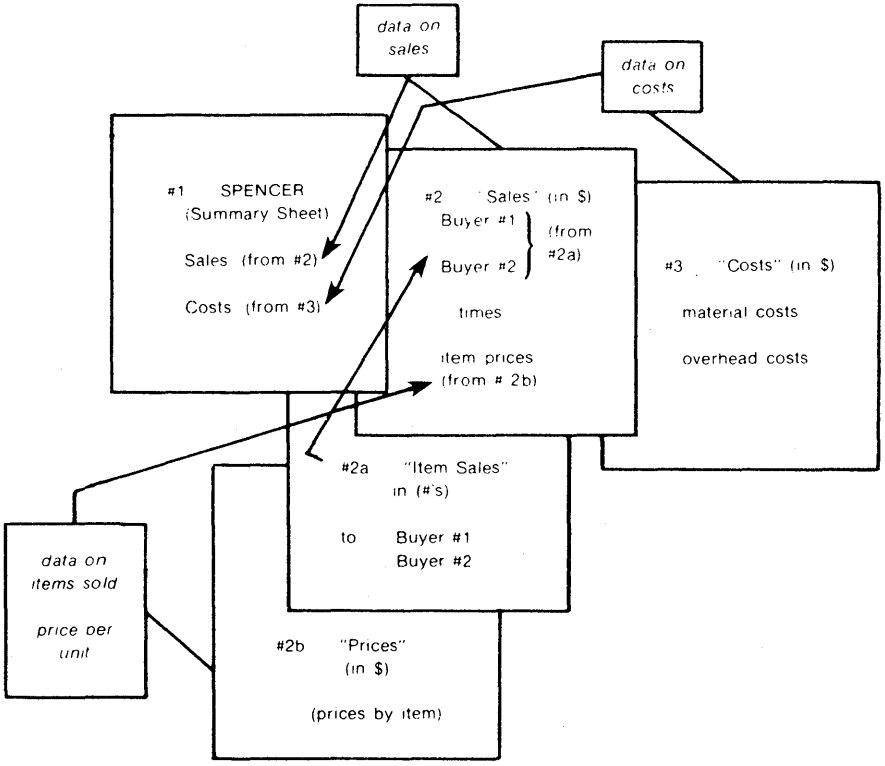
The worksheet you have been compiling for Spencer Ceramics is a summary worksheet showing sales, costs, and gross profits. It was based on information for one month, then projected into the remaining months of the year to show potential profits. Your worksheet should look like this:



You are now ready to use more detailed information about the company to set up separate, related worksheets for each major category. After naming important cells on these supporting worksheets, you will be able to use the eXternal command to retrieve that information for use in formulas on your main worksheet.

Relating Worksheets to Each Other

The information on Spencer Ceramics could be set up to interrelate like this:



Information on the number of items purchased (or sales) by each buyer (sheet #2a), when multiplied by the price per item (sheet #2b), would provide data for dollar sales (sheet #2). Data on sales (sheet #2) and on costs (sheet #3) would then be used to figure totals on the *Summary* sheet (sheet #1).

Using Multiplan, you will be able to set up separate worksheets like these, which can draw information, as needed, from one another.

If, for example, a cost figure changes on the *Costs* sheet, related numbers on the *SPENCER* sheet will change as well. When the

sales figures on the *Item Sales* sheet are updated, the new sales will be reflected in the *Dollar Sales* sheet when it is loaded. Those changes will also be reflected in the *Summary* sheet when it is loaded.

Supporting and Depending Sheets

Sheets that provide data for another sheet are called **supporting sheets**: they support the calculation of the other sheet by providing data to it. Sheets that use data from other sheets are called **dependent sheets**: they depend on the data of other sheets for their calculation.

Naming Related Worksheets

Each supporting worksheet must be given a name and saved in a file. That filename is used with the eXternal command to make the data accessible to dependent sheets. Multiplan is able to find any worksheet on the disk being used, but giving the sheets related names makes it easier to keep track of them and use them quickly and accurately.

You named the first worksheet *SPENCER*. Using a form of that name for related worksheets, which are also files once they have been saved, will help you to recognize later which sheets belong together. It is helpful to capitalize the names of the sheets to distinguish them from cell names, but it is not essential. Sheet names must be no more than 31 characters long.

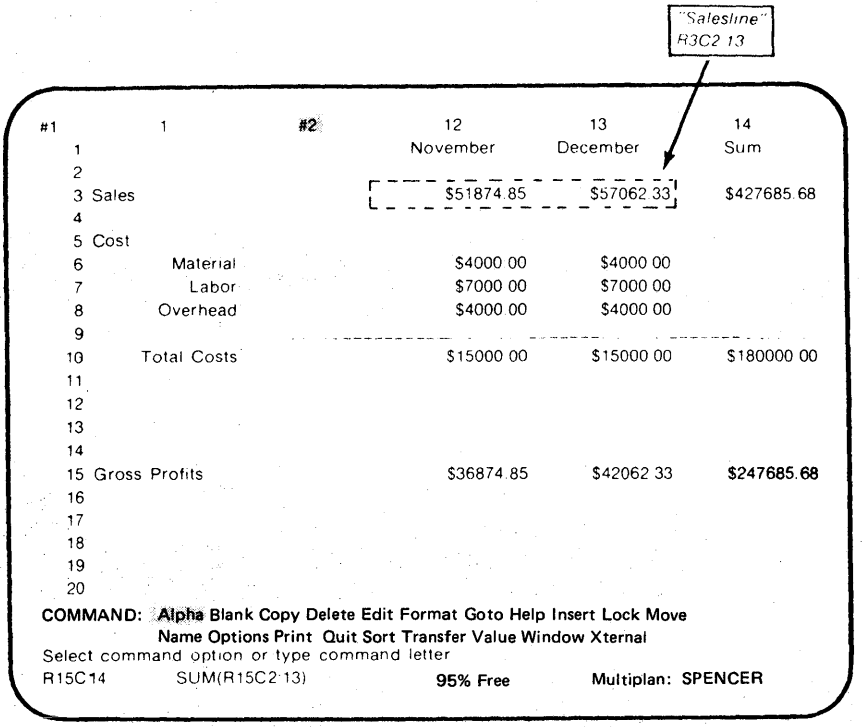
To name a supporting sheet, you could follow a procedure like this:

1. Use the general filename first (or some abbreviation of it).

2. Add the supporting filename next (a name that quickly identifies the sheet to you).

Note Remember not to use any symbols or spaces in worksheet names.

Before setting up a supporting worksheet to supply information for the main worksheet, review the data you already have. Load the worksheet *SPENCER.*

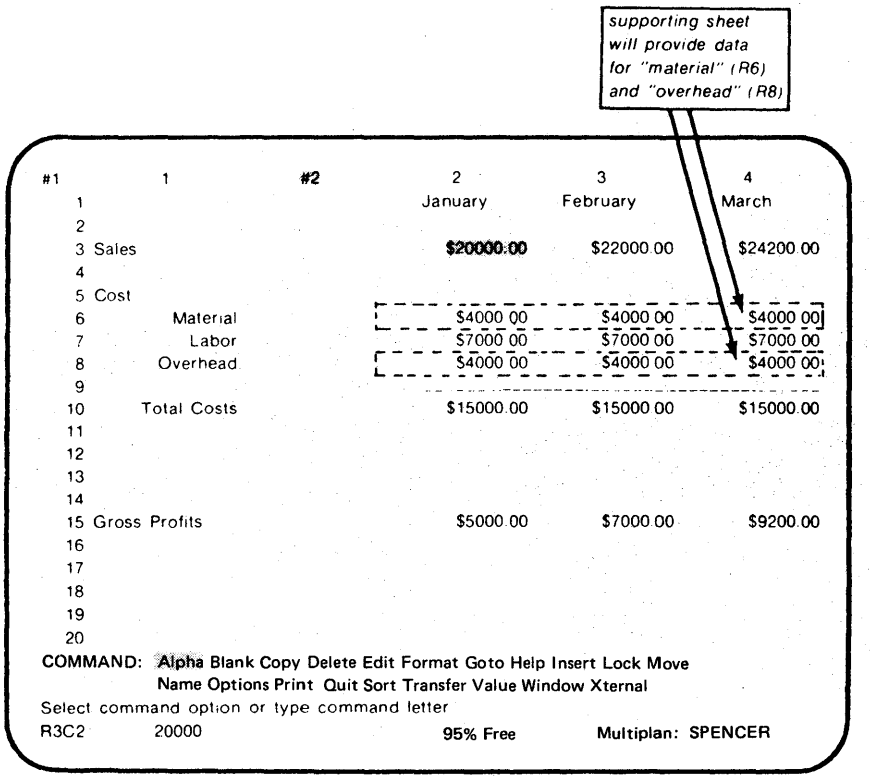


Once an inactive sheet has been connected to an active one, named cells from the former may be used in formulas if they have been prepared in a special way. We will come to that in a moment. (You will recall that one group of cells on *SPENCER* has already been named: *salesline* refers to row 3, columns 2 through 13.)

Look at the following more detailed breakdown of Spencer Ceramics' costs for January.

Material		Overhead	
Clay	$1500	Utilities	$1100
Glaze	1500	Rent	2500
Brushes	500	Telephone	200
Sponges	200	Water	200
Plaster	300		
Total	$4000	Total	$4000

You now want to set up a second worksheet for costs that will supply data for rows 6 and 8 (assuming for the present that labor costs remain the same).



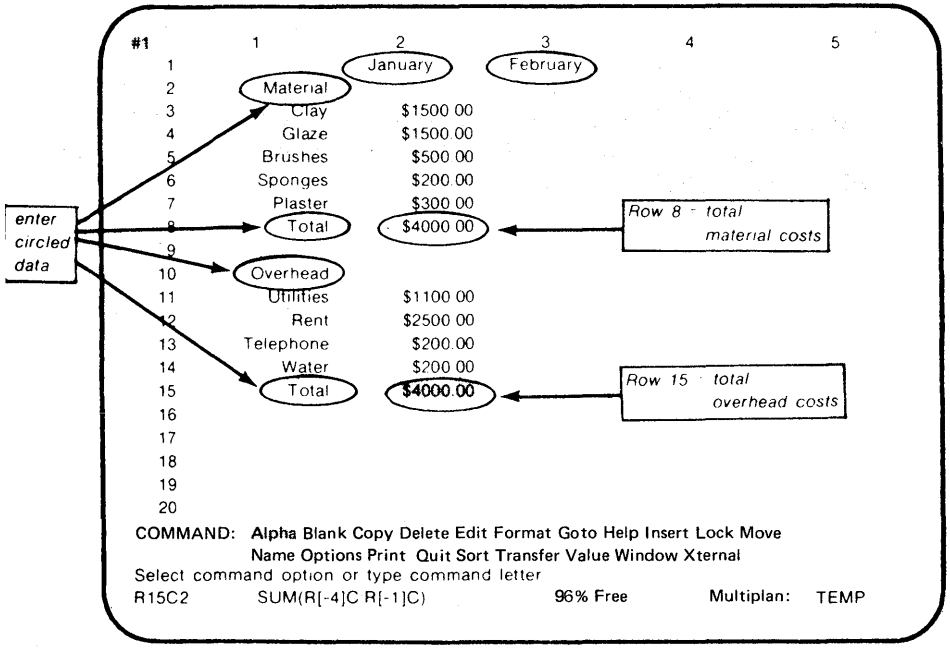
The Transfer Clear Command

Use the Transfer Clear command to clear the screen and make room for the new worksheet (be sure to save the *SPENCER* sheet first).

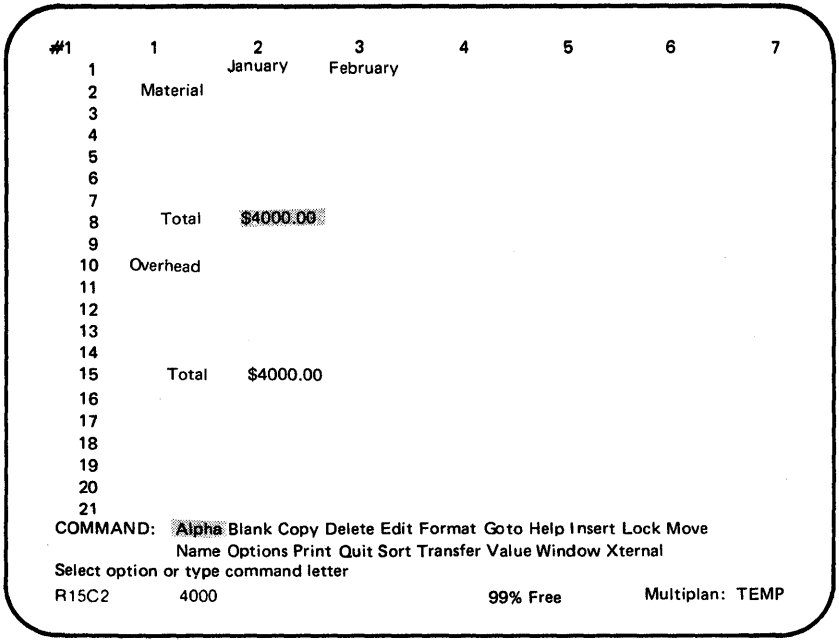
Note The Transfer Clear command clears the sheet of all numbers, entered information, and name definitions. It prepares a completely new sheet, destroying the old one unless it has been saved. Therefore, if you have entered any new permanent information since you loaded the sheet, be sure to save it first.

Building a Supporting Sheet

It is not necessary to construct an entire supporting sheet to illustrate the use of the eXternal command. You will be able to see how Multiplan draws from other worksheets by the use of a simple example. Use the following sample worksheet as a guide:



Set up just the totals of the two main categories, using row 8 for *Total Material Costs* and row 15 for *Total Overhead Costs* as follows:



Costs will increase as sales increase. Include these increases in your table. Starting with February, enter a formula increasing total costs in each category by 8%. Copy these formulas to the right 10 cells (RC[-1]*1.08).

The eXternal Command

Before you continue with the new figures, a word of explanation about the eXternal command would be helpful. The command is initiated by typing an X for "external."

First you will load the sheet containing the cells you want to use in your work in another sheet. Second, name the cells you want to use. Third, load the depending sheet and use the eXternal Copy subcommand to use the values associated with the name in step two.

The current sheet contains an itemized list of costs for each month of the year. You are now ready to name the cells from which you will draw information on the depending sheet.

The row showing material costs (R8C2:13) can be named **materialcosts** using the Name command. Cell names may be up to 31 characters long, so there is no need to abbreviate them unnecessarily. Now use the Name command again to name the row showing the overhead costs (R15C2:13) as **overheadcosts**.

Now that you have named the cells, use the Transfer Save command to save this sheet as SPENCOST. Then clear the screen using the Transfer Clear command.

You do not need to name the individual cells in the named row (e.g. materialscostsJanuary, materialCostsFebruary). When you call for a named area from an inactive sheet, Multiplan will import the area defined by the name.

To use the supporting data, load the Spencer sheet once more. Place the cell pointer on the cell showing Total Costs for January (R10C2). The formula on the status line shows that Total Costs are derived by adding the three rows above it:
SUM(R[-4]C:R[-2]C).

The Total Costs cell adds group totals for a bottomline cost figure. You have prepared supporting detail for these totals on the sheet SPENCOST, and totaled the detailed items there. You must now change this sheet to use those totals. While the group is broken down in detail on the supporting sheet, this summary sheet is kept uncluttered by detail. If Spencer Ceramics add a new type of material cost (such as packing boxes) on the SPENCOST sheet, total costs will still be reflected accurately in the summary sheet, SPENCER.

eXternal Copy Command

At this point you know that the data needed are part of the saved sheet, SPENCOST, but Multiplan doesn't. You must tell Multiplan about the supporting sheet with the eXternal Copy command. Position the cursor to R6C2.

Note You must Blank the cells which will become targets of an External copy. An eXternal Copy will not be allowed in a non-empty cell.

Blanks cells R6C2:13.

Now perform the eXternal Copy. Press X. Multiplan displays:

EXTERNAL: Copy List Use

Press C. Multiplan displays:

External Copy from sheet: **name:**
to : R6C2 **linked: (Yes) No**

Enter the name of the supporting sheet: SPENCOST and press TAB.

Type materialCosts in response to the name prompt and press TAB.

Multiplan has already suggested R6C2 as the destination. This is correct so press TAB.

The 'linked' field allows you to specify whether or not the depending sheet will be updated whenever the values in the supporting sheet are changed. If you specify NO, the value from the supporting sheet is copied at the time of the eXternal Copy and is never updated. Leave it as Yes and press RETURN.

The values in row 6 will be updated with the material cost totals from the SPENCOST sheet (i.e. R6C2 contains $4000.00, etc). Note that the value associated with R6C2 is [SPENCOST materialcosts].

Use eXternal Copy again to copy the overhead cost totals. You now have retrieved values from an inactive sheet! Changing the totals on the SPENCOST sheet will be reflected accurately in the summary sheet, SPENCER.

Restrictions on Cells Referencing Supporting Sheets

Certain restrictions apply to cells which are recipients of values from supporting sheets and are linked to them. Note that these restrictions only apply if a permanent link is associated with the eXternal Copy (linked = Yes).

1. Cells with values obtained via the eXternal Copy command cannot be BLANKed using the BLANK command. They, however, can be disassociated from their link by specifying the source sheet, the source name, and an empty destination.

2. These cells cannot be edited. Their values, however, can be referenced from other cells (i.e. in the example above, R6C2 can be part of a formula in any other cell).

3. A linked cell cannot be the source of a COPY command.

eXternal Command Summary

1. Develop the supporting sheet by naming the cells intended for use on the depending sheet.

2. Load the depending sheet by using the eXternal Copy command to copy the values (and optionally produce a link) to the supporting sheet.

3. Save the depending sheet (use Transfer Save) to maintain connections to the supporting sheets.

eXternal List Command

You may verify the connection by using the eXternal List command (XL).

The eXternal List command displays what Multiplan knows about the relationship between the various sheets. The lists of "sheets supporting" show the names used in the present sheet that call for values from other, saved, sheets. The lists of "sheets depending on" shows the names of other, saved sheets that call for a vlaue or values from the active sheet.

Multiplan displays this information on the screen by overwriting the current sheet. Press any key to regain the active sheet on the screen.

The relationship between SPENCER and SPENCOST is not, at present, permanent. You can make it so by saving the active sheet. Multiplan will record dependency — established with eXternal Copy — in both saved sheets. After you have saved the active sheet, SPENCER will always depend on SPENCOST, and SPENCOST will always support SPENCER. If you don't save SPENCER now, you will have to do the eXternal Copy again when you load it and re-enter the eXternal Copy command.

The eXternal Use Command

Suppose you create another sheet named "PROJECTEDSPENCOST" which, like the original SPENCOST, is an itemized tally of the costs projected with a 12% monthly increase?

Load the SPENCOST sheet, change the formula to use 12% instead of 8% and save the sheet as PROJECTEDSPENCOST. Reload your SPENCER sheet.

You could, of course, now use the eXternal Copy command to reference the costs from the new sheet. In order to do so, you would have to remove the existing link to SPENCOST, and make a link to PROJECTEDSPENCOST.

You can, however, use the eXternal Use command to substitute (or alias) the name of the supporting sheet. Press X and U (for Use). Multiplan displays:

External Use: sheet name: instead of:

Type in PROJECTEDSPENCOST and SPENCOST. Note how the values change to the new projections!

What if...?

Used in this manner, Multiplan is a very powerful tool, not only for keeping up-to-date, accurate records, but also for asking "What if...?" questions, such as:

What if material costs increase by 12% rather than 8%?

What if overhead costs rise sharply this fall?

What if sales of one item drop off dramatically?

By changing and saving figures on supporting sheets, you can immediately see the effects on overall costs and profits. Experiment for yourself now!

Using Multiplan With Business Graphics

Multiplan is an extremely useful tool for business calculations. Multiplan allows you to analyze data in many ways. How? For example, the final step in the analysis of data is typically the presentation of conclusions in a tabular fashion. Sheets full of numbers often tend to confuse rather than clarify trends. Careful analysis may get lost in the sea of numbers. The ability to graph results can surely enhance report generation and trend analysis.

The Business Graphic Package is a tool used for creating graphs from tabular data. Business Graphics can create Line, Pie, and Bar (stacked and comparative) graphs from the data compiled using Multiplan. Moments after the Multiplan sheet is completed, several graphs can be plotted to pictorially depict findings!

Using Business Graphics

Multiplan and Business Graphics are closely linked to provide quick transitions between programs. Multiplan is used to create the worksheet, enter data, and perform analysis. When ready to graph, select the data and type of graph, and instantly the graph appears on the screen.

The Business Graphics package can manipulate the graph -- change its size, combine with another graph, add annotations, etc. To select different data, simply reenter Multiplan, select new data or type of graph, and a new graph appears.

Each package has features for its role in the analysis process: Multiplan for entering and manipulating numbers; and Business Graphics for preparing, annotating, and manipulating the graph.

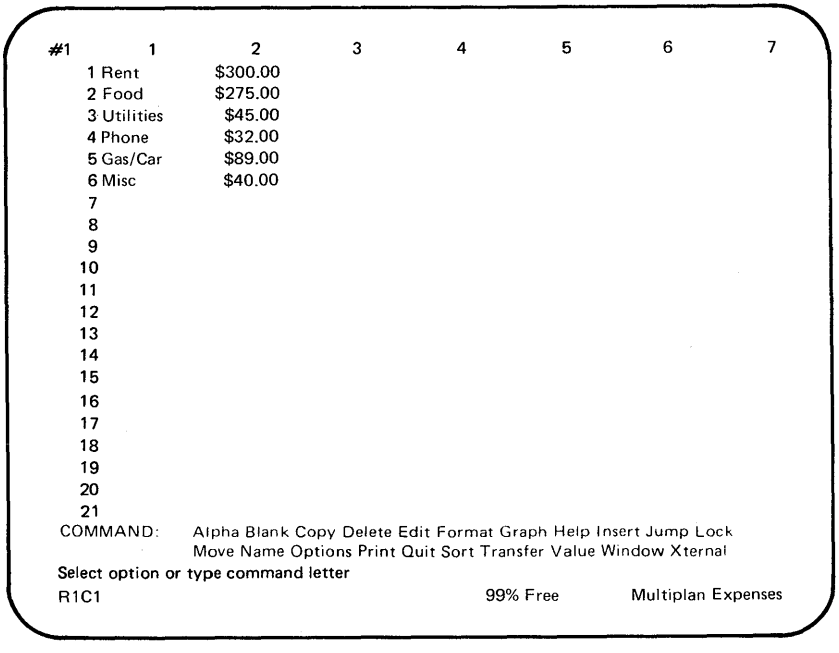
Before you continue with this lesson, review the Business Graphics User's Guide. This guide serves as an introduction to Business Graphics.

Sample work sheets are supplied with Multiplan. These worksheets will be used during the next portion of this lesson. These sheets are located in the Tutorial directory of your distribution diskette. If you have not already done so, copy these files from the Tutorial directory to your working directory. Do not use them directly from your distribution diskette!

Pie Graphs

Pie graphs are useful for showing the contribution of each element to the total. For example, what portion of one's income is spent on rent, food, utilities, etc.

Use the Transfer Load command to load the file called EXPENSES. When the file is successfully loaded, our screen will appear like this:



Now press *G*. The command line now shows:

GRAPH: Bar Line Pie Options

To select a pie graph, press *P*. The command line now shows:

GRAPH PIE segment labels: C1 values: C2
format file: [sys] <sys> Pie

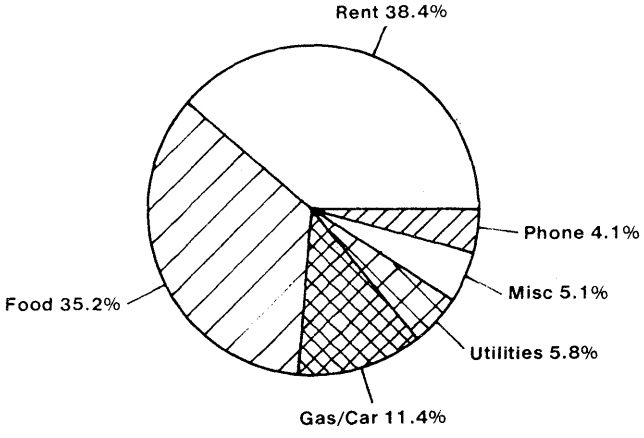
Press RETURN. The screen blanks and within a few seconds a pie graph appears on the screen depicting the portion of your income spent on each type of expense.

NOTE: If you have previously run this tutorial, the message:

"Expenses already exists. Overwrite?
Press GO to confirm, CANCEL to deny"

will appear at the bottom of the screen. Press GO and the graph will appear.

Expenses



For now, let's return to Multiplan. To do so, press FINISH and GO. The Multiplan spread sheet reappears on your screen.

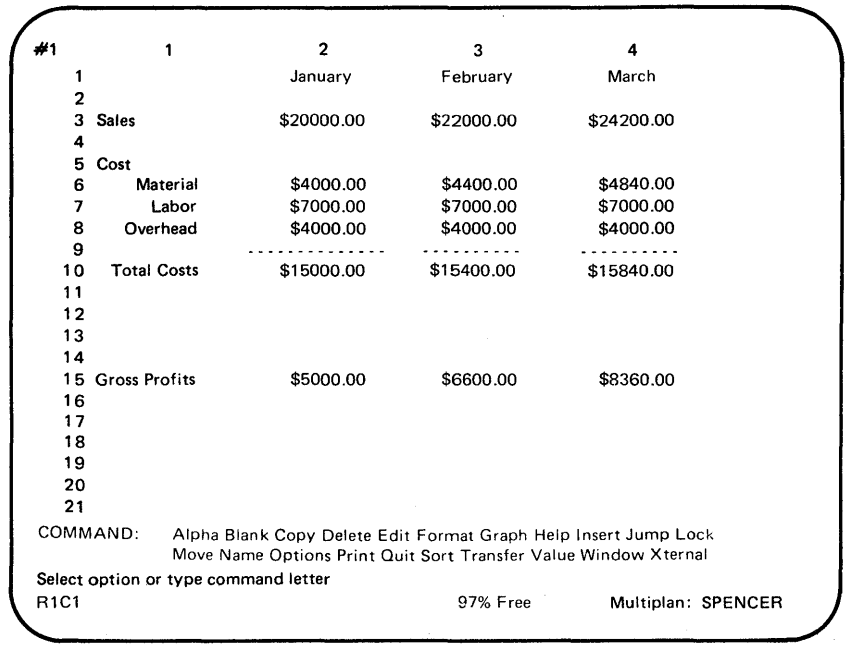
Press *G* and *P* to display the GRAPH PIE command line.

This command has three fields: LABELS, VALUES, and FORMAT FILE. Multiplan selects C1 (or column 1) as the proposed response for LABELS. This means that the cells in column 1 (in this case C1R1 through C1R6) are to be used as the labels. Column 2 is selected as the proposed response to the VALUES field. (The use of the Format File field will be discussed later).

Pie graph segments each contain two pieces of data: a label and a value. Multiplan proposes the cells in column 1 or row 1 (depending on the orientation of the sheet) for the labels, and the corresponding cells in column 2 or row 2 for the values. (Note: Multiplan's proposed responses are intended to be examples of typical responses to this command and may not work for all sheets which you construct).

Of course, the data which you wish to plot will not always be in the first two rows or columns of the sheet. You are allowed to select data from anywhere on the sheet.

Let's draw another pie graph. For this one, let's use the data from the SPENCER worksheet. Use the Transfer Load command to load the sheet named SPENCER. This sheet should be very familiar to you since it was used in the previous lessons.

