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N. Kantaris and P.R.M. Oliver



# **Excel 5 explained**

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**by**

**N. Kantaris  
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## ABOUT THIS BOOK

This book was written to help spreadsheet users, whether beginners or upgraders to this latest 3-dimensional Windows spreadsheet from Microsoft. The material in this book is presented on the 'what you need to know first, appears first' basis, although the underlying structure of the book is such that you don't have to start at the beginning and go right through to the end. The more experienced user can start from any section, as the sections have been designed to be self contained.

The book does not describe how to install Microsoft Windows, or how to set up your computer hardware, although the Windows environment is described in Chapter 3. If you need to know more about these topics, then may we suggest that you also refer to *A Concise User's Guide to Windows 3.1* (BP325), and to either *A Concise User's Guide to MS-DOS 5* (BP318), or *MS-DOS 6 Explained* (BP341), depending on the version of your Disc Operating System. These books are also published by BERNARD BABANI (publishing) Ltd.

Microsoft Excel 5 for Windows is a very powerful spreadsheet package that has the ability to work 3-dimensionally with both multiple worksheets and files. It is operated by selecting commands from drop-down menus, by using buttons, or by writing 'macros' to chain together menu commands. Each method of accessing the package is discussed separately, but the emphasis is mostly in the area of menu-driven command selection. Working under the Windows environment, as it does, gives the package an excellent Wysiwyg appearance which, in turn, allows for the production of highly professional quality printed material.

Below we list the major enhancements found in Microsoft Excel Version 5 for Windows over Version 4. These are:

- The inclusion of the TipWizard which allows you to learn shortcuts for the way you work.
- The ability to display ToolTips to see button names.
- The ability to enter and edit data directly in a cell or in the formula bar, and check your spelling.

- The ability to manage data simply by treating all files as workbooks.
- The inclusion of the Find File command to search for a workbook, even if its name is not known.
- The inclusion of the Format Painter button to quickly copy formats between cells and between objects.
- The ability to create named ranges in the Name box on the formula bar.
- The ability to create custom AutoFill series and automatically create grand totals with AutoSum.
- The ability to create 3-D formulae and 3-D names for powerful workbook models.
- The inclusion of the interactive Function Wizard to create formulae with worksheet functions.
- The ability to drag data directly onto a chart to add a data series or data points, and add trendlines and error bars to your data series.
- The ability to draw graphic objects directly on charts and to position objects, such as titles, anywhere you want them.
- The ability to sort data by using column labels from a list and the creation of custom sort orders, such as High, Med, and Low.
- The ability to access external databases with Microsoft Query and the use of the interactive PivotTable Wizard to cross-tabulate and summarise data from an existing list or table.
- The inclusion of the Scenario Manager to create, manage, and track changes to scenarios.
- The ability to use or customise any of the built-in toolbars, or create your own.
- The ability to use autotemplates to create new default workbooks and sheets.

- The inclusion of Visual Basic Programming System to create custom solutions in Microsoft Excel.
- The ability to display the precedent, dependent, and error tracers directly on your worksheet to locate problems in formulae.
- The inclusion of Object Linking and Embedding (OLE) allows you to link objects without leaving Microsoft Excel.

In addition to the above new features, Microsoft Excel Version 5 supports all the functionality built into Version 4, such as:

- Solving What-if problems by seeking a value that solves a formula.
- Using the Solver to analyse multiple-variable problems.
- Using the Data Analysis Tool to make statistical or engineering analysis easier.

In Microsoft Excel 5, there are two ways in which you can learn about and use the various worksheet functions. These are:

- Online Help, which includes complete worksheet function descriptions - search Help for 'worksheet functions'.
- The Function Wizard, which includes descriptions of all worksheet functions. It can be used to select a function, assemble the arguments correctly, and insert it into your formula.

Most features of the package (old and new) will be discussed using simple examples that the user is encouraged to type in, save, and modify as more advanced features are introduced. This provides the new user with a set of examples that aim to help with the learning of the most commonly used features of the package, and should help to provide the confidence needed to tackle some of the more advanced features of the package later.

Although the book is intended as a supplement to the documentation that comes with the package, at the back of the book, all the Excel functions are listed so that it is self contained and can be used as a reference long after you become an expert in the use of the program.

If you would like to purchase a floppy disc containing all the files/programs that appear in this, or any other listed book(s) by the same author(s), then fill-in the form at the back of the book and send it to the stipulated address.

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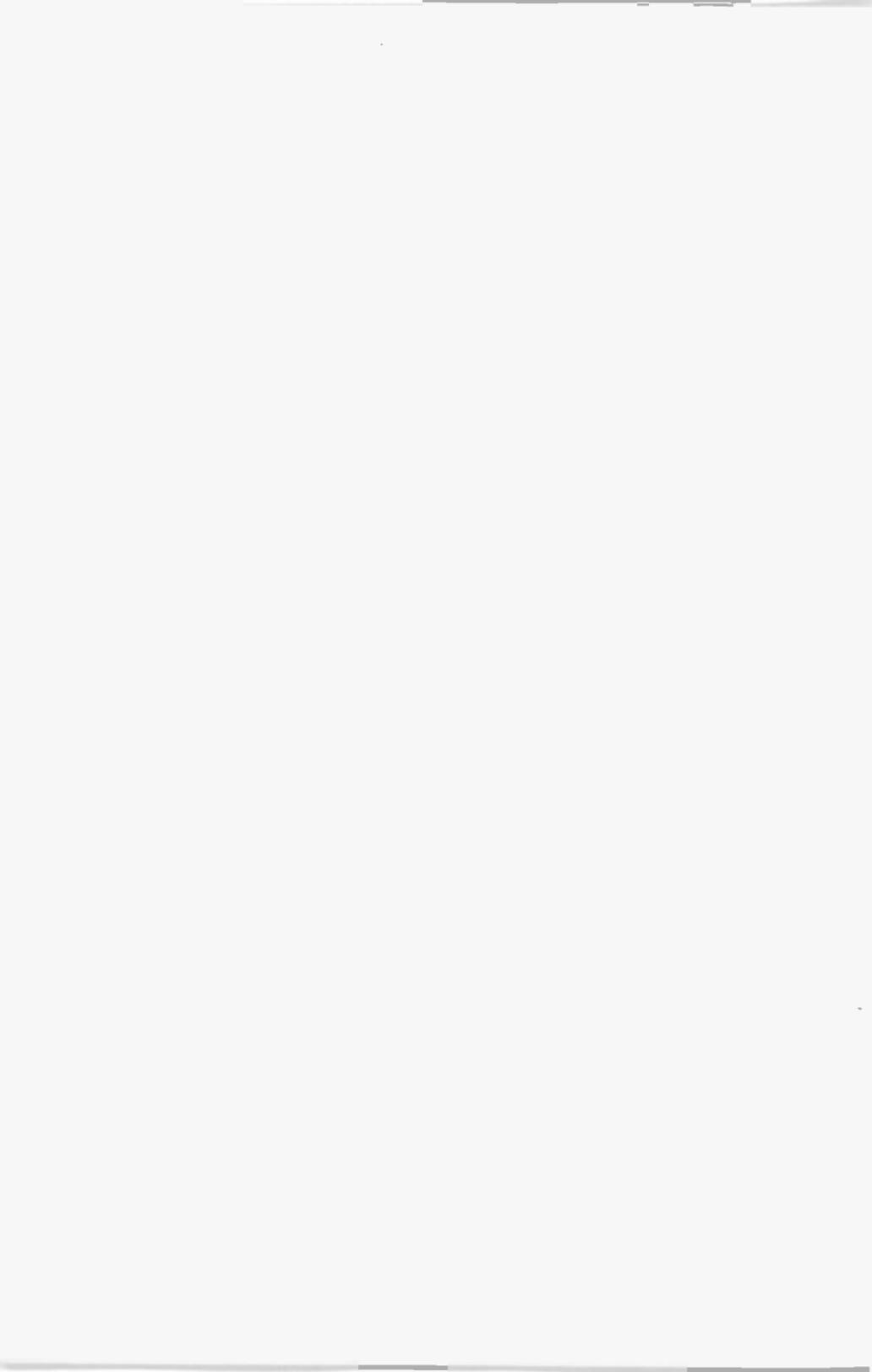
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# 1. INTRODUCTION

Microsoft Excel is a powerful and versatile software package which, over the last few years, has proved its usefulness, not only in the business world, but with scientific and engineering users as well. The program's power lies in its ability to emulate everything that can be done by the use of pencil, paper and a calculator. Thus, it is an 'electronic spreadsheet' or simply a 'spreadsheet', a name which is also used to describe it and other similar products. Its power is derived from the power of the computer it is running on, and the flexibility and accuracy with which it can deal with the solution of the various applications it is programmed to manage. These can vary from budgeting and forecasting to the solution of complex scientific and engineering problems.

Microsoft Excel comes in two flavours; one version runs on PCs under Windows, and the other on the Apple Macintosh computer. This book deals with Microsoft Excel for PCs Version 5.x for Windows. Spreadsheets built-up on previous versions of Excel or, indeed, on other spreadsheets, such as Lotus 1-2-3, Quattro Pro, Microsoft Works and Microsoft Multiplan, can easily be made to run on Excel Version 5.

## Hardware Requirements

To install and run Excel 5 successfully, you need an IBM compatible or PS/2 computer equipped with a VGA or SVGA graphics display, an Intel 80386 or higher processor, with at least 4 MB of RAM, and running under MS/PC-DOS 3.1 or higher, with Microsoft Windows 3.1 or higher, installed. Although the package is quite happy working with computers equipped with an 80286 processor and an EGA graphics display, running Windows 3.1 on such a computer will be far too slow and cumbersome.

Installing the complete package of Microsoft Excel 5 on a PC requires 16.5 MB of contiguous hard disc space. If you want, you could install a laptop computer option of the package, which requires less hard disc space than the complete installation.

Although it is possible to operate the package from the keyboard alone, the availability of a mouse is a must if you

are going to benefit from the program's features and from Windows' Graphical User Interface (GUI). After all, pointing and clicking (with the left mouse button) at an option on the screen to start an operation, or pointing and double-clicking at a button to start a program, is a lot easier than having to learn several different key combinations. So if you can, install a mouse.

## **New Features**

Some of the major enhancements Microsoft Excel 5 has over earlier releases of the package include:

- The addition of a new Scenario Manager to create and manage scenarios, protect or merge scenarios, and keep track of any changes made to scenarios.
- The adoption of the new Visual Basic Programming System to create custom solutions by using it instead of using the Macro Language available in earlier versions of the package.
- The acquisition of a new Function Wizard which includes descriptions of all worksheet functions. It can be used to select a function, assemble the arguments of the function correctly, and insert the function into formulae.
- The inclusion of a new TipWizard which alerts you if it has a tip about an alternative quick and efficient way of doing what you have just performed. Clicking the TipWizard button displays the tip or gives information about a related feature.
- The adoption of the workbook concept which is the electronic equivalent to a ring binder. Inside each workbook you can have several sheets, such as worksheets and chart sheets. These can be easily rearranged within a workbook, and can be moved or copied to another workbook.

Other new features deal with formatting charts, organising data, and retrieving and analysing data from lists and tables.

## **Icon Buttons**

These are becoming an important part of all the Windows application software produced by Microsoft. They are colourful buttons, or speed-keys, that give you mouse click access to the functions most often used in the program. Where feasible they are standard across the Microsoft applications which makes their learning and use much easier. The usual drop menus are still present and have been standardised with those of Microsoft Word for Windows, but are only necessary now for the lesser used commands.

Excel 5 supports numerous icon buttons which are to be found on two Toolbars, underneath the Menu bar, at the very top of the screen. The buttons on the first Tool bar allow you to perform the most common tasks, such as opening an existing workbook, saving your work to disc, printing your work, cutting and pasting information, etc. The buttons on the second Toolbar allow you to format and enhance your entries by allowing you to change the default font and its size, change the attributes of a font, such as bold, italic, and underline, or change justification of pre-selected entries, and format numerical entries.

To obtain a description of what an icon button can do when clicked, point to it with the mouse pointer. A second later, a description of its function appears immediately below it.

## **Styles and Templates**

Excel 5 allows you to define and save combinations of formats as styles, then apply these styles to another workbook. New workbooks are opened with the default built-in styles, but you can apply your own styles to it at any time.

Templates are special workbooks that you can use as a pattern to create other workbooks. They can contain text, graphics, formatting instructions, macros, and styles.

Once you get accustomed to using styles and templates, you will find it saves you an enormous amount of time with document formatting. It is, therefore, a good idea to build your own styles, either from scratch or by changing existing styles and then giving them a different name. Once a style is changed, the changes are reflected everywhere the style is used.

## Installing Excel

Installing Excel on your computer's hard disc is made very easy with the use of the SETUP program on Disk 1. You need to run this program because part of its job is to convert compressed files from the distribution discs prior to copying them onto your hard disc; it then configures Windows for Excel.

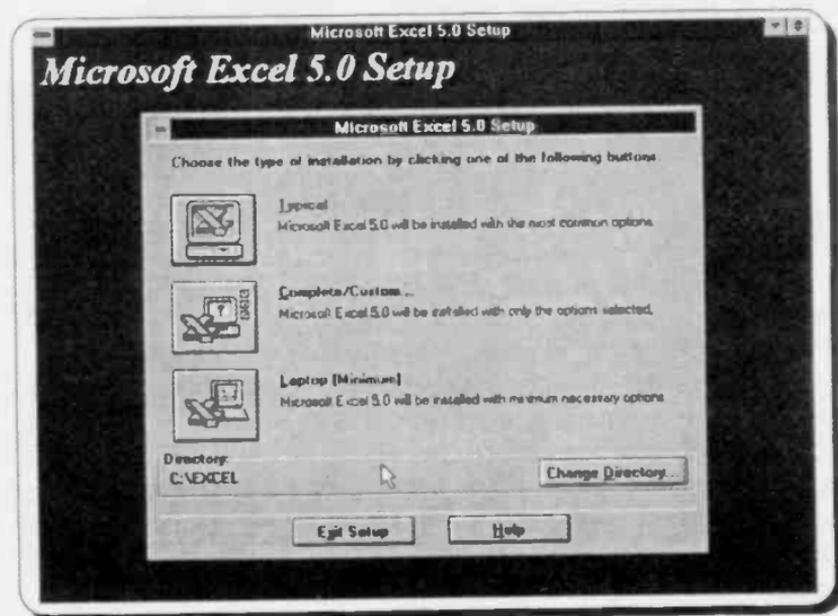
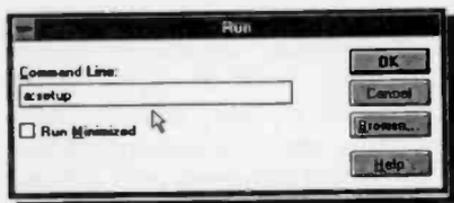
Insert the Microsoft Excel for Windows distribution disc #1 into drive A: and start the installation from the Program Manager of Windows, by clicking your mouse on **F**ile,

followed by **R**un. In the displayed Run dialogue box, shown here, type

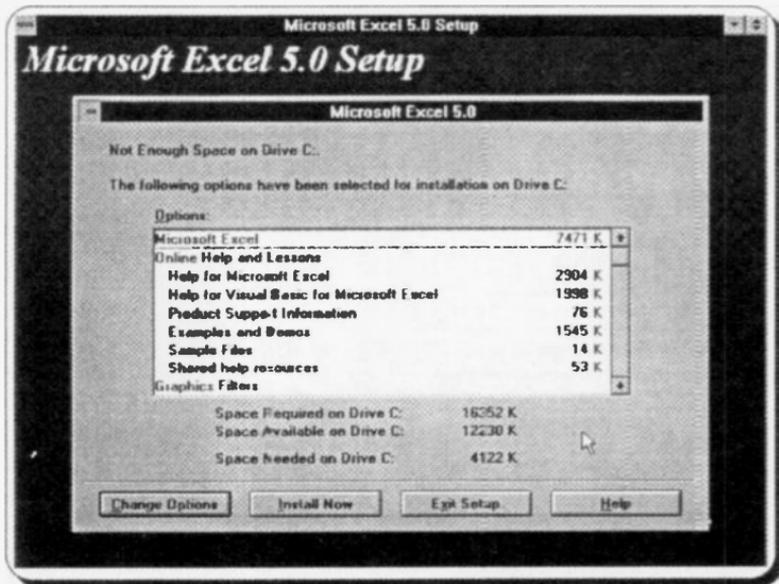
```
a:setup
```

This causes the display of the Welcome Screen, followed by the Name

and Organisation Information box in which you type your name. Next, the Product ID is displayed - make a note of this if you intend to seek technical support. Finally the Microsoft Excel 5 Setup screen is displayed, as shown below.



From this screen, you can choose one of three installations: 'Typical' (it requires nearly 16.5 MB of disc space), 'Complete/Custom', or 'Laptop (Minimum)'. Choosing 'Typical', if you don't have the disc space to install all the required components, displays the following screen:



If this happens to you, either exit SETUP and delete enough unwanted files to make up the shortfall in disc space, or decide from the above screen which components of Excel you don't want to install. If you proceed without taking either of the two options given above, you might waste the next hour installing Excel, only to find out at the very end the program runs out of disc space and the installation is not successful. If you have to re-install, don't delete the files already transferred, as SETUP will detect these and the installation time will be much shorter next time round.