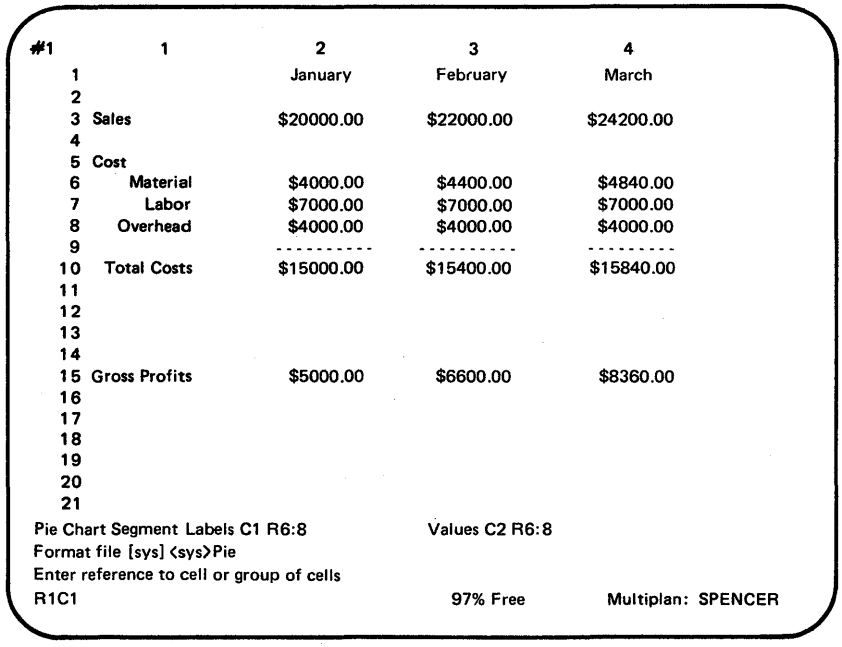


Suppose you wish to draw a pie graph detailing costs.

Press *G* for Graph.

Press *P* for Pie.

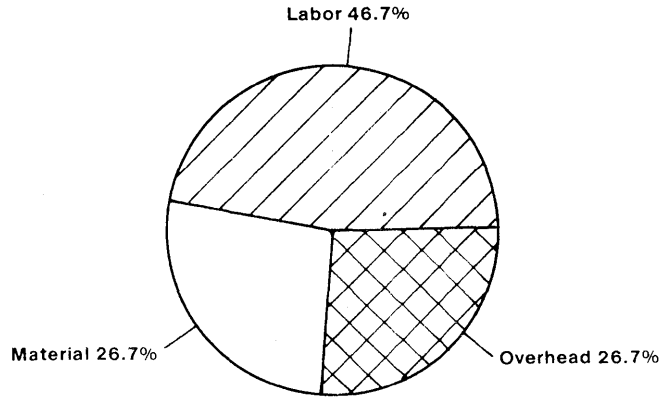
Enter C1R6:8 to select the cells "Material", "Labor", and "Overhead" as the labels.



Multiplan has selected C2 as the source of the values. Each label must have a matching value, therefore the cells in rows 6 to 8 of column 2 are picked as the values to graph.

Now press RETURN. Your screen shows a graph of the percentage each component contributed to your cost. Press FINISH and GO to return to Multiplan.

Spencer



When drawing pie graphs, always remember to select cells from the same row or column as labels. These cells, however, may be disjoint. Alpha or numeric cells may be used as labels.

The cells to be used as values should be all numeric. Blank or alpha cells are ignored. Cells containing a zero value are given a 0% segment.

Line Graphs

Line graphs are the most common graphs produced. For this example, let us use the SPENCER sheet again to plot Sales, Costs, and Profits for the year.

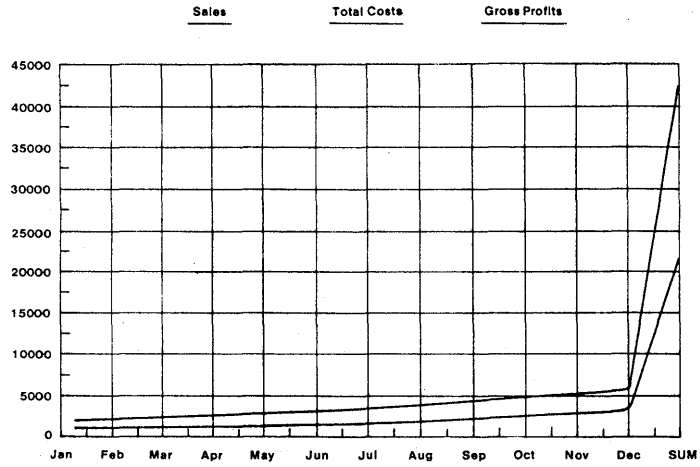
Select the Graph Line command by pressing *G* (Graph) and *L* (Line). The command line shows:

GRAPH LINE X Cells: C1 Y Cells: C2
Y axis label: format file: [sys] <sys> Line

Multiplan proposes graphing column 1 and column 2 (which is definitely an uninteresting line graph). Select R1 for the X Cells and R3,R10,R15 for the Y-Cells. Note that you are telling Multiplan to graph rows 3, 10, and 15. Each row is graphed as an individual line in the graph.

Now Press RETURN to produce the graph as shown below.

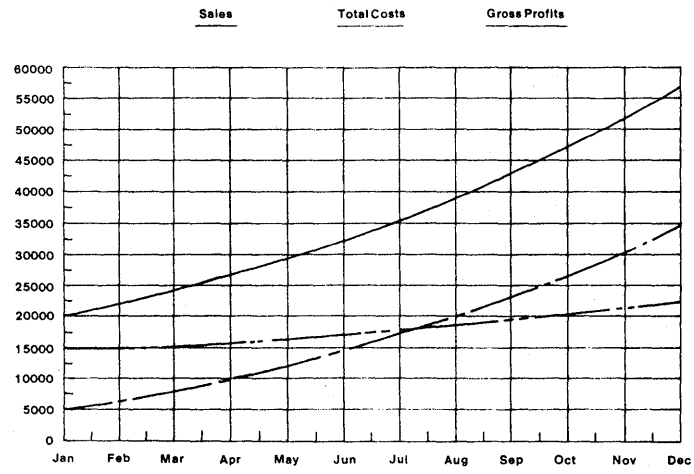
Spencer



The graph shows the growth of sales with marginally rising cost resulting in a strong growth in profits! But what is that large jump at the end? Why was there such a dramatic change in one month? Let's return to the Multiplan sheet to try to figure out what happened. To return to Multiplan, press FINISH and GO.

Use the RIGHT ARROW key to scroll right to columns 13 and 14. Note that the values in column 14 are the sum of the previous 12 columns! This column should not have been included in the graph. Multiplan did what you told it (i.e. graph the rows 3, 10, and 15 versus row 1). It had no way of knowing that it should not have included the values in column 14!

Let's adjust the command. Select the Graph Line command by pressing *G* and *L*. Now change the X value field from R1 to R1C1:13. Note that Multiplan automatically matches the Y values to the cells (i.e. R3C1:13,R10C1:13,R15C1:13) so you don't have to change the Y values. Now press RETURN. Your new graph is correct.



What just happened should demonstrate the need for you to verify the data which you are graphing. Perform visual checks on your data to assure the validity of the data until you become more familiar with Multiplan and Business Graphics.

To draw line graphs, specify the cells to be used for the X Axis in the field labeled X Cells. Typically, this reference is time-based such as a list of years, quarters, or months. The first cell in this reference is used as the label for the X Axis. The rest of the cells are placed along the X Axis. All of the X Cells must be from the same row or column.

Y Cells match the X Cells (i.e. if the X Cells field contains R1C2:5 then if the Y Cells field contains R5, Multiplan will automatically pick R5C2:5), so it is necessary to select only the row or column in the Y Cell field and not each individual cell. Like the X Cells, the first cell in each Y Cell row or column is used as the name (legend) of the line. Selecting several rows or columns draws multiple lines on the graph.

Bar Graphs

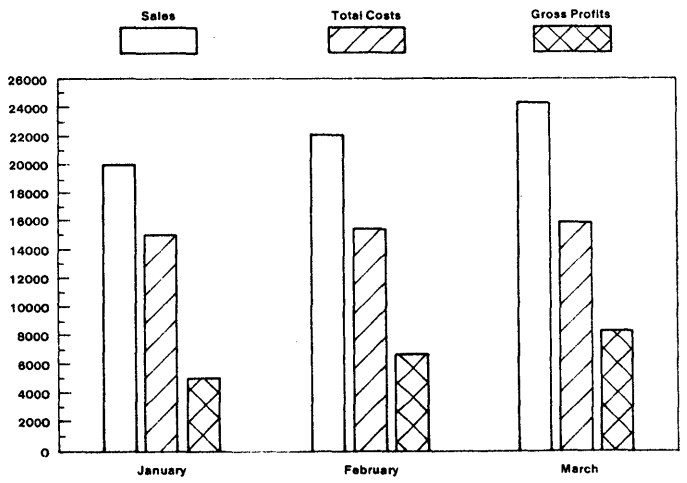
A bar graph is the most descriptive graph which can be produced. Bar graphs can add a third dimension to a graph by providing simultaneous comparisons of different objects. We previously used the SPENCER sheet to make a pie graph comparing the portion each of Material, Labor, and Overhead contributed to the cost of sales. We can use bar graphs to compare these portions for each month. Let's compare Sales, Cost, and Profits for the first three months of the year.

Select the Graph Bar command by pressing *G* (Graph) and *B* (Bar).

The first two fields are labeled 'Group by' and 'Legends'. The **Group by** field indicates which cells identify each bar graph group. To group the bars by month, type in C2:C4 corresponding to the columns for January, February, and March. The Legends select each bar to be graphed. Select legends as R3,R10,R15. This selection identifies three groups (months) each having three values (sales, cost, and profit).

GRAPH BAR group by: C2:4 legends: R3,R10,R15
Y axis label: format file: [Sys]<Sys>Bar

Press RETURN to graph the result. The graph appears as follows:



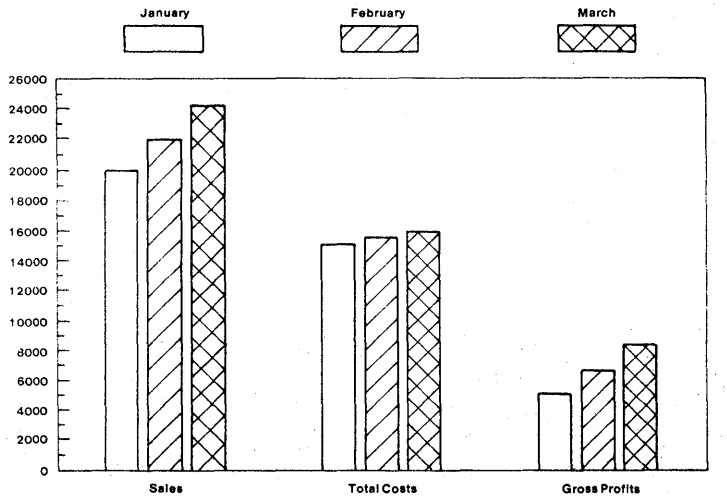
Press FINISH and GO to return to Multiplan.

Let's change our graph now. Select the Graph Bar command and type in the arguments as follows:

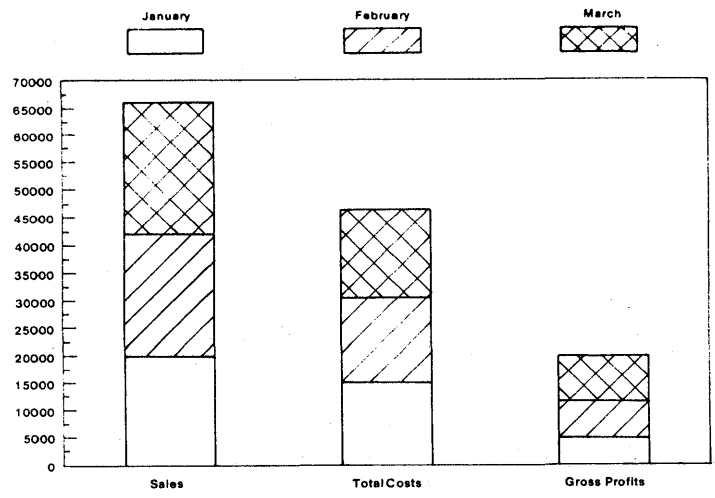
GRAPH BAR group by: R3,R10,R15 legends: C2:4
Y axis label: format file: [Sys] <Sys> Bar

Press RETURN to graph the result. Note that now we see the growth of sales and profit by month with little change in cost! Changing the orientation of the graph emphasizes something very different.

Spencer



Now press the MODIFY key (f1) to modify the graph and the AXES key (f5) to change the axis parameters. Press the DOWN ARROW and GO keys to select 'Stacked'. The new graph appears showing Sales, Costs, and Profits. Look at the Profits bar to see how most of the profits were produced in March. Again a small change in the display of the graph accents another feature.



Press FINISH and GO to return to Multiplan.

Here is an easy way to make bar graphs. Find the area on the sheet you wish to graph and draw a box around it. The left and upper edge of the box should contain the labels for the graph. If the labels of the upper edge are to be placed on the X Axis, then enter this list in the GROUP BY field.

Now enter the list of cells which make up the labels of the left edge of the box into the LEGENDS field.

Note that if the cells in the GROUP field define a row, the cells in the LEGENDS field must define a column and vice versa.

Format Files

Each of the graph commands has a field labeled "Format file". Format files are created within the Business Graphics Package and affect the presentation (annotations, scaling, etc.) of the graph. Multiplan automatically proposes the proper default format file supplied with the BGP distribution depending on whether you have a color system or not. Multiplan allows you to select a format file for each graph. Instructions for the creation of these files are provided in the Business Graphics User's Guide.

The Graph Options Command

Select the Graph Options command by pressing *G* and *O*.

Multiplan displays:

GRAPH OPTIONS title: Spencer palette file name: use labels from sheet: (Yes) No

All the graphs which you have been making had the name of the sheet as the title. This name is usually not appropriate as a title. The title field allows you to insert your own annotation for the title for the graph. This title is used for all graphs until you load a new Multiplan sheet or use the Transfer Clear command.

Graphing Complex Sheets

So far, we have made relatively simple graphs. Your spread sheets will become more and more complex as you become more familiar with Multiplan.

Multiplan helps you graph complex sheets by ignoring blank rows and columns. In addition, any rows or columns which have text are also completely ignored.

In order to select the data from these sheets, you should remember these rules:

Pie Graphs

- All of the labels must be from a single row or column. They can be disjoint, however. For example, the references R1C1:5 and R1C1:3,R1C6:8 are legal entries for labels. R1C1:5,R2C2:3 is not.

- Multiplan automatically picks the corresponding cells in the column / row as values. For example, if you specify:

  labels: R1C1:5,R1C7:9 values: R4

- Multiplan picks cells in columns 1 through 5 and columns 7 through 9 of row 4 as values to match the labels in row 1.

- Selections for values must be in the same single row or column and must correspond (or match up) with the labels. For example, the selection:

  labels: R1C1:5 values: R1C2:6

  is invalid because the labels and values do not line up. Similarly, the selection

  labels: R1C1:5 values: C7

  is also invalid because the labels are row-aligned and the values are column aligned.

Line Graphs

- Like pie graphs, the X values must be a single row or column. The first cell in your selection is used as the X axis title.
- Each Y value selection must be a single row or column and must correspond (or match up) with the X values.
- The first value of a selection is used as the name (or legend) of the line. For example, the reference R1C1:9 uses the cell R1C1 as a name and R1C2:9 as the values.

Bar Graphs

- Values for bar graphs are chosen from the intersection of the selections for groups and legends. For example, the selection:

  group by: C2:10 legends: R5

  is valid. However, the selection:

  group by: C2 legends: C6

  is invalid because the groups and legends never intersect.

Summary

You have learned much about operating Multiplan, one of the most versatile business programs yet developed. Further details of commands, subcommands, functions, and formulas are available in Parts 2 and 3 of this manual.

Multiplan has provided extensive help text available at your fingertips as you are using Multiplan. Press the HELP key whenever you are unsure about a command or a field in a command. The HELP key allows you to review information without having to refer to the manuals.

In this session you learned:

How worksheets interrelate.

How worksheets provide data to and/or take data from other worksheets.

How to name sheets for easy reference.

How to clear the screen, to start afresh, using the Transfer Clear command.

How to use the eXternal command to use the data from supporting sheets.

How to find out the relationships between sheets using the eXternal List command.

Part 2
Exploring Multiplan

Chapter 8
Command Entry and Editing

There are many typing aids available to make your input into Multiplan easier and more efficient. This chapter will tell you about them.

The command lines are used for two different activities: (1) giving commands to Multiplan, and (2) setting or changing the contents of cells. The two activities have different purposes and are done at different times, but Multiplan's typing aids are used in both. We'll look at command entry first.

Choosing Commands

You've probably noticed the first typing aid already: you never need to type more than one letter to select a command. This is called *choosing a command;* it's done when the command line shows the legend COMMAND: and a list of words. When you start Multiplan, it will be in this state. Note the legend COMMAND: and the list of words after it. The first word, Alpha, is highlighted. The message line (the second line from the bottom of the screen) reads "Select command option or type command letter."

At this moment Multiplan is in **choice mode** because all you can do is choose a command. Whenever Multiplan is in choice mode you are limited to choosing one from a list of actions. At the moment, your choice is limited to the names of the Multiplan commands, from Alpha to eXternal.

A choice can be made in either of two ways. You can choose an item from the list by typing its initial letter, such as A for Alpha. Or you can indicate your choice by moving the edit cursor (the highlighted box) onto the word you want and by pressing the RETURN key. Before you try either of those things, you should know about a great confidence-builder that Multiplan provides: the CANCEL key.

The CANCEL Key

One of the keys on your keyboard is devoted to stopping any command you don't want to finish. It could as well be called the "skip it" key. Whenever you want to say "skip it" to Multiplan, press that key. It stops all pending actions and puts you back to command choice at once. Try CANCEL now. Nothing much happens.

Exploring Command Choice

Choose the Print command. Do it by pressing the space bar 13 times. Each time you press the bar, the edit cursor jumps to the next word in the list (the BACKSPACE key moves it the other way). When the word *Print* is highlighted, press RETURN. Multiplan rewrites the command lines to show the Print command. The Print command is divided into four parts: Print File, Print Margins, Print Options, and Print Printer. Multiplan is waiting for you to choose which part you want. This is another example of being in choice mode. You can read about the Print command in Chapter 12, "Command Directory," and you'll find examples of its use in Chapter 6, "Printing Your Work." Our interest here is in the mechanics of entering commands.

Press CANCEL. See how easy it is to "skip it"? You can go as far into a command as you like. *As long as you press* CANCEL *rather than RETURN, nothing will happen.*

Choose the Jump command. You could do it by pressing the space bar six times and pressing RETURN, but there's a quicker way. Just pressing the *J* key has the same effect.

A number of commands are divided into parts in the same way that Print is. As you see, Jump is divided into Jump Row-column, Jump Window, and Jump Name. When a command is divided into parts, you must choose which you want. The second choice works just like the first: choose a part either by pressing its initial letter or by highlighting the word and pressing RETURN. *Z* is

not a choice offered by Jump; press it anyway. Multiplan emits a squawk and ignores your input. Press CANCEL; we don't want to Jump anywhere in particular just now.

Fields and Proposed Responses

Choose Print and then choose Margins (use either method of choosing—press *P* and then *M*, or press the space bar 13 times, then RETURN, then two spaces and RETURN, or any combination). Multiplan rewrites the command line to show the Print Margins command. That, like many commands, has several **fields.** Multiplan expects a **response** in each of them. The fields of Print Margins are headed "left:," "top:," "width:," and "length:."

In almost every case where Multiplan expects a response, it proposes one. These proposed responses show Multiplan's best guess at your choice and will be right about half the time. The rest of the time you'll have to change the proposed response.

The TAB Key

Notice that the response of 5 in the first field is highlighted by the **edit cursor.** The cursor shows the active field, the one you can work on right now.

The TAB key is used to move the cursor from one field to the next. Press TAB. The cursor jumps to the next field. Press it a few more times. The cursor moves from field to field; when it gets to the last one it jumps back to the first.

Replacing a Response

Whenever you've just tabbed to a field, you can blank out the response in it with one keystroke. TAB to the "width:" field, with its proposed response of 70. Notice that the cursor—the block of highlighted characters—has spread out to cover the entire re-

sponse of *50*. Hit the space bar just once. The entire response is blanked out. Type in *999* (you've just entered a response in a field).

Now TAB around the circle and come back to the "width:" field again. Notice that when you get there, the cursor widens to highlight the entire response of *999*. The wide cursor is the sign that the whole response is up for replacement. Type a *1*. All three characters *999* vanish and are replaced by the digit *1*.

The Meaning of a Wide Cursor

This action is unlike that of any typewriter you've ever seen, but it is consistent. The cursor shows where the next character you type will go. When the next character will insert before a single character, the cursor is just one character wide. The next character will replace an entire response, when the cursor widens out to cover that entire response.

Typing and Backspace

To introduce the editing keys we'll want a command that gives us more scope. Press CANCEL and then choose the Edit command (press *E*). Edit is one of the commands used to set or change the contents of a cell (we'll list them all shortly). If there's anything in the active cell, Multiplan writes it on the command line so that you can change it. The active cell is probably blank, so the command line will be empty.

Type the following words on the command line:

```
The quick brown fox jumps over the lazy dog
```

Notice how the cursor moves along as you type. Try the BACKSPACE key; it moves the cursor backward and erases a character. If you don't have a key labeled BACKSPACE, check the reference card for the substitute. Use BACKSPACE to correct any typing errors you might make, as you make them.

FORWARD (Next) (f10) and BACKWARD (Prior) (f9) Character Keys

Look on your keyboard to see the f9 key that serves the function of BACKWARD (prior) character. That key moves the cursor to the left without changing anything. Press it several times and watch the cursor move from character to character.

Check the keyboard again to find the f10 key that serves as the FORWARD (next) character key. Press it a few times; then alternate it with the BACKWARD character key (f9). Move the cursor into the middle of the sentence.

FORWARD (Next) (CODE-f10) and BACKWARD (Prior) (CODE-f9) Word Keys

The TAB and BACK-TAB keys move the cursor by whole fields; the FORWARD and BACKWARD character keys move it by single letters. There is a middle level of tabbing: the FORWARD and BACKWARD word keys. You'll find that Multiplan's idea of a "word" conforms pretty well to your own, except that it stops between words as well. Be sure to try these tab keys when working with a formula. You'll see then that Multiplan treats formula symbols as words.

Inserting Characters

Move the cursor to the word *quick* with the FORWARD (CODE-f10) and BACKWARD (CODE-f9) word keys. Then press the BACKWARD character key once. The cursor shrinks to cover only the *q*. Move it left once more using the BACKWARD character key. Now it is on the space between *The* and *quick*. Type the letters *very*. They do not replace anything; they

are inserted one at a time to the left of the cursor. Whenever the cursor is not at the right end of the field, a typed character is inserted among the characters that are already there.

Deleting Characters

Check the keyboard and find the key which serves as the DELETE key. The cursor is sitting on the space between *very* and *quick*. Move it once right with the FORWARD character key (f10). Then press DELETE. The *q* vanishes and the rest of the sentence moves over so that *u* is under the cursor. Remove the rest of the words *quick brown* with the DELETE key. Type in the letters *slow red*.

Use the BACKWARD word key to tab back to the word *very*. Notice that when you use the tab keys, the cursor spreads out to cover the entire word: it is now covering the entire word *very*. Press DELETE; it removes whatever is under the cursor. In this case it deleted the word *very*. It left the two spaces that used to separate *very* from *The* on its left and *slow* on its right. Press DELETE again to delete one space.

Editing Cell Contents

Even though the words now on the command line (*The slow red fox jumps over the lazy dog)* don't make a lot of sense, let's put them into the active cell anyway: press RETURN. Multiplan completes the Edit command by placing the words in the active cell. That's the whole purpose of Edit: to bring the contents of a cell to the command line where it can be modified, and then to return the modified contents to the cell.

The active cell should show the error display #NAME? (error displays are discussed in Chapter 10, "Formulas"). This one means Multiplan doesn't know what to make of *The,* not to mention a slow fox. We don't care what Multiplan thinks about it; this is an experiment. Notice that the actual contents of the cell are displayed on the status line.

Making a Change

Often you want to change a cell's contents by adding characters at the end. When the Edit command begins, it shows the present contents of the cell and positions the cursor at the end.

Try it: choose Edit. Backspace over the word *dog* and type the word *frog*.

Making a String

Type a double-quote (") after the word *frog*. Then move to the head of the line with the BACKWARD word and BACKWARD character keys, until the cursor is highlighting the *T* of *The*. Type another double-quote. You've converted the sentence into a string (a series of characters enclosed in quotes). Put it back into the active cell by pressing RETURN. The error message #NAME, disappears and the string appears on the sheet without the double quotes. Multiplan didn't understand the individual words, but a string in quotes is something it can accept.

Setting the Contents of Cells

The Edit command allows you to set anything in a cell: a string, a number, or a formula.

There are three ways (besides Edit) to signal Multiplan that you want to put something into the active cell. There are specific ways to enter a string, a number, and a formula.

Entering Strings

As you've just seen, you can enter a **string** by typing a double-quote, any characters you like, and another double-quote. If you don't use the double-quotes at each end, Multiplan will try to interpret your sentence or title as a formula. That's what happened when we first tried to store the sentence about the fox.

It's a bit tiresome to type the double-quotes when you have to enter several strings. The Alpha command saves you the effort. Move the cell pointer down again, and then choose *A*. Multiplan posts the legend ALPHA:, and puts a reminder on the prompt line that you don't have to use double-quotes. Type the sentence

A quick fox needs no quotes.

and press RETURN. Multiplan places the sentence in the active cell. Check the display of the cell contents on the status line; you'll see that quotes were added. Choose Edit. The sentence, with quotes, returns to the command line. Press ABORT, then choose Alpha. The sentence, without quotes, appears. You could edit it with either command. Press ABORT.

Entering Numbers

The majority of cells contain **numbers.** The easiest way to put a number into a cell is to type it. As soon as you type a digit from 0 to 9 or a minus (-), or a decimal point (.), Multiplan posts the legend VALUE: on the command line, followed by the digit. Keep typing the number; press RETURN when you're finished. Move the cell pointer down and type *2001.* As soon as you press the *2,* the command line changes to show VALUE: 2 followed by the cursor. Finish the number and press RETURN.

Entering Formulas

A **formula** is a recipe that tells Multiplan how to calculate a value; you'll find a longer discussion in Chapter 10, "Formulas," and examples in Chapters 2 through 6. There are two ways to put a formula in a cell. One is to use the Edit command, which you've already seen. The other is to use the Formula command, chosen by typing an equals sign (=), a plus (+), or a left parenthesis. Choose Formula by pressing = now. Multiplan writes VALUE: on the command line. At this point you could enter a number or a string in quotes. Instead, enter this simple formula:

```
2+2
```

and press RETURN. Multiplan places the formula in the cell, calculates its value, and displays that value. The status line shows the cell's contents (the formula 2+2) while the cell displays the value of the formula: 4.

Conclusion

This section has taught you about Multiplan's typing aids, an imaginative set of computer helps designed to make you more productive. Try to take advantage of all of them as you build your next sheet.

Chapter 9
Cell References

You *refer* to cells in both commands and formulas. For example, in the command

```
BLANK cells: R1C2
```

the letters *R1C2* are a **reference** to a particular cell; specifically to the second one from the left in the first row.

Reference Elements

Multiplan provides a variety of ways to state references, based on a few simple elements combined according to a few simple rules. The elements of references to rows are:

Element	Meaning
R	the active row
R*n*	row number *n*, from 1 to 255
R[+*n*]	the row *n* below the active one
R[-*n*]	the row *n* above the active one

The elements of references to columns are similar:

Element	Meaning
C	the active column
C*n*	column number *n*, from 1 to 63
C[+*n*]	the column *n* right of the active one
C[-*n*]	the column *n* left of the active one

Each of these elements is a correct reference itself. For example, the formula

```
MIN(C)
```

means "the least value in any cell in this column," while

```
BLANK cells: R2
```

means "put blanks in all cells in the second row."

The row and column elements may be combined to make other references according to three rules: the intersection rule, the range rule, and the union rule.