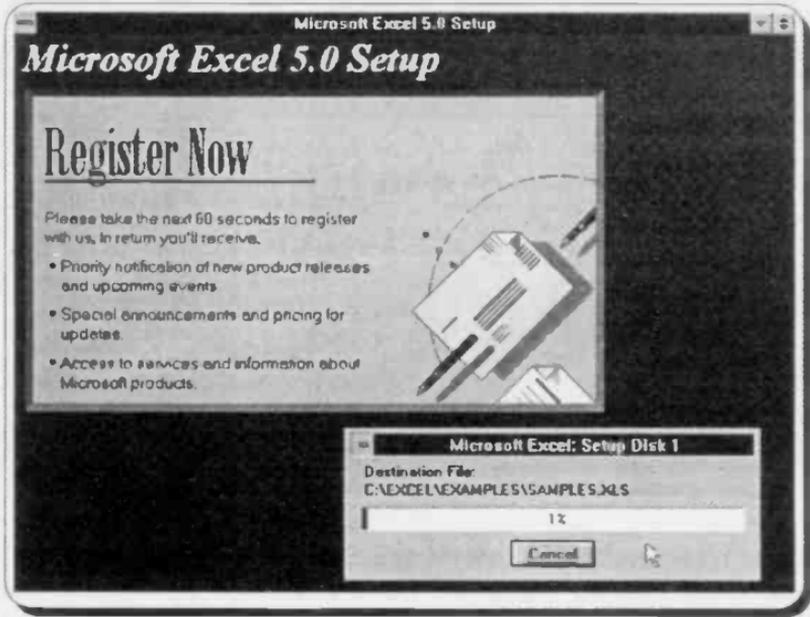
If you have the disc space required, Excel offers the directory

`\Excel`

as the default directory on which to place the program files.

This can be changed if you wish. Next, you are asked to choose the program group for the Windows icons, with the default name 'Microsoft Office' being offered.

From this point on, SETUP starts to uncompress the Excel program files onto your hard disc. When it needs you to change the disc in the A: drive, in order to transfer more files, it prompts you on a dialogue box superimposed on a screen similar to the one below.



The above screen window is continuously updated showing details of how the installation is progressing. At any time you can cancel the installation by pressing the **Cancel** button.

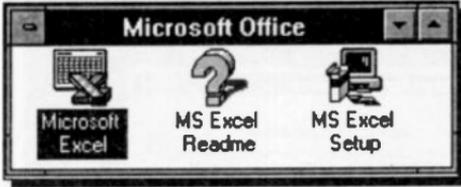
If the complete package is installed, 9 high density distribution discs will be used, and if successful, the three icons shown here will be added to the selected Group in the Windows Program Manager.



## 2. THE EXCEL ENVIRONMENT

### Starting the Excel Program

To start Excel, start Windows, open the Windows Program Manager, and if you are using a mouse, point to the Microsoft Excel icon, shown here highlighted, and double-click the left mouse button.



With the keyboard, after opening the Windows Program Manager, use the <Ctrl+Tab> key combination (while holding the <Ctrl> key down, press the <Tab> key), until the Microsoft Office Group is highlighted, then use the cursor keys to highlight the Microsoft Excel application icon, and press the <Enter> key.

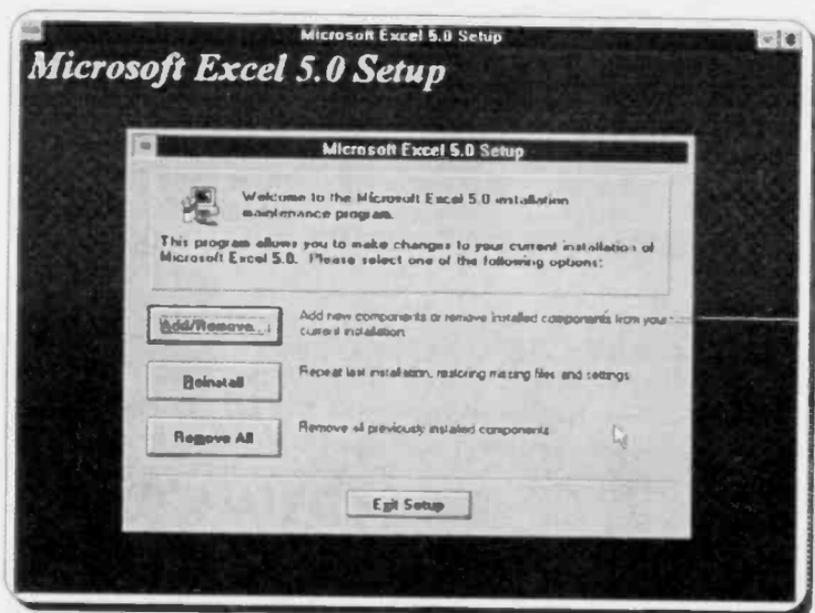
### The Program Icons:

The SETUP program either opens a new group window in the Program Manager of Windows and names it **Microsoft Office** (if it does not already exist, and provided this is the name you chose during installation), and places in it three icons, as shown above, or it adds these icons to an existing Group, depending on your choice.

You can leave the **Microsoft Office** window (if that is what you chose to call it) intact, which is the best strategy, or you can move some of the icons to one of your other Application Windows (by dragging them between the two windows with the left mouse button depressed). You can even delete unwanted applications by highlighting them and pressing the <Del> key. To delete a whole group of applications, close the group and highlight its icon before pressing the <Del> key. Manipulating icons or windows will be described more fully in the next chapter in which the Windows environment is discussed in some detail.

These icons are self-explanatory; the first starts Excel, while the second contains late information on several topics and can either be read on the screen or printed on paper.

The third icon activates the SETUP program which searches your hard disc for components of the program, then displays the following screen.



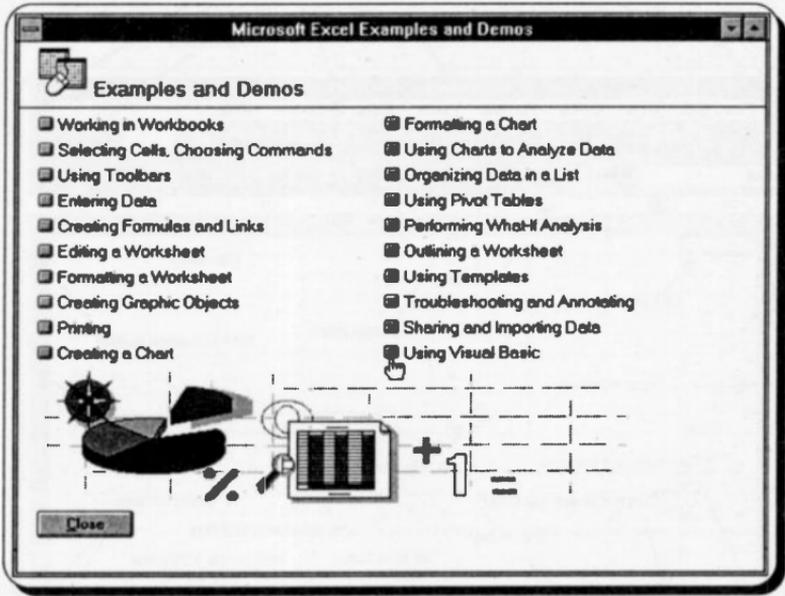
From this screen, you can add or remove components of the package, reinstall the package, or remove the whole package.

## Getting Familiar with Excel

Excel has two options under the **Help** menu which allow you to familiarise yourself with the package; **Quick Preview** and **Examples and Demos**.

The first one of these, is an interactive tutorial on four main options: Getting Started, What is New, Getting Information While You Work, and For Lotus 1-2-3 Users. To access this option, start Excel, then use the **Help, Quick Preview** command. This tutorial is a good introduction to the powerful features of Excel. It takes about half an hour to work through and is well worth the time. You can of course run through the different options as often as you like, and not necessarily in the presentation order. When you have finished, press the **Return to Microsoft Excel** button.

The second familiarisation option offers detailed information on a number of selected topics, and has the added ability of letting you practise on them. To access this option, start Excel and use the **Help, Examples and Demos** command, which causes the following screen to be displayed.



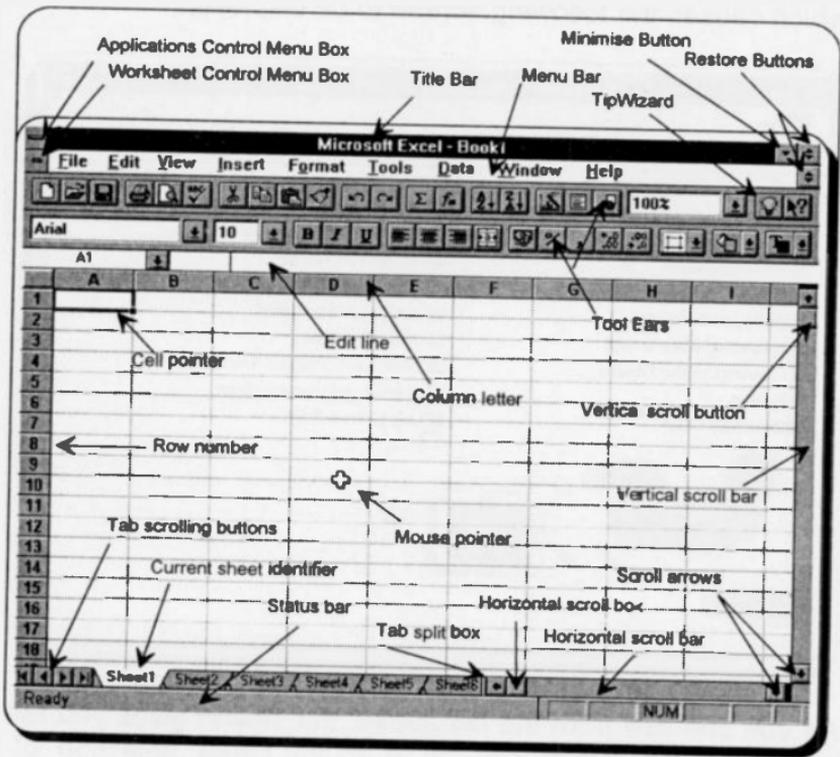
As you can see from the list above, this option gives you far more detailed information on a much larger selection of topics. We suggest you return to this option often to complete your knowledge of the package.

## The Excel Screen

The opening 'blank' screen of Excel is shown on the next page. It is perhaps worth spending some time looking at the various parts that make up this screen, or window. Excel follows the usual Microsoft Windows conventions and if you are familiar with these you can skip through this section. Otherwise a few minutes might be well spent here.

The window as shown takes up the full screen area available. If you click on the application restore button, the top one of the two restore buttons at the top right of the screen, you can make Excel show in a smaller window.

This can be useful when you are running several applications at the same time and you want to transfer between them with the mouse.



Note that the Excel window, which in this case displays an empty and untitled book (Book1), has a solid 'Title bar', indicating that it is the active application window. Although multiple windows can be displayed simultaneously, you can only enter data into the active window (which will always be displayed on top). Title bars of non-active windows appear a lighter shade than that of the active one.

The Excel screen is divided into several areas which have the following functions. These are described on the next page, starting from the top of the screen down, working from left to right.

<b>Area</b>	<b>Function</b>
Control boxes	Clicking on the top control menu box (upper left corner of window), displays the pull-down menu used to control the program window. It includes commands for re-sizing, moving, maximising, minimising, switching to another task, closing the window, and calling the Control Panel. The lower menu box controls the current Excel Book window in the same way.
Title bar	The bar at the top of a window which displays the application name and the name of the current book.
Minimise button	The button you point to and click to store an application as an icon (small symbol) at the bottom of the screen. Double-clicking on such an icon will restore the screen and even maintain the cursor position.
Restore buttons	Clicking on these buttons restores the active window to the position and size occupied before being maximised or minimised. The restore button is then replaced by a maximise button (with a single up-pointing arrow), used to set the window to its former size.
Menu bar	The bar below the title bar which allows you to choose from several menu options. Clicking on a menu item displays the pull-down menu associated with that item.
TipWizard	The bulb icon which lights up if there is a quicker or more efficient way of performing the action you have just performed. Clicking on the icon displays the tip, while clicking on the icon once more removes it.

Tool bars	These display the current set of icons, which can be clicked to quickly carry out commands, functions, or macros. Using the <b>View, Toolbars</b> command displays the other available sets of icons.
Edit line	Contains the selection indicator (cell co-ordinates), and the contents or edit line box (can include a number, a label, or the formula behind a displayed result).
Cell pointer	Marks the current cell.
Column letter	The letter that identifies each column.
Row number	The number that identifies each row.
Scroll bars	The areas on the screen (extreme right and bottom of each window) that contain scroll boxes in vertical and horizontal bars. Clicking on these bars allows you to control the part of a worksheet which is visible on the screen.
Scroll arrows	The arrowheads at each end of each scroll bar at which you can click to scroll the screen up and down one line, or left and right 10% of the screen, at a time.
Tab scrolling	Clicking on these buttons, scrolls sheet tabs right or left, when there are more tabs than can be displayed at once.
Current sheet	Shows the current sheet amongst a number of sheets in a file. These are named Sheet1, Sheet2, Sheet3, and so on, by default, but can be changed to, say, North, South, East, and West. Clicking on a sheet tab, moves you to that sheet.

Status bar	The bottom line of the screen that displays program information.
Tab split box	The split box which you drag left to see more of the scroll bar, or right to see more tabs.

There are two extra split boxes on Excel's worksheet screen dump, which have not been identified. Both of these have to do with splitting the screen; one horizontally (the split box for this is located at the extreme right of the screen above the 'top vertical scroll arrow' button), the other vertically (the split box for this is located at the extreme bottom-right corner of the screen, to the left of the 'right horizontal scroll arrow' button). The use of both these split boxes will be discussed later.

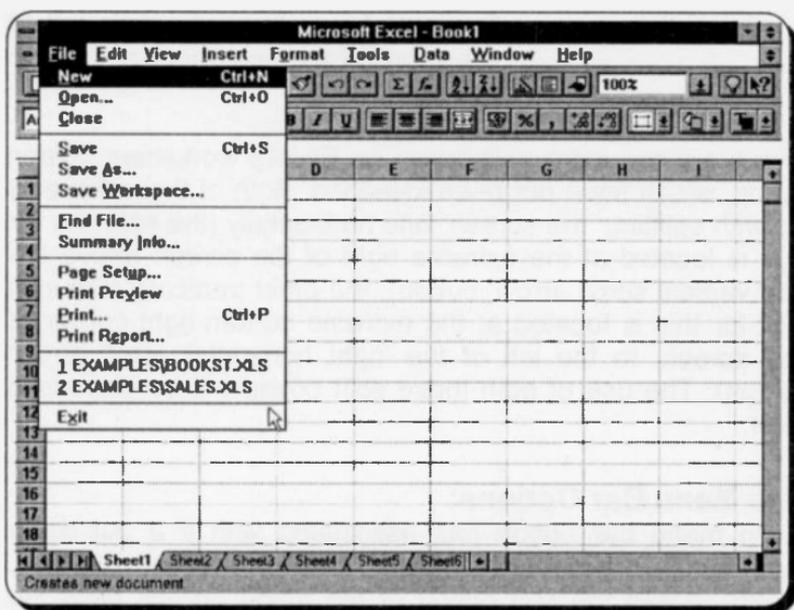
### **The Menu Bar Options:**

Each menu bar option has associated with it a pull-down sub-menu. To activate the menu, either press the <Alt> key, which causes the first option of the menu (in this case the current Book Control Menu box) to be highlighted, then use the right and left arrow keys to highlight any of the options in the menu, or use the mouse to point to an option. Pressing either the <Enter> key, or the left mouse button, reveals the pull-down sub-menu of the highlighted menu option.

Menu options can also be activated directly by pressing the <Alt> key followed by the underlined letter of the required option. Thus, pressing <Alt+F>, causes the pull-down sub-menu of the File menu to be displayed. You can use the up and down arrow keys to move the highlighted bar up and down a sub-menu, or the right and left arrow keys to move along the options in the menu bar.

Note that as you move up and down a sub-menu, a brief description of the highlighted option appears in the Status bar. Pressing the <Enter> key selects the highlighted option or executes the highlighted command. Pressing the <Esc> key once, closes the pull-down sub-menu, while pressing the <Esc> key for a second time, closes the menu system.

The sub-menu of the File option is shown below.



Some of the sub-menu options can be accessed with 'quick key' combinations from the keyboard. Such combinations are shown on the drop-down menus, for example, under the File sub-menu there are four such quick key combinations; <Ctrl+N> for the New option, <Ctrl+O> for the Open option, <Ctrl+S> for the Save option, and <Ctrl+P> for the Print option.

If a sub-menu option is not available, at any time, it will display in a grey colour. Some menu options only appear in Excel when that tool or command is being used, but the following options remain constant. Such tools or commands are marked with a solid arrow head (▶) on the right of the relevant menu entry. For a more detailed description of each sub-menu item, either highlight it and read the text on the Status line, or use the on-line Help system, described later.

## The Main Menu Options:

Each item on the main menu offers the following options:

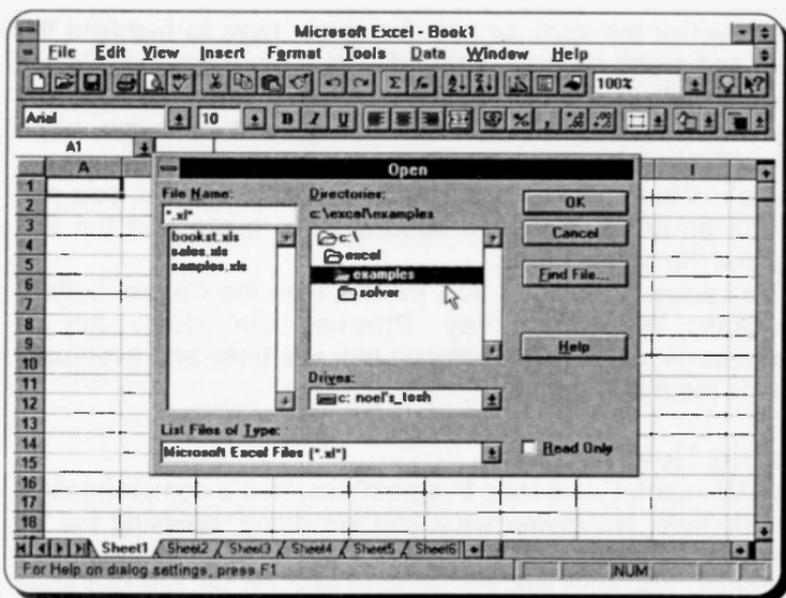
- File** Produces a pull-down menu of mainly file related tasks, such as creating a **New** file, the ability to **Open**, or **Close** files, **Save** files with the same name, **Save As** a different name, or save changed documents together as **Save Workspace**. Other options, such as **Find File** allow you to search for specific files, while **Summary Info** allows you to enter information specific to a file. Further options allow you to **Print Preview**, **Print** or **Print Report**. Finally **Exit** allows you to quit the program.
- Edit** Gives options to **Undo** changes made, to **Cut**, **Copy** and **Paste** data via the clipboard, to **Fill** cells with data, **Clear** data from a cell directly, **Delete** individual cells, rows, columns or sheets, to **Move** or **Copy** sheets, to **Find** and **Replace** characters in cells, or **Go To** a specific cell. Finally, the **Links** option allows you to open linked documents or change links, while **Objects** allows you to edit selected objects.
- View** Lets you change screen display options by switching on or off the **Formula Bar** or **Status Bar**, by showing or hiding the **Toolbars**, by toggling **Full Screen** on/off, or by changing the **Zoom** magnification of a window. Lastly, the **View Manager** shows or defines a named view.
- Insert** Allows you to insert **Cells**, **Rows**, **Columns**, **Worksheets**, **Charts**, or a **Page Break**, to create a **Macro**, to activate the **Function Wizard** to insert or edit a function, to **Name** and apply definitions to ranges, charts, or objects, to add or remove a **Note** from a cell, and to insert a **Picture** or an **Object**.

- Format** Allows you to change the form of **C**ells with borders, alignment and other formats, to change a **R**ow (or **C**olumn) height (or width), to rename or hide/unhide a **S**heet, to **A**utoformat tabular reports, to apply or define a cell **S**yle, or to use **P**lacement to place selected objects in front of or overlapping other objects.
- Tools** Allows you to check the **S**pelling of your documents, to use **A**uditing techniques to trace precedents, dependants and errors, to use the **G**oal **S**eeK procedure to find solutions to single-input problems, to use **S**cenarios to create and examine what-if problems, to use **S**olver to find solutions to worksheet models, to apply **P**rotection to sheets and workbooks, to install and remove **A**dd-ins, to run a **M**acro, use the **R**ecord **M**acro procedure, and to change various **E**xcel **O**ptions.
- Data** This menu allows manipulation of data in a range. You can **S**ort the entries in a range of cells, **F**ilter data according to given criteria, use **F**orm to find, change and delete database records, add **S**ubtotals to a list of data, create a **T**able in a selected range of cells, use **T**ext to **C**olumns to rearrange text entries in a range of cells into columns, **C**onsolidate multiple worksheets into a range of cells, use **G**roup and **O**utline to group information in columns or rows, to create, modify, and work with data in a **P**ivot **T**able.
- Window** Produces a sub-menu to control the display of existing open windows on the screen.
- Help** Activates the help window and displays an 'index' of help or offers help on selected topics; as well as giving access to the **Q**uick **P**review and **E**xamples and **D**emos.

## Dialogue Boxes:

Three periods after a sub-menu option or command, means that a dialogue box will open when the option or command is selected. A dialogue box is used for the insertion of additional information, such as the name of a file or path.

To see a dialogue box, press <Alt+F>, and select the **O**pen option; the 'Open' dialogue box appears on the screen. Double-clicking at the **e**xamples subdirectory lists three Excel files (with the distinctive .xls extension to the filename) as shown below.



When a dialogue box opens, the easiest way to move around it is by pointing and clicking with the left mouse button at the required field. With the keyboard, the <Tab> key can be used to move the cursor from one field in the box to another (<Shift+Tab> moves the cursor backwards), or alternatively you can move directly to a desired field by holding the <Alt> key down and pressing the underlined letter in the field name. Within a column of options you must use the arrow keys to move from one to another. Having selected an option or

typed in information, you must press a command button, such as the **OK** or **Cancel** button, or choose from additional options. To select the **OK** button with the mouse, simply point and click, while with the keyboard, you must first press the <Tab> key until the dotted rectangle moves to the required button, and then press the <Enter> key. Pressing <Enter> at any time while a dialogue box is open, will cause the marked items to be selected and the box to be closed.

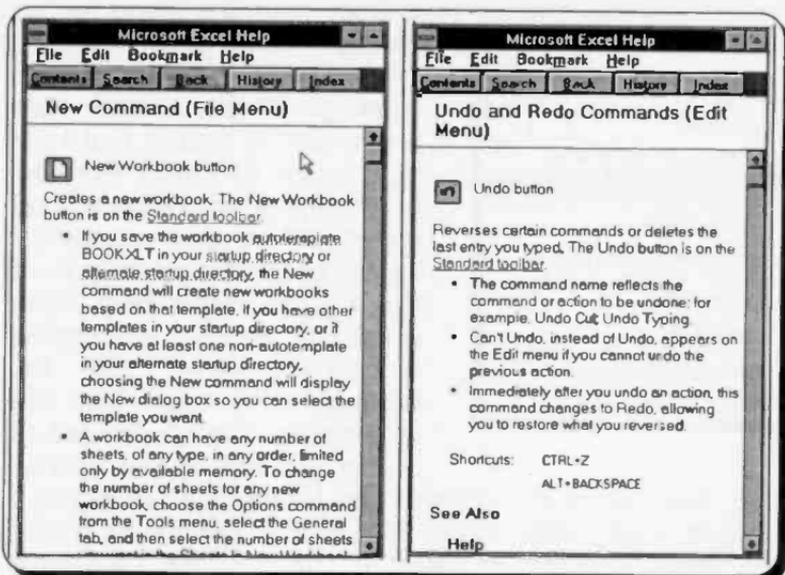
Some dialogue boxes contain List boxes which show a column of available choices. If there are more choices than can be seen in the area provided, use the scroll bars to reveal them. To select a single item from a List box, either double-click the item, or use the arrow keys to highlight the item and press <Enter>. Other dialogue boxes contain Option buttons with a list of mutually exclusive items. The default choice is marked with a black dot against its name, while unavailable options are dimmed. Other dialogue boxes contain Check boxes which offer a list of options you can switch on or off. Selected options show a cross in the box against the option name.

To cancel a dialogue box, either press the **Cancel** button, or press the <Esc> key. Pressing the <Esc> key in succession, closes one dialogue box at a time, and eventually aborts the menu option.

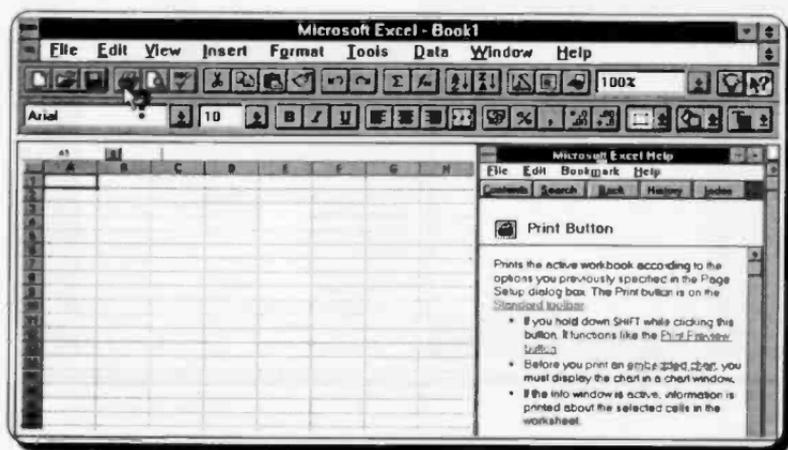
## Using Help in Excel

The Microsoft Excel Help Program provides a comprehensive on-line help. No matter what you are doing, pressing the F1 function key displays context sensitive help screens. For example, pressing the F1 function key on an opened **N**ew worksheet, when the Status indicator (at the bottom left corner of the worksheet) is in **R**eady mode, displays the left help window screen shown on the next page, while pressing the F1 function key when the **E**dit sub-menu is activated and the **U**ndo option is highlighted, displays the right help window screen.

To close a Help window and return to your original screen, either double-click the Help window Control Menu Box (the large negative sign at the top left corner of the window), or use the **F**ile, **E**xit command from within the Help window.

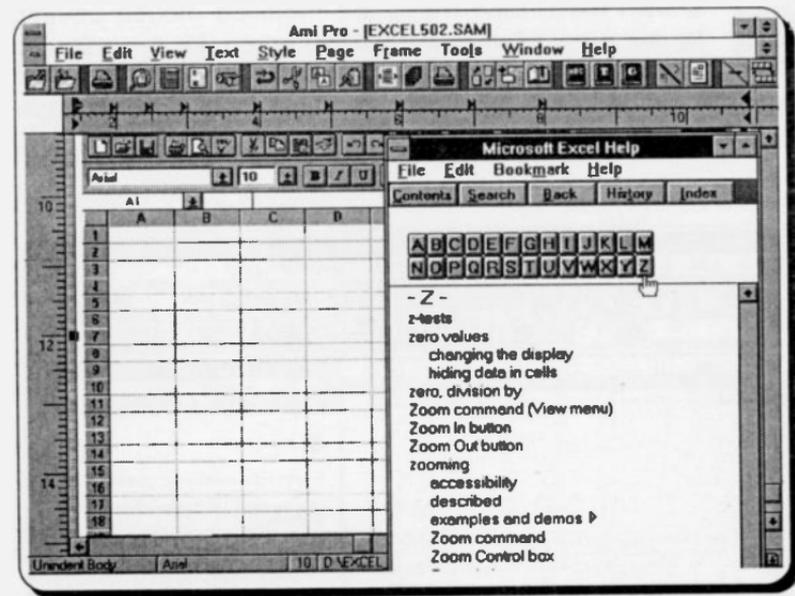


Another way of getting context sensitive help is to double-click the Help button on the Standard toolbar, shown here, then move the modified mouse pointer to an area of the worksheet or on to a particular toolbar button and press the left mouse button. For example, doing this and pointing to the Print button, displays the following screen.



Finally, you can choose **H**elp from the Main Menu bar, to display a short menu. Choose **I**ndex to display the Excel Help index, (or choose another Help menu item to display that Help topic, such as **Q**uick Preview or **E**xamples and Demos) and select the Help topic you want, if visible, or a letter button to jump to the area of the Help index where the required topic starts, as shown below. With the keyboard, press the <Tab> key to progress through the letters of the alphabet to the desired

letter, then press the <Enter> key to select it. To select a particular topic, press <Tab> to progress through the topics, then press <Enter> to select it. To progress backwards through topics press the two key combination <Shift+Tab> (keep the <Shift> key down while pressing the <Tab> key).



## 3. THE WINDOWS ENVIRONMENT

### The Mouse Pointers

As with all other graphical based programs the use of a mouse makes many operations both easier and more fun to carry out.

Microsoft Excel has several different mouse pointers (similar to those found in Windows 3.1) which it uses for its various functions. Most of these are listed below. When the program is initially started up the first you will see is the hourglass, which turns into an upward pointing hollow arrow.



The hourglass which displays when you are waiting while 1-2-3 is performing a function.



The arrow which appears when the pointer is placed over menus, scrolling bars, and buttons, or when moving a selection of cells.



The I-beam which appears when you enter or edit data.



The large 4-headed arrow which appears after choosing to size a window with the keyboard.



The double arrows which appear when you size a window with the mouse by dragging the sides or the corners of the window.



The split arrow which appears when you select to create a horizontal pane by placing the mouse pointer on the split box above the vertical scroll bar, or when inserting rows,



and when you size a row.



The split arrow which appears when you select to create a vertical pane by placing the mouse pointer on the split box to the right of the horizontal scroll bar, or when inserting columns,



and when you size a column.



The pointer which appears when you are copying a selection of cells.



The pointer which appears when you are filling rows or columns, or when positioning a draw object.



The Help hand which appears in the help windows, and is used to access 'hypertext' type links.



The chart pointer which appears when you activate the Chart Wizard to position a new chart.



The draw pointer which appears when you are drawing freehand.

## Manipulating Windows

Like any other Windows application, Excel allows the display of multiple windows. At some stage you may need to manipulate a series of windows, by selecting which one is to be active, by moving them so that you can see all the relevant parts, or indeed by re-sizing them. What follows is a short discussion on how to manipulate windows.

### Changing the Active Window:

To select the active window amongst those displayed on the screen, point to it and click the left mouse button, or, if you are in full screen mode, choose the **Window** option of the main menu and select the appropriate number of the window you want to make the active one.

### Moving Windows and Dialogue Boxes:

When you have multiple windows or dialogue boxes on the screen, you might want to move a particular one to a different part of the screen. This can be achieved with either the mouse or the keyboard, but not if the window occupies the full screen, for obvious reasons.

To move a window, or a dialogue box, with the mouse, point to the title bar and drag it (press the left button and keep it pressed while moving the mouse) until the shadow border is where you want it to be, then release the mouse button.

To move with the keyboard, press <Alt+Spacebar> to reveal the Application Control menu, or <Alt+-> to reveal the Document Control menu. Then, press **m** to select **M**ove which causes a four-headed arrow to appear in the title bar and use the arrow keys to move the shadow border of the window to the required place. Press <Enter> to fix the window in its new position or <Esc> to cancel the relocation.

### **Sizing a Window:**

You can change the size of a window with either the mouse or the keyboard. To size an active window with the mouse, move the window so that the side you want to change is visible, then move the mouse pointer to the edge of the window or corner so that it changes to a two-headed arrow, then drag the two-headed arrow in the direction you want that side or corner to move. Continue dragging until the shadow border is the size you want, then release the mouse button.

To size with the keyboard, press either <Alt+Spacebar> or <Alt+-> to reveal the Application Control menu or the Document Control menu, then press **s** to select **S**ize which causes the four-headed arrow to appear. Now press the arrow key that corresponds to the edge you want to move, or if a corner, press the two arrow keys (one after the other) corresponding to the particular corner, which causes the pointer to change to a two-headed arrow. Press an appropriate arrow key in the direction you want that side or corner to move and continue to do so until the shadow border is the size you require, then press <Enter> to fix the new window size, or <Esc> to cancel the operation.

### **Minimising and Maximising Windows:**

Excel, or a document, can be minimised into an icon at the bottom of the screen by either using the mouse to click at the 'Minimise' button (the downward arrow in the upper-right corner of the window), or by pressing <Alt+Spacebar> or <Alt+-> to reveal the Application Control menu or the Document Control menu, and selecting **n** for **M**inimise.

To maximise a window so that it fills the entire screen, either click on the 'maximise' button (the upward arrow in the upper-right corner of the window), or press <Alt+Spacebar> or <Alt+-> to display the Application Control menu or the Document Control menu, and select **x** for **Maximise**.

An application which has been minimised or maximised can be returned to its original size and position on the screen by either double clicking on its icon to expand it to a window, or clicking on the double-headed button in the upper-right corner of the maximised window to reduce it to its former size. With the keyboard, press <Alt+Spacebar> to display the Application Control menu, or <Alt+-> to display the Document Control menu, and select **r** for **Restore**.

### **Closing a Window**

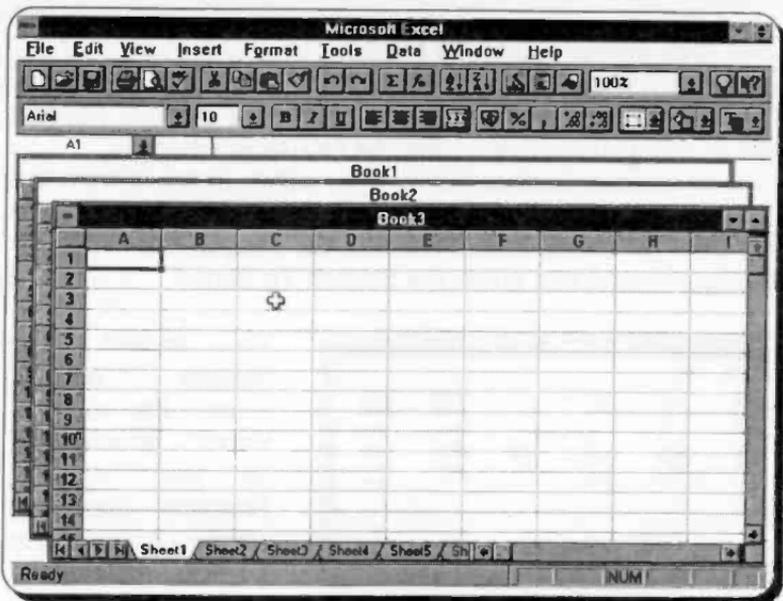
Excel itself, or a worksheet window, can be closed at any time to save screen space and memory. To close a window; double click on the Control menu button (the large hyphen in the upper-left corner of the window, use <Ctrl+F4>, or press <Alt+-> and select **c** for **Close** from the Control menu.

If you have made any changes to the sheet since the last time you saved it, Excel will warn you with the appearance of a dialogue box asking confirmation prior to closing it.