Intersection of Elements

The **intersection** rule says that when two references are written with nothing but a space between them, the reference is to the cells at the intersection of those two references; that is, to the cells that the two references have in common.

The most common use of intersections is to name a single cell. For example, R3C5 is a reference to the single cell at the intersection of row 3 and column 5. R3C5 is such a clear designation of that cell that you probably don't think of it as an intersection; it's just the way you refer to that cell. Multiplan, however, sees it as a reference R3 (meaning all cells in row 3) intersected with C5 (all cells in column 5). The only cell that row 3 and column 5 have in common is the single cell you have in mind.

The elements above may be intersected in any combination. Here are all sixteen possible intersections of elements.

RC	RC[+*n*]
R*n*C	RnC[+m]
R[+*n*]C	R[+*n*]C[+*m*]
R[-*n*]C	R[-*n*]C[+*m*]
RC*n*	RC[-*n*]
R*n*C*m*	RnC[-*n*]
R[+*n*]C*m*	R[+n]C[-*m*]
R[-*n*]C*m*	R[-n]C[-*m*]

Of course you could give any of those references in reverse order. RC and CR are identical in their effect.

When writing simple intersections it's easiest to run the elements together: R1C1.

Range of Elements

The second combining rule is the **range** rule. It says that when two references are written with a colon between them, the reference is to the smallest rectangular area that contains both.

The most common use of the range rule is to refer to ranges of rows or columns. For example, R3:R9 is a reference to all cells in rows 3, 4, 5, 6, 7, 8, and 9. That's the "smallest rectangular area" that includes all of R3 and all of R9.

When you write a range of rows or a range of columns you may in some cases leave out the second *R* or *C*. Thus R3:9 is the same as R3:R9.

Ranges are often combined with intersections. For example, R3:5 C8 is a reference to the intersection of column 8 with rows 3, 4, and 5; in other words, a reference to the three cells R3 C8, R4 C8, and R5 C8.

Ranges may be formed from any combination of elements. Here are some you might not have thought of:

Reference	Meaning
R[-2]:R[+2] C	five cells in this column centered on the active row
R C1:C[-1]	all cells in this row from column 1 to the one left of the active cell
R1C1 : R255 C63	the entire worksheet

The last example deserves comment. It is a range between one single cell and another one. The first reference is to R1C1, the single cell in the upper left corner. The second reference is to R255 C63, the cell in the lower right corner. The range rule says

that the combined reference is to the smallest rectangular area containing both. The smallest rectangle containing both the upper left and lower right corners of the sheet is the whole sheet. Here are four other ways of referring to the whole sheet:

Reference	Meaning
R1:255	all rows
C1:63	all columns
R1 C63:R255 C1	range of upper right, lower left
R1:C1	range of all of R1 and all of C1

Unions of Elements

The rule of **unions** says that when you write two references separated by a comma, the reference is to every cell named by either reference. For example the union

```
R1C1, R2C2
```

is a reference to the two cells R1C1 and R2C2. Think about the difference between the *union* R1C1, R2C2 and the *range* R1C1:R2C2. The range refers to four cells in a rectangular area (R1C1, R1C2, R2C1, and R2C2). The union refers to just the two cells given.

Here are some examples of unions:

Reference	Meaning
R,R1	this row and row 1 (nothing in between)
R1:5C1,R6:8	an L-shaped area
RC, R[+1] C[+1], R[+2] C[+2]	a diagonal line of three cells

You can think of a union as being a list of references if you want to, but there's one thing to note. It's possible that in the list will be two references covering the same cells. For instance, the union R3,C5 names the cell R3C5 twice: once as part of R3 and once as part of C5.

When Multiplan processes the cells referred to by a union, it works its way through each reference in the union, one at a time. The result is that it *will* process a cell twice if the cell is named twice. If you ask for SUM(R3,C5), the cell at R3C5 will be used twice in computing SUM.

More Elaborate References

Of course, there's no reason you can't combine unions into ranges, and either or both with intersections. This often happens when you combine named areas. Suppose one name is defined as being a union and another name is defined as a range. Then to write the names one after the other (with a space between) is to specify an intersection between a union and a range. In what follows we are going to define some names over complex areas and work with them.

To make the results of our elaborate references visible we need to fill the Multiplan screen with a regular display. Set it up this way:

1. Use Transfer Clear to empty the sheet.

2. Put a string of 10 asterisks (**********) in R20C1.

You now have a sheet, with one cell of asterisks.

Now let's define some names for areas. The names we'll use will be descriptive of their geometric area on our sheet. In normal use

you'd employ names descriptive of the data in the cells. Use the Name command to define these names:

Name	To refer to	
stars	R20	C1
h_bar	R8:12	C1:7
v_bar	R1:19	C4
ul_block	R1:7	C1:3
ur_block	R1:7	C5:7

We need a few more names, but wait a moment. If you aren't used to the Name command you may not be aware of one of its nicer features. It's easy to lose track of what names have been defined, and what their definitions are. Name definitions are often complicated, and it's easy to make mistakes. Name The command allows you to review what you've defined, and to correct mistakes.

Start the Name command (by pressing *N*). Rather than typing the next name, press the up arrow key instead. Multiplan will display the first name defined on this sheet (*stars* in our case), and its definition. Press the right arrow key and Multiplan shows you the next name (*h_bar*). The right arrow key walks forward through the list; the left arrow key walks backward.

Use the arrow keys to check your definitions to this point. The name *ul_block* stands for "upper-left block"; make sure you used a lowercase letter *l* not a digit *1*. Then continue defining names:

Name	To refer to
ll_block	R13:19 C1:3
lr_block	R13:19 C5:7
cross	h_bar,v_bar

Pause again; that last definition was different. You've just demonstrated that you are not limited to reference elements in defining names. The Name command will accept references that are ranges, unions, and intersections of other names. We've defined *cross* as the union of h__bar and v__bar. However, Multiplan doesn't keep the definition in that form.

Start the Name command and use the down arrow key. Multiplan shows you the last name defined (*cross*) and its reference. Notice that Multiplan has converted your symbolic reference (of *h__bar,v__bar*) into its reference elements. Although you entered the definition of *cross* in terms of other names, Multiplan stored it in a form not dependent on those names. Should you later change the definition of *h__bar*, the definition of *cross* will not be affected. Do two more definitions:

Name	**To refer to**
corners	ul__block,ur__block,ll__block,lr__block
stripes	(R2,R4,R6,R14,R16,R18) C1:7

Use the Name command and the direction keys to step through your list of names and check them. If you mis-typed a definition, correct it by tabbing to the definition field and using the edit keys. Can you see to what areas the names refer? We'll make them visible in a moment. Finally, the definition of *stripes* is the first use we've made of parentheses in a reference. Ordinarily when Multiplan works out the meaning of a reference it does intersections first, then ranges, then unions. By using parentheses we can force it to do the union first and the intersection last.

Ok, use Transfer Save to save the sheet (you might name it *light*), and then let's have some fun. Do these commands:

COPY FROM cells: stars to cells: ul__block:lr__block

BLANK cells: cross

BLANK cells: (stripes ur__block), stripes ll__block

COPY FROM cells: stars to cells: stripes v__bar

BLANK cells: ul__block, lr__block

```
COPY FROM cells: stars
                to cells: stripes (ul_block,lr_block)

COPY FROM cells: stars to cells: v_bar
```

In normal use references are used to control money totals and such, not to put on a light show. Think about what is happening during these commands. See if you can improve the script of the light show, and you'll soon appreciate the power of Multiplan's reference scheme.

Chapter 10
Formulas

A cell may hold any of three things: a string such as *Violets are blue* or *Net Pay,* a number such as *17* or *3.1415926,* or a formula. Strings and numbers are **values.** A formula is not a value itself; rather, it is a recipe telling Multiplan how a value is to be produced. When Multiplan calculates the sheet, it works through each formula to arrive at a value (a number or a string). Then it displays the value rather than the formula that produced it.

Elements of Formulas

Formulas are made from simple elements combined according to simple rules. The elements of formulas are of two kinds: **data** and **functions.** Data consists of values (strings and numbers) and references to other cells (see Part 3, "Reference to Multiplan." Functions include the usual arithmetic operations and a number of special ones.

Simple Formulas

The simplest formula consists of a reference to another cell:

```
R[-1] C
```

That formula tells Multiplan: "to arrive at the value of this cell, copy the present value of the cell just above it." Suppose the cell above contains the number 68. Both cells will be displayed with a value of *68,* but there is a fundamental difference between putting 68 in a cell and putting R[-1] C in it. The difference is this: if the cell above is changed, this cell will change as well. That wouldn't be true if both cells held numbers. The next simplest formula makes some arithmetic calculation on another cell's value:

```
R[-1]C + 1
```

Use the Transfer Clear command to clear the whole sheet. Put the above formula in R2C1. Multiplan displays a value of 1. That's because R1C1 is a blank cell. When asked to fetch a

numeric value from a *blank* cell, Multiplan supplies a zero. Put the number *1* in R1C1 and note that R2C1 displays a value of 2.

Note Here and in the examples that follow we assume that Multiplan has been set to recalculate the sheet after each entry. If that's not the case, use the Options command to make it true.

Progressions of Values

Such formulas can be repeated along a row or column to produce a regular progression of values. Use the Copy Down command to duplicate R2C1's formula in every cell R2:19 C1. Each cell produces a value by adding one to the value of the cell above it, which is one more than the value of the cell above that, and so on back to R1C1. The 18 identical formulas produce a progression of numbers (the row numbers, in fact).

Progressions work horizontally as well. Put

```
RC[-1] + 1
```

in R1C2, then use the Copy Right command to duplicate it five times. The column numbers appear across the first row.

Formulas with Two References

Progressions work in two dimensions as well, but require the combination of two references rather than the combination of a reference and a number. Put

```
C1    R*R1    C
```

into the cell at R2C2. That directs Multiplan as follows: "to arrive at the value of this cell, take the value of the cell in column 1 of this row and multiply it by the value of the cell in row 1 of this column." The result for R2C2 is 4, from the 2 in R2C1 times the 2 in R1C2.

Use the Copy From command to duplicate the formula to the rest of the screen:

```
COPY FROM cells: R2 C2 to cells: R2:19 C2:7
```

Every cell now shows the product of its row number times its column number. In other words, you've made Multiplan build a multiplication table for you! Perhaps you'd prefer a subtraction table? Put the following formula in all cells R2:19 C2:7 as you did for the multiplication formula:

```
C1    R-R1    C
```

Then make a division table by changing all the formulas to:

```
C1    R/R1    C
```

Note that throughout all this, there has been only one constant value on the whole sheet, the 1 in R1C1. All the other values being displayed are derived from it according to formulas. Prove it to yourself by changing the value at R1C1 from 1 to 101. All the other displays change too, for all the numbers are derived from formulas that, directly or indirectly, depend on R1C1.

The #DIV/0! Display

You probably recall that division by zero isn't permitted by the rules of arithmetic, for it has no reasonable answer but infinity. Since you have a division table in front of you, let's see how Multiplan handles division by zero. Put the value -4 in R1C1. The progression of row and column numbers will go -4, -3, -2, -1, reaching zero in row 5 and column 5. You presently have the formula C1 R / R1 C in every cell. All the way down column 5 the formula is telling Multiplan to divide by zero.

Multiplan protests against being asked to do the impossible by displaying #DIV/0! in each of those cells. That display comes up whenever Multiplan is asked to divide by zero. Relieve its anxiety by clearing the sheet with the Transfer Clear command (save it first with Transfer Save, if you like).

Formulas with Names

Let's do another trick with a progression of cells. Compound interest is a progression. Each period's new principal is the last period's principal increased by an interest rate. Stated that way, it's reminiscent of R[-1] C, isn't it? More formally, the new value of your savings account is the previous value plus a fraction of that previous value:

prior + prior * fraction

Bankers and other higher mathematicians make one obvious simplification to that formula. They observe that it is equivalent to

(prior * 1 + prior * fraction)

and in that formula, prior can be factored out, leaving

prior * (1 + fraction)

so we'll use that. With Multiplan, prior can just be R[-1] C. Put a principal amount of 1000 in R2 C1 (we'll have other uses for row 1). Then put the compounding formula in R3 C1:

R[-1]C * (1 + fraction)

Multiplan immediately protests #NAME? because we haven't defined the name *fraction.* Ignore it for the moment; Copy Down the formula 10 times (R3:13 C1 will all show #NAME?).

Now use the Name command to define *fraction* as the cell R1C2:

NAME: define name: fraction to refer to: R1 C2

At once Multiplan's difficulties are resolved. It knows where *fraction* is and can calculate our formula. Or can it? The cell R1C2 is blank; there's no value in it. Multiplan supplies a zero for the fraction. The results are all 1000. No increase occurs, as you would expect for an interest rate of zero.

Put a rate in R1C2: .0525 (five and a quarter percent, the usual savings account rate) for a start. R12C1 shows the compounded

value after 12 years. What if you could get the prime rate on your account? Change R1C2 to the current prime rate (.205 at this writing).

Constant Expressions

Our example isn't realistic, for it assumes compounding only once a year. Let's change it so that it shows monthly values with monthly compounding. The interest rate, *fraction,* specifies one year's increase in the principal. The monthly increase is one-twelfth of that. Use the Edit command to change R3C1 to read

```
R[-1]C * (1+fraction/12)
```

and Copy it Down the column. Now R13C1 shows the principal after one year with interest compounded monthly. (Or does it? Actually, at this point a **bug** crept into our sheet. We'll fix it later.)

We'd like to extend the example further, but the formula is getting a bit clumsy. To simplify it, observe that the only **variable** part of the formula (the only part that is supplied differently each place the formula is calculated) is *R*[-1] C. The multiplier *(1+fraction/12)* is constant in all 12 formulas. Therefore we can move it to a cell of its own, and refer to it by name in the formulas. Put

```
1+fraction/12
```

in R1C3, and use the Name command to name it *rate.* Then change all of R3:13 to read:

```
R[-1]C * rate
```

The numbers should be the same as they were. Multiplan might calculate the sheet a trace faster, because it's being asked to calculate *1+fraction/12* only once instead of 12 times. This can be a useful trick to simplify a crowded sheet. Look for constant expressions in formulas and give them their own, named, cells.

Exponentiation

Most savings institutions offer daily compounding, in which interest is added to the principal on a daily basis rather than monthly or annually. Banks have very large computers, but if they were employed in recalculating the principal of every savings deposit every day they'd never get the checks processed. A formula can be worked out like this: the daily interest fraction is the annual fraction divided by 365 (neglecting leap year). In other words, tomorrow's balance is today's principal times *1+fraction*/365. The formula 1+*fraction*/365 can be called *dr* for *daily rate*. Then the balance for the week looks like this:

Monday:	principal
Tuesday:	principal * dr
Wednesday:	(principal * dr) * dr
Thursday:	((principal * dr) * dr) * dr
Friday:	(((principal * dr) * dr) * dr) * dr

and so on for the rest of the year. The parentheses aren't really needed. Saturday's principal is

Saturday: principal * dr * dr * dr * dr * dr

or alternatively

Saturday: principal * (dr * dr * dr * dr * dr)

The mathematical term for multiplying something by itself is **exponentiation.** Multiplan's symbol for exponentiation is the circumflex (^). Using that, Saturday's principal is just

Saturday: principal * (dr^5)

that is, principal multiplied by dr-times-itself-five-times, or "dr raised to the fifth power." The principal at the end of any month is the starting principal multiplied by the daily rate raised to the power of the number of days in the month.

Let's make our sheet reflect daily compounding. To do so, we'll need a column showing the number of days in each month. It will be convenient to have this column at the left edge of the sheet, so use the Insert command to add a new column there:

```
INSERT COLUMNS #columns: 1 before column: 1
```

Run down the new cells R2:13 C1 putting in the number of days in the month, which are: 31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, and 31. (Recall that you can just type a number, hit the down arrow, type the next number, and so on.)

Now fix the cell "rate," R1C4, to reflect a daily rate:

```
1 + fraction/365
```

Finally we can put the formula for a monthly balance with daily compounding in each of cells R3:13 C2:

```
R[-1]C * rate ^ R C1
```

That is, the prior month's balance times the daily rate raised to the power of the number of days in this month.

Fixing a Bug

It's lovely, but it isn't right! The cell at R2C2 contains the number *1000*, the initial deposit. It should show the value of the initial principal at the end of the first month of the year, just as R13C2 should show the principal at the end of the twelfth month of the year. As things stand, our sheet shows only eleven months' worth of compounding. It shows the result of depositing $1000 on the last day of January, rather than on the first day of January. This is an example of the kind of bug—a satisfying term from computer programming—that can slip into an otherwise well-planned sheet.

The bug is easily exterminated. We'll put the initial principal in R1C2, and another copy of the compounding formula in R2C2. Do these two things now.

Adding More Years

One more extension of the sheet, then we'll turn to other functions of interest. It would be convenient to see more than one year of growth. One way to do this, assuming we still want the monthly detail, is to have a column for each year. Most of the cells in those extra columns will be identical to the cells already prepared. They just continue the compounding process in the same way. We can set up five more years' worth of columns with a single Copy From command:

```
COPY FROM cells: R2 C2 to cells: R2:13 C3:7
```

The numbers in these new rows look peculiar; why? Each column picks up its starting principal from row 1. In that row, only R1C2 has a legitimate figure for the principal. Each new column has to get its starting balance from the bottom of the column to its left, not from row 1. By now the way to do this should be obvious to you. Each cell R2 C3:7 should contain

```
R13 C[-1] * (rate ^ R C1)
```

Then the top cell in each row will be getting its principal, not from the cell above it, but from the December cell of the row to its left. Put that formula in R2 C3:7 and you'll have six years' financial growth mapped out. If you left the rate at 0.205 while building this display, you should see that at the end of December in the sixth year (R13C7), the $1000 amount has grown to $3420 and some change. If the rate is 0.0525, the bottom line should show about $1370. Now you know what's so "prime" about the prime rate. Experiment with the effect of changes in the interest rate (R1C3) and starting principal (R1C2).

Area Functions

The functions we've used so far (the four arithmetic operations and exponentiation) will accept only single values as their arguments (the values on the left and right of the function symbol). For example, while you can add two *cells* (e.g., R1C1+R1C2) you cannot add two *rows* (e.g., R1+R2). Multiplan has five functions

that will accept up to five arguments that are any references (or expressions) whatever: any cells grouped in any shape.

Those five functions have a similar form, which we can specify in skeletal form this way: FUNCTION(reference). That is, each is used by giving its name in caps, an opening parenthesis, a reference, and a closing parenthesis. The names are SUM, AVERAGE, MIN, MAX, and COUNT (all the functions are described in detail in the "Function Directory," Chapter 13). The reference may consist of a range, an intersection, or a union of several references.

We can demonstrate the use of the area functions, in a rather artificial way, on the active sheet. To save typing, let's name an area:

NAME: define name: compound to refer to: R2:13 C2

Now we can try out the grouping functions across row 19. In what follows, you might like to put the name of the function being used, as a string, in the cell above the one where it is used.

The SUM function adds all the numbers in the area to which its argument refers. Put the formula SUM(compound) in R19 C1. Its value is the sum of all the numbers in the area *compound;* the sum of all the monthly balances in the first year.

The COUNT function counts all the non-blank cells in the area given that contain numeric values. Put the formula COUNT (compound) in R19C2; its value ought to be 12.

The AVERAGE function returns the numerical average of the numbers in the given reference. Put AVERAGE(compound) in R19C3. Then just for fun put

SUM(compound)/COUNT(compound)

in the next cell, R19C4. The two numbers should be the same. AVERAGE(reference) yields the same result as SUM(reference)/COUNT(reference).

The MIN and MAX functions return the smallest number and the largest number, respectively, in their reference arguments. (Remember, all negative numbers are smaller than all positive numbers.) Try them: put MIN(compound) and MAX(compound) in cells R19C5 and R19C6.

Other Functions

Multiplan supports a number of other functions. Unlike the arithmetic functions and the area functions, there's no general rule for how to call them. All follow the general pattern of NAME(arguments), but each has its own rules for its arguments (all are listed in the "Function Directory"). We'll glance at them here in related groups.

Mathematical Functions

Several of the functions supply common mathematical operations on single numeric values. Three of the mathematical functions are often needed in commercial work. ABS(value) returns the absolute (non-negative) value of its argument. INT(value) returns its argument rounded to an integer.

ROUND requires a list of two arguments. The second specifies a number of decimal places while the first is a number or a numeric formula. The result of ROUND is its second argument rounded to the number of decimal places specified. Rounding is important in commercial arithmetic; rounding done at the wrong point in a calculation can cause errors. It's important to realize that when Multiplan displays a number in dollar format it rounds the display only. The numeric value of the cell is not rounded, only its display. By inserting ROUND(value,2) in a formula you can force a number to be rounded to the penny at that point.

The remainder of the mathematical functions provide for operations common in engineering work: the trignometric functions like SIN and COS, EXP and logarithms to the base *e* (LN) and the base 10 (LOG10).

String Functions

The string functions work on characters; they allow you to build formulas whose values are strings. Such formulas are used to produce informative displays on the sheet.

The fundamental string function is one used like an arithmetic function. It is catenate, specified with the ampersand (&) character. To see its effect, put this formula in R18C7:

```
"left" & "right"
```

The result is displayed as *leftright,* but the status line at the bottom of the screen reveals that the formula is still in the cell. Catenate glues together the string on its left to the string on its right. As we just used it, it may not look like much. Its real utility is apparent when it is used to connect a string to the result of a string function, as we'll now do.

The Formatting Functions

There are two string formatting functions. Their names are DOLLAR and FIXED. Each converts a number (or numeric formula) into a string that is that number formatted as specified.

You may not be used to the idea of making a distinction between a number and the representation of the number in characters. Computer programs often insist that you make the distinction. Consider these lines:

```
5.25%
five and a quarter percent
5.25E-2
525/10000
```

Each is a representation of that intangible idea, a number. Multiplan carries all numbers in yet another representation, one not too different from the third one shown. That's for the program's own convenience; it represents all numbers in the way

that is most convenient for machine arithmetic. For your convenience, Multiplan displays its internal representation of a number in different formats according to the directions you give it with the Format command.

When Multiplan converts a number to a different representation, the result is a string of characters, not a number. If it displays the number *1000* in dollar format, it produces and displays the dollar character ($), the one character (1), three zero characters (0), the decimal point character (.), and two more zero characters (0). The formatting functions make the result of a format conversion directly available within a formula. You can then manipulate that character string; in particular you can catenate it to other strings to make titles containing numbers.

Let's do just that. The interest rate in R1C3 (we named it *fraction)* has to be a decimal fraction like .0525 for the formulas to work. A clerk using this sheet might prefer to think in percentage points. Help the clerk by building a title in R17C1:

```
"rate=" & FIXED(100*fraction,2) & "%"
```

Taking that from the inside out, it tells Multiplan

1. Multiply the value of *fraction* by 100.

2. Produce the characters that represent that number, to two decimal places.

3. Catenate *rate=* on the left of it, and % on the right of it.

The result should be a character string that, if *fraction* is now *.0525,* will say *rate=5.25%.* One small problem: if the string exceeds the usual column width of ten characters, the right end of the string won't show. Put the prime rate of .205 in *fraction* to see this happen. We don't want to widen column 1 (it's just a list of days in the months; if anything we should make it narrower). Use the Format Cells command to give R17 C1:2 the C (Continuous) code. Then the title will be allowed to spill over into the next cell to the right.

#VALUE!, #NUM!, and #REF!

Thus far we have seen Multiplan protest impossible formulas by displaying #NAME? and #DIV/0!. There are three more error displays that might come up in your work with formulas. Let's provoke them now. Put this formula in R15C1:

```
R18C7 + 1
```

That asks Multiplan to do arithmetic on the formula whose result is *leftright*. Multiplan can't do arithmetic on a string, and it says so by displaying #VALUE!. Multiplan displays that message whenever the types of the arguments—character or numeric—don't agree with the needs of a function. It would come up if you tried to catenate two numbers with &.

Try this formula in R15C2:

```
RC[-2] + 2
```

Multiplan displays #REF! to indicate that it can't make sense of the reference. That's reasonable, because two columns left of column 2 takes it off the edge of the sheet.

Try this in R15C3:

```
LOG10(-2)
```

That's asking Multiplan to calculate the base-10 logarithm of a negative number, a meaningless operation. Multiplan objects to that by displaying #NUM!.

The Value of an Error

An error display is *not* a cause for alarm; Multiplan won't be broken by hitting a divide by zero or an impossible reference. It is one of Multiplan's strengths that, having found an error, it notifies you with a special display and carries on with its calculations.

But what if, in carrying on, it finds a formula that refers to a cell containing an error display? You have a #VALUE! error in R15C1; put this in R15C4:

```
R15C1 + 2
```

To arrive at the value of R15C4, Multiplan must obtain a value from R18C1. But R18C1 has an incomputable value and is displaying #VALUE!. Multiplan handles the problem this way. Its logic says that there are really three kinds of values: numbers, strings, and **errors**. The result of calculating a formula is usually a number or a string. Once in a while, the result of calculating a formula is an error. The value of that cell, for computational purposes, is *error*. If the cell's value is called for in some other formula, *error* is supplied. The result of any function with an argument of *error* is also *error*, and so the problem is resolved. R18C3 displays a #VALUE! error because *error+2* calculates to a result of *error*.

Multiplan works from the top of the sheet down and from left to right. So if you are faced with a whole spattering of error displays, examine your formulas from top to bottom and from left to right. Often, fixing the error at the upper left will clear up many other error displays below and to the right of it.

Chapter 11
Saved Sheets, Files, and the BTOS™ Operating System

Multiplan is but one of many functions which can be run on your workstation. It may be that you use Multiplan exclusively and never deal with any other program, though this is highly unlikely given the flexibility afforded you by your workstation.

Multiplan, in conjunction with the BTOS Operating System, provides many services which are not necessarily provided in other, less sophisticated, equipment. For example, in cluster configurations, you can access not only the files located at your workstation, but also those at the master workstation.

Multiplan is designed for users who are not acquainted with computers, programs, and operating systems. As you use Multiplan and become more comfortable with your workstation, you will want to use more of your workstation's capabilities.

This chapter explains the interaction of Multiplan with the BTOS Operating System. More information about BTOS is provided in the Operating System, Executive, and System Utilities Manuals. You may wish to refer to these at some later time.

BTOS Directories

The crucial job of the BTOS Operating System is the maintenance of files on the disk. A file is a collection of data, any kind of data at all. The meaning of a file, the sense of what it contains, is established by the programs that read it and by the human who directs those programs. Multiplan writes and reads files containing worksheets; other programs read and write files containing other kinds of data.

The operating system maintains files on disk. Each disk or volume can contain several directories which are groupings of files associated with a user or function. When you Signon at your workstation, you are assigned a default directory on a disk volume. Work sheets and printed files are loaded and saved by Multiplan from this directory. You can, however, access files from other directories if you wish to do so. This is done by entering a path name in the Directory field of the Transfer Options command. Remember, that after you do so, all files accessed by Multiplan will come from this directory until you blank the Directory field. Directory names have the form [VolumeName]<DirName>.

If you wish to access only one file from another directory, you can prefix the file name with the volume and/or directory name (e.g. [Vol]<OldSheets>Feb or <OldSheets>Jan).

Multiplan Files

Multiplan deals with four types of files:

- Worksheets in binary form.
- Worksheets in symbolic form.
- Visicalc files.
- Printed sheets.

While in Multiplan, you are not concerned with your Word Processor files, etc. In addition, if you are trying to load a new worksheet, you are only concerned with the list of work sheets stored in the directory and not in any print files.

Multiplan appends a suffix to each filename which it accesses. These suffixes differentiate different types of files. The suffixes which Multiplan uses are:

- .mp for binary worksheets.
- .sl for symbolic worksheets.
- .xx for Visicalc and printed sheets.

Whenever Multiplan reads, writes, or provides a list of the files, it appends the suffix to the name. This suffix is hidden from you when you are in Multiplan. You should, however, remember to use this suffix if you make use of Multiplan files in programs other than Multiplan.