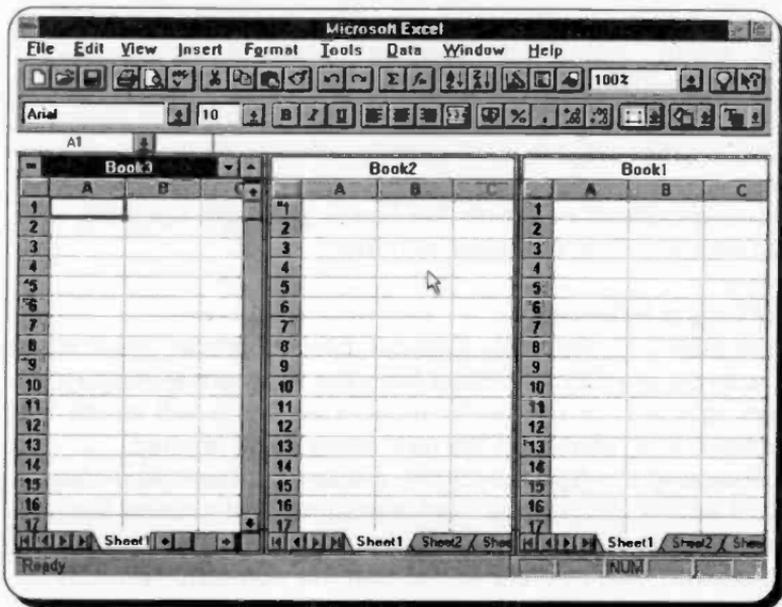
### **Windows Display Arrangement**

In Microsoft Excel, you can display multiple windows in either 'cascade' (overlapping) or 'tile' form - the choice being a matter of balance between personal preference and the type of work you are doing at the time. To illustrate the point, select the **File, New** command twice; each time you select this command, an additional worksheet window is added on the screen, on top of 'Book1'.

The default layout of multiple windows on display is in cascade form - that is, overlapping one another, with each newly opened window being located slightly below and to the right of the previous one. You can see this arrangement by pressing the 'Minimise' (double-headed) button located at the extreme right end of the Menu bar. Doing so, displays the screen shown on the next page.



To change the display from cascade to tile, use the menu option **Window** and select **Arrange, Vertical**. The screen will rearrange itself automatically to the display shown below.



## The Windows Control Panel

The Control Panel provides a quick and easy way to change the hardware and software settings of your system. For the sake of completeness we describe its use at this point.

Access to the Control Panel, from within Excel, is from the Application Control Menu box, situated at the left end of the Title Bar. To do so, select **Switch To**, choose the **Program Manager** option and press the **Switch To** button.



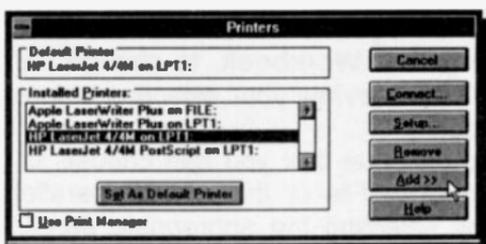
To access the various options within the Control Panel, double-click its icon in the Program Manager, which opens the window shown here.

Double-clicking at the Control Panel icons allows you to change the display colours, change the display and printer fonts, specify parameters for any installed serial ports, change the settings of your mouse, change the appearance of your display, specify resource allocations when running in 386 mode, install and configure your printer(s), specify international settings, such as the formatting of numbers and dates, change the keyboard repeat rate, change the date and time of your system, and specify whether Windows should beep when it detects an error. All of these features control the environment in which the Excel package operates and you should become familiar with them.

### Adding a Printer:

Each time you choose to install a different printer, you'll have to activate the Control Panel from the Program Manager and then double-click on the 'Printers' icon which will cause the dialogue box, shown on the next page, to be opened.

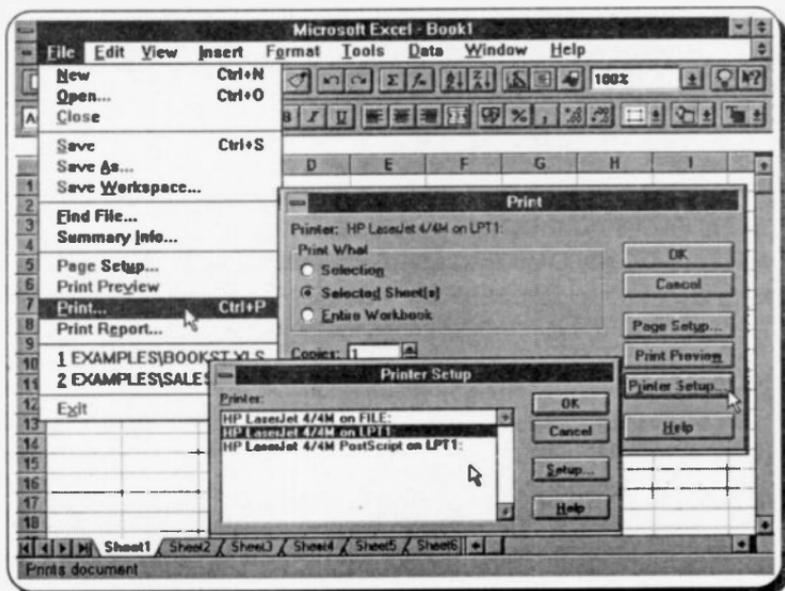
Selecting the **Add >>** button, causes Windows to display a list of supported printers from which you can choose the one you require. Windows will then ask you to insert a specific installation disc in drive A:, so that the correct driver can be copied on to your hard disc.



In this case, three printer drivers were installed; an Apple LaserWriter Plus, configured for output to a File, as well as via the parallel port LPT1, an HP LaserJet

4/4M, and an HP LaserJet 4/4M PostScript, both configured for output via the parallel port LPT1. The penultimate printer's name is highlighted and it also appears in the Default Printer box. Any of the other installed printers can be made the default by highlighting them and pressing the **C**onnect button. The **S**etup button allows you to select the size of paper and orientation of printout (portrait or landscape).

Any of the printers installed through the Control Panel can be accessed by Excel. If you so wish, you can select a printer other than the default one by using the **F**ile, **P**rint, **P**rinter **S**etup command which displays the Printer Setup dialogue box, shown below in a composite screen dump.



From the Print dialogue box you could choose to print **Selected Sheet(s)** or an **Entire Workbook**, to change the **Page Setup**, or to even **Print Preview** your selection before committing yourself to paper.

From the Printer Setup dialogue box you can choose to, say, print a given worksheet to File or through the parallel port LPT1 to a printer, by selecting the appropriate printer from the displayed list.

## 4. THE EXCEL WORKSHEET

When you first enter Excel, the program sets up a huge electronic page, or worksheet, in your computer's memory, many times larger than the small part shown on the screen. Individual cells are identified by column and row location (in that order), with present size extending to 256 columns and 16,384 rows. The columns are labelled from A to Z, followed by AA to AZ, BA to BZ, and so on, to IV, while the rows are numbered from 1 to 16,384.

A worksheet can be thought of as a two-dimensional table made up of rows and columns. The point where a row and column intersect is called a cell, while the reference points of a cell are known as the cell address. The active cell (A1 when you first enter the program) is boxed.

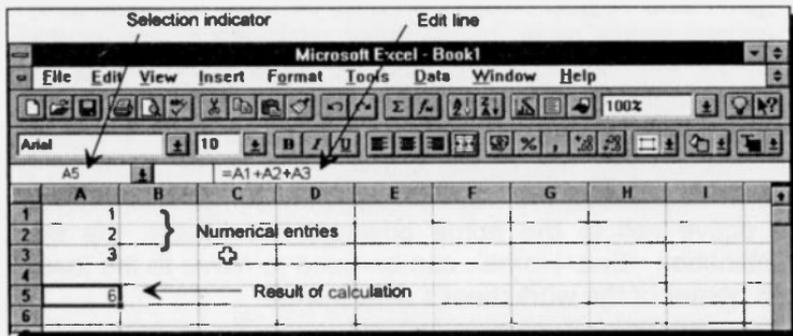
### Worksheet Navigation

Navigation around the worksheet is achieved by use of the four arrow keys (→↓←↑). Each time one of these keys is pressed, the active cell moves one position right, down, left or up, depending on which arrow key was pressed. The <PgDn> and <PgUp> keys can also be used to move down or up one visible page, respectively, while the <Ctrl+→> and <Ctrl+↓> key combinations can be used to move to the extreme right of the worksheet (column IV) or extreme bottom of the worksheet (row 16,384), respectively. Pressing the <Home> key, moves the active cell to the beginning of a row, while pressing the <Ctrl+Home> key combination moves the active cell to the home position, A1. Finally, the key combination <End+Home> can be used to move to the lower right corner of the worksheet's active area.

You can move the active cell with a mouse by moving the mouse pointer to the cell you want to activate and clicking the left mouse button. If the cell is not visible, then move the window by clicking on the scroll bar arrowhead that points in the direction you want to move, until the cell you want to activate is visible. To move a page at a time, click in the scroll bar itself, or for larger moves, drag the box in the scroll bar (the furthest you can go with this method in an empty worksheet is cell location R54).

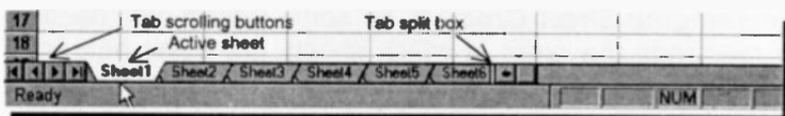
When you have finished navigating around the worksheet, press the <Ctrl+Home> key combination which will move the active cell to the A1 position (provided you have not fixed titles in any rows or columns or have no hidden rows or columns). Note that the area within which you can move the active cell is referred to as the working area of the worksheet, while the letters and numbers in the border at the top and left of the working area give the 'co-ordinates' of the cells in a worksheet.

The location of the active cell is constantly monitored by the 'selection indicator' which is to be found on the extreme left below the lower Tool bar of the application window. As the active cell is moved, this indicator displays its address, as shown below. The contents of a cell are displayed above the column letters within what is known as the 'Edit line'. If you type text in the active cell, what you type appears in both the 'Edit line' and the cell itself. Typing a formula which is preceded by the equals sign (=) to, say, add the contents of three cells, causes the actual formula to appear in the 'Edit line', while the result of the actual calculation appears in the active cell when the <Enter> key is pressed.



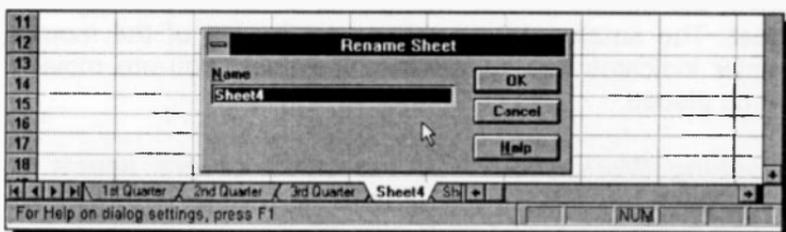
### Moving Between Sheets:

You can scroll between sheets by clicking one of the arrows situated to the left of Sheet 1, as shown on the next page. The inner arrows scroll sheets one at a time in the direction of the arrow, while the outer arrows scroll to the end, or beginning, of the group of available sheets. A sheet is then made current by clicking its tab.



With the keyboard, you can scroll one sheet at a time, and make it active at the same time, by using the <Ctrl+PgDn> key combination. Using <Ctrl+PgUp> scrolls in the reverse direction.

To display more sheet tabs at a time, drag the split box to the right. The reverse action displays less sheet tabs. To rename sheets, double-click at their tab, then type a new name in the Rename Sheet dialogue box, as shown below.

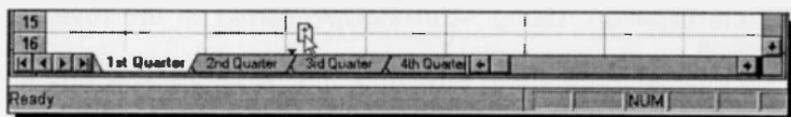


To insert a sheet in front of a certain sheet, make that sheet current, then use the **Insert, Worksheet** command sequence. To delete a sheet, make it current and use the **Edit, Delete Sheet** command sequence.

**Types of Sheets:** There are six different types of sheets in a workbook. These are:

<i>Type of sheet</i>	<i>Purpose</i>
Worksheet	For entering data.
Chart	For charts not embedded in a worksheet.
Dialogue	For Visual Basic language.
Visual Basic Module	For Visual Basic language.
Microsoft Excel 4.0 macro	For compatibility with earlier versions of Excel.
Microsoft Excel 4.0 International macro.	For compatibility with earlier versions of Excel.

**Rearranging Sheet Order:** If, for some reason, you needed to rearrange the order in which sheets are being held in a workbook, you could do so by pointing to the tab of the sheet you wanted to move, pressing the left mouse button down, and moving the mouse pointer to the new position, as shown below:



While you are dragging the tab of the sheet you want to move, the mouse pointer changes to an arrow pointing to a sheet. The small solid arrowhead to the left of the mouse pointer indicates the place where the sheet you are moving will be placed.

**Grouping Worksheets:** You can select several sheets to group them together so that data entry, editing, or formatting can be made easier and more consistent.

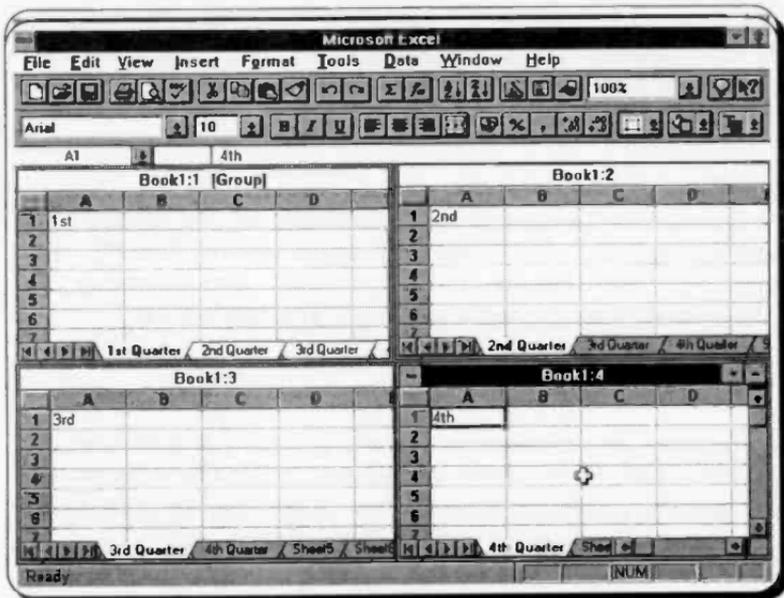
To select adjacent sheets, click the first sheet tab, hold down the <Shift> key and then click the last sheet tab in the group. To select non-adjacent sheets, click the first sheet tab, hold down the <Ctrl> key and then click the other sheet tabs you want to group together.

Selecting sheets in the above manner, whether adjacent or not, causes the word "[Group]" to appear in the Title bar of the active window, and the tabs of the selected sheets are shown in white. To cancel the selection, click at the tab of any sheet which is not part of the selected group.

**Shortcut Menus:** While a range of cells in a sheet is selected, or a group of sheets are active, you can access a shortcut menu with commands relevant to working with a range or sheets by pressing the right mouse button. This produces a shortcut menu of the most common commands relevant to what you are doing at the time, as shown on the next page.



**Viewing Multiple Workbook Sheets:** To see more clearly what you are doing when moving between multiple workbook sheets, type the text '1st' in location A1 of 1st Quarter sheet, '2nd' in the 2nd Quarter sheet, and so on. Then use the **Window, New Window** command to add three extra windows to your worksheet, and the **Window, Arrange, Tiled** command to display the four sheets as shown below.

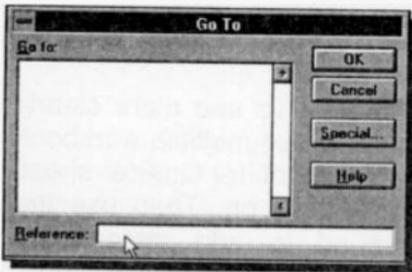


To move from one window to another, simply point with the mouse to the cell of the window you want to go to and click the left mouse button. To display a different sheet in each window, go to a window and click the sheet's tab.

To return to single-window view mode from a tiled mode, click the maximise button of the active window

### The Go To Command:

The Go To key (F5) can still be used to move to any location on any sheet, or file, currently active. If you press F5, you get the following dialogue box:



From here you can select to Go To a named range (names with a preceding underline character are displayed if you have used the Insert, Name, Create command to name ranges - more about this later). If a list of names is

displayed, use the mouse to highlight one of these and click the **OK** button to move to the named location on the worksheet. If you have not named ranges, you can type the cell co-ordinate in the **Reference** box and press <Enter>. The cell pointer jumps to the typed cell reference, which is also added to the Go To list.

### Entering Information

We will now investigate how information can be entered into a worksheet. But first, make sure you are in Sheet1, then return to the Home (A1) position, by pressing the <Ctrl+Home> key combination, then type the words:

PROJECT ANALYSIS

As you type, the characters appear in both the 'Edit line' and the active cell. If you make a mistake, press the <BkSp> key to erase the previous letter or the <Esc> key to start again. When you have finished, press <Enter>.

Note that what you have just typed in has been entered in cell A1, even though the whole of the word ANALYSIS appears to be in cell B1. If you use the right arrow key to move the active cell to B1 you will see that the cell is indeed empty.

Typing any letter at the beginning of an entry into a cell results in a 'text' entry being formed, otherwise known as a 'label'. If the length of the text is longer than the width of a cell, it will continue into the next cell to the right of the current active cell, provided that cell is empty, otherwise the displayed information will be truncated.

### **The EDIT Command:**

To edit information already in a cell, double-click the cell in question, or make that cell the active cell and press the **F2** function key. The cursor keys, the <Home> and <End> keys, as well as the <Ins> and <Del> keys can be used to move the cursor and/or edit information as required.

You can also 'undo' the most recent operation that has been carried out since the program was last in the **Ready** mode, by using the

#### **Edit, Undo Entry**

command.

Now use the arrow keys to move the active cell to B3 and type

Jan

Pressing the right arrow key (→) will automatically enter the typed information into the cell and also move the active cell one cell to the right, in this case C3. Now type

Feb

and press <Enter>.

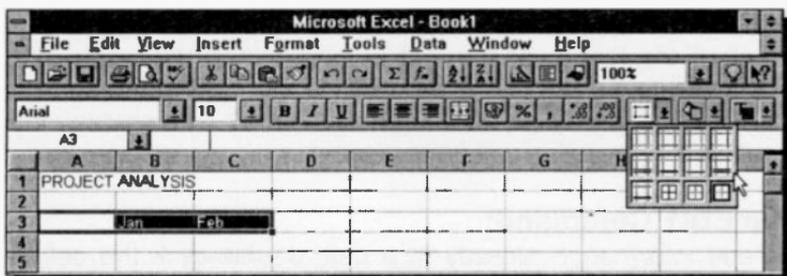
The looks of a worksheet can be enhanced somewhat by using different types of borders around specific cells. To do



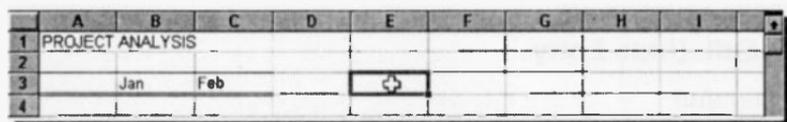
this, first select the range of cells you would like to surround with a border, then click at the down-arrow of the Borders icon on the second Tool bar, shown here, which displays a choice of twelve different types of borders, as shown overleaf.

## Selecting a Range of Cells:

To select a range of cells, say, A3:C3, point to cell A3, press the left mouse button, and while holding it pressed, drag the mouse to the right to highlight the required range, as shown below:



In our example, we have selected the cell range A3:C3, then we chose the 8th border from the display table. Moving the cell pointer to the right, out of the way reveals a better looking worksheet, as follows:



To select a range from the keyboard, first make active the first cell in the range, then use the right arrow key (→) to highlight the required range.

To select a 3D range, across a several sheets, select the range in the first sheet, release the mouse button, hold down the <Shift> key, and click the Tab of the last sheet in the range.

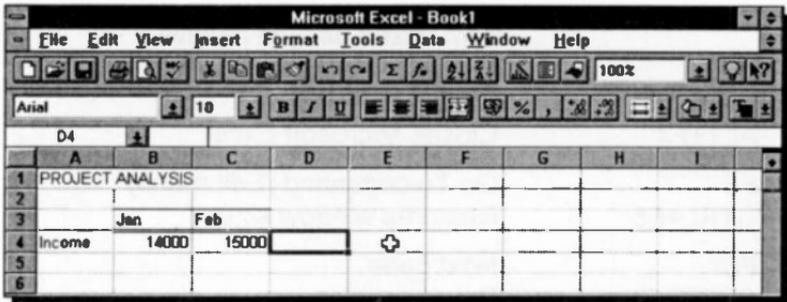
To continue with our example, move to cell A4 and type

Income

then enter the numbers listed below into the corresponding cells:

B4	C4
14000	15000

What you should have on your screen now, is shown below:



Note how the labels 'Jan' and 'Feb' do not appear above the numbers 14000 and 15000. This is because by default, labels are left justified, while numbers are right justified.

## Using Function Keys

Each function key performs several operations; one when pressed by itself, another when pressed with the <Shift> key held down, another with the <Ctrl> key held down, and another with the <Ctrl+Shift> keys held down.

All the Excel function keys, together with the details of what they can do when pressed, can be found by looking up the 'Function keys' entry within the Help system. These are reproduced in the table below for convenience.

<b>Key</b>	<b>Description</b>
F1	Help
SHIFT+F1	Context-sensitive Help
F2	Activates the formula bar
SHIFT+F2	Note command (Insert menu)
CTRL+F2	Displays the Info window
F3	Displays the Paste Name dialogue box if there are names defined
SHIFT+F3	Displays the Function Wizard
CTRL+F3	Define command (Insert menu, Name sub-menu)
CTRL+SHIFT+F3	Create command (Insert menu, Name sub-menu)

F4	When you are editing a formula, converts a reference from relative to absolute, from absolute to mixed, or from mixed back to relative
F4	Repeats the last action
CTRL+F4	Closes the window
ALT+F4	Closes Microsoft Excel
F5	Go To command (Edit menu)
CTRL+F5	Restores window size
F6	Next pane
SHIFT+F6	Previous pane
CTRL+F6	Next window
CTRL+SHIFT+F6	Previous window
F7	Checks spelling
CTRL+F7	Move command (document Control menu)
F8	Turns Extend mode on or off
SHIFT+F8	Turns Add mode on or off
CTRL+F8	Size command (document Control menu)
F9	Calculates all sheets in all open workbooks
SHIFT+F9	Calculates the active sheet
CTRL+F9	Minimises the workbook
F10	Activates the menu bar (unavailable when the Transition Navigation Keys box on the Transition tab of the <b>Tools, Options</b> menu is checked).
SHIFT+F10	Activates the shortcut menu
CTRL+F10	Maximises the workbook
F11	Inserts new chart sheet
SHIFT+F11	Inserts new worksheet
CTRL+F11	Inserts new Excel 4.0 macro sheet
F12	Save As command (File menu)
SHIFT+F12	Save command (File menu)
CTRL+F12	Open command (File menu)
CTRL+SHIFT+F12	Print command (File menu).

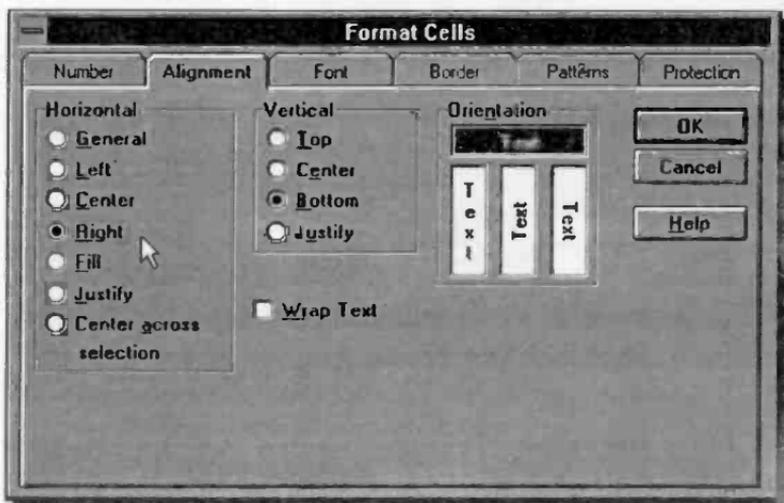
## Changing Text Alignment and Fonts:

One way of improving the looks of this worksheet is to also right justify the text 'Jan' and 'Feb' within their respective cells. To do this, move the active cell to B3 and select the range B3 to C3 by dragging the mouse, then either click the 'Align Right' icon, shown here, or choose the



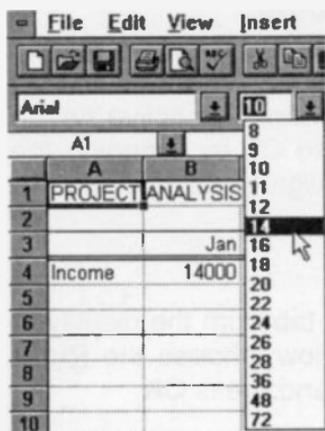
### Format Cells

command, then select the **Alignment** tab from the displayed Format Cells dialogue box, shown below, choose the **Right** button from the list under **Horizontal**, and press **OK**.



No matter which method you choose, the text should now appear right justified within their cells. However, although the latter method is lengthier, it nevertheless provides you with greater flexibility in displaying text, both in terms of position and orientation.

We could further improve the looks of our worksheet by choosing a different font for the heading 'Project Analysis'. To achieve this, select cell A1, then click on the 'Font Size' button on the second Tool bar, to reveal the band of available point sizes for the selected font, as shown overleaf. From this band, choose 14, then click in succession the 'Bold' and

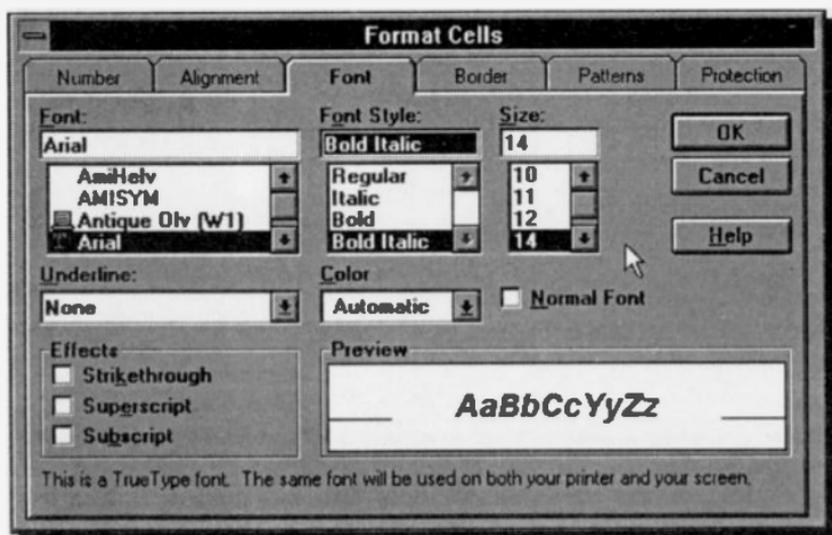


'Italic' icons, shown here.

You can also do this by using the **Format, Cells** command, selecting the **Font** tab in the displayed **Format Cells** dialogue box, then choosing the appropriate attribute and point size from the lists under **Font Style**, and **Size**, as shown below, and pressing the **OK** button.

The actual name of the font will depend on the default font

supported by your printer.



Finally, since the numbers in cells B4 to C4 represent money, it would be better if these were prefixed with the £ sign. To do this, select the cell range B4:C4, then either click the 'Currency Style' button on the second Tool bar, shown here,



### **Format, Style**

command and select **Currency** from the list under **Style Name** in the displayed **Style** dialogue box.

The numbers within the chosen range will now be displayed in currency form, provided the width of the cells is sufficiently wide to accommodate them. In our example, the entered numbers are far too long to fit in currency form in the default cell width and appear as shown under the 'Feb' entry. To see the actual numbers we must increase the width of the columns B4:C4 to 11 characters wide

Width: 11.00			14000	
	A	B	C	+D
1	<b>PROJECT ANALYSIS</b>			
2				
3		Jan	Feb	
4	Income	£ 14,000.00	#####	
5				

(as shown at the top left of the adjacent display). To do this, place the mouse pointer in between the column letters on

the dividing line, and drag the pointer to the right, as shown above, until the width of the column is displayed as 11.00. The resultant worksheet should look as follows:

	A	B	C	D	E	F	G	H	I
1	<b>PROJECT ANALYSIS</b>								
2									
3		Jan	Feb						
4	Income	£ 14,000.00	£15,000.00						
5									

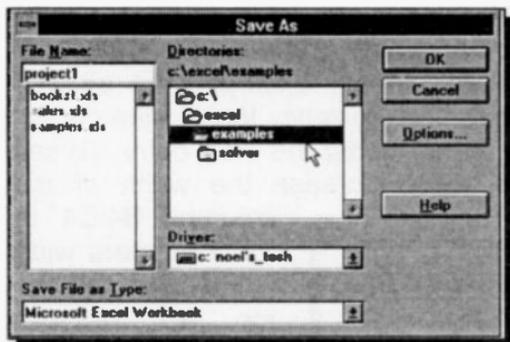
## Saving a Worksheet

Now, let us assume that we would like to stop at this point, but would also like to save the work entered so far before leaving the program. First, return to the Home position by pressing <Ctrl+Home>. This is good practice because when a workbook is opened later, the position of the cell pointer at the time of saving the file appears at the top left corner of the opened worksheet which might cause confusion if below and to the right of it there are no entries - you might think that you opened an empty worksheet.

Next, choose the

### File, Save

command to reveal the Save As dialogue box, shown overleaf.



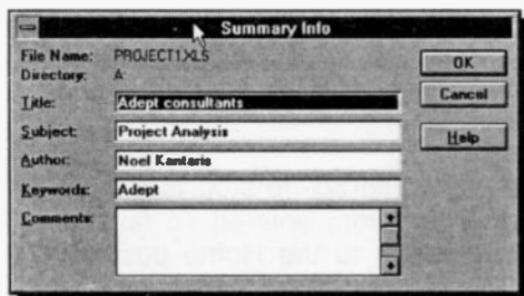
First, type the new name of the file, say, **project1** in the **File Name** box (the extension **.xls** is added by the program), which replaces the default highlighted name **book1.xls**. Next, to make sure that the

file is saved in the correct subdirectory of the **excel** directory, double-click on the **c:\** file option of the **Directories** box, select the **excel** directory, then the **examples** subdirectory, so that the file path under **Directories** is shown as

**c:\excel\examples**

If you prefer to save your work on a floppy disc, choose the **a:** drive from the **Drives** box of the above dialogue box.

Pressing the **OK** button, causes the following Summary Info dialogue box to appear on the screen:



If you do not want to fill-in this dialogue box, press **OK**, otherwise type in some appropriate information so that you could identify the contents of the file later by looking

at the information with the use of the **File, Summary Info** command. Pressing the **OK** button saves the file in the selected drive and path and the default filename 'Book1' on the Title bar changes to 'PROJECT1'.

If the worksheet is an old one which has been 'opened' and modified, the **Save** command would automatically re-save it using the original name. In such a case you could also use the 'Save' icon shown here.



If you want to save a modified worksheet with another name, choose the **File, Save As** command which allows you to change the original filename.

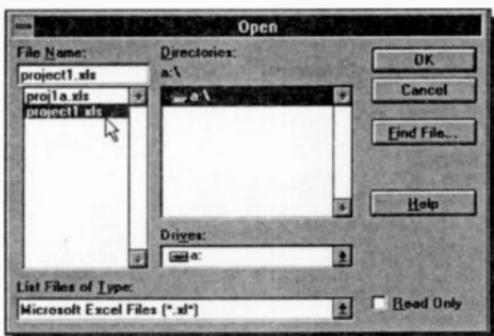
## Opening a Worksheet

An already saved worksheet - a workbook - can be opened by either clicking at the 'Open' icon, shown here, or selecting the



### **File, O**pen

command which displays the dialogue box shown below, assuming that you have changed the drive to **a:**.



Excel asks for a filename to open, with the default name **\*.xls\*** being displayed in the **File Name** box. This default is also shown at the bottom of the dialogue box from which you can

choose to open worksheets saved in other spreadsheet formats. In the box below the **File Name** box, all appropriate files in the logged directory are displayed. From here you can change the logged directory and drive.

To select a file with the mouse, point to the filename and click. This causes the selected filename to be displayed in the **File Name** field and pressing <Enter> or clicking at the **OK** button, opens the file. From the keyboard, press <Tab> to move to the box below the **File Name** box and use the ↓ & ↑ arrow keys (as necessary) to highlight a filename.

If you want to change the logged drive, then select the appropriate drive from the **Drives** box of the dialogue box, then select the appropriate directory from the list displayed in the **Directories** box. Once these selections have been made, the filenames now displayed will be those from the newly logged drive/path.

## **Exiting Excel**

To exit Excel, make sure that the word **Ready** is displayed on the status bar (press <Esc> until it does), and choose the

### **File, Exit**

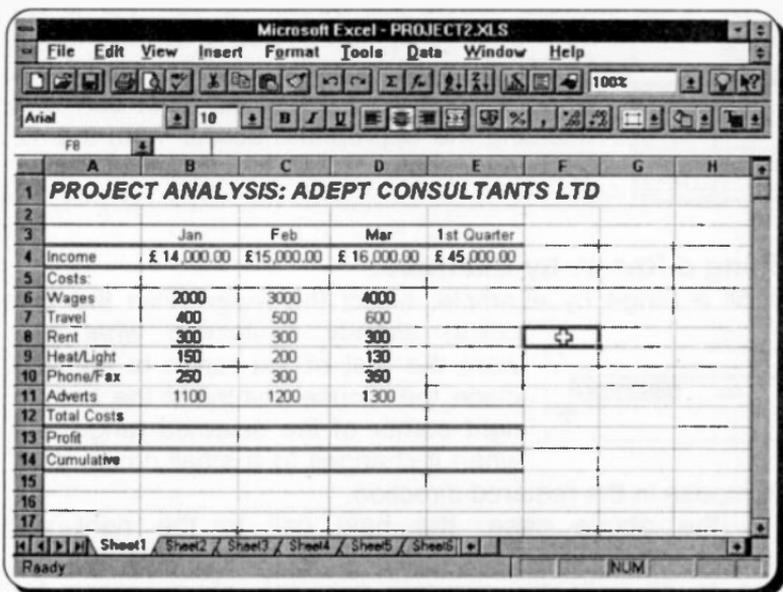
command, or use the <Alt+F4> key combination.

If you have made any changes to your work since the last time you saved it, you will be warned before exiting.

## 5. FILLING IN A WORKSHEET

We will use, as an example on how a spreadsheet can be built up, the few entries on 'Project Analysis' from the previous chapter. If you have saved PROJECT1, then either click the file 'Open' icon, or use the **File, Open** command, then highlight its filename in the Open dialogue box, and press **OK**. If you haven't saved it, don't worry as you could just as easily start afresh.

Next use the **F2** function key to 'Edit' existing entries or simply retype the contents of cells (see below for formatting) so that your worksheet looks as follows:



The screenshot shows the Microsoft Excel interface with the following data in the spreadsheet:

	Jan	Feb	Mar	1st Quarter
Income	£ 14,000.00	£ 15,000.00	£ 16,000.00	£ 45,000.00
Costs				
Wages	2000	3000	4000	
Travel	400	500	600	
Rent	300	300	300	
Heat/Light	150	200	130	
Phone/Fax	250	300	360	
Adverts	1100	1200	1300	
Total Costs				
Profit				
Cumulative				

### Formatting Entries

The information in cell A1 (PROJECT ANALYSIS: ADEPT CONSULTANTS LTD) was entered left justified and formatted by clicking on the 'Font Size' button on the second Tool bar, and selecting 14 point font size from the band of available font sizes, then clicking in succession the 'Bold' and 'Italic' icons. To format using the keyboard, refer to the end of Chapter 4.