Note Multiplan looks for files with this suffix only. Therefore, Multiplan will list any files with the .mp suffix whether or not they were generated by Multiplan. In addition, Multiplan will not recognize valid worksheets which do not contain the proper suffix.

Transfer Load and the Operating System

Transfer Load is the Multiplan command with which you bring a saved sheet from disk and make it active. While it is on disk, the sheet is invisible and out of reach. When active, the sheet can be viewed on the screen, edited, and used.

Here's how Transfer Load works. You supply a filename and press RETURN. Multiplan appends the proper suffix to your filename and passes it to the operating system with a request that the file be loaded from the disk. The Operating System searches its directory for that filename. From the directory it learns where on the disk the file contents were recorded. It directs the mechanical operations that cause the disk drive to copy the recorded data into your workstation memory. Then it returns to Multiplan. Multiplan re-draws the screen to display the newly loaded sheet.

Transfer Save and the Operating System

Transfer Save is the command with which you save a copy of the active sheet on disk for safekeeping. A copy of the active sheet, exactly as Multiplan has it in memory, is written as a file. The operating system is used at several points.

Here's what happens. You supply a filename and press RETURN. Multiplan appends the suffix to the filename and calls BTOS with the filename, asking only for a search of the directory. The operating system searches the directory and returns, telling Multiplan whether it found the name.

If the filename does appear in the directory, it means that a file of that name already exists on the disk. Multiplan has no way of knowing whether you really want to overwrite that file or if you typed the name by mistake.

This is the moment when Multiplan writes the message "Overwrite existing file?" on the screen and waits for your response. If you respond Y to give the OK, Multiplan copies the file currently on disk to a new file called name-old and saves the new copy of the sheet on the disk. Responding with any other key aborts the save operation. The old copy allows you to change your mind if you discover that you really did not want to destroy it. This old copy can be used just like any other sheet.

After your wishes have been verified, Multiplan can proceed with the save. It calls the Operating system once again, passing the filename and the location in storage of Multiplan's representation of the worksheet. The operating system directs the disk drive in writing a copy onto the disk. It then records the filename, and the disk location of the data, in the directory. This new file contains a saved worksheet, and the Transfer Load command can bring it back at any later time.

The Form of the Active Sheet

The sheet as you see it on the screen and the sheet as Multiplan represents it in computer storage are very different things. It's fairly obvious that data in computer storage is encoded in electrical patterns invisible to the eye. Even so, you might suppose that Multiplan keeps an electrical version of what you see on the screen. For instance, if a cells displays as $9.32, you might think that somewhere in storage there are the electrical versions of $, 9, ., 3, and 2, in that order.

This is the case only for strings. If a cell contains the title **Total Costs,** somewhere in storage will be the electrical patterns by which a computer represents the letters 'T', 'o', and so forth. Numbers and formulas are not kept that way.

Numbers are represented in their binary form, which programmers think of as sequences of ls and Os but which do not add up to displayable digits. Before such binary information can be displayed it must be formatted. Since all numbers on the sheet are kept in binary, all must be formatted before they can be shown. With the Format Cells and Format Default Cells commands, you establish the particular format to be used.

Each cell in memory is accompanied by binary numbers that signal its format and alignment codes. These formatting codes direct Multiplan in the process of displaying the cell value. A formula is encoded as a sequence of binary numbers so that Multiplan an scan it rapidly. All these elements are tied together with still other binary numbers representing storage addresses; these link the different cells in proper order.

The sheet in storage also contains a table of the names you've defined, with their definitions. It also contains the list of cells whose values have been imported with the eXternal Copy command. A supporting sheet will contain a list of the filenames of sheets that are dependent on it; a dependent sheet will contain a list of the filenames of sheets upon which it depends.

Finally, blank cells are only summarized in storage. Multiplan stores only cells that have contents in their full representation; this minimizes the amount of memory needed. When the Blank command is used, the blanked cells aren't simply given blank contents; they are discarded altogether and most of their space is released for use.

Hazards to Saved Sheets

As Multiplan becomes more valuable in your work you'll store more business data as saved sheets, data whose loss could cost you money. As you collect more and more useful figures and formulas in saved sheets, you will inevitably become concerned about safety. The time and thought you'll have invested in creating the sheets is important.

There is an important difference between computer storage media and paper. Paper tossed in the wastebasket can be retrieved. Numbers on paper can be read after erasure, and will remain visible under spilled coffee. A computer medium is not so sturdy. A computer record is either robustly there, or it isn't readable at all. Once erased, it is gone. If a file is damaged in even one small part, Multiplan is not able to load it.

Files can be lost through error, through mechanical damage to the medium, or through hardware failures in the machine. Whatever the cause, a lost sheet means lost labor and possible lost money.

Securing Files

The best way to protect your saved sheets against all hazards is to keep multiple copies. Multiplan automatically makes an old copy of your worksheet whenever you update it. The old copies are useful when you make a mistake, "Oops, I didn't want to use that name!" However, you must realize that both copies are on the same directory and therefore on the same medium.

You should keep copies of your worksheets in different places. You should also review your collection of sheets periodically and make sure you have a backup copy for each important sheet. It is not silly to store the backup copies off the premises; if a fire destroyed the backup copies along with the originals, you might as well not have made them.

The BTOS Operating System provides programs for producing backups of your work. Information about these programs is provided in the Software Operation Guide.

Copying Files

A backup copy is just that: a copy. One way to make a copy of a saved sheet is to use the Transfer Load command to load it, the Transfer Save command to save it under a different name or on a different disk. That creates a second file with the same contents as the first. The only problem with this procedure is that it can be fairly tedious when there are several dozen sheets on a disk.

The BTOS Executive provides commands to copy groups of files.

Erasing and Renaming Sheets

Like sheets of paper on your desk, old Multiplan sheets collect in untidy heaps in your directories. Occasionally you'll want to clean house, getting rid of unneeded sheets and organizing those you want to keep.

The Multiplan command to erase a saved sheet is Transfer Delete. To clean house, combine it with Transfer Load and use the direction keys to step through the directory until you see the name of a sheet that you no longer need. Complete the Transfer Load and look at the sheet. If you no longer need it, use Transfer Delete to erase the saved copy.

If you have a lot of sheets to review, you can the Executive delete command to speed up the process. The delete command can delete an entire list of old sheets quickly. However, such a command is the computer equivalent of sweeping an entire pile of papers into the wastebasket; you have to be careful that an important sheet doesn't get into the pile by mistake.

As part of your housekeeping, you might like to organize the saved sheets under more meaningful names. You can, of course, do this by loading a sheet, saving it under its new name, and erasing the first version. (Transfer Rename is the appropriate command to do this). However, the Executive has the Rename command to quickly change the name without loading the file first. Do remember, however, to leave the suffix intact. Changing the file suffix --- which you don't normally see in Multiplan --- will cause Multiplan to ignore the file.

Erasing and Renaming Linked Sheets

Saved sheets are said to be linked when one supports the other (see Chapter 7). The linkage is set up temporarily when the dependent sheet is loaded and the eXternal Copy command is done. At that moment, Multiplan reads the file copy of the saved supported sheet and notes the imported names and values. These can then be used in calculating the active, dependent sheet formulas.

If the dependent sheet is then saved in a file, Multiplan makes the linkage between the two sheets permanent. It forms the linkage by changing both the new, dependent sheet file and the old, supporting sheet file. In the dependent sheet file it records the filename of the filename of the supporting sheets. Then it adds information to the file containing the supporting sheet. Thereafter when you load the dependent sheet, Multiplan knows where it is to get the supporting data. When you load the supporting sheet, Multiplan knows it is a supporting sheet and what sheets it supports.

As we said, the linkage is not permanent -- not recorded on disk -- until the dependent sheet is saved. Once that had been done, each sheet filename is recorded as part of the file of the other sheet. As we pointed out above, BTOS does not concern itself with the contents of files. The linkage is records as part of the contents of the two files. Therefore, BTOS does not know about the linkage between sheets.

In short, use the Multiplan Rename command to rename a sheet which is depending on or supporting another sheet. Multiplan automatically updates the disk copies of the other sheets with the new name. The Executive Rename command does not.

Displaying Saved Sheets

A saved sheet is a binary file; that is, one that contains binary numbers. If the file is displayed at your workstation or printer, the binary data will appear as meaningless junk. Use Multiplan whenever you wish to display the contents of sheets.

Printing to Files

The Print command causes Multiplan to format all cells to characters, as it does for the screen. It then writes those characters to the printer. The Print File command alters the destination of this stream of characters. Instead of sending the display of the sheet to the printer, Multiplan directs it to the file you name.

A file created by Print File is not a binary file. Each character in it is readable and useful without further formatting. Such a file is an exact copy of the printed form of a sheet; the only difference is that the characters are written on a disk rather than being written on paper.

There is a profound and important difference between a file created by Print and a file created by Transfer Save. The saved sheet contains binary numbers, encoded formulas, formatting codes, and all the other notations and marks that Multiplan needs during its operations. The print file contains none of these things; it contains only printable characters. Where a saved sheet might contain the binary equivalent of "R2C8, value is 9.37, format as dollars and align right," the print file will contain the characters $9.37 — very useful to you and worthless to Multiplan. Print files cannot be loaded by Multiplan for changing!

The thing to note is that **a saved sheet and its printed form are different.** A print file cannot be loaded with Transfer Load. On the other hand, a saved sheet cannot be printed.

Uses of Print Files

There are several good reasons for using the Print File command. The resulting printable file can be processed by other programs such as the Word Processor. You can use the Word Processor to add more text to the file, or to insert it as a table into another document. In addition, this file can be printed several times without having to re-enter Multiplan to do so.

Using Printers

Your workstation can make use of several types of printers. These printers can be attached directly to your workstation or, in cluster configurations, be located at the master workstation. You can have a daisy wheel printer which is attached to a serial port, and a fast line printer attached to a parallel port. You can print directly, or use the spooling services provided by BTOS. In any event you can see that the possibilities are endless.

How does Multiplan know what printer to use when you use the Print Pritner command?

Multiplan makes use of a printer name file which provides it information about the printers which can be used. This printer name file, [Sys]<Sys>Sys.Printers, contains an entry for each printer that you can use. The first entry in the file defines the default printer. This printer is used when you invoke the Print Printer command without changing the Printer Options. You can use a different printer by entering a name in the Printer field of the Print Options command.

The format of the printer name file is:

name 1: printer specification 1 : RETURN
name 2: printer specification 2 : RETURN

The **name** field is a nickname or alias for the printer. This can be any character string such as Printer1, or Spooler. This name is used when specifying a printer other than the Multiplan default printer. Type in this name in the Printer field of the Printer Options command.

The **printer specification** field is the name which Multiplan provides to BTOS whenever you wish to print a sheet on a printer. Information about printer specifications is provided in the BTOS Software Operation Guide.

Any text following the second colon (:) and the RETURN is ignored. This is to provide a format compatible with the Word Processor printer name file.

An example of a printer name file is:

```
DIRECT:[Lpt]&[Sys]<Sys>MPLptConfig.sys:Parallel Printer
PARALLEL:[Spl]                         :Spooler
SERIAL:[SplB]                          :Diablo
```

If Sys>Printers contains the text above, the Print Printer command will default to the parallel printer named ([Lpt]). You can, however, specify PARALLEL or SERIAL as different printer names.

Each user can have different printer name files. This is done by changing the user configuration file. Include the line:

:SysPrinters:PrinterNameFile

where PrinterNameFile is the actual filename Multiplan is to use to select printer names. Information about user configuration files and printer specificiations is provided in the Software Operation Guide.

Part 3
Reference to Multiplan

Chapter 12
Command Directory

The following directory explains in depth the many commands that you can give to Multiplan. The examples that are provided are designed specifically to demonstrate Multiplan's behavior in different contexts. Cross-references are given to lead you to commands that are related to the command being described. You may, in addition, want to refer to all the subcommands for a particular entry. See the chapter outline for a list of all the entries in the directory.

Alpha

ALPHA:

Enter text (no double quotes)

Description

Replaces the contents of the active cell with a character string. If the active cell already contains a string, that string is the proposed response of the command, so that it can be edited. Double quotes should not be used in this command.

Example

To put the title *Net Present Value* into the active cell, enter

ALPHA: Net Present Value

See Also

Edit to alter the contents of any cell.

Formula to enter a string as part of a formula.

Value to enter a number.

Blank

BLANK cells: (active cell)

Enter list of references

Description

Replaces contents of all specified cells with blanks. Names are not affected; if a cell was referred to by a name before use of this command, that name will still apply.

When a formula refers to a blank cell, that cell's numeric value is taken to be zero, and its string value is a string of zero characters.

Examples

To blank the cell in row 3 column 2, enter

BLANK cells: R3C2

To blank all cells in the area named sales, enter:

BLANK cells: sales

To blank an irregular area, specify a union (list) of references:

BLANK cells: R1:6C1,R7:8

See Also

Delete to remove cells from the sheet entirely.

Transfer Clear to clear the entire sheet.

Copy

COPY From Right Down

Select command option or type command letter

Description

Presents a choice of three ways of copying the contents of some cells into other cells. If you want to duplicate one cell across several to its right, choose Right. If you want to duplicate one cell across several below it, choose Down. To copy any cell or cells to any others, choose From.

See Also

Blank to put blanks in cells.

Insert to add new cells between existing ones.

Move to move cells to other locations.

Copy Down

COPY DOWN number of cells: starting at: (active cell)

Enter a number

Description

Copies one cell into one or more cells below it. Used to fill a column with identical values (the same effect can be had with Copy From; Copy Down is provided to make a common operation easier). Both cell contents and cell format are copied. The proposed response for "number of cells" is the number used in the last Copy Down or Copy Right command.

As many new copies are made as you specify; the total number of identical cells will be number given plus one (the original).

The command can also copy a group of cells.

Examples

To fill the 10 cells below the active cell with the same value as the active cell, enter

COPY DOWN number of cells: 10 starting at: (active cell)

To duplicate the first 5 columns of the top row four times, enter

COPY DOWN number of cells: 4 starting at: R1C1:5

The row of 5 cells will be duplicated in rows 2, 3, 4 and 5.

See Also

Blank to put blanks in cells.

Copy From to copy areas.

Copy Right to duplicate a cell across a row.

Copy From

COPY FROM cells: (active cell) to cells: (active cell)

Enter reference to cell or group of cells

Description

Copies the contents of a cell or group of cells to another location on the sheet. The "from" cells are not altered. Both cell contents and cell format are copied.

When there is but one "from" cell, that cell content is duplicated in each "to" cell.

When there is a group of "from" cells, the entire group is copied. When only one "to" cell is given, it marks the upper left corner of the receiving group.

In general, either the "from" or the "to" group should consist of a single cell, or they should be nonparallel vectors (from vertical to horizontal or vice versa). If other forms of copies are attempted, the system will abort the copy command with an "Illegal parameter" message. If more than one "to" cell is given the copy is done once for each cell in the "to" group. This may produce unexpected results: most of the receiving cells will be identical to the upper left corner cell of the "from" group.

Examples

To copy the cell at R1C1 to the cell at R5C3, enter

COPY FROM cells: R1C1 to cells: R5C3

To duplicate cell R1C1 in every cell of column 8, enter:

COPY FROM cells: R1C1 to cells: C8

To make a copy of a square patch of cells in the upper left corner four rows further down:

```
COPY FROM cells: R1:4C1:4        to cells: R8C1
```

Afterward, R8C1 is a copy of R1C1, R8C2 is a copy of R1C2, and so on to R11C4, which has a copy of R4C4.

See Also

Blank to put blanks in cells.

Copy Down, Copy Right to duplicate cells over rows and columns.

Insert to insert new rows or columns.

Move to move (not copy) rows or columns.

Copy Right

COPY RIGHT number of cells: starting at: (active cell)

Enter a number

Description

Copies the contents of one cell into one or more cells to its right. Used to make a row of identical values (the same effect can be gotten with Copy From; Copy Right is supplied to make a common operation easier). Both cell contents and cell format are copied. The proposed response for "number of cells" is the number used in the last Copy Down or Copy Right command.

As many new copies are made as you specify; the total number of identical cells will be that number plus one (the original).

The command can also copy a group of cells.

Examples

To duplicate the active cell in the 8 cells to its right, enter

COPY RIGHT number of cells: 9 starting at: (active cell)

To duplicate the 5-row column of cells R1:5C1, enter:

COPY RIGHT number of cells: 1 starting at: R1:5C1

See Also

Blank to put blanks in cells.

Copy Down to duplicate a cell down a column.

Copy From to copy areas of cells.

Delete

DELETE: Row Column

Select command option or type command letter

Description

Presents a two-way choice to delete cells. If you want to delete a row or rows, choose R. If you want to delete a column or columns, choose C. If you simply want to blank out the cells, use the Blank command.

Inserting, Moving, or Deleting columns or rows between cells which have been copied from a parent cell coes not correctly update relative references. For example, if the formula r[-1]c is inserted in r2c1 and copied right 3 cells, then Moving, Inserting, or Deleting any of columns 1 through 4 will yield erroneous results. To avoid this, use Absolute References, or perform the Moving, Inserting, or Deleting before executing the Copy command.

See Also

Blank to make cells empty.

Insert to insert new rows or columns.

Move to move rows or columns.

Delete Columns

DELETE COLUMNS # of columns: 1 starting with: (active column)
between rows: 1 and: 255

Enter a number

Description

Deletes all or part of a column or columns. The most common use is to delete complete columns (accepting the proposed responses of rows 1 and 255). Columns to the right of the deleted columns move left, and new columns of blank cells are added at the right edge of the sheet.

The command can be used to delete parts of columns. The deletion takes place between the specified rows; other rows are not affected.

Multiplan adjusts all references affected by the deletion. Suppose you delete columns 3 and 4. Any cells that previously referred to column 5 will be altered to refer to column 3 instead, because that's where the cells that were in column 5 have now gone. Deleting a column that forms the ending bound of a REFERENCE will give you a #REF error. For example. deleting column 2 will give you a #REF error in the reference (R2C2:R2C4).

If a name refers to the deleted area, the name's definition is adjusted. Suppose that *col2__5* is a name defined as C2:5. If columns 3 and 4 are deleted, the definition of *col2__5* will be changed so that it refers to C2:3, the columns of its former area that still exist. If a name's entire area is deleted, the name exists, but refers to an illegal (#REF) area.

If a formula refers to an area that is completely deleted, the formula becomes illegal (contains #REF). If the area is only partially deleted, the reference is adjusted (as for names). Shared expressions (obtained via copies) are updated for the upper-left cell that uses them. Both relative and absolute references are updated.

Examples

To delete the active column, simply press RETURN:

```
DELETE COLUMNS # of columns: 1      starting at: (active
                                    column)
                  between rows: 1   and 255
```

To delete a rectangular area in columns 3 and 4 between rows 3 and 8:

```
DELETE COLUMNS # of columns: 2      starting at: 3
                  between rows: 3   and 8
```

See Also

Blank to make cells empty without deleting them.

Delete Rows to delete whole or partial rows.

Insert to insert new cells.

Move to move rows or columns.

Delete Rows

```
DELETE ROWS # of rows: 1        starting at: (active row)
       between columns: 1       and: 63

Enter a number
```

Description

Deletes all or part of a row or rows. The most common use is to delete complete rows (accepting the proposed responses of columns 1 and 63). Rows below those deleted move up, and new rows of blank cells are added at the bottom of the sheet.

The command can be used to delete parts of rows. The deletion takes place between the specified columns; other columns are not affected.

Multiplan adjusts all references affected by the deletion. Suppose you delete rows 4 and 5. Any cells that previously referred to row 6 will be altered to refer to row 4 instead, because that's where the cells that were in row 6 have now gone. Deleting a row that forms the ending bound of a REFERENCE will give you an #REF error. For example. deleting row 2 will give you a #REF error in the reference (R2C2:R5C2).

See *Delete Columns* for more information.

Examples

To delete the active row simply press RETURN:

```
DELETE ROWS # of rows: 1        starting at: (active row)
       between col's: 1         and 63
```

To delete a rectangular area in rows 4 and 5 between columns 1 and 8:

```
DELETE ROWS # of rows: 2        starting at: 4
       between col's: 1         and 8
```

See Also

Blank to make cells empty without deleting them.

Delete Columns to delete whole or partial columns.

Insert to insert new cells.

Move to move rows or columns.

Edit

EDIT: (contents of active cell)

Enter a formula

Description

Makes contents of the active cell available for editing. Place the cell pointer on the cell to be edited and press *E*. The cell's contents are then placed on the command line for you to modify. The edit cursor is placed at the end of the current contents rather than highlighting the whole command, as is done for other defaults. If the cell contains a string, it is presented in double quotes. After you have edited the cell's contents, press RETURN to put the contents back in the cell (or press ABORT to cancel any changes).

See Chapter 8, "Command Entry and Editing," for the use of editing keys.

See Also

Alpha for entry or replacement of strings.

Formula for entry of formulas.

Value for entry of numbers.

Format

FORMAT: Cells Default Options Width

Select option or type command letter

Description

Presents a choice of various display adjustments.

Format Cells alters the alignment and format of a cell or group of cells.

Format Default sets the default alignment, format, and width for all cells.

Format Options controls the display of formulas, commas in numbers, and the width of the screen.

Format Width sets the width of a column or columns.

The setting in the "alignment" field controls the placement of the contents within the available spaces of the cell; whether the empty space is placed to the right of the contents, to the left, or on both sides.

The setting in the "format" field, together with the response in the "# of decimals" field, controls how the value is displayed, as a dollar amount, as a percentage, as decimal value, and so on.

In both the "alignment" and "format" fields, there is a "Default" setting. The "Default" setting is defined by the Format Default command. The options selected in the "alignment" and "format" fields of the Format Default Cells command and the number given in response to the Format Default Width command define the settings for all cells with the "Default" setting in the Format Cells and Format Width commands.

All cells have the default setting initially. (When Multiplan is first started, the TEMP worksheet has default settings of General alignment, General format, 0 # of decimals, and a 10 character column width.) If you insert new rows or columns, the inserted cells receive the default setting, however "Default" is defined by the Format Default commands.

The format given to the default settings can be changed at any time by using the Format Default command. This allows you to change easily the format of all cells that have the default code setting, which may be most of the cells.

We recommend that you define the most common format you will be using as the default, and alter a cell or some cells to display their contents differently from the default with the Format Cells command.

The subcommands are explained individually on the following pages.

See Also

Print Margins to set the format of a printed copy of the sheet.

Format Cells

```
FORMAT
  cells: RC
  alignment: Def Ctr Gen Left Right -
  format code: Def Cont Exp Fix Gen Int $ * % -
  # of decimals:
```

Enter reference to cell or group of cells.

Description

Alters the alignment and format codes of one or more cells.

The proposed responses are the format codes of the active cell. So, this command may be used to review the settings for the active cell.

If you are changing the alignment code of a group of cells but not the format code, select the hyphen response in the "format code" field to keep the format codes as they are. Otherwise, all cells in the group receive the format code of the menu setting.

Similarly, if you wish to change the format code but not the alignment code of a group of cells, select the hyphen response in the "alignment field."

Def	Default	Align this cell by the default alignment.
Ctr	Center	The cell display is centered in the column.

Gen	General	Text is aligned left, numbers are aligned right.
Left	Left	The cell display is left-justified in the column.
Right	Right	The cell display is right-justified in the column.

Leave all alignment codes as is. Used when changing the format code of a group of cells but not the alignment codes.

Text is displayed only for the width of the cell unless the Continuous format code is selected.

The format codes are as follows:

Def	Default	Display this cell with the default format.
Cont	Continuous	Text longer than the column width is displayed at its full width, crossing into the column on the right, if necessary (the cell to the right must be blank and must have the Continuous format also). Numbers are displayed in the General format code. Typically, you will want to format an entire row when using continuous format code.
Exp	Scientific	Numbers are displayed as a decimal notation times a power of ten; for instance, 2.1E6 for 2100000. The number of decimal places used is set in the "# of decimals" field of the Format Cells command.

Fix	Fixed point	Numbers are displayed with a fixed number of digits of decimal fraction. The number of digits is set in the "# of decimals" field of the Format Cells command.
Gen	General	Numbers are displayed as precisely as possible in the available width of the cell, with scientific notation used automatically, as needed.
Int	Integer	Numbers with a decimal fraction are rounded to integers.
$	Dollar	Money amounts are displayed with a leading dollar sign and the number of decimal places specified in the "# of decimals field."
*	Bar graph	When the cell contains a number, it is rounded to an integer and that many asterisks are displayed. For example, all values between 2.5 and 3.5 will be displayed as three asterisks. Use the Bar graph format code to build a bar graph. Only as many asterisks as the width of the cell allows are shown. To see all asterisks, use the Format Width command to widen the cell.

%	Percent	Numbers are displayed as a percentage. The number of decimals is set in the "# of decimals" field of the Format Cells command. For example, the value .1 will be displayed 10% if the # of decimals is zero; or as 10.0% if the # of decimals is 1.
_		Leave all format codes as is. Used when changing the alignment code of a group of cells but not the format codes.

The "# of decimals" field is used only for the Fix, Exp, $ and % format codes. If you enter a response to this prompt for the other format codes, your response is ignored. If you are not specifying one of these three format codes, simply press RETURN after specifying the format code.

Examples

To align the contents of the active cell (R5C15) in the center of the available spaces:

```
FORMAT CELLS: R5C15
alignment: Def (Ctr) Gen Left Right -
format code: (Def) Cont Exp Fix Gen Int $ * % -
# of decimals: 0
```

To display the cells in column 2, rows 3 through 6 as money values preceded with a dollar sign and displayed with two decimal places:

```
FORMAT CELLS: R3:6C2
alignment: (Def) Ctr Gen Left Right -
format code: Def Cont Exp Fix Gen Int ($) * % -
# of decimals: 2
```

Notice that the alignment of all cells in this group is now default. If any of the cells had an alignment other than the default and if you want to preserve the special alignment, select the hyphen response instead of the Def response in the "alignment code" field.

To display the values in rows 1 through 12 of column 10 as percentages with up to four decimal places accuracy:

FORMAT CELLS: R1:12C10
alignment: Def Ctr Gen Left Right (-)
format code: Def Cont Exp Fix Gen Int $ * (%) -
# of decimals: 4

Any alignment already specified for any of the cells in this group is retained.

See Also

Format Default to set the default format.

Format Width to set the width of specific columns.

Format Default Cells

FORMAT DEFAULT CELLS
alignment: Ctr Gen Left Right
format code: Cont Exp Fix Gen Int $ * %
# of decimals: 0

Description

Sets the alignment and format for all cells that have the default setting. The initial default alignment and format code is General.

The alignment and format codes are listed and described under the Format Cells command.

Example

To set the default format code to money amounts ($) with zero decimals:

FORMAT DEFAULT CELLS
alignment: Ctr (GEN) Left Right
format code: Cont Exp Fix Gen Int ($) * %
# of decimals: 0

Format Default Width

FORMAT DEFAULT column width in chars: 10

Enter a number

Description

Sets the display width of any column for which a specific width has not been set or for which the D default width has been explicitly set. The initial default width is 10 characters.

Example

To set the default width of 12, enter:

FORMAT DEFAULT column width in chars: 12

See also

Format Width to set the width of specific columns.

Format Default Cells to set the default cell format.

Format Options

FORMAT OPTIONS
commas: Yes No formulas: Yes No Width: 80 132

Select option or type command letter

Description

The proposed responses are the current settings of the options.

For cells that have Fixed, Integer, $, or % format codes, the comma option groups a number into thousands and separates the groups with comas. For example, a number such as 12345678 under the comma option would be displayed as 12,345,678.

The formulas option causes cells that contain formulas to display the formula instead of its value. The width of all columns is doubled. Cells that contain text display their contents in double quotes.

A cell normally displays the value of a formula placed in it. The formulas option permits you to see what generates the value in every cell. With the "formulas" option off (No), check the formula in a cell by using the Edit command or by moving the cell pointer to the cell; the formula appears in the status line.