The text in the cell block B3:E3 was formatted by first selecting the range and then clicking the 'Centre' alignment icon on the second Tool bar, so the text within the range is displayed centre justified.

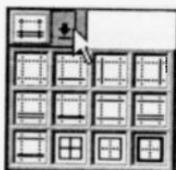


The numbers within the cell block B4:E4 were formatted by first selecting the range, then clicking the 'Currency Style' icon on the second Tool bar, shown here, so the numbers appear with two digits after the decimal point and prefixed with the £ sign.



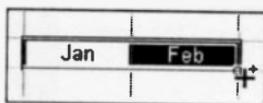
All the text appearing in column A (apart from that in cell A1) was just typed in (left justified), as shown in the screen dump on the previous page.

The lines, like the double line stretching from A3 to E3 were entered by first selecting the cell range A3:E3, then clicking the down-arrow of the 'Borders' icon on the second Tool bar, and selecting the appropriate border from the 12 displayed options.



### Filling a Range by Example:

To fill a range by example, select the range, with the first cell(s) already containing what you want the rest of the range to contain, place the mouse pointer at the bottom right corner of the selected range and when it changes to a small cross, drag the mouse in the required direction.



In the above case, the next cell to the right will automatically fill with the text 'Mar' (Excel anticipates that you want to fill cells by example with the abbreviations for months, and does it for you). Not only that, but it also copies the format of the selected range forward. It is, therefore, evident that selecting ranges and using icons makes various tasks a lot easier.

Microsoft Excel allows you to format both text (labels) and numbers in any way you choose. For example, you can have numbers centre justified in their cells, if you so wished.

## Entering Text, Numbers and Formulae:

When text, a number, a formula, or an Excel function is entered into a cell, or reference is made to the contents of a cell by the cell address, then the content of the status bar changes from **Ready** to **Enter**. This status can be changed back to **Ready** by either completing an entry and pressing <Enter> or one of the arrow keys, or by pressing <Esc>.

We can find the 1st quarter total income from consultancy, by activating cell E4, typing

**=B4+C4+D4**

and pressing <Enter>. The total first quarter income is added, using the above formula, and the result is placed in cell E4.

Now complete the insertion into the spreadsheet of the various amounts under 'costs' and then choose the

### **File, Save As**

command to save the resultant worksheet under the filename PROJECT2, before going on any further. Remember that saving your work on disc often enough is a good thing to get used to, as even the shortest power cut can cause the loss of hours of hard work! Also remember that filenames should be limited to 8 alphanumeric characters, and must not contain any spaces. The extension .XLS is added by Excel.

## Using Functions

In our example, writing a formula that adds the contents of three columns is not too difficult or lengthy a task. But imagine having to add 20 columns! For this reason Excel has an in-built summation function (for others see Appendix A) in the form of

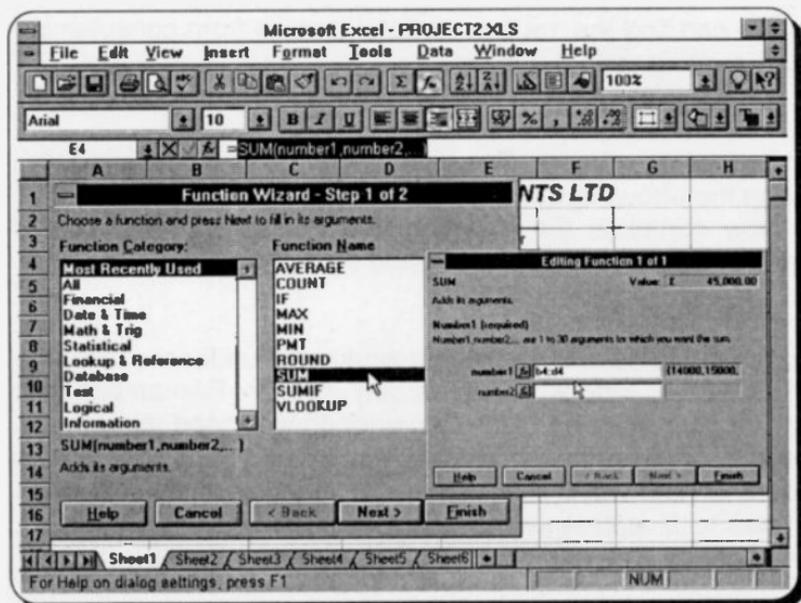
**=SUM(Number1:Number2)**

which can be used to add any number of columns (or rows).

To illustrate how this and other functions can be used, activate cell E4 and press the Function Wizard button shown here. If the function you require appears on the displayed dialogue box under **Function Name**, choose it, otherwise select the appropriate class from the list under **Function Category** from which you can then choose the required function.



Choosing the SUM function from the Function Wizard dialogue box, inserts the entry 'SUM(number1,number2,...)' in the Edit line. Pressing the **Next** button, causes the appearance of a second dialogue box, as shown in the composite screen dump below, which allows you to insert the range over which the function is to be effective.



In this case, we enter B4:D4 as the range we want to summate is continuous. If the range is not continuous, separate the various continuous portions of it by a comma (,).

Pressing <Enter> or clicking the **Finish** button causes the result of the calculation to appear in the active cell.

### Using the AutoSum Icon:

With addition, there is a better and quicker way of letting Excel work out the desired result. To illustrate this, select the cell range B6:E12, which contains the 'Costs' we would like to add up. To add these in both the horizontal and vertical direction, we include in the selected range an empty column to the right of the numbers and an empty row below the numbers, as shown on the next page.

	A	B	C	D	E	F	G	H
1	<b>PROJECT ANALYSIS: ADEPT CONSULTANTS LTD</b>							
2								
3		Jan	Feb	Mar	1st Quarter			
4	Income	£ 14,000.00	£ 15,000.00	£ 16,000.00	£ 45,000.00			
5	Costs:							
6	Wages	2000	3000	4000				
7	Travel	400	500	600				
8	Rent	300	300	300				
9	Heat/Light	150	200	130				
10	Phone/Fax	250	300	350				
11	Adverts	1100	1200	1300				
12	Total Costs							

Pressing the 'AutoSum' icon, shown here, inserts the result of the summations in the empty column and row, as shown below. The selected range remains selected so that any other formatting can be applied by simply pressing the appropriate icon button.



	A	B	C	D	E	F	G	H
1	<b>PROJECT ANALYSIS: ADEPT CONSULTANTS LTD</b>							
2								
3		Jan	Feb	Mar	1st Quarter			
4	Income	£ 14,000.00	£ 15,000.00	£ 16,000.00	£ 45,000.00			
5	Costs:							
6	Wages	2000	3000	4000	9000			
7	Travel	400	500	600	1500			
8	Rent	300	300	300	900			
9	Heat/Light	150	200	130	480			
10	Phone/Fax	250	300	350	900			
11	Adverts	1100	1200	1300	3600			
12	Total Costs	4200	5500	6580	16380			

Now complete the insertion of formulae in the rest of the worksheet, noting that 'Profit', in B13, is the difference between 'Income' and 'Total Cost', calculated by the formula

$$=B4-B12$$

To complete the entry, the above formula should be copied using the 'fill by example' method into the three cells to its right, as explained earlier in this chapter.

The 'Cumulative' entry in cell B14 should be a simple reference to cell B13, that is  $=B13$ , while in cell C14 should be  $=B14+C13$ . Similarly, the latter formula is copied into cell D14 using the 'fill by example' method.

Finally, format the entire range B6:E12 as currency by selecting the range and clicking the 'Currency Style' button.

If you make any mistakes and copy formats or information into cells you did not mean to, use the

### **Edit, Undo**

command which allows you to selectively undo what you were just doing. To blank the contents within a range of cells, first select the range, then press the <Del> key.

The worksheet, up to this point, should look as follows:

	Jan	Feb	Mar	1st Quarter
Income	£ 14,000.00	£ 15,000.00	£ 16,000.00	£ 45,000.00
Costs:				
Wages	£ 2,000.00	£ 3,000.00	£ 4,000.00	£ 9,000.00
Travel	£ 400.00	£ 500.00	£ 600.00	£ 1,500.00
Rent	£ 300.00	£ 300.00	£ 300.00	£ 900.00
Heat/Light	£ 150.00	£ 200.00	£ 130.00	£ 480.00
Phone/Fax	£ 250.00	£ 300.00	£ 350.00	£ 900.00
Adverts	£ 1,100.00	£ 1,200.00	£ 1,300.00	£ 3,600.00
Total Costs	£ 4,200.00	£ 5,500.00	£ 6,680.00	£ 16,380.00
Profit	£ 9,800.00	£ 9,500.00	£ 9,320.00	£ 28,620.00
Cumulative	£ 9,800.00	£ 19,300.00	£ 28,620.00	

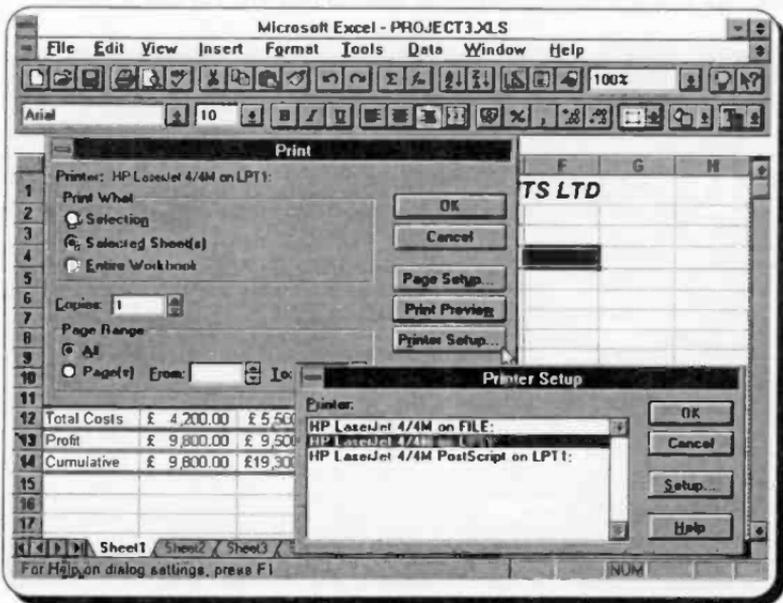
If everything is correct, use the **File, Save As** command to save the worksheet under the filename PROJECT3.

### **Printing a Worksheet**

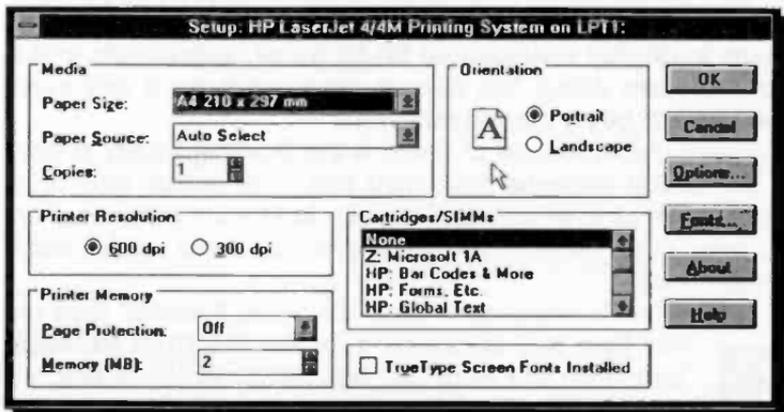
To print a worksheet, make sure that the printer you propose to use was defined when you first installed Windows. If you want to add a new printer to the installation, refer to the 'Adding a Printer' procedure at the end of Chapter 3.

If you have named more than one printer in your original installation of Windows, and want to select a printer other than your original first choice, then select the **File, Print** command and select the **Printer Setup** button on the displayed Print dialog box.

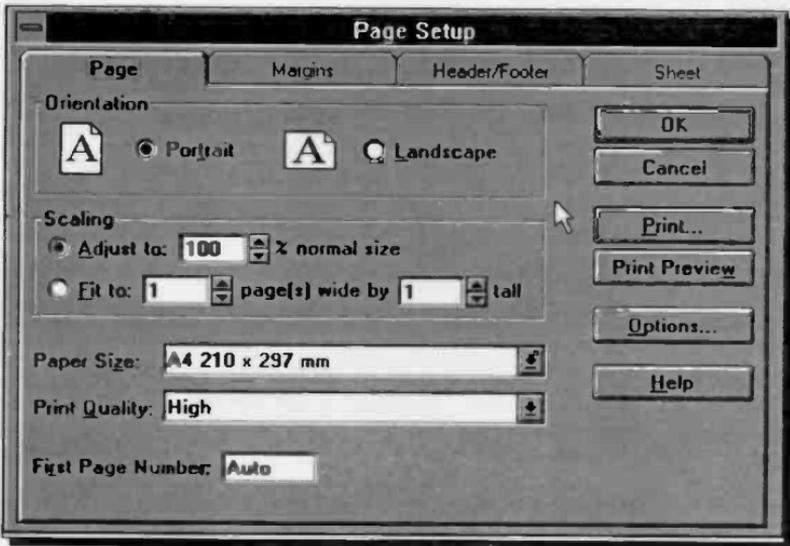
The two dialogue boxes are shown below in a composite screen dump.



If you want to change the paper size, number of copies, print orientation, or printer resolution, choose the **S**etup button on the Printer Setup dialogue box which causes the printer specific Setup dialogue box, shown below, to be displayed.



You can further change the appearance of the printout by using the **File, Page Setup** command, or clicking at the **Page Setup** button of the Print dialogue box. Either of these causes the following dialogue box to appear on the screen.



By selecting the appropriate Tab on this dialogue box, you can change your **Page** settings, page **Margins**, specify a **Header/Footer**, and control how a **Sheet** should be printed. Each Tab displays a different dialogue box, appropriate to the function at hand. In the **Header/Footer** dialogue box you can even click the down-arrow against the Header and Footer boxes to display a suggested list for these, appropriate to the work you are doing, the person responsible for it and even the date it is being carried out! Try it.

A very useful feature of Excel is the **Scaling** facility shown in the above dialogue box. You can print actual size or a percentage of it, or you can choose to fit your worksheet on to one page which allows Excel to scale your work automatically.

To preview a worksheet, click the 'Print Preview' icon on the Tool bar, shown here, or use the **Print Preview** button on the Print or Page Setup dialogue box, or use the **File, Print Preview** command.

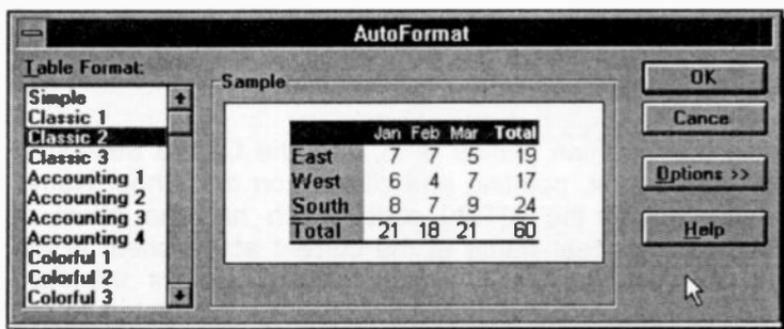


Although the output is good enough to be incorporated in a report, it is possible to make a worksheet look far more professional than the one saved under PROJECT3.

## Enhancing a Worksheet

You can make your work look more professional by adopting various enhancements, such as single and double line cell borders, shading certain cells, and adding meaningful headers and footers.

However, with Excel you can select easily a pre-defined style to display your work on both the screen and on paper. To do this, place the active cell within the table (or range) you want to format, say C5, then select the **Format, AutoFormat** which will cause the following dialogue box to appear on the screen, displaying a sample of the chosen table format. In this way you can choose what best suits your needs.



Next, reduce the title of the worksheet to PROJECT ANALYSIS, then centre it within the range A1:E1, by first selecting the range, then clicking the 'Centre Across Columns' icon, shown here, which causes the title to centre within the specified range.

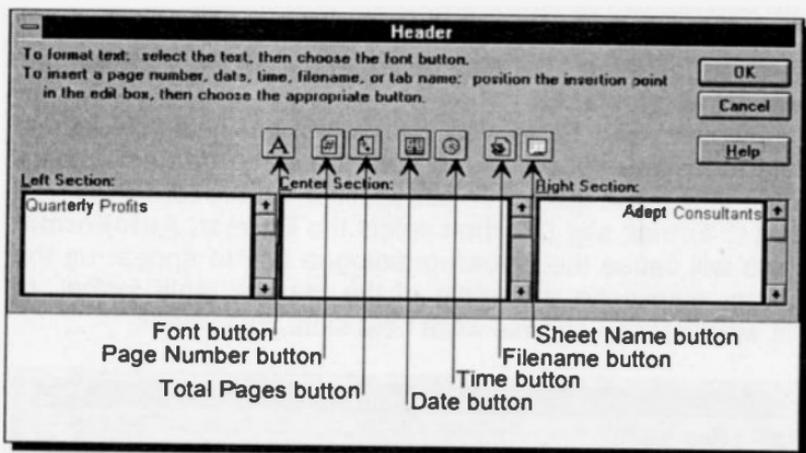


Finally, save the worksheet as PROJECT4, before going on.

## Header and Footer Icons and Codes:

With the help of header and footer icons and their codes, shown below, you can position text or automatically insert information at the top or bottom of a report printout.