The width option allows you to dynamically change the width of the screen from 80 to 132 (or vice versa) on B 22 workstations. The width of the screen can also be changed by pressing CODE-z, or the f8 function key.

Example

To display formulas in the cells that contain them:

FORMAT OPTIONS
commas: Yes (No) formulas: (Yes) No

Format Width

FORMAT WIDTH in chars or d(efault): Column: through:

Description

Sets the default width of the cell within the columns specified. Specifing "d" as the width will default to the width set with the format default width command.

Graph

GRAPH: Bar Line Pie Options

Description

Presents a choice of graphs to produce.

The Business Graphics Package and special graphics hardware is required to perform this function.

See Also

Graph Bar for bar graphs.

Graph Line for line graphs.

Graph Pie for pie graphs.

Graph Options for changing titles, etc.

Graph Bar

GRAPH BAR group by: legends:
Y axis label: format file:

Enter reference to group of cells

Description

Graphs the selected cells as a bar graph.

The group by field selects the cells to be used as labels along the X Axis. The legends field selects the cells to be used as legends. The values to be plotted are taken at the intersection of these references.

The Y axis label inserts the text in the upper left hand corner of the graph.

The format file allows the selection of a non-standard format file. Format files specify the graph presentation (annotations, grids, scaling, etc). Refer to the Business Graphics User's Guide for more information on the creation and use of format files.

Graph Line

GRAPH LINE X cells: Y cells:
X axis label: format file:

Enter reference to cell or group of cells

Description

Graphs a line graph containing one or several lines.

The X cells select the cells to be plotted on the X Axis. All of these cells must be from the same row or column. If any of the cells specified as X values contains Alpha data, the whole line is considered Alpha and graphed as labels for the data points. The first cell in the reference is used as the label for X Axis (and is not used as data).

The Y cells select the cells to be plotted on the Y Axis. Each Y cell must have a corresponding X cell. Multiple lines may be plotted by specifying multiple rows. For example, specifying R2:4 draws three lines obtaining the values from rows 2, 3, and 4. The first cell in each reference is used as the name (or legend) for the line.

The Y axis label field inserts the text in the upper left hand corner of the graph. This field can be used to label the units of the Y axis.

The format file field allows the selection of a non-standard format file. Format files specify the presentation of the graph (grid, scaling, annotations, etc). Refer to the Business Graphics User's Guide for more information on the creation and use of format files.

Graph Pie

GRAPH PIE segment labels: values:
format file:

Enter reference to cell or group of cells

Description

Graphs a pie graph comparing the portion each value has to the sum of the values.

The "labels" field selects the cells to be used as the segment labels. The labels must be from the same row or column.

The "values" field defines the size of each pie segment. Each label must have a corresponding value. All values must be from one row or column.

The format file field allows the selection of a non-standard format file. Format files specify the presentation of the graph (patterns, annotations, etc). Refer to the Business Graphics User's Guide for more information on the creation and use of format files.

Graph Options

GRAPH OPTIONS title: palette file name:
use labels from sheet: Yes No

Enter text

Description

The title field can be filled in with any text. This text is the title assigned to the graph. This field defaults to the name of the sheet.

The palette file name field is used for entering a user-defined palette file name, or for a directory search of available palette files using the direction keys. This is only applicable on a Color Graphics Workstation. A palette file is used for color selection in BGP.

The "use labels from sheet?" field specifies whether the graph annotations are to be provided from the Multiplan sheet or from the format file. If you specify No, the graph title and labels are obtained from the format file. Instructions on creating format files and palette files are provided in the Business Graphics User's Guide.

Help

HELP: Resume Start Next Previous
Commands Editing Formulas General Keyboard

Select option or type command letter

Description

Provides helpful information about Multiplan.

Help information is read from a disk file. Information in the Help file is requested two ways: either (1) using the main command menu, or (2) pressing the HELP action key. When you request Help, the worksheet is replaced by text from the Help file, and the Help command menu appears.

The worksheet display resumes when you either select the "Resume" subcommand (press "R" or RETURN) or press CANCEL.

The information displayed depends on when Help is requested. In particular:

If you use SPACE or BACKSPACE to highlight a command word in a menu, the action describing that command is shown.

If the edit cursor is in a command field, the section describing that field is shown.

If the message line shows an error message, either the section describing the previous command or the section describing the error is shown.

Once in the Help command, you can request Help information by the following options on the Help menu:

Resume	return to the main command menu and worksheet display.
Start	show the beginning of the Help file.
Next	show the next screenful of Help information. Typically, not all the relevant information is shown, and Next (press the letter N) should be used.
Previous	show the previous screenful of Help information.
Commands	show the description of the first command (Alpha).
Editing	show the description of Multiplan editing.
Formulas	show a list of all functions and the rules about formulas.
General	show a list of common problems paired with the names of the commands that offer solutions.
Keyboard	show the keytop labels corresponding to Multiplan action keys.

Insert

INSERT Row Column

Select command option or type command letter

Description

Presents a choice of ways to insert new cells into the sheet. To insert new rows choose Row. To insert new columns choose Column.

Inserting, Moving, or Deleting columns or rows between cells which have been copied from a parent cell does not correctly update relative references. For example, if the formula r[-1]c is inserted in r2c1 and copied right 3 cells, then Moving, Inserting, or Deleting any of columns 1 through 4 will yield erroneous results. To avoid this, use Absolute References, or perform the Moving, Inserting, or Deleting before executing the Copy command.

See Also

Move to move rows or columns on the sheet.

Delete to remove rows or columns.

Insert Columns

```
INSERT COLUMN # of columns: 1      before col: (active
                                     column)
                  between rows: 1  and: 255

Enter a number
```

Description

Inserts blank cells in the shape of all or part of a column or columns. The most common use is to insert complete new columns (accepting the proposed responses of rows 1 and 255). Columns to the right of the inserted ones move right, and the column or columns farthest right on the sheet are lost.

The command can be used to insert parts of columns. Insertion takes place between the specified rows; other rows are not affected.

Multiplan adjusts all references affected by the insertion. Suppose you insert a column between columns 3 and 4. Any cells that previously referred to column 4 will be altered to refer to column 5 instead, because that's where the cells that were in column 4 have been moved.

If a name refers to the expanded area, the name's definition is adjusted. Suppose that *col2__5* is a name defined as C2:5. If a new column is inserted before column 3, the definition of *col2__5* will be changed so that it refers to C2:6 and covers all the cells it did before.

Shared expressions (obtained via copies) are adjusted in accordance with the first use of them.

Examples

To add a column just left of the active one, simply press RETURN:

```
INSERT COLUMN # of columns: 1      before col: (active
                                     column)
                  between rows: 1  and: 255
```

To insert a rectangular area in columns 3 and 4 between rows 3 and 8 (causing parts of rows 3-8 to move right to make room):

```
INSERT COLUMN # of columns: 2      before col: 3
                  between rows: 3  and: 8
```

See Also

Delete to remove columns or rows.

Insert Rows to insert whole or partial rows.

Move to move rows or columns.

Insert Rows

```
INSERT ROW # of rows: 1        before row: (active row)
      between columns: 1       and: 63

Enter a number
```

Description

Inserts blank cells in the shape of all or part of a row or rows. The most common use is to insert complete rows (accepting the proposed responses of columns 1 and 63). Rows below the ones added move down, and the bottom rows of the sheet are lost.

The command can be used to insert parts of rows. Insertion takes place between the specified columns; other columns are not affected.

Multiplan adjusts all references affected by the insertion. Suppose you add a row above row 5. Any cells that previously referred to row 6 will be altered to refer to row 7 instead, because that's where the cells that were in row 6 have gone.

If a name refers to the expanded area, the name's definition is adjusted. Suppose that *row3__9* is a name defined as R3:9. If a row is added before row 5, the definition of *row3__9* will be changed to refer to R3:10, thus covering the same cells as before.

Shared expressions (obtained via copies) are updated in accordance with their first use.

Examples

To add a row before the active row, simply press RETURN:

```
INSERT ROW # of rows: 1        before row: (active row)
      between columns: 1       and: 63
```

To insert a rectangular area in rows 4 and 5 between columns 1 and 8 (causing the lower parts of columns 1-8 to move down to make room):

```
INSERT ROW # of rows: 2        before row: 4
      between columns: 1       and: 8
```

See Also

Delete to remove rows or columns.

Insert Columns to insert whole or partial columns.

Move to move rows or columns.

Jump

JUMP: Name Row-col Window

Select command option or type command letter

Description

Presents a choice of ways to move the cell pointer over the sheet. To display a specific row and column, choose Row-col. To display a named area, choose Name. To go to a different window, choose window.

See Also

JumpTo Name to move the cell pointer to a named area.

JumpTo Row to move the cell pointer to a specific row and column.

JumpTo Window to position to another window.

JumpTo Name

JUMPTO NAME:

Enter reference to cell or group of cells

Description

Moves the cell pointer (and the active window, if necessary) over the worksheet so that a named area is visible. The cell pointer is placed on the upper left corner cell of the named area. If that cell is already visible on the screen, the screen is not moved on the sheet. Otherwise the screen is shifted to make the area visible. The direction keys may be used to step through the name table.

Example

To make the upper left corner of the area named sum__of__costs visible, enter:

JUMPTO NAME: sum__of__costs

See Also

JumpTo Row to make a certain row-column intersection visible.

JumpTo Window to position to another window.

JumpTo Row-col

JUMPTO row: (active row) column: (active column)

Enter a number

Description

Moves the cell pointer (and the active window, if necessary) over the worksheet so that a certain row-column intersection is active. The cell pointer is placed on the specified cell. If the cell requested is already visible on the screen, the screen is not moved on the sheet. Otherwise the screen is shifted so that it shows the part of the sheet containing the specified cell.

Examples

To move to a different row while keeping the present columns on the screen, enter only a row number:

JUMPTO row: 25 column: (active column)

To make row 37, column 9 visible toward the center of the screen, enter:

JUMPTO row: 37 column: 9

See Also

JumpTo Name to make a named area visible on the screen.

JumpTo Window to position to another window.

JumpTo Window

JUMPTO WINDOW window number: row: column:

Enter a number

Description

Moves the cell pointer to the window selected. The cell pointer is placed on the specified cell. The screen is shifted so that the window shows the part of the sheet containing the specified cell.

Examples

To move to a different window and displaying the current cell in that window, enter only a window number:

JUMPTO WINDOW window number:2 row: (active row) column: (active column)

To go to row 23 column 45 in window 3, enter:

JUMPTO WINDOW window number: 3 row: 23 column: 45

See Also

JumpTo Name to make a named area visible on the screen.

JumpTo Row to make a certain row-column intersection visible.

Lock

LOCK: Cells Formulas

Select option or type command letter

Description

Provides two ways to lock cells to protect them from accidental change.

Lock Cells lock and unlocks selected cells.

Lock Formulas locks all cells that contain text or formulas.

The values of locked cells can not be changed by the commands Alpha, Blank, Copy, Edit, or Value.

Locked cells are still affected by the commands Format, Delete, Insert, Move, and Sort.

When some cells are locked, the action key "Next unlocked cell" positions the cell pointer on the next unlocked cell that is not blank. Using lock and this action key, you can quickly locate variable quantities on a complex worksheet and perform "what if" experiments.

The subcommands are explained individually on the following pages.

Lock Cells

LOCK cells: RC status: Locked Unlocked

Enter reference to cell or group of cells

Description

Displays and changes the protection status of cells.

The proposed responses show the status of the active cell.

Lock or unlock selected cells by selecting the appropriate response in the "status" field.

Example

To lock an unlocked cell (R1C1):

LOCK cells: R1C1 status: (Locked) Unlocked

to unlock the whole worksheet:

LOCK cells: R1:R255 status: Locked (Unlocked)

Lock Formulas

LOCK FORMULAS:

Press GO to lock formulas, CANCEL to cancel command.

Description

Pressing GO locks all cells that contain text or formulas. Cells that contain numbers are not changed by the Lock Formulas command.

The Lock Formulas command protects all values generated by formulas. Numbers and any entries made after locking are the exception, and you must decide which unlockcells you want to lock.

See Also

Lock Cells to lock cells with numbers and to unlock cells.

Move

MOVE: Row Column

Select command option or type command letter

Description

Presents a choice of ways to move cells around the sheet. If you want to move whole rows, choose Row. If you want to move whole columns, choose Column.

Inserting, Moving, or Deleting columns or rows between cells which have been copied from a parent cell does not correctly update relative references. For example, if the formula r[-1]c is inserted in r2c1 and copied right 3 cells, then Moving, Inserting, or Deleting any of columns 1 through 4 will yield erroneous results. To avoid this, use Absolute References, or perform the Moving, Inserting, or Deleting before executing the Copy command.

See Also

Copy to duplicate cells.

Delete to delete rows or columns.

Insert to add rows or columns.

Move Column

```
MOVE COLUMN from column: (active column)
                to left of column: (active column)   # of
                                                     columns: 1

Enter a number
```

Description

Changes the order of columns on the sheet by shifting one or more columns left or right. Note: column widths do not move, only the cells.

Multiplan adjusts all references affected by the move. Suppose you move column 5 to a position left of column 2; what was column 5 is now column 2, while former columns 2, 3, and 4 are now columns 3, 4, and 5. This will affect the meaning of all cells that had references to the (former) columns 2-5.

Wherever a cell had a reference to C2, C3, or C4, Multiplan adjusted the reference to be C3, C4, or C5. Where a cell contained a reference to C5, Multiplan corrected it to refer to C2 (where the former C4 has gone).

Multiplan also adjusts relative references after a move. If a cell in the former column 5 had a reference to C[+1], that was a reference to column 6. After the move Multiplan alters the reference to C[+4], so the cell still refers to column 6 despite its change in position.

Multiplan adjusts the definitions of names. Suppose a name *column1_4* had been defined as C1:4 before the move. Multiplan will adjust it to C1:5 so it still accounts for the cells it did before. The name now encompasses the moved column as well.

Example

To move the active column to the left of the sheet (moving all columns now between it and the left edge right by one to make room), enter:

```
MOVE COLUMN: from column:  (active column) to before
                           column: 1
                # of columns:  1
```

See Also

Delete to delete rows or columns.

Move Row to move whole rows.

Insert to add new rows or columns.

Move Row

MOVE ROW from row: (active row) to before row: (active row)
# of rows: 1

Enter a number

Description

Changes the order of rows on the sheet by shifting one or more rows up or down.

Multiplan adjusts all references affected by the move. Suppose you move row 4 to a position above row 2; what was row 4 is now row 2, while former rows 2 and 3 are now rows 3 and 4. This will affect the meaning of all cells that had references to the (former) rows 2-4.

Wherever a cell had a reference to R2 or R3, Multiplan adjusted the reference to be R3 or R4. Where a cell contained a reference to R4, Multiplan corrected it to refer to R2 (where the former R4 has gone).

Multiplan also adjusts relative references after a move. If a cell in the former row 2 had a reference to R[-1], that was a reference to row 1. After the move Multiplan alters the reference to R[-2], so that the cell will still refer to row 1 despite its change in position.

Multiplan adjusts the definitions of names. Suppose a name *row1__3* had been defined as R1:3 before the move. Multiplan will adjust it to R1:4, so that it will still account for the same cells as before. The name now encompasses the moved row as well.

Example

To move the active row to the top of the sheet (moving all rows now between it and the top down by one to make room) enter:

MOVE ROW from row: (active row) to before row: 1
# of rows: 1

See Also

Delete to delete columns or rows.

Insert to add new rows or columns.

Move Columns to move whole columns.

Name

NAME: define name: to refer to:

Enter name

Description

Assigns a name to a cell or area of cells. The name may then be used to refer to that cell or area in a command or formula.

The proposed response for the "define name" field is either a blank or text. If the active cell contains text, Multiplan proposes that text, with any illegal characters removed, as the name to be defined. This makes it easy to convert a title already given to a row or column into a name.

If cell R5C1 contains the text Costs as a title, then the Name command can be used to define the name Costs as R5C2:15. Text used as titles and names are very different and should not be confused. However, it will be easier to read your formulas if their names correspond to the visible titles on your worksheet.

The proposed response for the "to refer to" field is either the active cell or, if the last name defined as a vector (portion of a row or column), the same vector shifted to the active row or column. This feature makes defining parallel groups a simple task.

If the name you enter is already defined, the proposed response in the "to refer to" field is the current definition.

Names must begin with a letter. The rest of the characters of a name may be any combination of letters, numbers, the period (.), and the underscore (_). (These rules are the same ones used in the BASIC programming language.)

Names may be up to 31 characters long.

Names may not be a combination of characters that could be confused with a reference. See the descriptions of references in the "Formulas" section of Chapter 8.

To see the names that have been defined, begin the Name command. Use the direction keys to display each defined name and its definition in the command fields.

To change the definition of a name after viewing it, use the edit keys to alter the response in the "to refer to" field and press RETURN.

Example

To define row 10, columns 3 through 15 as Sales:

NAME:
define name: Sales to refer to: R10C3:15

See Also

eXternal Copy for names associated with external links.

Options

OPTIONS recalc: Yes No mute: Yes No

Select option

Description

The proposed responses show the current settings.

The Recalc option controls when Multiplan performs formula calculations. If the Recalc option is on, Multiplan recalculates all formulas whenever a cell is changed. If the Recalc option is off, recalculation is done only when the RECALC key (f3) is pressed or during Transfer Save.

The length of time Multiplan takes to recalculate a sheet depends on how many cells are in use, and on the complexity of the formulas in them. When you want to make many entries on a busy worksheet, turn the Recalc option off for quicker response. Turn Recalc on again when you want to see the effect of each change.

The Mute option controls the Multiplan audible alarm. The initial setting is No, which means the alarm sounds when an error is made. Select Yes when you want to mute the alarm.

After you press the RETURN key, Multiplan displays in the message line its version number and the total bytes of storage (corresponding to 100% Free) that the computer has.

Print

PRINT: Printer File Margins Options

Select option or type command letter

Description

Presents a choice of four actions related to printing the active worksheet.

Print Printer begins printing.

Print File stores printable output in a disk file.

Print Margins sets the margins that will be used on the printed output.

Print Options specifies the part of the worksheet to be printed and controls part of the printed format and printer setup.

The subcommands are explained individually on the following pages.

Print File

PRINT on file:

Enter a filename

Description

Stores printed output in a disk file rather than sending it to the printer. Such files have several uses. The file might be printed at a later time. You might use a text editor to alter the file before printing it, or you could include the file as an illustration in another text file.

If a file of the same name exists, Multiplan will display the message "Press GO to overwrite existing file?" Press GO to start printing. Pressing any other key cancels the Print File command.

Example

To write a print formatted version of a file to the name BUDGET:

PRINT on file: BUDGET

Print Margins

PRINT MARGINS:
left: 5 top: 6 print width: 70
print length: 54 page length: 66

Enter a number

Description

Alters the margins and page length to be used with printed output. The left margin and the print width are given as a number of characters. The top margin, print length, and page length are given as a number of lines.

The print width sets the maximum number of characters to be printed on each line. The print length sets the maximum number of lines of print on each page. The page length sets the length of the paper so that a form feed advances the paper the correct number of lines to begin printing the next page. When the Print Margins command is complete, the Print command is displayed again.

Example

A sheet of letter-size paper is 8-1/2" x 11". Assuming 10 characters per inch across a page and 6 lines per inch down a page, the page length is 66 lines by 85 characters. To fill these dimensions, you might want a top margin of 3 and a print length of 60 for a bottom margin of 3. A print width of 65 characters leaves 20 characters total for the right and left margins. To center lines on the page, you need a left margin of 10.

PRINT MARGINS: left: 10 top: 3 print width: 65 print length: 60 page length: 66

Print Options

PRINT OPTIONS: area: Printer: formulas: Yes No
row-col numbers: Yes No manual paper feed: Yes No

Enter reference to cell or group of cells

Description

Sets five optional features before printing:

printing only part of the sheet,

printing formulas rather than their values,

suppressing row and column numbers from the printed page,

specifying a printer name other than the default provided by Multiplan,

allowing for manual paper feed.

If you want to print only part of the entire worksheet, specify a reference to a rectangular group of cells, in the "area" field.

You can use a printer other than the Multiplan default printer name. Just enter the name of the printer which you wish to use. More information on specifying printers is provided in Chapter 11.

If you choose to print "formulas," the listing displays the actual formulas that appear in each cell, rather than the calculated values of the formulas, as it normally would. This feature is useful when you want a record of the logic behind a worksheet. Column widths are doubled when "formulas" is set to "Yes."

If you select No for the "row-col" field, row and column numbers are suppressed from the printed page.

If you want Multiplan to pause between pages when printing so you may insert single sheet paper, say "Yes" to manual paper feed.

Example

To print only an area named "Factors," which holds discount percentages:

```
PRINT OPTIONS:
area: Factors Printer:      formulas: Yes No
row-col:  (Yes) No  manual paper feed: Yes (No)
```

Print Printer

PRINT on printer:

Press GO to print, CANCEL to cancel command

Description

Starts printing the sheet under the conditions set up by the Print Margins and Print Options commands.

The time it takes to print depends on the size of the sheet and the speed of the printer.

Empty columns at the right of, and empty rows at the bottom of, the sheet are not printed. Each print line begins with a four-character row number. Multiplan prints as many columns across the page as will fit in the print margins. If there are columns left over, it prints a second page, repeating the same rows and showing the remaining columns. When all the columns have been displayed, Multiplan starts the next set of row numbers on a new page. Thus, if the area to be printed is wider than the paper, you can assemble the complete width by cutting and pasting later.

If a printer error occurs during printing, Multiplan displays the "system file error" message.

See Also

Print File to direct output to a file.

Print Margins to set the dimensions of a page.

Print Options to specify printing of a part of a sheet or to add a title.

Quit

QUIT:

Press GO to quit, CANCEL to cancel command.

Description

Ends the Multiplan session without saving the active sheet. Multiplan requests confirmation; if it is given, Multiplan terminates, returning control to the operating system. The active sheet is lost unless it has been saved as a file; press CANCEL if you have forgotten to save it.

See Also

Transfer Save to save the active sheet.

Sort

SORT by column:
between rows: 1 and: 255 order: (>) <

Enter a number

Description

Reorders the rows on the worksheet within the specified column so that the values will be sorted.

The proposed response for the column field is the active column. The proposed response for the rows is the whole column. The proposed sorting order is ascending order, from least to greatest.

The column to be sorted may contain numbers, text, or other values. Sorting collects the different types into the following groups:

1st - Numbers
2nd - Text
3rd - Logical and error values
4th - Blank cells

Numbers and text are further sorted into either ascending (>) or descending (<) order. Text is arranged according to the ASCII standard character sequence, which is, from "least" to "greatest":

! " # $ % & ' ( ) * + , - . / 0-9 : ; < = > ? @
A Z [/] _ a-z { | } ~

Within each type, equal values are left in the order Multiplan encounters them.

The worksheet can be sorted on multiple columns. To do this, sort the least significant column first. Then, sort the other columns one at a time, from the least significant to the most significant. The example below illustrates this method.

References on the worksheet are updated as described in the "Transforming the Worksheet" section of Chapter 8.

Example

To sort a list of checks into categories (in column 1) by amount (in column 2) with largest amount at the top of each category, first sort all checks by amount in descending order:

SORT by column: 2 between rows: 1 and: 255 order: > (<)

The checks are listed from largest to smallest, but with the categories unsorted. To sort the categories alphabetically:

SORT by column: 1 between rows: 1 and: 255 order: (>) <

The checks are now sorted into categories. The checks within each category are arranged from largest to smallest. Because Multiplan leaves equal items in the order it finds them in the column it is sorting, any previous sorting in other columns is retained.

Transfer

TRANSFER:
Load Save Clear Delete Opticns Rename

Select option or type command letter

Description

Offers a choice of five subcommands which affect an entire sheet.

Transfer Load loads a saved sheet, replacing the active sheet.

Transfer Save saves the active sheet in a disk file.

Transfer Clear clears the active sheet, deleting all its contents.

Transfer Delete deletes the disk copy of the active sheet.

Transfer Options specifies which disk drive to use, or which file formats.

Transfer Rename saves the active sheet under a new name and updates external links.

The subcommands are explained individually on the following pages.

Transfer Clear

TRANSFER CLEAR:

Press GO to clear sheet, CANCEL to cancel command.

Description

Clears the worksheet work area, and restores the formatting to the default settings. This allows you to start a new worksheet. Transfer Clear does not save a copy of the worksheet on disk. See the Transfer Save command to save the worksheet.

Transfer Delete

TRANSFER DELETE filename: (name of active sheet)

Enter a filename, or use direction/page keys to view directory

Description

Deletes a saved worksheet from the disk.

The proposed response is the active worksheet name. Pressing one of the direction keys when you see the proposed response causes Multiplan to display a directory of files. To use the direction keys, see the directory display explanation under the Transfer Load command. Press the RETURN key to select the filename that is highlighted.

When you press the RETURN key, Multiplan displays the message "Press GO to delete, CANCEL to cancel command." Press GO to delete the file. Pressing CANCEL will cancel the Transfer Delete command.

Use Transfer Delete to clear your disk of unwanted files.

Transfer Load

TRANSFER LOAD filename:

Enter a filename, or use direction/page keys to view directory.

Description

Loads a sheet from a disk file. The disk file name must be spelled and punctuated as it was when the sheet was saved with the Transfer Save command. Multiplan, however, is not case sensitive. The file "aaa" is equivalent to the file "AAA".

Pressing any one of the direction keys causes Multiplan to display a directory of files.

Once the directory is on the screen, use the direction keys to move the highlight among the filenames. As you do, the filename also appears as a proposed response in the "filename" field in the command line. Press the RETURN key to load the highlighted file.

While the directory is visible, pressing any other key besides a direction key causes the worksheet previously on the screen to reappear. This other key has the same effect as it does while editing responses in command fields that need to be filled in, as described in the "Editing" section of Chapter 8.

When a "Normal" mode Multiplan worksheet disk file is loaded, it replaces the sheet on display and becomes the active sheet.

As a special feature, the Transfer Load command can also load worksheets from files written by other systems in an acceptable interchange format. Data read from one of these files will be merged with the active worksheet, rather than replacing it. To avoid this merging, first use the Transfer Clear command.

Example

To load a sheet saved in a file named INCOME:

TRANSFER LOAD filename: INCOME

SeeAlso

Transfer Save to save the active sheet as a disk file.

Transfer Options

TRANSFER OPTIONS
mode: Normal Symbolic Other Path:

Select option

Description

The "Path" field changes the directory currently being used for all subsequent Transfer commands.

The "mode" field specifies the file format for all subsequent Transfer Load and Transfer Save commands.

The format choices are:

Normal:	the Multiplan binary format. External references require that the referenced worksheet be saved in Normal format. This format is also the most efficient use of disk space and requires the least transfer time.
Symbolic:	the format for data interchange with other programs.
Other:	Visicalc™ file format. Multiplan can load files in this format. The loaded file is merged with the active sheet. Worksheets cannot be saved in Other mode. If you try to do so, Multiplan displays an "Illegal parameter" error message.

Transfer Rename

TRANSFER RENAME filename: (name of active sheet)

Enter a filename

Description

Gives the active sheet a new name. The present name is displayed as the proposed response; a clear sheet has the name *TEMP*. The renamed sheet is saved and external linkages are adjusted.

The name has limited use except in the Transfer Save and Transfer Delete commands; then it appears as the proposed response for the filename to be saved or deleted.

The filename may be up to eight characters long and must be composed of uppercase letters and digits.

Examples

To give the active sheet the name JUNE82, enter

```
TRANSFER RENAME filename: JUNE82
```

See Also

Transfer Clear to clear the screen of the active sheet.

Transfer Load to load a saved sheet.

Transfer Save to save the active sheet as a disk file.

Transfer Save

TRANSFER SAVE filename: (active sheet's name)

Enter a filename

Description

Saves the active sheet as a disk file, from which it can later be loaded with Transfer Load. The proposed name for the disk file is the name last given with Transfer Rename, or the name last loaded with Transfer Load, or TEMP if the sheet is a clear one.

If the filename is a duplicate of one that exists on the disk already, the message

Press GO to overwrite existing file, CANCEL to cancel command

appears when RETURN is pressed, requesting permission to replace the file of the same name now on the disk. Respond with GO to give permission, or with CANCEL to abort the save and preserve the existing file.

Examples

To save the active sheet under the proposed name, simply press RETURN.

To save it under the name *PRACTICE*, enter:

TRANSFER SAVE filename: PRACTICE

See Also

Print File to put the displayed form of the sheet in a disk file.

Transfer Load to load a sheet saved previously.

Transfer Rename to change the name for the sheet.

Window

WINDOW: Split Close Border Link

Select command option or type command letter

Description

Presents a choice of four things that can be done with windows.

To open a new window by splitting the active window horizontally or vertically, or to open a window used strictly for titles, choose Split (or just press TAB).

To close a window by removing it from screen, choose Close.

To add or remove a decorative border around a window, choose Border.

To link or unlink two windows, choose Link.

Window Border

WINDOW change border in window number: (active window)

Description

Changes the border of the specified window. If the window presently has a border, it is removed. If it lacks a border, one is added.

A border takes up one screen position on each side of the window, reducing the area for the display of data by two screen lines and two screen columns.

Window Close

WINDOW CLOSE window number: (active window)

Enter a number

Description

Closes a window (removes it from the screen). The window's shape, location on the screen, and view of the sheet are forgotten.

The other windows stretch out to occupy the screen area used by the closed window. Windows are renumbered.

If there is only one window open, the Window Close command is ignored.

See Also

Window Split to open windows.

Window Link

WINDOW LINK window number: with window number:

Enter a number

Description

Links two or more windows together to allow both windows to scroll together. You can link only windows which are neighbors. The direction of the linking follows the direction of the original split. You can break existing links by specifing the windows to be separated and pressing GO.

Examples

To link window 1 and window 3 together:

WINDOW LINK window number:1 with window number: 3

To break the link of window 1 and window 2:

WINDOW LINK window number: 1 with window number: 2

Window Split

WINDOW SPLIT: Horizontal Vertical Titles

Select command option or type command letter

Description

Presents a choice of three ways to open a window by splitting the active window. To split the active window across the screen, giving two windows wider than they are high, choose Horizontal (or just press TAB). To split the active window between columns, choose Vertical. To split both vertically and horizontally and freeze titles on the screen, choose Titles.

See Also

Window Close to close a window.

Window Split Horizontal

```
WINDOW SPLIT HORIZONTAL at row: (active row)
Linked?    Yes[No]

Enter a number
```

Description

The active window is split horizontally. The display space used by the given row and the rows below it becomes the new window; the space above the given row remains part of the original window.

The new window is given the next unused window number, and is made the active window.

Example

To split the active window at the active row, just press RETURN.

To split it at the display line presently showing row 34, and to make the windows linked, enter:

```
WINDOW: SPLIT HORIZONTAL at row: 34    Linked?
Yes[No]
```

See Also

Window Close to close a window.

Window Split Titles to split the window both horizontally and vertically.

Window Split Vertical to split the active window along a column.

Window Split Vertical

WINDOW SPLIT VERTICAL at column: (active column)
linked: Yes (No)

Enter a number

Description

The active window is split vertically. The display space used for the given column and the columns to its right is used for the new window; the space used for columns to the left of the active column remains part of the original window.

The new window is given the next unused window number, and becomes the active window.

Examples

To split the window at the active column, just press RETURN.

To split the window at the column presently displaying column 3, enter:

```
WINDOW SPLIT VERTICAL at column: 3   Linked?   Yes[No]
```

See Also

Window Close to close a window.

Window Split Horizontal to split a window along a row.

Window Split Titles to split the window both horizontally and vertically.

Window Split Titles

WINDOW SPLIT TITLES: # of rows: # of columns:

Enter a number

Description

The active window is split to form two or four windows. The windows formed are linked, so that they will scroll together.

The specified number of rows becomes a window at the top of the display space occupied by the original window.

The specified number of columns becomes a window at the left of the display space occupied by the original window.

The remaining display space becomes the active window. It is linked for horizontal movement with the window above it, and for vertical movement with the window to its left.

Example

Suppose that column 1 contains descriptive titles for the rows of the sheet, and columns 2-25 contain data matching those titles. You would like to scroll the data columns horizontally while holding the titles fixed on the screen. If you scroll vertically, both titles and data should move so that the titles will remain aligned with the matching data. Enter:

WINDOW SPLIT TITLES: # of rows: 0 # of columns: 1

See Also

Window Close to close a window.

Window Split Horizontal to split a window along a row.

Window Split Vertical to split a window along a column.

eXternal

EXTERNAL: Copy List Use

Select option or type command letter

Description

Presents a choice of actions relating to the use of data on inactive (external) sheets.

eXternal Copy copies data from an inactive worksheet to the active worksheet. This command can also establish an external link, a permanent relationship that automatically causes data to be copied from a source, or supporting sheet, to the active, or dependent, sheet every time the latter is loaded into Multiplan.

eXternal List displays the lists of supporting and dependent worksheets.

eXternal Use assigns a substitute name for a specified sheet.

See the "Files" section in Chapter 8 for more information on external links and file accesses.

The subcommands are explained individually on the following pages.

eXternal Copy

EXTERNAL COPY from sheet: name:
to:RC link: Yes (No)

Enter name

Description

Copies values from a group of cells on an external worksheet to the active sheet. The source sheet is defined in the "from sheet" field of the command. The proposed response for the "from sheet" field is the sheet name used in the last eXternal Copy command.

The cells to be copied from the source sheet are described in the "name" field. This field may contain a name which is defined on the source sheet to refer to a group of cells, or it may be an absolute reference to a single rectangle on that sheet (e.g., R2C1:12; see also the discussion of absolute references in the "Formulas" section of Chapter 8).

The "to" field is used to specify the destination of the copy on the active sheet. The proposed response is the active cell. If a single cell is specified in this field, the source group will be copied starting at the cell. If a group of cells is specified in the "to" field, the shape of the group must correspond to the shape of the source group, cell-by-cell. Otherwise, an error message is displayed, and the copy does not take place.

The integrity of the active sheet is further protected by checking that all destination cells are blank. An attempt to copy into a nonblank cell also causes an error message, and copying is canceled.

The eXternal Copy command does not copy formulas, but only the values derived from formulas. This is different from the "Copy" group of commands because those commands copy formulas as well as values. For example, if a cell containing the formula 100*rate is copied from an external sheet, the destination cell may receive the constant value 20 (assuming rate = .20).

This value alone does not show the dependence of the result on changes to the "rate" cell on an external sheet. The external link facility is provided to express permanently the relationship between the value on the "depending" sheet and the source of the value (the formula on the "supporting" sheet).

External links are controlled by the options in the "link" field of the eXternal Copy command. If "No" link is selected, the command has no other effect than copying the values as described above. Information on possible dependencies is not recorded at all. If the source data is not expected to change, this option would be the most convenient.

Selecting "Yes" in the "link" field establishes an external link between the source data and the destination. The source sheet is supporting the active, or dependent, sheet. Of course, the same sheet may be in supporting and dependent roles in different external links.

After an external link is established, every time the dependent sheet is loaded (using Transfer Load command), all the data described in the external links is automatically copied from the source sheets to the specified destinations. Any change in the source data is reflected on the dependent sheet.

The "formulas" associated with the destination cells - as seen on the status line or using the "formulas" Format Option - also show the data in the cells as dependent on a link, in the form:

[sheetname sourcename]

Destination cells are protected from changes just as if they were locked. However, they can be "unlocked" only by removing or redefining the external link in which the cells participate.

To remove a link, specify the source sheet, source name, empty destination, and "Yes" for linking in the eXternal Copy command.

To redefine a link so that it has a different destination on the active sheet, redefine the link with a new destination on the active sheet. Because a source area on an inactive sheet may be copied only once by each active sheet, the new destination replaces the former one in the ink.

Both the removing and redefining of links, as well as the review of the existing links, is simplified by the use of the direction keys to step through the source (supporting) sheet names or the names of source cells in a given sheet. The "to" field is filled in by Multiplan to show the destination of the external link, as currently defined.

The Name command, when used immediately after an eXternal Copy, will propose to the define the name

sheet·source

to refer to the destination of the copy. If defined (by pressing RETURN), this name can be used in other formulas on the active sheet to refer to the copied data.

The automatic copying process from supporting sheets requires that the files that contain the sheets be available to Multiplan. This topic is discussed in the "Files" section in Chapter 8.

Before copying the data in each link, the definition of the name for the source cells is checked. If the name definition has been changed since the link was established, an error message is displayed, and the copy does not take place. Otherwise, the cells are copied to the destination cells, even though they are not blank but contain the results of the previous external copy.

Areas that have been eXternally copied from or to other worksheets should not be altered in size or shape. Only the format or contents of externally copied cells should be modified.

Example

To copy the value of the area named Sales from the worksheet named INCOME to the area starting at cell R5C5 on the active worksheet, and to set a permanent link:

EXTERNAL COPY
from sheet: INCOME name: Sales
to: R5C5 linked: (Yes) No

Assuming that the area named "Sales" is a 12 cell wide part of a row, the destination for the copy will be R5C5:16. The Name command proposes:

NAME define
name: INCOME·Sales to refer to R5C5:16

eXternal List

EXTERNAL LIST:

Description

Produces a display of the names of worksheets supporting the active sheet and those dependent on the active sheet. The "supporting" and "dependent" relationships are explained in detail under eXternal Copy and in the "Files" section in Chapter 8.

The list of supporting sheets includes the "alias" names defined by eXternal Use.

Example

Sheets supporting Department:

Year81 instead of year
Labor

Sheets depending on Department:

Consolidated

eXternal Use

EXTERNAL USE filename: instead of:

Enter filename

Description

Sets a substitute name (alias) for a sheet.

The proposed response in the second field is the previous response, if any; otherwise, blank.

All references to the name in the "instead of" field will be directed to the name in the "filename" field. Copies from the affected file, if any, will be redone.

The name in the "instead of" field need not be the name of an actual file. The example shows how this feature may be used.

Example

Assume that an active sheet has links to the supporting file PLAN82. To view the figures that result from using the data on PLAN83 instead (which must be identical in format to PLAN82):

EXTERNAL USE filename: PLAN83 instead of: PLAN82

This saves you having to remove the links from PLAN82 then redefine links to PLAN83. Also, you can return to PLAN82 easily by switching the responses in the fields of this command.

As an alternative, you could use a "logical name" when referring to supporting sheets. (A "logical name" is not the name of an actual file, but a name used only for setting up external links.) Under this method, a substitution must be made through the eXternal Use command before setting up links between sheets:

EXTERNAL USE filename: PLAN 82 instead of: PLAN

Then, the name PLAN, which is not a file but a "logic name" used for defining links, may be used to set up the links in the eXternal Copy command and as a response in the "instead of" field in the eXternal Use command in future substitutions. For example, when you want to see the results of your plan for 1983:

EXTERNAL USE filename: PLAN83 instead of: PLAN

and all links will now be changed to refer to PLAN83.

This method permits you to refer to whatever file you choose in the eXternal Use command without having to remember which file is the pattern for the substitutions. It is easier to specify PLAN than to remenber that the current links are to PLAN82, or whatever file.

Chapter 13
Function Directory

The following examines all the functions that can be used in Multiplan formulas. Each entry describes the operation of a function and its requirements for input. Cross-references are given to lead you to functions that are related to the function being described. You may, in addition, want to refer to the chapter outline for a list of all the functions described in this directory.

ABS (Numeric Value)

Description

Returns the absolute value of the argument. If the argument is zero or positive, the result is equal to the argument. If the argument is negative, the result has the same magnitude and a positive sign.

Requirements

Numeric value must be a single numeric value. It may be a number, a reference to a single cell, or a formula.

Examples

```
"Difference:" & DOLLAR(ABS(first - second))
LOG10(ABS(anyvalue))
```

See Also

SIGN for the sign of a number; ABS is equivalent to number*SIGN(number).

MAX for the larger of two numbers.

MIN for the lesser of two numbers.

ATAN (Numeric Value)

Description

Calculates the Arctangent (inverse Tangent) function of the argument, an angle in radians.

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Example

```
ATAN (thetarow C)
```

See Also

TAN for the Tangent function.

AND (list)

Description

Returns the logical value true if all of the specified argument values are true. Otherwise, returns false.

Requirements

The argument entries must be logical values. If not, the #VALUE! error value is returned.

Example

IF(AND(SUM(WORK)>82, Final>50)), credit, "failed")

See Also

OR and NOT to operate on logical values.

IF to test a logical value.

AVERAGE (Number or Reference)

Description

Returns the average (numerical mean) of all cells contained in the arguments given. Up to five arguments (separated by commas) may be specified.

Example

```
AVERAGE(balance)

AVERAGE(scores R10)
```

See Also

MAX for the largest value in an area.

MIN for the least value in an area.

SUM for the sum of all numeric values in an area.

COUNT for a count of numeric cells in an area.

COS (Numeric Value)

Description

Calculates the Cosine of the argument, an angle in radians.

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Example

```
COS(thetarow C)
```

See Also

SIN and *TAN* for the other trignometric functions.

ABS for the absolute value of a number.

COLUMN()

Description

Returns the number of the column in which the formula containing this function appears.

Example

1981+COLUMN()-4

can produce the sequence of years 1981, 1982,..., starting in column 4. (Place this formula in column 4, then Copy Right from column 4 as many cells as the number of years you want in the series.)

COUNT (Number or Reference)

Description

Returns the count of cells containing numbers or numeric formulas in the area defined by the reference given. Cells are not counted if they contain strings or are blank. Up to five arguments (separated by commas) may be specified.

Example

```
FIXED(COUNT(deposits),0) & "deposits"
```

See Also

MAX for the largest value in an area.

MIN for the least value in an area.

AVERAGE for the average value of an area.

SUM for the sum of the values in an area.

DOLLAR (Numeric Value)

Description

Produces a character string representing its argument, formatted for display as an amount in dollars.

The number is rounded to two decimal places. If it is less than 1, a zero appears in the units position. A dollar sign is added before the leftmost digit. If the number is less than zero, the result is enclosed in parentheses (the standard way of showing a negative balance in bookkeeping). Here are examples of these rules:

DOLLAR(2.715) produces "$2.72"

DOLLAR(0.15) produces "$0.15"

DOLLAR(0) produces "$0.00"

DOLLAR(-1) produces "($1.00)"

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Example

```
"Total:" & DOLLAR(SUM(deposits ))
```

See Also

FIXED to format a number without the dollar sign.

VALUE to change a numeric display back to a number.

EXP (Numeric Value)

Description

Calculates e (2.7182818, the base of the natural logarithms) to the power of the argument. This is the inverse (antilog) function of LN.

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Example

```
"'e' is" & FIXED(EXP(1),14)
"SINH =" & FIXED( (EXP(theta)-EXP(-theta))/2 ,8)
```

See Also

LN for the natural logarithm of a number.

FIXED (Numeric Value, Digits)

Description

Produces a character string representing its first argument formatted as a fixed-decimal number with the given number of decimal digits. The first character of the string is a minus sign if it is negative.

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Digits must be an integer between -30 and 30. It may be a reference to a single cell, a number, or a formula. If digits is a negative number, this says to round that number of places to the left of the decimal (e.g., FIXED (1234, -2) is 1200).

Example

```
FIXED((first/second)*100, 2) & "percent"
```

See Also

DOLLAR to format money amounts.

VALUE to convert a numeric display back to a number.

FALSE()

Description

Returns the logical value false.

Example

If you are planning on putting a complicated condition into a cell, you can use FALSE() to put a logical value in for testing before you construct the more complicated expression.

See Also

AND, OR, and NOT to operate on logical value.

IF to test a logical value.

IF(Logical Value, Then Value, Else Value)

Description

If the logical value is true, returns the then value. Otherwise, returns the else value. These values may be numeric, text or logical values.

Example

IF(grade>80,"excellent",grade)

See Also

AND, OR, and NOT to operate on logical values.

ISNA and ISERROR to check for error values.

INDEX(Area, Subscripts)

Description

Returns the value of a cell selected by subscripts from the rectangular area.

One or two subscripts may be given. With one subscript, the area must be a row or column with a height or width equal to one. Subscript value 1 selects the first cell in the row or column, value 2 the second cell, and so on.

If two subscripts (separated by commas) are given, the area may be rectangular. The subscripts select the row and column in the area, starting at 1 in each case.

If any index exceeds the limits of the area, the #NA! (not available) error value is returned.

Example

To repeat the first column in the first row, copy the formula

INDEX(C1,COLUMN())

throughout the first row.

If the area Score is a table giving adjusted composite scores for raw scores on two components in a test, then:

INDEX(Score,Raw1 C,Raw2 C)

will give the appropriate composite score, based on the two raw scores.

INT(N)

Description

Returns the argument as an integer, truncating any fraction it may have.

Example

"fraction="&FIXED(number-INT(number),4)

INT(6) is 6

INT(8.9) is 8

INT(-123.999) is -124

See Also

ROUND to round a number to a certain decimal place.

ISERROR(Value)

Description

Returns the logical value true if the argument is any of the error values (#N/A,#VALUE!, #REF!, #DIV/0!, #NUM!, #NAME?,#NULL!). Otherwise returns false.

Example

IF(ISERROR(ratio),"check your numbers","")

See Also

IF to test a logical value.

ISNA(Value)

Description

Returns the logical value true if the argument is #N?A (not available). Otherwise, returns false.

Example

IF(ISNA(balance),"0",balance)

See Also

NA to produce #N/A! value.

IF to test a logical value.

ISERROR to test for all error values.

LEN(T)

Description

Returns the number of characters in the text value.

Example

IF(LEN(Roster)>280, "disqualify", "OK")

LN (Numeric Value)

Description

Calculates the natural logarithm (log to the base e) of the argument.

Requirements

Numeric value must be a single, positive numeric value. It may be a reference to a single cell, a number, or a formula. A #NUM error occurs if the value is less than or equal to zero.

Example

```
"log2=" & FIXED(LN(value)/LN(2),8)
```

See Also

ABS to ensure that the argument is positive.

EXP for the inverse (antilog) of LN.

LOG10 for logarithms to the base 10.

LOG10 (Numeric Value)

Description

Calculates the logarithm to the base 10 of the argument. The inverse function (antilog) can be gotten by the constant 10 to the power of a log, using the exponentiation function (^).

Requirements

Numeric value must be a single, positive numeric value. It may be a reference to a single cell, a number, or a formula. A #NUM error will occur if the number is negative or zero.

Example

```
REPT( "+", INT( LOG10( ABS(value))) )
```

See Also

ABS to ensure that the argument is positive.

LN for logarithms to the base e, and other bases.

LOOKUP (Argument, Table)

Description

Searches for *argument* in the first row or column of the area reference as table. Returns the contents of a cell from the last row or column of table.

The dimensions of *table* determine the way the search is done. If *table* is wider than it is high (has more columns than it has rows), then the *argument* is searched for among the first cell in each column of *table,* and the result is taken from the cell in the last column.

If *table* is square, or higher than it is wide, the search is made among the first cells of each row of the table and the result is taken from the cell of the last row.

The search proceeds along a column or row until a cell is found that is numerically equal to or greater than *argument.* The cell next to that cell is returned as the result of the function. If all cells are less than argument, the last one is taken as the result.

The function works only with numeric values. An *argument* that is a character string will cause a #VALUE error, and a result that is a character string will be returned as zero.

Requirements

Argument must be a single numeric value. It may be a reference to a single cell, a number, or a formula. *Table* should be a reference to a rectangular area. Areas of other shapes are permissible but the function is harder to interpret.

Examples

You have created a two-column table named *Brackets* in which the first column contains the largest annual salary in a given tax bracket, and the second column contains the tax rate percentage for that bracket. A cell named *Salary* contains a salary. Then a cell named *Tax* could contain this formula:

```
Salary * LOOKUP (Salary, Brackets)
```

MAX (Number or Reference)

Description

Produces the largest numeric value in the area given by the argument. Up to five arguments (separated by commas) may be specified.

Example

```
"Best of" & FIXED( COUNT(scores),0 ) & "is"
      & FIXED( MAX(scores),2 )
```

See Also

MIN for the least value in an area.

AVERAGE for the average value of an area.

SUM for the total of an area.

COUNT for the number of numeric cells in an area.

MID (String, Start, Count)

Description

Produces some of the center characters of the first argument. The first character to be taken is set by the second argument. The number of characters is set by the third argument.

If *start* is equal to one, the function is equivalent to LEFT. If it is between one and the length of *string*, the result will begin with the character indexed by *start*.

If *count* is zero, or if *start* is greater than the length of *string*, no characters are produced; the result is still a string but has zero length. Otherwise, the result has as many characters from *string* as possible, from one up to count.

If *count* is negative, a #VALUE error results.

Requirements

String must be a single string. It may be a reference to a single cell, a string constant, or a formula that produces a string.

Start and *count* must be single numeric values. They may be references to single cells, numbers, or formulas. If either has a fractional part it is truncated to an integer before use.

Example

```
MID("HmmOK WOW", 4+3*SIGN(INT(grade/10)-8), 3)
```

See Also

LEFT or *RIGHT* to select the left or right part of a string.

REPT to produce a string of identical characters.

MIN (Number or Reference)

Description

Produces the least numeric value in the area given by the argument. The *least* value is also the smallest value when all values are positive. If there are negative values, then the *least* value is the most negative one. Up to five arguments (separated by commas) may be specified.

Example

```
"Best of" & FIXED(COUNT(times),0) &
      "is" & FIXED(MIN(times),0)
```

See Also

MAX for the largest value in an area.

AVERAGE for the average value of an area.

SUM for the total of an area.

COUNT for the number of numeric cells in an area.

MOD(dividend, divisor)

Description

Returns the remainder of dividend divided by divisor. The result has the same sign as the dividend.

Requirements

Both parts of the argument must be numeric value. If the divisor is zero, a #DIV/O! error value is returned.

Example

MOD(3,2) = 1

MOD(-3,2) = -1

MOD(-3,-2) = -1

MOD(3,-2) = 1

In general: MOD(x,y) = x-INT(x/y)*y

NA ( )

Description

Returns the #N/A (not available) special value. This value may be used to mark data points that are yet to be defined.

Example

By assigning NA() to the interest rate, all values on the worksheet that depend on the interest rate will change to #N/A.

NOT(Logical Value)

Description

Returns the opposite of the logical value argument (false if the argument is true; true if the argument is false).

Example

IF(OR(credit>limit,NOT(AND
(conditions))), "not qualified","")

where "conditions" is a group of cells and each cell contains one necessary condition of credit worthiness.

See Also

AND and OR to operate on logical values.

IF to test a logical value.

NPV (Rate, Annual Flow)

Description

Produces the present value of a series of annual future receipts, given a discount rate.

Net Present Value is the amount of money that, if you had it now, would make it possible to produce a specified amount in the future, given some interest rate.

For example, what amount would be required today to produce $1000 a year from now, given an interest rate of 12%? (The answer is $892.86.)

The NPV function is generalized to handle a series of cash flows, each representing one year's total receipts from an investment of the specified rate.

Requirements

Rate is an interest rate, expressed as a decimal fraction (less than 1 (0.11 is a rate of 11%). It must be a single numeric value, either a reference to a single cell, a formula, or a numeric constant.

Annual flow may be one or more numeric values. It may be a reference to a cell or group of cells, or a series of numeric values separated by commas. The first value is taken as the required income this year; the second as the required income next year, etc.

Example

You require $1000 next year and $1500 at the end of the year thereafter. You are offered an interest rate of 12% annual. How much must you invest? Enter:

```
NPV(0.12,0,1000,1500)
```

OR(List)

Description

Returns the logical value true if any value in the list is true. Otherwise, returns false.

Requirements

The argument entries must be logical values. If not, the #VALUE! error value is returned.

Example

IF(OR(grad>80,final>=150),"good work","")

See Also

AND and NOT to operate on logical values.

IF to test a logical value.

PI()

Description

Returns the value 3.1415926535898, an approximation of the mathematical constant PI.

Example

SIN(PI()/4)

REPT(T, Count)

Description

Returns a text value consisting of count repetitions of T. If count is zero or negative, no characters are returned. Otherwise, the length of the result will be the length of T multiplied by count.

This function may be used to create bar graphs, or repeating patterns (such as printer rules) to separate areas of the worksheet.

Requirements

T is usually a single character, but it may be any number of characters.

Count must be a numeric value, which will be truncated to an integer.

Example

REPT("+",SCORE/3)

ROUND (Numeric Value, Digit)

Description

Produces the first argument, rounded to the number of decimal places specified by the second argument.

The second argument, *digit*, specifies the rounding as follows. If it is greater than zero, then the result will be rounded so that it has that many decimal places. For example, ROUND(3.1416,3) produces 3.142.

If digit is zero, the result is rounded to an integer. If digit is negative, rounding is carried into the integral part of the number. For example, ROUND(26,-1) produces 30 while ROUND (999,-2) produces 1000.

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Digits must be a single numeric value. It may be a reference to a single cell, a number, or a formula. If it has a fractional part it is truncated to an integer before use.

Example

```
"Change is" &
    FIXED( ROUND( 100*(new-old)/old, 2), 2) & "%"
```

See Also

INT to produce the integer part of a number.

FIXED to format a number to a given number of decimal places.

SIGN (Numeric Value)

Description

Produces a number representing the algebraic sign of the argument. If *numeric value* is positive, the function produces 1. If it is zero, the function produces 0. If it is negative, the function produces -1.

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Example

You want to display both the logarithm of a number and its sign:

```
MID('- +',SIGN(num)+2,1) & FIXED(ABS(LOG10(num)),6)
```

See Also

ABS to produce the absolute value of a number.

SIN (Numeric Value)

Description

Calculates the Sine of the argument, an angle in radians.

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Example

```
SIN(thetarow C)
```

See Also

COS and *TAN* for the other trigonometric functions.

ABS for the absolute value of a number.

SUM (Number or Reference)

Description

Returns the sum of the values of the cells that contain numeric values in the area defined by the reference. Up to five arguments (separated by commas) may be specified.

Requirements

If the referenced area includes blank cells or strings they are ignored.

Example

```
(1+rate)*SUM(deposits January)
```

See Also

MAX for the largest value in an area.

MIN for the least value in an area.

AVERAGE for the average value of an area.

COUNT to count the numeric cells in an area.

STDEV(List)

Description

Calculates the sample standard deviation of the number values represented by the list according to the formula:

$$\sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}}$$

Example

STDEV(grades)

See Also

AVERAGE for the average value.

TRUE()

Description

Returns the logical value true.

Example

If you are planning on putting a complicated condition into a cell, you can use TRUE() to put a logical value in for testing before you construct the more complicated expression.

See Also

AND, OR, and NOT to operate on logical values.

IF to test a logical value.

TAN (Numeric Value)

Description

Calculates the Tangent of the argument, an angle in radians. The result of the function changes rapidly when the angle is near pi/2 or an odd multiple of pi/2. You should not rely on the full precision of the result in such cases.

Requirements

Numeric value must be a single numeric value. It may be a reference to a single cell, a number, or a formula.

Example

```
TAN(thetarow C)
```

See Also

COS and *SIN* for the other trigonometric functions.

ABS for the absolute value of a number.

VALUE (String)

Description

Produces the number described by the argument. The argument must be the display form of a number, as produced by any of the formatting codes used by Multiplan. It may contain leading or trailing spaces, a leading dollar sign, a leading minus sign, or be enclosed in parentheses. It may contain a decimal point. It may be in scientific notation.

For example, the following character strings will all yield the numeric value 10: 10, $10.00, 1E1. The following strings will yield negative 10: -10, -1E1, (10), ($10.0000).

Requirements

String must be a single string. It may be a reference to a single cell, a constant string, or a formula with a string result. If the contents of the string don't describe a number—if they include letters, for instance, or two decimal points—a #VALUE error will occur.

Example

Suppose that the cell date contains the string 6/14/83. Then

```
VALUE(MID(date,4,2))
```

produces the number 14.