To add a header to our printed example, use the **File, Page Setup** command and click on the **Header/Footer Tab**, press the **Custom Header** button and type the information displayed below in the Left Section and Right Section of the Header box:



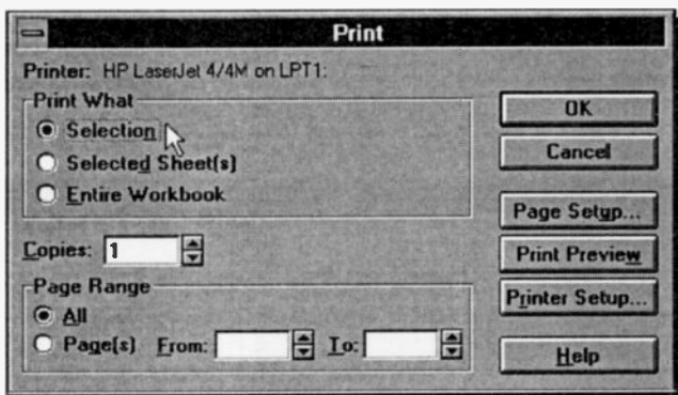
While the insertion pointer is in, say, the Centre Section of the Header box, pointing and clicking on the 'Sheet Name' button, inserts the `&[Tab]` code which has the effect of inserting the sheet name of the current active sheet at the time of printing. The first icon button displays the Font dialogue box, while the others display the codes listed below, which produce the following action:

<b>Code</b>	<b>Action</b>
<code>&amp;[Page]</code>	Inserts a page number.
<code>&amp;[Pages]</code>	Inserts the total number of pages.
<code>&amp;[Date]</code>	Inserts the current date.
<code>&amp;[Time]</code>	Inserts the current time.
<code>&amp;[File]</code>	Inserts the filename of the current workbook.
<code>&amp;[Tab]</code>	Inserts the sheet name of the current active sheet.

The above icon buttons and codes are also available in the Footer dialogue box.

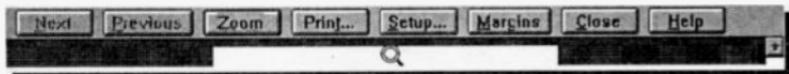
## Setting a Print Area:

To select a smaller print area than the current worksheet, select the required area by highlighting the starting cell of the area and dragging the mouse, or using the <Shift+Arrows>, to highlight the block, and use the **File, Print** command which displays the following dialogue box:



Choose the **Selection** button in the **Print What** box, and either press the **Print Preview** or the **OK** button to preview your report on screen or print it on paper.

Once in preview mode, the following icons are available to you.



The first two allow you to change sheets, while the next one allows you to review your print output magnified or at full page size - when in full page size, the mouse pointer looks like a magnifying glass, as above. The next three icons can be used to print, change page settings, or to display the margins. To leave the preview option, press the Close icon.

If you want to return to the option of printing selected sheets or the entire workbook, then click the appropriate button in the **Print What** box of the **Print** dialogue box.

The default selection in the **Print What** box is **Selected Sheet(s)** which is also what will be printed out if you click the 'Print' icon, shown here.



If you have included headers and footers, these will be printed out irrespective of whether you choose to print a selected range or a selected worksheet.

Printing our worksheet produces the following page:

Quarterly Profits		Adept Consultants		
	Jan	Feb	Mar	1st Quarter
<b>Income</b>	£ 14,000.00	£ 15,000.00	£ 16,000.00	£ 45,000.00
<b>Costs:</b>				
Wages	£ 2,000.00	£ 3,000.00	£ 4,000.00	£ 9,000.00
Travel	£ 400.00	£ 500.00	£ 600.00	£ 1,500.00
Rent	£ 300.00	£ 300.00	£ 300.00	£ 900.00
Heat/Light	£ 150.00	£ 200.00	£ 130.00	£ 480.00
Phone/Fax	£ 250.00	£ 300.00	£ 350.00	£ 900.00
Adverts	£ 1,100.00	£ 1,200.00	£ 1,300.00	£ 3,600.00
<b>Total Costs</b>	£ 4,200.00	£ 5,500.00	£ 6,680.00	£ 16,380.00
<b>Profit</b>	£ 9,800.00	£ 9,500.00	£ 9,320.00	£ 28,620.00
<b>Cumulative</b>	£ 9,800.00	£ 19,300.00	£ 28,620.00	

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## 6. 3-DIMENSIONAL WORKSHEETS

In Excel, a 3-dimensional file is one made up with a series of flat 2-dimensional sheets stacked 'on top of each other'. Each sheet is the same size, and in itself, behaves the same as the more ordinary worksheets. As mentioned previously, each separate sheet in a file has its own Tab identifier at the bottom of the screen. Ranges can be set to span several different sheets to build up 3-dimensional blocks of data. These blocks can then be manipulated, copied, or moved to other locations in the file. A cell can reference any other cell in the file, no matter what sheet it is on, and an extended range of functions can be used to process these 3-dimensional ranges.

### Manipulating Ranges

The best way to demonstrate a new idea is to work through an example. We will use the worksheet saved under PROJECT4 (see end of previous chapter). If you haven't saved PROJECT4 on disc, then either change the contents of PROJECT3 or enter into Excel the information shown below.

If you have saved PROJECT4 (or need to amend PROJECT3), then enter Excel, use the **File, Open** command, or click the 'file open' icon, and select the appropriate file. If the chosen file is PROJECT4, on pressing <Enter>, the worksheet is displayed on the screen as shown below.



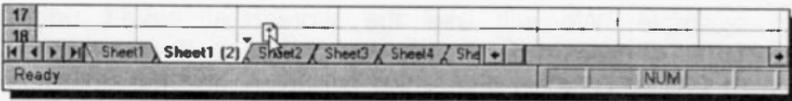
	A	B	C	D	E	F	G	H
1	<b>PROJECT ANALYSIS 1st Quarter</b>							
2								
3		Jan	Feb	Mar	1st Quarter			
4	Income	£ 14,000.00	£ 15,000.00	£ 16,000.00	£ 45,000.00			
5	Costs:							
6	Wages	£ 2,000.00	£ 3,000.00	£ 4,000.00	£ 9,000.00			
7	Travel	£ 400.00	£ 500.00	£ 600.00	£ 1,500.00			
8	Rent	£ 300.00	£ 300.00	£ 300.00	£ 900.00			
9	Heat/Light	£ 150.00	£ 200.00	£ 130.00	£ 480.00			
10	Phone/Fax	£ 250.00	£ 300.00	£ 350.00	£ 900.00			
11	Adverts	£ 1,100.00	£ 1,200.00	£ 1,300.00	£ 3,600.00			
12	Total Costs	£ 4,200.00	£ 5,500.00	£ 6,680.00	£ 16,380.00			
13	Profit	£ 9,800.00	£ 9,500.00	£ 9,320.00	£ 28,620.00			
14	Cumulative	£ 9,800.00	£ 19,300.00	£ 28,620.00				
15								

## Copying Sheets into a Workbook

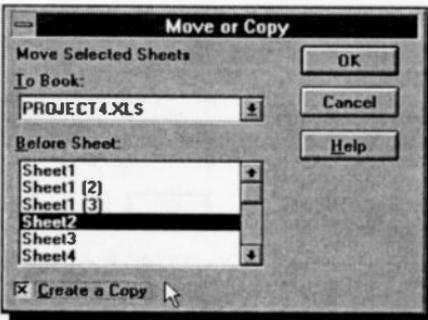
We will now fill another three sheets behind the present one, in order to include information about ADEPT Consultants' trading during the other three quarters of the year. The easiest way of doing this is by copying the information in Sheet1, including the formatting and the entered formulae, onto the other three sheets, then edit the numerical information in these appropriately.

To simplify this operation, Excel has a facility which allows you to copy a sheet into a workbook. There two ways of doing this: (a) with the use of the mouse, or (b) with the use of menus.

With the mouse, make the sheet you want to copy the current sheet, then press the <Ctrl> key, and while keeping it pressed, point with the mouse on the Tab of Sheet1 and drag it to the right, as follows:



A small black triangle indicates the place where the copy will be inserted. If you insert a copy, say before Sheet2, when you release the mouse button the inserted sheet will be given the name Sheet1(2), as shown above, where we are about to insert a second copy before Sheet2 which will be named Sheet1(3).



To copy a sheet with the use of menus, select the **Edit, Move or Copy Sheet** command, then highlight Sheet2 in the **Before Sheet** list of the displayed dialogue box, then check the **Create a Copy** option at the bottom of the dialogue box, and press the **OK**

button. Sheet1(4) will be inserted in the Workbook.

Next, double click the Tabs of these four new sheets and change their names to 'Quarter 1', 'Quarter 2', 'Quarter 3' and 'Quarter 4', respectively.

The contents of the second sheet should be as follows:

	A	B	C	D	E	F
1	<b>PROJECT ANALYSIS 2nd Quarter</b>					
2						
3		Apr	May	Jun	2nd Quarter	
4	Income	£ 15,500.00	£ 16,000.00	£ 16,500.00	£ 48,000.00	
5	Costs:					
6	Wages	£ 3,500.00	£ 4,000.00	£ 4,500.00	£ 12,000.00	
7	Travel	£ 500.00	£ 550.00	£ 580.00	£ 1,630.00	
8	Rent	£ 300.00	£ 300.00	£ 300.00	£ 900.00	
9	Heat/Light	£ 150.00	£ 120.00	£ 100.00	£ 370.00	
10	Phone/Fax	£ 300.00	£ 350.00	£ 400.00	£ 1,050.00	
11	Adverts	£ 1,250.00	£ 1,300.00	£ 1,350.00	£ 3,900.00	
12	Total Costs	£ 6,000.00	£ 6,620.00	£ 7,230.00	£ 19,850.00	
13	Profit	£ 9,500.00	£ 9,380.00	£ 9,270.00	£ 28,150.00	
14	Cumulative	£ 9,500.00	£ 18,880.00	£ 28,150.00		
15						
16						
17						
18						

The easiest way to enter these 2nd Quarter results is to edit the copied data (from Quarter 1) by either using the EDIT key (F2), or double-clicking the cell you want to edit. You should now be in a position to complete editing the sheets of the other quarters. Be extra careful, from now on, to check the identification Tab at the bottom of the screen, so as not to get the sheets mixed up. You do not want to spend time editing the wrong worksheet!

After building up the four worksheets (one for each quarter - see beginning of next chapter for details on the 3rd and 4th quarters) save the file as PROJECT5.

## Linking Sheets

A consolidation sheet could be placed in front of our 'stack' of data sheets to show a full year's results, by making a copy of the 1st Quarter sheet and placing it in front of it. Next, delete the entries in columns B to E, and name it 'Consolidation'.

We are now in a position to link the consolidation sheet to the other quarterly data sheets so that the information contained on them is automatically summarised and updated on it.

The quarter totals in columns E of sheets Quarter 1, Quarter 2, Quarter 3, and Quarter 4, can be copied in turn to the clipboard using the **Edit, Copy** command, and then pasted to the appropriate column of the Consolidate sheet with the use of the

### **Edit, Paste Special**

command and pressing the **Paste Link** button on the displayed dialogue box.

**Note:** Empty cells linked with this method, like those in cells E5 of each quarter, appear as 0 (zero) in the Consolidation sheet, and cannot be removed. To correct this, copy each column E of each quarter in two stages; E3:E4, then E6:E13.

Finally, insert appropriate formulae in row 14 to correctly calculate the cumulative values in the consolidation sheet. Your screen display should now look similar to that below:

E13		[=Quarter 4!\$E\$6:\$E\$13]				
	A	B	C	D	E	F
1	<b>PROJECT ANALYSIS - Year Summary</b>					
2						
3		<b>1st Quarter</b>	<b>2nd Quarter</b>	<b>3rd Quarter</b>	<b>4th Quarter</b>	
4	<b>Income</b>	£ 45,000.00	£ 48,000.00	£ 52,500.00	£ 57,000.00	
5	<b>Costs:</b>					
6	<b>Wages</b>	£ 9,000.00	£ 12,000.00	£ 13,500.00	£ 15,000.00	
7	<b>Travel</b>	£ 1,500.00	£ 1,630.00	£ 1,930.00	£ 2,000.00	
8	<b>Rent</b>	£ 900.00	£ 900.00	£ 900.00	£ 900.00	
9	<b>Heat/Light</b>	£ 480.00	£ 370.00	£ 250.00	£ 610.00	
10	<b>Phone/Fax</b>	£ 900.00	£ 1,050.00	£ 1,150.00	£ 1,270.00	
11	<b>Adverts</b>	£ 3,600.00	£ 3,900.00	£ 4,350.00	£ 4,510.00	
12	<b>Total Costs</b>	£ 16,380.00	£ 19,850.00	£ 22,080.00	£ 24,290.00	
13	<b>Profit</b>	£ 28,620.00	£ 28,150.00	£ 30,420.00	£ 32,710.00	
14	<b>Cumulative</b>	£ 28,620.00	£ 56,770.00	£ 87,190.00	£ 119,900.00	
15						
16						
17						
18						

Save the resultant workbook under the filename PROJECT6.

## Linking Files

In the last example we built a consolidation report on a separate sheet in front of several parallel data sheets. All these sheets were, however, part of the same file. There may be times, however, when the consolidation data would be preferable in a separate file. As an example of linking files, we will work through an exercise to carry out this operation.

### File Commands:

Use the **File, Close** command to close PROJECT6 and clear the computer's memory, and **File, Open** to open PROJECT5. Next, place another empty file in memory using the **File, New** command. You can tell that a new file has been created, because the filename Book2 appears on the Title bar.

We would like to paste links between columns E of each quarter sheet of file PROJECT 5 and the newly opened file. This is best done if both files can be viewed at the same time, so use the **Window, Arrange, Tiled** command, then copy all the labels from sheet Quarter 1 of the file PROJECT5 onto Sheet1 of the new file using the **Edit, Copy** and **Edit, Paste Special** command. The result so far should be as follows:

PROJECT ANALYSIS 1st Quarter			
	Jan	Feb	Mar
Income	£ 14,000.00	£ 15,000.00	£ 16,000.00
Costs:			
Wages	£ 2,000.00	£ 3,000.00	£ 4,000.00
Travel	£ 400.00	£ 500.00	£ 600.00
Rent	£ 300.00	£ 300.00	£ 300.00
Heat/Light	£ 150.00	£ 200.00	£ 130.00
Phone/Fax	£ 250.00	£ 300.00	£ 350.00
Adverts	£ 1,100.00	£ 1,200.00	£ 1,300.00
Total Costs	£ 4,200.00	£ 5,500.00	£ 6,680.00
Profit	£ 9,800.00	£ 9,500.00	£ 9,320.00
Cumulative	£ 9,800.00	£ 19,300.00	£ 28,620.00

Note that the only difference between the styles of the two files is that the column widths have not transferred across when copying in this manner, therefore adjust them to a width of 11. Also the contents of cell A1 are not centred within the range A1:E1, as they should be.

Copying between files is the same as copying between the separate sheets of a file. However, here we would like to paste both the formats of the cells, and the links, therefore a two fold copy and paste process is necessary. First, select in turn each quarter's totals from PROJECT5 (cells E3:E14 of each sheet), use the **Edit, Copy** command, and paste the formats with the **Edit, Paste Special** command, clicking the **Formats** button on the displayed dialogue box, and pressing **OK**.

Next, select each contiguous part of each quarter separately (to avoid pasting zeroes where spaces should appear), copy them, and paste them with file links onto Sheet1 of the new file in columns B to E, using the **Edit, Paste Special** command and pressing the **Paste Link** button on the displayed dialogue box. Below we show this process in action when the second quarter has just been linked to Sheet1 of Book2.

Book2				PROJECT5.XLS			
	A	B	C		C	D	E
1	<b>PROJECT ANALYSIS 1</b>			1	<b>VALYSIS 2nd Quarter</b>		
2				2			
3		<b>1st Quarter</b>	<b>2nd Quarter</b>	3	<b>May</b>	<b>Jun</b>	<b>2nd Quarter</b>
4	Income	£ 45,000.00	£ 48,000.00	4	£ 16,000.00	£ 16,500.00	£ 48,000.00
5	Costs:			5			
6	Wages	£ 9,000.00	£ 12,000.00	6	£ 4,000.00	£ 4,500.00	£ 12,000.00
7	Travel	£ 1,500.00	£ 1,630.00	7	£ 560.00	£ 580.00	£ 1,630.00
8	Rent	£ 900.00	£ 900.00	8	£ 300.00	£ 300.00	£ 900.00
9	Heat/Light	£ 480.00	£ 370.00	9	£ 120.00	£ 100.00	£ 370.00
10	Phone/Fax	£ 900.00	£ 1,050.00	10	£ 350.00	£ 400.00	£ 1,050.00
11	Adverts	£ 3,600.00	£ 3,900.00	11	£ 1,300.00	£ 1,350.00	£ 3,900.00
12	Total Costs	£ 16,380.00	£ 19,850.00	12	£ 6,620.00	£ 7,230.00	£ 19,850.00
13	Profit	£ 28,620.00	£ 28,150.00	13	£ 9,380.00	£ 9,270.00	£ 28,150.00
14	Cumulative			14	£ 18,880.00	£ 28,150.00	
15				15			
16				16			

Below we show the maximised consolidated file for all four quarters.

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
4 Income	£ 45,000.00	£ 48,000.00	£ 52,500.00	£ 57,000.00
5 Costs:				
6 Wages	£ 9,000.00	£ 12,000.00	£ 13,500.00	£ 15,000.00
7 Travel	£ 1,500.00	£ 1,630.00	£ 1,930.00	£ 2,000.00
8 Rent	£ 900.00	£ 900.00	£ 900.00	£ 900.00
9 Heat/Light	£ 480.00	£ 370.00	£ 250.00	£ 610.00
10 Phone/Fax	£ 900.00	£ 1,060.00	£ 1,190.00	£ 1,270.00
11 Adverts	£ 3,600.00	£ 3,900.00	£ 4,350.00	£ 4,510.00
12 Total Costs	£ 16,380.00	£ 19,850.00	£ 22,080.00	£ 24,290.00
13 Profit	£ 28,620.00	£ 28,150.00	£ 30,420.00	£ 32,710.00
14 Cumulative	£ 28,620.00	£ 56,770.00	£ 87,190.00	£ 119,900.00

Note how cell references between different files (which could have been typed in) are shown with the filename and sheet name included in apostrophes ('...'), placed before the cell address, if the sheet name includes a space. For example

`{=A'[PROJECT5.XLS]Quarter 4!$E$3:$E$4}`

which implies that both files are on the drive and path.