Chapter 14
Message Directory

The following directory lists all the possible messages and prompts that Multiplan may display, along with explanations of the possible causes of the messages and what actions you may take in response to them.

Cannot open file

Cause. The file for a supporting sheet cannot be found when Multiplan attempts to make a linkage permanent or remove it. This is unlikely to occur unless you have switched diskettes or have a hardware problem.

Action. Make sure that the disk file really exists. If you have diskette drives, make sure the right diskette is mounted. If you have a multi-user computer system, check to see if you have both read and write access to the file.

Cannot read file

Cause. The file named in a Transfer Load cannot be found or is not accessible to Multiplan.

Action. Make sure that the disk file really exists. If you have diskette drives, make sure the correct diskette is mounted. If you have a multi-user computer system, check to see if you have both read and write access to the file.

Cannot write file

Cause. The file named in a Transfer Save or Print File cannot be written to disk, either because (1) the disk is full; (2) a file of the same name exists and has been **write-protected**; or (3) the entire disk or diskette is write-protected.

Action. Look for operating system error messages on the screen; check them in system documentation. Try the Save again with a filename you know to be unique; if it works, the cause was (2). If you have diskette drives, perhaps the diskette is full. Try a different diskette.

Check diskette and enter *Y* to retry access to <filename>

Cause. The file named cannot be found or is not accessible to Multiplan.

Action. Enter *N* if the file is not appropriate. Make sure that the disk file really exists. If you have diskette drives, make sure the correct diskette is mounted. If you have a multi-user computer system, check to see if you have both read and write access to the file.

Circular references unresolved

Cause. A chain of cells is referring to each other and the last back to the first. (The simplest case is a cell containing a reference to itself—RC—but the chain may be many steps long.) Multiplan has calculated all the cells of the chain once and found itself starting over. It stops calculating, leaving the cells in the circular chain in an undefined state.

Action. Alter the logic of the sheet so that there is no circularity.

Command is too long

Cause. The command, formula, or string on the command line is too long to be displayed there.

Action. The command, formula, or string must be shortened.

Enter a formula

Cause. Multiplan awaits a formula. The direction keys can be used to put a reference into the formula.

Action. Enter a formula, a number, or a string (enclosed in quotes), or press ABORT to cancel the command.

Enter a filename

Cause. The active field of the command takes the name of a file to be written.

Action. Enter a filename, or press ABORT to cancel the command.

Enter a filename, or use direction keys to step through directory

Cause. The active field of the command takes a filename existing on the disk. The direction keys may be used to review the next filename in sequence: the left arrow shows the prior filename, the right arrow shows the next; if your system allows it, the up arrow shows the first file, and the down arrow shows the last.

Action. If you know the name of the file desired, enter it. If you want to examine the names of all saved sheets, use the direction keys to step through the list. Or you may press ABORT to cancel the command.

Enter a number

Cause. The active field of the command takes a single number: a row or column number, or a quantity, such as margin spacing.

Action. Enter a number (a small integer; don't use a decimal point or scientific notation), or press ABORT to cancel the command. Note that it is possible to enter a formula, though it must result in a small integer.

Enter a number, or D for DEFAULT

Cause. In the Format Width command, the width of a column can be set to a specific width in characters, or to the width set by the Format Default Width command.

Action. Enter a number from 3 to 32, or the letter D, or press ABORT to cancel the command.

Enter reference to cell or group of cells

Cause. The active field of the command takes a reference of any kind, including a list (a union) of references.

Action. Enter a reference to a cell (or cells), or press ABORT to cancel the command.

Enter name (no single quotes)

Cause. The active field of the command takes a name. Names may contain spaces and special characters; when they do they normally have to be enclosed in single quotes. Quotes aren't needed here because only a name is expected in this field. Multiplan may have proposed a response.

Action. To accept the proposed response, press TAB to move to the next field or press RETURN. You may edit the response, enter a (different) name, or press ABORT to cancel the command.

Enter text

Cause. The active field takes a response of any characters.

Action. Enter the text you want, or press TAB to move to another field, or press ABORT to cancel the command.

Enter text (no double quotes)

Cause. The active field of the command takes a string of characters. In a formula, a string has to be enclosed in double quotes. Quotes aren't needed here because only a string is expected in this field. Multiplan may have proposed a response.

Action. To accept the proposed response, TAB to the next field or press RETURN. You may edit the response, type a different one, or press ABORT to cancel the command.

Enter Y to confirm

Cause. You have asked Multiplan to make a major change in the active sheet. Please carefully consider whether this action is correct.

Action. If it is safe for the command to proceed, type a *Y*. If it is not safe press any other character and Multiplan will do nothing.

Error in formula

Cause. Any one of several possible mistakes has been made in the formula you are entering. The highlighted area begins at the point an error was noted.

Action. Check all punctuation, especially parentheses, quotes, and brackets. Check the spelling of function names. Check for a mismatch of data types, as in concatenating a string to a number.

Field has too many words

Cause. The formula or string being edited has more numbers or words than Multiplan can handle for purposes of tabbing from word to word with the FORWARD (next) and BACKWARD (Prior) word keys.

Action. None needed; the formula or string is valid and may be used. However, the FORWARD and BACKWARD word keys can't be used while editing it.

File is not a saved worksheet

Cause. The file you are trying to load or link to was not created with the Transfer Save command.

Action. Check the spelling of the filename. Make sure the right diskette is mounted.

Help file not available

Cause. The disk file containing the on-line reference information can't be found.

Action. If you have diskette drives, make sure the diskette with the help file is mounted. If you are using a multi-user computer system, seek access to the help file from the operator.

Illegal option

Cause. A menu is displayed and a character is typed that does not appear as a starting letter of any of the menu options.

Action. Check the menu for the option that you wish to select and type the first letter of the menu item, or press ABORT to cancel the command.

Illegal parameter

Cause. One field of the command last entered had a numeric response that made no sense. For instance, if the "number of cells" field of Copy Down was given the response 299, this message would appear when RETURN was pressed. There are only 255 rows, so 299 copies could never be made.

Action. The command had no effect, so re-enter it. Pay attention to numeric responses.

Illegal width of column

Cause. The column width you requested was impossible.

Action. Re-enter the command. Make sure you specify the width as a number between 3 and 32 inclusive.

Insufficient memory

Cause. Multiplan has run out of storage space; it has no space left for new cell contents.

Action. Save the sheet at once. Then consider ways to simplify it. Delete removes cells from your sheet. Blank cells take little space, so blank any unwanted cells. If you have large areas of blanks between areas in use, make the sheet more compact. Beyond that you may have to break the application into additional sheets to fit in all the information.

Name already in use

Cause. In the eXternal Open command, the logical sheet name given is the same as the name of an area on the active sheet. In the Name command, the name you are trying to define is the same as the logical name of an external sheet.

Action. Re-enter the command using a unique name. You may use the Name command to review the names of areas on the sheet.

Name not defined

Cause. The active command field requires a name that has been defined previously with the Name command. The name you've entered has not been.

Action. Check the spelling of the name. You may abort the command, then use the Name command to review the names that exist.

Name too long

Cause. Names may not exceed 31 characters. The name you have entered exceeds this.

Action. Think of a shorter name.

Overwrite existing file?

Cause. The disk file Multiplan is about to create—either a saved worksheet or a file of printer lines from the Print File command—has the same name as an existing file. If Multiplan continues, it will replace the existing file with the new one.

Action. Think carefully! If you agree that the existing file is of no importance, reply Y to let the command proceed. If the file might be important, reply N and re-enter the command giving a different, unique, filename.

Press any key to redraw screen

Cause. The eXternal List command or the Help command has put an information display on the screen in place of the usual windows on the sheet.

Action. When you have seen enough of the information display press any key to return to the normal display.

Select command option or type command letter

Cause. Multiplan awaits your choice from a list of alternatives.

Action. Select one of the items shown by moving the edit cursor to it with the space bar and BACKSPACE key (as necessary), then pressing RETURN. Or, just type the initial letter of the item you want.

Select option

Cause. Multiplan is waiting for your choice among a short list of options.

Action. Selection in this case is similar to command selection. Move the edit cursor to the desired option using the space bar and BACKSPACE key, (as necessary), then press RETURN. Or type the initial letter of the option.

Sheet linkage error

Cause. Multiplan has tried to remove a linkage that should exist, but was unable to do so. This situation is unlikely to occur as long as you use Multiplan for all sheet deletion and renaming.

Action. Ignore the message, but it is likely that linkages may not have been correctly made.

System file error

Cause. While attempting to read or write a file Multiplan was told of a serious error by the operating system. Perhaps there was a hardware error with the disk device, or perhaps the disk (or your portion of it) is full.

Action. Look for error messages from the operating system on the screen and check them out in the system's documentation. If you have diskette drives, make sure you have the correct diskette mounted. If you were trying to save a sheet, try again under a different name or on a different diskette.

Too many depending sheets

Cause. A sheet may supply data to at most eight other sheets at once. The eXternal Open command has been asked to connect to a ninth. It is possible that more than four levels of hierarchy have been created (i.e., A supports B, which supports C, which supports D, which supports E).

Action. You will have to redesign the logic of the sheets to require that no sheet supply data to more than eight supporting sheets.

Too many windows

Cause. There is a limit of eight windows and the Window Split has been used in an attempt to open a ninth.

Action. Review the existing windows; use Window Close to delete some of them.

Window will not fit

Cause. The window you are trying to Border or Split is too small.

Action. Close an adjacent window to get more room on the screen, or re-think your screen layout.

Multiplan Error Messages for Graphics

A number is required at RnCn.

Cause. Your selection for data includes a cell which is not a number.

Action. Check to make sure that you have correctly selected the area which you wish to graph.

Bar Graphs are limited to 13 groups.

Cause. The selection contains more than 13 groups for bar graphs.

Action. Select fewer groups.

Bar graphs are limited to five legends.

Cause. The selection contains more than five legends per graph.

Action. Select fewer legends.

Business Graphics Package required for this function.

Cause. The Business Graphics Package is provided separately from Multiplan. The Graph command requires it for graphing data.

Cell contains a value which cannot be graphed at RnCn.

Cause. The selection contains a cell which contains an unrecognized value. For example, cells containing TRUE, FALSE, #DIV/0 cannot be graphed.

Action. Replace that value or remove that cell from the selection.

Error calling Business Graphics.

Cause. An error was encountered while trying to link to the Business Graphics Package.

Action. Make sure that you have correctly installed the Business Graphics Package, most importantly [Sys] <Sys> BGP.Run.

Groups are not in same row or column.

Cause. A group must be from the same row or column. For example, the reference R1C1:8,R2C2:10 is invalid.

Action. If you do indeed wish to graph this irregular shape, use a separate area of the sheet to copy the data in a form acceptable for graphing.

Labels and values do not match.

Cause. Each label must have a corresponding value which must lie in the same row or column. For example, the value associated with the label at R3C10 can be from cells in R3 or in cells from column 10.

Action. Check your selection for labels and values.

Legends are not in same row or column.

Cause. Legends (like groups) must be from the same row or column.

Action. If you do indeed wish to graph this irregular shape, use a separate area of the sheet to copy the data in a form acceptable for graphing.

Line graphs can contain up to five lines.

Cause. You have selected more than five rows or columns as Y Cells.

Action. Select fewer rows or columns.

No more than eight segments are allowed in a pie graph.

Cause. You have selected more than 8 cells as pie graph labels.

Action. Select fewer than eight segments.

Selection contains no data to graph.

Cause. Your selection contains all blank cells.

Action. Check your selection to make sure it is accurate.

Selection for groups and legends is invalid.

Cause. The selection for groups and legends does not form intersections from which the data is gathered. For example, specifying R1:R3 for groups and R6 for legends is invalid since the cells never intersect.

Action. Make sure that your selection for groups and legends intersects.

Selection is outside the logical sheet boundary.

Cause. A portion of your selection is an area of the sheet which contains no data.

Action. Make sure that you have correctly selected the area which you wish to graph.

Sheet is empty.

Cause. You are trying to graph from a blank sheet.

Action. Enter some data into the sheet.

Too many cells have been selected for graphing.

Cause. Your selection is too large for graphing. Multiplan reserves 4000 bytes (or approximately 1000 cells) for graphing functions. Each text character requires one byte and each number four bytes.

Action. Select fewer cells to graph.

Values are not from same row or column.

Cause. The selection for values of the pie graph are not from the same row or column.

Action. If you do indeed wish to graph this irregular shape, use a separate area of the sheet to copy the data in a form acceptable for graphing.

X values are not in same row or column.

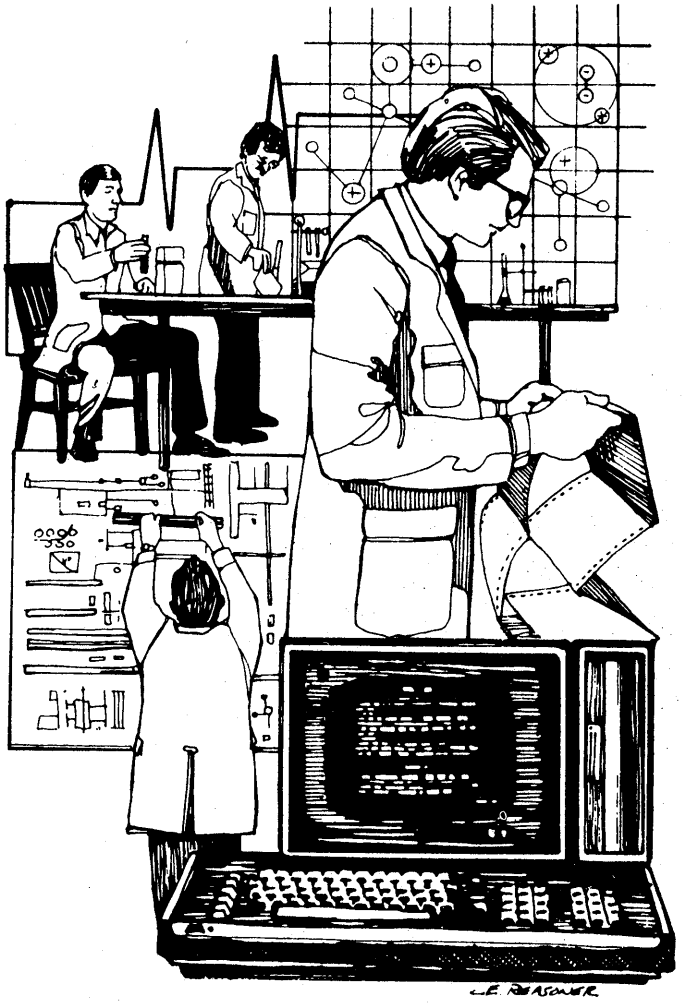
Cause. The X Cells in a line graph are not from the same row or column.

Y values do not correspond with X values.

Cause. Each X Cell must have a corresponding Y Cell which must lie in the same row or column. For example, the value asociated with the label at R3C10 can be from cells in R3 or in cells from column 10.

Action. Match your Y Cells references with your X Cells.

Appendices



Appendix A
Glossary

CANCEL key

Action key that causes Multiplan to abandon the current command and return to command choice.

Absolute reference

A reference to a cell that uses specific row and column numbers; for instance, R17C12. Opposed to relative reference, as R[+1] C[-2]. *See also* Intersection, Range, Reference, and Union.

Action keys

Keys that cause Multiplan to carry out an action at once. The action keys include the CANCEL key, NEXT-WINDOW key (f7), and RETURN key. Refer to Direction keys, Edit keys.

Active

Something in use right now and immediately accessible, such as the active window, active cell, or active field of a command.

Active cell

The cell indicated by the cell pointer. The contents of the active cell can be seen on the status line and may be edited with the Edit command.

Active window

The window containing the active cell, marked on the screen by a highlighted window number. A window becomes active when created with Window Split, or when it is selected by the NEXT-WINDOW key (f7), or by use of the Window Home Command.

Alignment

The rule for the horizontal positioning of the display of a cell's value. Values may be left or right justified or centered.

Area (of cells)

A group of cells; usually a rectangular area but may be any shape. *See also* Intersection, Range, Reference, and Union.

Argument

The values upon which a function works. The arguments of arithmetic functions are given on either side of the function symbol. Thus in the formula "1.05*Principal", the arguments of the multiplication (*) function are "1.05" and "Principal." Some functions have names rather than symbols; their arguments are given inside parentheses after the name. For example, in SIN(Theta), the argument of the SIN function is the named cell *Theta.*

Arithmetic functions

The five functions of addition (+), subtraction (-), multiplication (*), division (/), and exponentiation (^), collectively. The arithmetic functions are similar in that each is represented by a single character and operates on two arguments given one on either side of the symbol.

Backup copy

A copy of a file or of an entire disk, made as insurance against the loss of the original. It is absolutely essential to make backup copies of important files. Not to do so is to risk the loss of many hours of work if the disk is damaged, or if the file is erased in error.

Binary

A number system especially well adapted for computer hardware use. A number, whether expressed in binary or the usual decimal digits, is still the same number, but a computer can do calculations on the binary representation more easily than on the decimal representation.

Bug

Term for a mistaken instruction given to a computer. If you put R[-1]C in a cell when you really meant RC[-1], you have introduced a bug into your sheet. It can be very difficult to find such bugs.

Byte

A unit of computer storage. A byte may be visualized as a very small box in which the computer can store a single character or two digits of a number. Computer storage is measured in bytes, and several thousand of them are available for storing the active sheet.

Calculate

To produce the value of a formula by (1), finding the value of each item of data named in the formula and, (2), combining those values according to the rules of the functions named in the formula.

Cell

One position on the worksheet, a place where data or a formula may be stored. A cell has a location and may be referred to by one or more names. The contents of a cell determine its value; the cell's format determines how its value is displayed.

Cell pointer

An illuminated pointer that selects one cell from all the cells in the worksheet. That cell becomes the active cell. The cell pointer is moved from cell to cell with the direction keys, or directly with the Jump command.

Chain (of references)

A formula in one cell may refer to the value of another cell. If that cell refers in turn to a third, the three cells compose a chain of references. A chain may be of any length—the third cell might refer to a fourth, and so on. A circular chain is one in which the chain eventually comes back to the first cell again.

Character

A symbol that can be displayed on the screen; includes letters, digits, punctuation, and special characters like $, +, and %.

Character keys

Keys that type characters, as opposed to action keys, edit keys, and direction keys.

Choice

One selection from a list of alternatives. A choice is indicated in one of two ways: by moving a highlight through the list with the space bar and selecting the highlighted choice with the TAB key, or by typing the initial letter of the chosen item.

Choice mode

The state of the keyboard when Multiplan presents a list of choices. In choice mode the only keys to which Multiplan will respond are action keys and the initial letters of appropriate commands.

Close

To close a window is to remove it from display.

Column

A vertical line of cells down the worksheet. There are 63 columns, designated by the numbers 1 through 63.

Command

A sequence of prompts and fields instructing Multiplan to do something. You choose a command, type responses in its fields, then either tell Multiplan to carry it out by pressing the RETURN key, or tell Multiplan to cancel it by pressing the CANCEL key.

Command choice

The state of Multiplan while it is awaiting your next command. The prompt COMMAND: is displayed on the command line along with a list of command names for you to choose among.

Command line

The third and fourth screen lines from the bottom of the screen, upon which commands are built.

Concatenate

To join end to end. In Multiplan, strings are concatenated with the ampersand (&) symbol.

Constant

A part of a cell's contents that will never change under calculation. A number or string typed by the user.

Contents (of a cell)

That which has been put into a cell. If nothing has been put in, the cell is empty and its contents are blank. Otherwise the cell contains either data (a string or a number) or a formula.

Cursor

See Edit cursor.

Data

A string of characters or a number. Data may have been typed into a cell directly, or (in a formula) may result from a reference to another cell.

Default

In general, what Multiplan will do whenever it is not told differently. Usually, Multiplan makes the default action visible as a proposed response in a command field. A proposed response shows what Multiplan will do, in default of a different response set by the user.

Dependent sheet

A sheet that uses values from another sheet. The dependent sheet depends on information calculated on another, saved, sheet to which it is linked by the External Open command. *See also* Link.

Direction keys

Keys that move the cell pointer. The up, down, left, and right arrow keys move the pointer one cell at a time. The home key (f4) moves it to the cell in the upper left corner of the active window.

Directory

The table of file names kept on each disk by the operating system. The directory lists each file and its location on the disk.

Disk

Rotating discs coated with magnetic material upon which the computer can write. Thus files may be stored outside the computer. *Diskette* refers specifically to a removable disc of plastic in a plastic jacket. *Disk* is used when the device uses sealed, metal disks (a hard disk). Used casually, as in "Let's save this on disk," the word may refer to either a hard disk or a diskette.

Display

Multiplan's visible presentation of the active worksheet on the terminal screen. Cell display is controlled by the cell's format, which is independent of the way Multiplan stores the cell's contents in computer storage.

Edit

Altering a response in a field of command. The edit keys are used to move a cursor over the response, and the character keys are used to replace or insert characters.

Edit cursor

The highlighted part of a command on the command line, which may be as small as one character or as large as an entire field. The edit cursor is moved with edit keys. It shows where alterations can be made to the command.

Edit keys

Keys that move the edit cursor within the command line. Includes FORWARD and BACKWARD word keys and FORWARD and BACKWARD character keys.

Empty

The condition of a cell containing nothing but spaces.

Exponentiation

The arithmetic function of multiplying a number by itself some number of times (also known as "raising a number to a power"). Exponentiation is symbolized in a formula with the ^ symbol. The formula "R[-1]C^3" means "the value of the cell to the left, raised to the third power." The second number need not be an integer.

Export

A term for sending values from one sheet (the supporting sheet) to be used in another (the dependent sheet). *See also* Link.

Field

A portion of a command in which you type a response to instruct Multiplan in some detail of the command's work. When Multiplan first shows a field it fills it with a proposed response; you can replace or edit that response if it isn't what you want.

File

A named unit of data stored on disk or diskette. When a worksheet is saved it is written into a file. Not all files represent saved worksheets, but those that are can be loaded or linked to other worksheets.

Filename

The name by which the system knows a file. The filename must be given when a worksheet is saved, loaded, or linked to another sheet.

Format

Rules for the display of a cell's value. The format controls numeric punctuation and the alignment of the displayed value. A format can be specified for a cell or cells with the Format Cell command; cells without a specific format are displayed according to a default format set with the Format Default command.

Formula

A recipe for how a value is to be calculated from data and functions. Whenever the contents of a cell are changed, Multiplan recalculates all the formulas on the worksheet (unless automatic recalculation has been turned off).

Function

An operation combining one or more values according to some rule to produce a result. The addition function, symbolized by a plus sign (+), adds two values to produce their sum. The dollar function converts a number into a string of characters representing that number as money.

Hardware

The mechanical and electronic parts of a computer system, as opposed to the software (programs) that runs in the hardware. The relationship of hardware to software is similar to the relationship between a record player and the records played upon it.

Inactive

Applies to something that exists but is not presently in use. An inactive worksheet is one that exists (in a file) but hasn't been loaded for use; an inactive window is one that has been opened but isn't in use.

Intersection

A reference to the common cells of two areas. An intersection is indicated by writing references to the two areas side by side. For example, R1C8 is the intersection of the cells in row 1 and the cells in column 8 (a single cell). The intersection of the area named *Totals* with the area named *Sales* could be stated as *Total Sales*. *See also* Range, Reference, and Union.

Keyboard

The typewriter-like arrangement of keys used to control Multiplan. *See also* Action keys, Character keys, Direction keys, and Edit keys.

Link

The use of data from an inactive sheet in calculations on the active sheet is called the supporting sheet. The data to be used must have been marked with the External Name command, the name of the *supporting sheet* must have been given with the External Copy command. Then data from tne supporting sheet may be used in formulas on the active sheet.

Load

To make a saved sheet active again. The sheet to be loaded must have been saved. The Transfer Load command is used to copy the saved sheet from its file to working storage, where it becomes the active sheet.

Location

The position of a cell on the worksheet, given as its row and column numbers in that order. How you state a location depends on the context. It may be given in two separate fields of a command as in "row: 13 col: 6," or as a reference in a formula as R13C6.

Message

A notice posted by Multiplan on the message line to explain a problem or suggest what kind of input the system is waiting for.

Message line

The next to the last line on the display.

Name (of a cell or group)

A label or tag, associated with a cell or area of cells by the Name command. Once a cell or area has been named, the name can be used to refer to the cell or cells in formulas. Names may be up to 31 characters long. A name may contain blanks and special characters; if so, it must always be given within single quotes. An underscore is not considered a special character.

Number

Number is a fundamental concept. Multiplan represents a number internally in binary; it displays the number according to a format specified for the cell containing the number.

Numeric value

A value, either specified as a constant or arising from calculation of a formula, that is a number.

Print

To cause all or part of the worksheet to be displayed on paper by the system's printer device. The Print command can also put the display of the worksheet into a file for later printing.

Proposed response

Response supplied by Multiplan. It is usually based on the most recent responses by the user or on the current status of Multiplan.

Range

The smallest rectangular area of cells containing two references. A range is designated by the colon (:). The range R3:R8 defines the rectangular area containing all of rows 3 and 8, namely rows 3, 4, 5, 6, 7, and 8. *See also* Intersection, Reference, and Union.

Reference

The designation of a cell or an area of cells. The simplest reference is to a single cell: R9C2. A reference may be relative to the cell containing the reference, as in R[-1]C. A reference may be to a single cell, as the prior two, or to an area of cells: R6 refers to all of row 6. A reference may be composed of intersections of references, ranges of references, or unions of references. *See also* Intersection, Range, and Union.

Relative reference

A reference to a cell relative to the cell containing the reference, as R[-1]C meaning "the row above, in this column." Opposed to absolute reference, in which the actual column and row numbers are stated. *See also* Intersection, Range, Reference, and Union.

Response

What the user types in a field of command. May be a row or column number, a count, a name, or the contents to be put in a cell. When Multiplan displays a command on the command line it usually supplies a proposed response in every field of the command; the user may replace the proposed response or edit it.

Row

A horizontal line of cells across the worksheet. There are 255 possible rows, designated by the numbers 1 through 255.

Save

The operation of making a permanent copy of the active worksheet. The copy is placed in a file on disk.

Screen

The whole face of the television-like terminal. The screen is divided horizontally into lines. Multiplan uses the bottom four lines for information and control. The bottom line is the status line, next is the message line, and the two above it are the command lines. All other lines compose the display area, where part of the worksheet is displayed through one or more windows.

Scroll

To move the display of the worksheet across the screen one row or column at a time. Scrolling is done with the direction keys. For example, if the right arrow key is pressed until the cell pointer reaches the right edge of the screen, and then pressed again, Multiplan scrolls the worksheet display one column to the left.

Software

General term for computer programs. More specifically, the collection of programs used on a particular computer system. A program is a list of machine instruction codes, expressed as small numbers. A program is recorded in a file. In can be loaded into the computer's storage where the hardware will execute it, that is, carry out the the instructions in sequence.

Status line

Bottom line of the screen, where Multiplan presents status information such as the location of the active cell and its contents.

String

A sequence of characters.

Supporting sheet

A sheet providing values to another sheet. The sheet supports the other sheet (the dependent sheet) with data that has been designated with the External Copy command. *See also* Link.

System

The computer, its attached devices (terminal, printer, disks), and its operating system. The system provides the medium in which Multiplan executes.

Union

A combination of two or more rectangular areas on the sheet. A union is specified as references connected with commas. The union R3C2, R5C9 refers to two cells; the union Sales, Costs, Taxes" refers to three named areas. *See also*, Intersection, Range, and Reference.

Value

The information content of a cell: its numeric value if it contains a number; its string if it contains a string; or, if it contains a formula, the result of calculating that formula.

Variable

A part of a cell's contents that may change from one calculation to the next. A reference to another cell is variable because, if the other cell is changed, the value of the reference changes.

Window

A rectangular portion of the display area within which Multiplan displays a part of the worksheet. As many as eight windows may be open at once; they are opened or closed with the Window command. Each window has a window number from 1 through 8 shown in its upper left corner. The window number of the active window is highlighted; that window contains the cell pointer and the active cell.

Worksheet

The simulated worksheet that Multiplan presents to its user: an array of cells, each of which may contain a value.

Write-protected

The term indicating that you cannot write to a file.

Appendix B
Notes for the VisiCalc™ User

If you have previously used VisiCalc, you are probably curious about how that product differs from Multiplan. Multiplan does everything VisiCalc can do—and a great deal more. Indeed, where operations are similar, you will find Multiplan a great deal easier to direct than VisiCalc.

In this appendix we will contrast and compare the operations and features of the two. We'll speak first of the operations the two programs have in common, roughly in the order in which they are presented on the VisiCalc reference card. Second, we'll mention the features unique to Multiplan.

Note Terms in italics refer to Multiplan; those in quotes to VisiCalc.

The Multiplan Screen

Multiplan divides the screen into a display area, command lines, a message line, and a status line. Parts of the worksheet are shown in the display area. Unlike VisiCalc,which allows you to create just two windows, Multiplan allows you to create as many as eight different windows within the display area. You have complete control over the size and placement of each window, you can have windows with or without borders, and you can freeze title columns and rows. All these functions are controlled by the Window Command (see Chapter 12).

A point of nomenclature: in this book we refer to one position on the worksheet as a cell. The active cell is the highlighted one into which you can make entries; the highlight itself we call the cell pointer rather than the "cursor". Multiplan indicates where you're about to type on the command lines with a solid highlight we call the cursor rather than the "blinking block."

The message line contains Multiplan's comments on the progress of any command; you're never in doubt about what it expects you to type next. The status line at the bottom of the screen always displays the coordinates of the active cell, its actual contents, and the amount of storage that remains. The command lines are used for the entry of commands. There are a number of those, and you'll find that selecting a command and filling it in is very easy.

Moving the Cell Pointer

Five keys move the cell pointer within the active window: the four direction keys and the Home key. The Home key sends the cell pointer to the upper left cell of the window; the others move it one cell in each direction. You may also move the cell pointer to a specific cell with the Jump Command, which lets you move to a particular row and column or to a particular cell by name (refer to "Names" below). The semicolon key moves the cell pointer to the next window in sequence.

Correcting Errors, Aborting Commands

Multiplan provides a separate key—the CANCEL key—whose only function is to cancel any command you might have begun. The BACKSPACE key wipes out the last character typed. There are several other editing keys used to correct typing errors. (Refer to Chapter 8.)

Entering Titles and Strings

A cell may contain a title, a simple string of characters documenting a row or column on the worksheet. To enter one, choose the Alpha command, type the title, and press RETURN or any direction key.

Multiplan also allows a string of characters to be part of a formula. You can build a title from a formula, using the & symbol to concatenate strings to the formatted results of calculations (see Chapters 3 and 10). To include a string as part of a formula, enter it in double quotes.

Entering Numbers

A cell may contain a number. To enter one, just start typing it. Put the finished number in the active cell by pressing RETURN or any direction key. Numbers may be in decimal form or in scientific notation.

Entering Formulas

A formula is composed of strings, numbers, cell references, function symbols (+-*/^), and function names (SUM, MIN, etc.) Unlike VisiCalc, but like most programming languages, Multiplan evaluates formulas according to the priority of functions: functions, exponentiation (^) first, then multiplication (*), then division (/), then addition (+), and then subtraction (-). You may (in fact, you should) use parentheses to make the order of calculation explicit.

To enter a formula, type +, or =, or (. While you are entering a formula you may enter a reference to another cell by pointing to that cell with the direction keys. All the editing keys are available to you while entering a formula; the FORWARD (Next) and BACKWARD (Prior) word keys are especially helpful.

References

In a formula you may refer to the value of a cell or cells in any of several ways, You may give an absolute reference to a row and column (R3C5) or to a range along a row or column (R3:6C9, R5,

C1:8). You may give a reference relative to the cell holding the formula (R[-1]C for "this column, one row up"). Most important, you can give a name to any cell or group of cells. For instance, the name salesline might refer to R9C2:9 (row 9, columns 2 through 9). Then the formula SUM (salesline) will produce the sum of all numbers in those cells.

References of any of those three kinds may be combined by intersection or union to make other references (see Chapter 9 for details and examples).

Functions

Multiplan supports most of the named functions familiar to you from VisiCalc, as well as others. (See Table 1 for a comparison of the VisiCalc functions to their Multiplan counterparts; see Chapter 13 for details on each Multiplan function. Multiplan function names do not begin with "@".

Multiplan provides several named functions not existing in VisiCalc, listed in Table 2. As you see, most of them relate to the use of strings and the construction of titles with formulas.

Table 1
VisiCalc Functions
and Their Multiplan Counterparts

Multiplan	VisiCalc
ABS(n)	@ABS(n)
use PI()/2-ASIN(n)	@ACOS(n)
AND(list)	@AND(list)
use ATAN(n/SQRT(1-n2)	@ASIN(n)
ATAN(n)	@ATAN(n)
AVERAGE(list)	@AVERAGE(list)
INDEX(area,subscripts)	@CHOOSE
COS(n)	@COS(n)
COUNT(list)	@COUNT(list)
use undef-name	@ERROR
EXP(n)	@EXP(n)
FALSE()	@FALSE
IF(1,v1,v2)	@IF(1,v1,v2)
INT(n)	@INT(n)
ISERROR(n)	@ISERROR
ISNA(n)	@ISNA
LN(n)	@LN(n)
LOG10(n)	@LOG10(n)
LOOKUP(n,area)	@LOOKUP(n,range)
MAX(list)	@MAX(list)
MIN(list)	@MIN(list)
NA()	@NA
NOT(1)	@NOT(1)
NPV(dr,list)	@NPV(dr,range)
OR(list)	@OR(list)
PI()	@PI
SIN(n)	@SIN(n)
SQRT(n)	@SQRT(n)
SUM(list)	@SUM(list)
TAN(n)	@TAN(n)
TRUE()	@TRUE

Table 2
Functions Unique to Multiplan

ROUND (n,v)	Value of v rounded to n decimal places.
FIXED (n,v)	Character string form of v formatted with n decimal places.
DOLLAR (v)	Character string form of v formatted as a dollar amount; negative v shown in parentheses.
VALUE(s)	Numeric value of string s; s may represent a number in any format including dollar amounts.
REPT (n,s)	Character string made of n repetitions of string s.
MID (s,m,n)	The n characters of string value s starting at m.

Commands

You choose a Multiplan command by typing a single letter. As soon as you have chosen a command, Multiplan displays the complete command in more or less grammatical English on the command line. For that reason we always refer to the commands by their full names, capitalizing their initial choice letter. Some commands have several parts; those commands have multi-word names. Table 3 shows the VisiCalc commands and their Multiplan counterparts (for complete details on the Multiplan commands see Chapter 12). Remember as you scan that you type only the capitalized letters when choosing an Multiplan command.

The Blank command not only empties a cell(s), it releases most of the occupied storage space. As a consequence, a Blanked cell reverts to the current default format.

It's worth noting that Multiplan's Insert, Delete, and Move commands can operate on more than one row or column at a time. You can move several rows. Insert and Delete allow you to handle any rectangular area; you aren't restricted to handling entire rows or columns. Multiplan adjusts all references (absolute or relative) and name definitions to account for the changes.

The Multiplan Format command can set the format of one cell, or of an area of cells, or of a list of areas of cells. The "/GO" (order of calculation) command isn't needed in Multiplan because Multiplan continues to recalculate cells until all have reached the correct values (or until Multiplan finds an endless chain of references). You don't have to be concerned with the order of calculation in Multiplan!

Table 3
VisiCalc™ Commands and Their EP Counterparts

Multiplan	VisiCalc
Blank	/B
Transfer Clear	/C
Delete Columns, Delete Rows	/D
Format Cells	/F
Format Cells	/FD
Format Width	/GC
Format Default	/GF
no counterpart; see text	/GO
Option	/GR
Insert Columns, Insert Rows	/I
Move Columns, Move Rows	/M
Print	/P
Copy From, Copy Down, Copy Right	/R
Transfer (see Table 4)	/S
Window Split Titles	/T
no counterpart	/V
Window Open, Window Split, etc.	/W
see Table 2, REPT function	/-

Note: You only type the capitalized characters of the Multiplan command notes.

Printing

Multiplan has a full set of printing operations, invoked by the Print command. You may print all or any rectangular area of the worksheet; an area can be specified by name or specific references. Multiplan can send the printed representation of the worksheet to a file on disk. You may then use that file with operating system commands and other programs: you could, for instance, incorporate a worksheet listing within another document.

Copying Cells

Multiplan's Copy command performs the operations that, in VisiCalc, are done with "/R". Copy Down and Copy Right provide especially easy ways to duplicate one cell down a column or across a row. The general Copy From operation will duplicate a single cell into an area of any shape, or duplicate an area of any shape in another area of the same shape. Multiplan doesn't ask whether references should be adjusted or not; if you build your formulas with relative references and name references they are position-independent.

Worksheet Transfers

The Transfer command handles operations on the whole worksheet. Table 4 compares the parts of Transfer to the variations of the "/S" command. There are several differences. The "/SW" (write to cassette) command is omitted because cassette operations are not supported in Multiplan's host system; "/SI" (initialize diskette) is omitted because Multiplan uses the host operating system for file operations and so relies on it to handle disk formats. The "/SL" (load and merge entries) operation is omitted because Multiplan's ability to link sheets provides a much better way to combine two or more worksheets. For more details on file operations, see Chapter 11.

Table 4
VisiCalc™ Commands for Saving and Loading Sheets from Disk and Their Multiplan Counterparts

Multiplan	VisiCalc
Transfer Save	/SS
no counterpart; see text	/SW
no counterpart; see text	/SL
Transfer Load	/SR
Transfer Delete	/SD
no counterpart; see text	/SI

Multiplan Names

Multiplan allows you to name cells. This ability is one of three features setting Multiplan apart from all other worksheet programs. The Name command allows you to define a name as referring to a single cell, or to an area of cells of any shape, or even to a list of unconnected areas of cells. Once you've done so, you may use that name as an argument of a function or, in many cases, as a response in a command. A name may be a single word or a series of words connected with underscores. In fact, a name may be any sequence of characters at all, but if it contains blanks or special characters you must always surround it with single quotes (').

This naming ability can make a big difference in the clarity of your sheets. Consider this formula:

```
R1C2 * (R2C2 * (1 - R3C2))
```

That's the Multiplan equivalent of B1*(B2*(1-B3)). But what an improvement if you write it this way!

```
Quantity * (Price * (1 - '% discount'))
```

As we noted earlier, you can place a constant factor anywhere on the sheet, name the cell it's in, and use the name in formulas thereafter. You can name an area and use that name as an argument to SUM, MIN, MAX, COUNT, or AVERAGE.

Of course, you may accumulate quite a lot of names on a complicated sheet. The Name command allows you to step through all your name definitions using the direction keys to move back and forth in the list. See Chapters 9 and 10 for examples of the use of names.

Multiplan References

The primary benefit of a worksheet program lies in its ability to use the value of one cell in calculating the value of another. Multiplan has considerably extended this notion of cell-to-cell reference. Aside from the ability to reference cells by name, it supports relative references and a very simple, regular notation for stating references to areas of cells. The details are spelled out in Chapter 9. In brief, a relative reference designates a cell in a position relative to the cell containing the reference. The reference RC[-1] refers to the cell in "this row, one column to the left." Suppose the first row of the sheet contains sales by month and the second row contains costs by month. Then you can type this formula once:

```
R[-2]C - R[-1]C
```

and replicate it across the third row to produce a row of net-by-month cells.

Linking Sheets

Another strong point of Multiplan is its ability to use values on one sheet in the formulas of another sheet. We call a sheet that provides values a supporting sheet, and the sheet using values a dependent sheet. The linkage between sheets is made with the eXternal command; you can find the details in Chapter 7 and some technical considerations in Chapter 11.

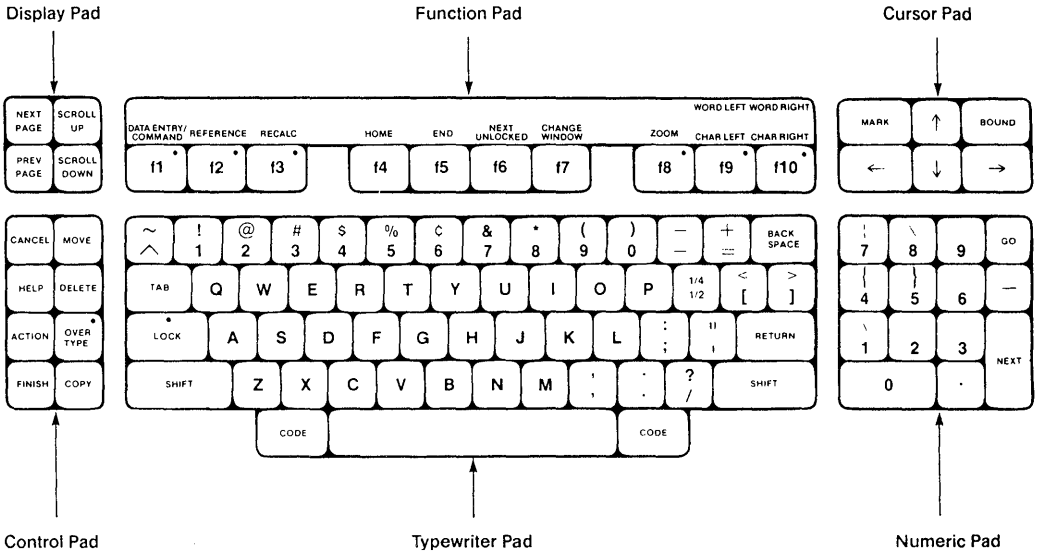
Use sheet linkage to construct a hierarchy of worksheets. You might have a detailed sheet for fixed costs and another for production costs. Those might feed their totals into a sheet summarizing costs, which in turn can feed total costs into an overall balance sheet. You update the figures on a detail sheet and save it; when you next load a summary sheet dependent on it, the new totals are retrieved automatically.

Summary

Multiplan was designed to go a step beyond other worksheet programs. As such it must stand up to comparison with the best-known of these, VisiCalc. As we've seen, Multiplan provides counterparts for most VisiCalc functions, improvements on others, and features that are unique to itself.

Appendix C

KEYBOARD Definition



The following is a table of the B 20 Special Keys and their functions:

B 20 Key	Definition

f1 **Data Entry/Command.**
Toggles between Data Entry and Command Mode. In Command Mode, a command is invoked by pressing the first letter of the command. In Data Entry Mode, typing a letter automatically selects ALPHA Command. Use the "/" key, to start a command.

f2 **Reference.**
Use to change a Relative reference into an Absolute reference. Also used to step through the list of names when entering Formulas.

f3 **Recalculate.**
Recalculates all of the values on the worksheet. This is done automatically unless the Recalc Option is turned off (refer to Options).

F4 **Home.**
Moves the cell pointer to row 1, column 1 (Also CODE-up arrow).

f5 **End.**
Moves the cell pointer to the last active cell (last non-blanked cell) (Also CODE-down arrow).

f6 **Next Unlocked.**
Moves the cell pointer to the Next Unlocked Cell in the sheet.

f7 **Change Window.**
Moves the cell pointer to the next window on the sheet.

f8 **Zoom.**
On B22 workstations, toggles the screen size from 80 to 132 columns and vice versa. (Also CODE-z)

f9 **Character Left.**
When entering or editing data or text, selects the character to the left of the cursor (Also MARK).

f10 **Character Right.**
When entering or editing data or text, selects the character to the right of the cursor (Also BOUND).

CODE-f9 **Word Left.**
When entering or editing data or text, selects the word to the left of the cursor.

CODE-f10 **Word Right.**
When entering or editing data or text, selects the word to the right of the cursor.

NEXT PAGE	**Page Down.** Moves the cell pointer down several rows.
PREV PAGE	**Page Up.** Moves the cell pointer up several rows.
SCROLL UP	**Page Right.** Moves the cell pointer several cells to the right (Also CODE-right arrow).
SCROLL DOWN	**Page Left.** Moves the cell pointer several cells to the left (Also CODE-left arrow).
CANCEL	Cancels (or Aborts) the current menu.
RETURN/GO ENTER	Run the current function as selected by the menu.
TAB	Moves to the next field in the menu. If the menu has only one field, selects the next menu item.
BACKSPACE	When editing, deletes the character before the cursor. When selecting items in a menu, press BACKSPACE to select the previous menu item.
DELETE	When editing, deletes the character(s) under the cursor.
right arrow	Moves the cell pointer right one cell.
left arrow	Moves the cell pointer left one cell.
down arrow	Moves the cell pointer down one cell.
up arrow	Moves the cell pointer up one cell.

HELP	Invokes the HELP function.
FINISH	Invokes the QUIT command.
COPY	Invokes the COPY function.
MOVE	Invokes the MOVE function.

Appendix D
Suggestions

Helpful Suggestions for Using Multiplan 2.3

This list offers hints for saving space in worksheet memory, on your diskettes, and for saving time during your MULTIPLAN sessions by making MULTIPLAN easier to use.

1. Use the eXternal commands to split sheets at logical places. The method of splitting up your work should follow the natural breaks in your tasks. By splitting up your task into smaller tasks, you can keep your worksheets smaller and faster to work with.

2. Keep the worksheet compact. Keep the amount of blank space within the worksheet to a minimum. Also, avoid extending the worksheet size unnecessarily.

   Placing any number outside the general work area, even formatting a cell unintentionally, can use more memory and diskette storage than necessary.

   If you suspect that too much memory is being used (check the % Free indicator at the bottom of the screen), try deleting all columns to the right and all rows below your work area on the sheet. This ensures the minimum size for your worksheet.

3. Define names for the common areas on your worksheet. By defining names, you speed up references to a group of cells. For example, it is much easier and faster to type "Sales" than R2C3:15, or "Totals" than R3C4,R5C6, R5C8. Use the REFERENCE key to enter names directly from the name table.

4. Place common subexpressions in an intermediate cell, then refer to that cell when the subexpression is needed in a formula in another cell. This saves retyping and recomputing the same information. For example, SUM (Sales) may appear in several formulas:

   MIN(1000,SUM(Sales)
   SUM(Sales)*commission %
   SUM(Sales)-SUM(Costs)

   It is more efficient to compute SUM(Sales) once in a cell, then refer to that cell from other formulas. Having the intermediate result visible also helps with tracing problems in the setup of the formulas.

5. Use the Copy commands for filling in cells with identical values, especially formulas, but also numbers and text. Copying is simpler, less error prone, and more space efficient than manually entering repeated values into cells individually.

6. To quickly copy the format of a group of cells into another part of worksheet, first copy the group of cells as they are. Then blank the cells in the new area.

7. Use primitive forms of references wherever possible. For example, it is more efficient to use R2C2 than R2 C2; or R1:2C1 than R1C1:R2C1.

8. Turn off automatic recalculation and use the RECALC key. This way you can enter new values and edit current values without waiting for each recalculation. Recalculation also occurs when you change text. Use the Recalc Key (f3) at logical breaks while building your worksheet. This will help you locate "Circular References" errors.

9. Use "Continuous" cell format code sparingly. Formatting whole rows with "Continuous" format or specifying "Continuous" as the default setting is expensive.

10. Format entire rows or columns at one time, except for "Continuous" format. Formatting entire rows or columns does not extend your worksheet.

11. Avoid functions or operations over unnecessarily large ranges. For example, instead of SUM(R2), specify only the range of columns that contain values, for instance SUM(R2C1:5). Or, try to restructure the function or operation so that large ranges are not necessary.

12. Avoid extensive use of forward references because they are slower to recalculate. For example, a reference to cell R10C10 from cell R5C5 is slower than a reference to R5C5 from R10C10.

13. Use the NEXT PAGE, PREV PAGE, SCROLL UP, SCROLL DOWN, HOME (f4), and END (f5) keys to scroll rapidly around the worksheet.

14. Perform similar operations together. Try to define all names at once. Copy all cells at once. Many MULTIPLAN commands offer you proposed responses. By performing similar operations together, you can make maximum use of the proposed responses, which saves considerable time.

15. Simply press the RETURN key to select the Alpha command whenever the main command menu is displayed.

16. Position the cell pointer before selecting a command. This also makes it easier to use proposed responses.

17. Use the Normal mode for saving and loading files, whenever possible. If you load a file that is in Symbolic or Other mode, save it in Normal mode when you are finished. Files in Normal mode load much faster than files in the other modes.

18. Data from cells imported from supporting sheets are updated *only* when that sheet is loaded into Multiplan. Therefore, incorrect results will be obtained if intermediate sheets are not loaded and saved prior to loading the highest level sheet. For example, if A supports B which supports C, you must load B (to update the data from A) prior to loading C. A sheet can import data from an unlimited number of sheets. However, a sheet can support only up to 8 sheets.

19. You may prematurely terminate printing to a file or to a printer by pressing the CANCEL key. The PRINT OPTIONS and PRINT MARGINS are maintained with the model when it is saved to disk. You do not need to reset the margins once they have been set for the sheet.

Appendix E
Programmers Notes

Programmers Notes to the Multiplan Symbolic File Format (SYLK)

The purpose of the SYLK (SYmbolic LinK) format is to exchange information between Multiplan and application programs. The format is designed with the capability of being extended, ease of generation, ease of parsing, and storage efficiency in mind. The worksheet can be completely represented by SYLK files. This means that a program can generate a Multiplan worksheet, such as a program to build a cash-flow forecasting worksheet from a general ledger chart of accounts. It is useful to subdivide the definition of SYLK into the following "layers":

1. SYLK record and field formats: This layer provides for the identification of the files, a degree of data compression, and an easy way for a program to separate information that is important for its purpose from information that the program has no interest in handling.

2. The "C" or cell or data point record: This is probably the record type of the most universal interest.

3. Other Multiplan-specific records and fields: This collection of formats affords complete control or complete overview for a communicating program of the state of a Multiplan session, including the worksheet, windows, options, etc.

The first layer is defined as follows. The contents of a SYLK file - encoded in ASCII - are divided into records by either CR or LF characters. Empty records are ignored. Nonempty records are further subdivided into an RTD (record-type descriptor) optionally followed by a list of fields. Each field in the list is preceded by an FTD (Field-type descriptor). The content of the fields is determined by the RTD and the FTD and is described as follows:

RTDs consist of up to two letters. They determine the meaning of the record according to the following standards.

FTDs consist of a semicolon and a single letter that determines the meaning of the field. The meanings of FTSs; ;U ;V ;W ;X ;Y, and ;Z will be the same for all records. The meanings of other FTDs will depend on the record type.

The field contents can be arbitrary except for the following: CRs of LFs may not be included, and semicolons must be doubled.

A degree of data compression is achieved by the following rule:

For certain fields, the last field value will be automatically substituted if the field contents are empty. Such fields are said to be differentially encoded and will be marked by (diff) in their description.

The FTDs ;X and ;Y determine x and y coordinates in a worksheet or other two-dimensional space containing data points. Coordinates of the first cell are 1,1. ;X and ;Y are differentially encoded, and they may be altogether omitted from records if the last defined value is to be used.

In general, programs that process SYLK files cannot be expected to handle all RTDs, all FTDs, or even the full range of field contents for two reasons. First, their interest may be limited to some aspect of the available data. Second, SYLK may very well be expanded after the release of the program in question. This means that programs must be prepared to ignore records and fields that they do not understand. Data with coordinates that lie outside of the space that the program can process should also be ignored.

The following data records and fields are currently defined:

Record type: C

These records describe a data point that exists in a two-dimensional space with coordinates ;X and ;Y. The Multiplan concept of cell is one example of a data point. Besides its coordinates, data points may also possess a number or text value, an expression, a protection state (locked or unlocked), and several Multiplan-specific properties. Formatting properties for data points may be in a separate record type (refer to F).

Fields are:

;X, :Y	(diff) cell coordinates.
;K	Value of the data point. Numerical values are given in decimal or exponential form (refer to Multiplan "Gen" format code). Text values are enclosed in double quotes. The logical values TRUE and FALSE are given this way. Error values are preceded by # and appear in Multiplan.
;P	Protection state. If ;P appears, the data is locked; otherwise, it is not locked.
;E	An expression that computes the value of the data point. The field contents appear exactly as a Multiplan formula.
;R, ;C	(diff) Used by ;S
;S	Expression for the data point is given at another coordinate. X is given by ;C (column), Y is given by ;R (row). The field contents are decimal coordinates. Note that ;E must not appear together with ;S. Additionally, the data point at (;R, ;C) must be marked with either ;D or :G. In the latter case, the value of the data point is taken to be the (constant) expression.
;D	;E expression is shared by some other data point.
;G	;K value is shared by some other data point. ;E must not appear.

Record type: B

Defines the bounds of the two-dimensional space of data points. This record should appear at the beginning of a SYLK file.

Record type: E

Defines the end of the SYLK file.

Record type: F

Describes the Multiplan formatting properties of individual cells or of the whole worksheet. (Refer to the descriptions of the Format group of commands in Chapter 12.)

Fields are:

;X, ;Y (diff) cell coordinates.

;Fc1nc2 (diff) Cell formatting properties are defined by the contents where c1 is a one-character formatting code (D, C, E, F, G, $, or *), n is the " # of digits" argument, and c2 is a one-character alignment code (D, C, G, L, or R).

;R, ;C ;F properties are to be applied to a whole row or whole column of the Multiplan worksheet. Contents are decimal row or column numbers, respectively.

;Dc1nc2n2 "Default" format properties are defined as in ;F (except that the "D" codes may not be used). n3 is the "default" width of columns.

;K, ;E Appear if the commas and formulas Format Options are set, respectively.

;Wn1 n2 n3 Defines the widths of a group of columns in the worksheet where n1 is the first column (x), n2 is the last column in the group, and n3 is the width of the columns in the group expressed as number of characters (cf. Format Width command). Columns that are not mentioned in any format record will have the "default" width setting.

Record Type: ID

The first record in the SYLK file must be an ID record. This convention helps with the identification of the file as a SYLK file.

Field is:

;Pname — The name of the program that produced the file (for example, MP).

Record type: NN

This record defines a Multiplan name as a union of rectangular areas expressed with absolute references.

Fields are:

;Nname — The name to be defined.

;Ee — Expression describing the area. Its general form is;

Rn11:n12Cn13:n14,Rn21:n22Cn23:n24,.....

Ranges of single values may be written without the ":" operator. Ranges R1:225 or C1:63 (but not both) may be omitted.

Record type: NE

The record describes a link to an inactive sheet.

Fields are:

;F — Filename (or logical filename) for source sheet.

;S — Description of the source area, typically a name of a group of cells.

;E — Expression defining target area, as in NN.

Record type: NU

Describes an external filename substitution.

Fields are:

;L	Filename (or logical filename)
;F	Filename to be used instead of ;L

Record type: W

The window structure of a Multiplan screen is described in part by the states of the windows and in part by the operations that create the windows. To discover the correct description for a particular placement of windows within the screen display, the best approach is to use Multiplan to set up the windows and then to inspect SYLK output from Multiplan.

Fields are:

;N	Window number, as shown by Multiplan.
;Ay x	Coordinates of the cell shown in the upper left corner of window ;N
;B	Window ;N is bordered if (and only if) ;B appears.
;STcy cx or ;SH1cy or ;SV1cx	Split window ;N to create new window. The window number of the new window will be one greater than the largest number previously in use. The letters T, H, or V define Title, Horizontal, or Vertical splits, respectively. The symbol 1 stands for the letter L if the windows are to be linked for scrolling, otherwise it is omitted. Cx is the number of character positions in the new window, cy is the number of screen lines, also in the new window.

Order of records

There are only a few restrictions on the order of records in SYLK files.

1. ID must be the first record.

2. B should be used (although not required) for Multiplan input.

3. For Multiplan C records: ;D or ;G must appear before another C record that refers to it (with ;S, ;R, ;C).

4. Name definition should precede name use for efficiency, although this is not required.

5. Window splits and window properties must be in strict logical order.

6. NU records must precede NE records.

7. E must be the last record.

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