If, however, PROJECT5 was on a different drive and, say D: and in the \DATA subdirectory, then the above formula would be given as:

`{='D:\DATA\[PROJECT5.XLS]Quarter 4!$E$3:$E$4}`

Finally, add the appropriate formulae in row 14 to calculate the cumulative profits and change the contents of cell A1 from 'PROJECT ANALYSIS 1st Quarter' to 'PROJECT ANALYSIS - Year Summary', before saving the linked books as ADEPT1.

## Relative and Absolute Cell Addresses

Entering a mathematical expression into Excel, such as the formula in cell C14 which was

=B14+C13

causes Excel to interpret it as 'add the contents of cell one column to the left of the current position, to the contents of cell one row above the current position'. In this way, when the formula was later copied into cell address D14, the contents of the cell relative to the left position of D14 (i.e. C14) and the contents of the cell one row above it (i.e. D13) were used, instead of the original cell addresses entered in C14. This is relative addressing.

To see the effect of relative versus absolute addressing, copy the formula in cell C14 into C17, as shown below:

	A	B	C	D	E	F
1	<b>PROJECT ANALYSIS - Year Summary</b>					
2						
3		<b>1st Quarter</b>	<b>2nd Quarter</b>	<b>3rd Quarter</b>	<b>4th Quarter</b>	
4	Income	£ 45,000.00	£ 48,000.00	£ 52,500.00	£ 57,000.00	
5	Costs:					
6	Wages	£ 9,000.00	£ 12,000.00	£ 13,500.00	£ 15,000.00	
7	Travel	£ 1,500.00	£ 1,630.00	£ 1,930.00	£ 2,000.00	
8	Rent	£ 900.00	£ 900.00	£ 900.00	£ 900.00	
9	Heat/Light	£ 480.00	£ 370.00	£ 250.00	£ 610.00	
10	Phone/Fax	£ 900.00	£ 1,050.00	£ 1,150.00	£ 1,270.00	
11	Adverts	£ 3,600.00	£ 3,900.00	£ 4,350.00	£ 4,510.00	
12	Total Costs	£ 16,360.00	£ 19,850.00	£ 22,080.00	£ 24,290.00	
13	Profit	£ 28,620.00	£ 28,150.00	£ 30,420.00	£ 32,710.00	
14	Cumulative	£ 28,620.00	£ 56,770.00	£ 87,190.00	£ 119,900.00	
15						
16						
17			£ -			

Note that in cell C14 the formula was =B14+C13. However, when copied into cell C17 the formula appears as

=B17+C16

because it has been interpreted as relative addressing. In this case, no value appears in cell C17 because we are attempting to add two blank cells.

Now change the formula in C14 by editing it to

`=B$14+$C$13`

which is interpreted as absolute addressing. Copying this formula into cell C17 calculates the correct result. Highlight cell C17 and observe the cell references in its formula; they have not changed from those of cell C14.

The \$ sign must prefix both the column reference and the row reference. Mixed cell addressing is permitted; as for example when a column address reference is needed to be taken as absolute, while a row address reference is needed to be taken as relative. In such a case, the column letter is prefixed by the \$ sign.

## Freezing Panes on Screen

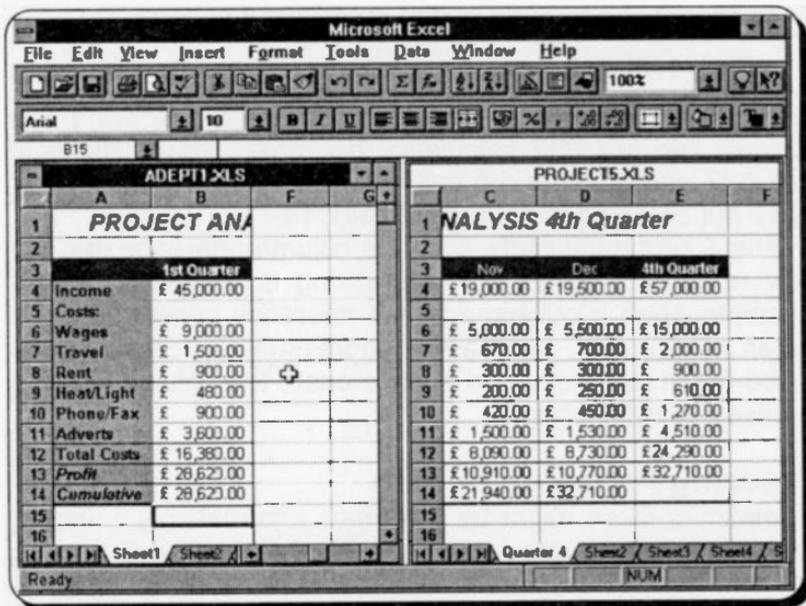
Sometimes there might be too much information on screen and attempting to see a certain part of a sheet might cause the text (labels) associated with that information to scroll off the screen.

To freeze column (or row) labels on a worksheet, move the cell pointer to the right (or below) the column (or row) which you want to freeze the labels on the screen, and use the

### **Window, Freeze Panes**

command. Everything to the left of (or above) the cell pointer will freeze on the screen.

In the example on the next page, the cell pointer was placed in cell B4 of the ADEPT1 workbook, before issuing the command to freeze the panes. As seen on the screen dump, Excel added a vertical line between columns A and B, and a horizontal line between rows 3 and 4. Scrolling horizontally or vertically leaves column A and rows 1-3 always on screen.



To remove unwanted frozen panes, or move their position on the worksheet, use the

### Unfreeze Panes

command.

## 7. SPREADSHEET GRAPHS

Excel allows information within a worksheet to be represented in graphical form which makes data more accessible to non-expert users who might not be familiar with the spreadsheet format. The saying 'a picture is worth a thousand words', applies equally well to charts and figures.

The package allows the use of several chart and graph types, including area, bar, column, line, doughnut, radar, XY, pie, combination, and several 3-D options of these charts. In all, Excel allows fifteen different types of charts, with a total of 102 pre-defined formats, which can be selected with the use of an appropriate icon, made available to you once you have selected the data you want to chart and indicated the place you want the chart to appear on your worksheet.

These charts (you can have several per worksheet) can be displayed on screen at the same time as the worksheet from which they were derived since they appear in their own 'chart' frame and can be embedded anywhere on a worksheet. Furthermore, they can be sent to an appropriate output device, such as a plotter or printer. Although this charting module rivals a stand alone graphics package, and one could write a separate book on it, an attempt will be made to present its basics, in the space available.

### Preparing for a Column Chart

In order to illustrate some of the graphing capabilities of Excel, we will now plot the income of the consulting company we discussed in the PROJECT6 file. However, before we can go on, you will need to complete the entries for the last two quarters of trading of the Adept Consultants' example, if you haven't already done so, as follows:

	Jul	Aug	Sep	Oct	Nov	Dec
Income	17,000	17,500	18,000	18,500	19,000	19,500
Costs:						
Wages	4,000	4,500	5,000	4,500	5,000	5,500
Travel	600	650	680	630	670	700
Rent	300	300	300	300	300	300
Heat/Light	50	80	120	160	200	250
Phone/Fax	350	380	420	400	420	450
Adverts	1,400	1,450	1,500	1,480	1,500	1,530

Next, link the quarterly totals to the consolidation sheet and calculate the year's total, then save the work as PROJECT7.

PROJECT7.XLS						
	A	B	C	D	E	F
1	<b>PROJECT ANALYSIS - Year Summary</b>					
2						
3		<b>1st Quarter</b>	<b>2nd Quarter</b>	<b>3rd Quarter</b>	<b>4th Quarter</b>	
4	<b>Income</b>	£ 45,000.00	£ 48,000.00	£ 52,500.00	£ 57,000.00	£202,500.00
5	<b>Costs:</b>					
6	<b>Wages</b>	£ 9,000.00	£ 12,000.00	£ 13,500.00	£ 15,000.00	£ 49,500.00
7	<b>Travel</b>	£ 1,500.00	£ 1,630.00	£ 1,930.00	£ 2,000.00	£ 7,060.00
8	<b>Rent</b>	£ 900.00	£ 900.00	£ 900.00	£ 900.00	£ 3,600.00
9	<b>Heat/Light</b>	£ 480.00	£ 370.00	£ 250.00	£ 610.00	£ 1,710.00
10	<b>Phone/Fax</b>	£ 900.00	£ 1,050.00	£ 1,150.00	£ 1,270.00	£ 4,370.00
11	<b>Adverts</b>	£ 3,600.00	£ 3,900.00	£ 4,350.00	£ 4,510.00	£ 16,360.00
12	<b>Total Costs</b>	£ 16,380.00	£ 19,850.00	£ 22,080.00	£ 24,290.00	£ 82,600.00
13	<b>Profit</b>	£ 28,620.00	£ 28,150.00	£ 30,420.00	£ 32,710.00	£119,900.00
14	<b>Cumulative</b>	£ 28,620.00	£ 56,770.00	£ 87,190.00	£ 119,900.00	
15						
16						

Now we need to select the range of the data we want to graph. The range of data to be graphed in Excel does not have to be contiguous for each graph, as with most other spreadsheets. With Excel, you select your data from different parts of a sheet with the <Ctrl> key pressed down. This method has the advantage of automatic recalculation should any changes be made to the original data. You could also collect data from different sheets to one 'graphing' sheet by linking them as we did with the consolidation sheet.

If you don't want the chart to be recalculated when you do this, then you must use the **E**dit, **C**opy and **E**dit, **P**aste **S**pecial commands and choose the **V**alues option from the displayed dialogue box, which copies a selected range to a specified target area of the worksheet and converts formulae to values. This is necessary, as cells containing formulae cannot be pasted directly since it would cause the relative cell addresses to adjust to the new locations and each formula would then recalculate a new value for each cell and give wrong results.

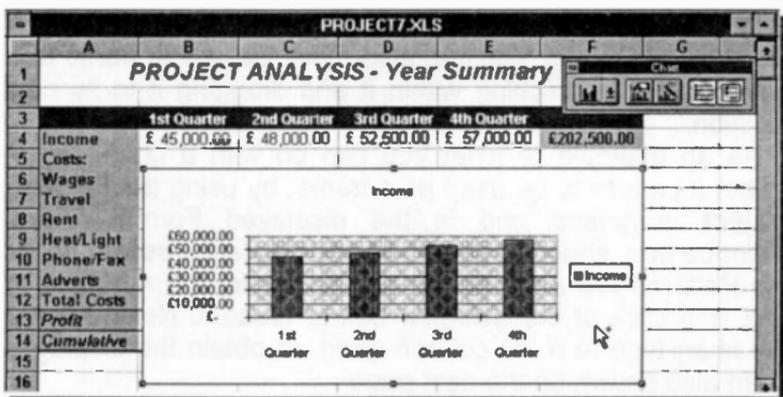
## The ChartWizard:

To obtain a chart of 'Income' versus 'Quarters', select the data in cell range A3..E4, then either click at the ChartWizard, shown here, or use the **Insert, Chart, On This Sheet** command. On doing so, the cursor changes (once in the worksheet area) to a small column chart, as shown below.

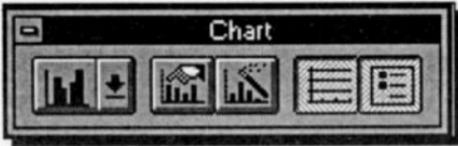


PROJECT7.XLS						
	A	B	C	D	E	F
1	<b>PROJECT ANALYSIS - Year Summary</b>					
2						
3		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
4	Income	£ 45,000.00	£ 48,000.00	£ 52,500.00	£ 57,000.00	£202,500.00
5	Costs:					
6	Wages	£ 9,000.00	£ 12,000.00	£ 13,500.00	£ 15,000.00	£ 49,500.00
7	Travel	£ 1,500.00	£ 1,630.00	£ 1,930.00	£ 2,000.00	£ 7,060.00
8	Rent	£ 900.00	£ 900.00	£ 900.00	£ 900.00	£ 3,600.00
9	Heat/Light	£ 480.00	£ 370.00	£ 250.00	£ 610.00	£ 1,710.00
10	Phone/Fax	£ 900.00	£ 1,050.00	£ 1,150.00	£ 1,270.00	£ 4,370.00
11	Adverts	£ 3,600.00	£ 3,900.00	£ 4,350.00	£ 4,510.00	£ 16,360.00
12	Total Costs	£ 16,380.00	£ 19,850.00	£ 22,080.00	£ 24,290.00	£ 82,600.00
13	Profit	£ 28,620.00	£ 28,150.00	£ 30,420.00	£ 32,710.00	£119,900.00
14	Cumulative	£ 28,620.00	£ 56,770.00	£ 87,190.00	£ 119,900.00	
15						

Now move the mouse pointer to the place you want to position the top-left corner of your chart, press the left mouse button and while keeping it pressed, drag the mouse down and to the right to form a dotted rectangle within which the chart will appear automatically once you release the mouse button and have selected the chart type. The result could be as follows:



Note that while the frame containing a chart is selected (you can tell from the presence of the small black squares around it), a special Chart toolbar, shown here, appears above and to the right of it. These icons have the following function:



Produces a drop-down series of icons from which you can select the chart type.



Allows you to select the default chart.



Allows you to select ChartWizard's dialogue boxes to specify the data range for the chart and whether the data series is in rows or columns.



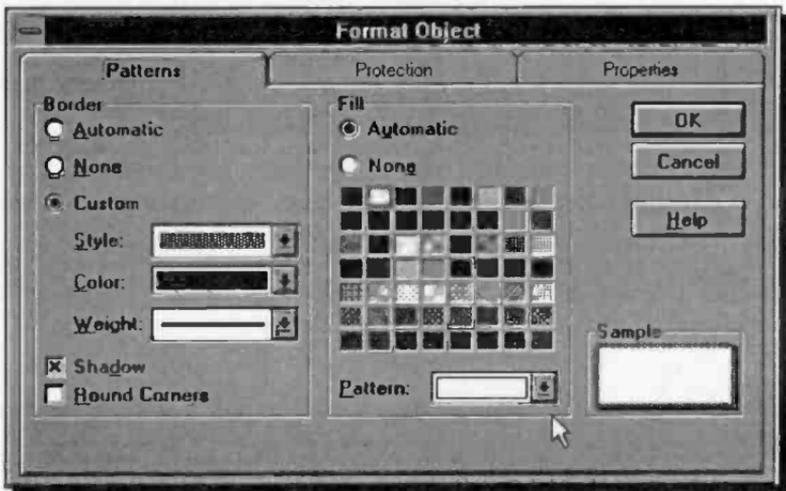
Toggles the horizontal gridlines on or off.



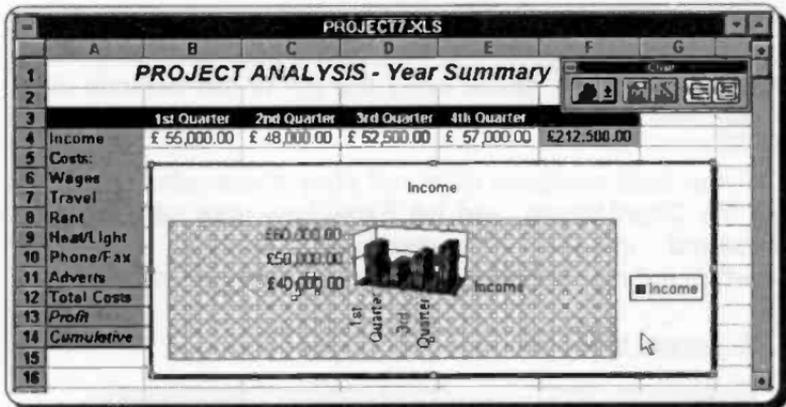
Toggles the legends on or off.

You can change the size of a selected chart by dragging the small four-headed arrow pointer (which appears when the mouse pointer is placed at the edges of the frame and on the small black boxes). You can also move the whole frame to a new position by clicking within it and dragging it to its new position.

As an example of what you can do with a chart, let us select a pattern to be used as a frame, by using the **Format, Object** command and in the displayed Format Object dialogue box, shown on the next page, select **Custom** under the Patterns tab and choose the 7th **Style**, the 4th **Weight** line, and click at the **Shadow** box to cross it. Next, change the chart type to a 3D column chart, to obtain the displayed chart also shown on the next page.



Try it, then change the first quarter income from £45,000 to £55,000 (on the Quarter 1 sheet), and watch how the change is reflected on the redrawn graph on the Consolidation sheet.

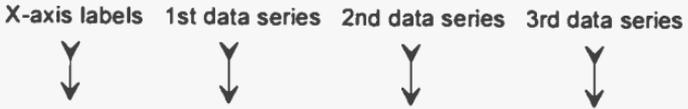


Finally, revert to the original entry for the first quarter's income, change your chart back to a simple column type, and then save your work again under the filename PROJECT7 by simply pressing the Save icon shown here. Your current work will be saved to disc replacing the previous version under the same filename.

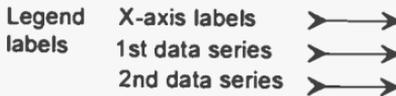


When Excel creates a chart, it plots each row or column of data in the selected range as a 'data series', such as a group of bars, lines, etc. A chart can contain many data series, but Excel charts data according to the following rules:

1. If the selected range contains more rows than columns of data, Excel plots the data series by columns.



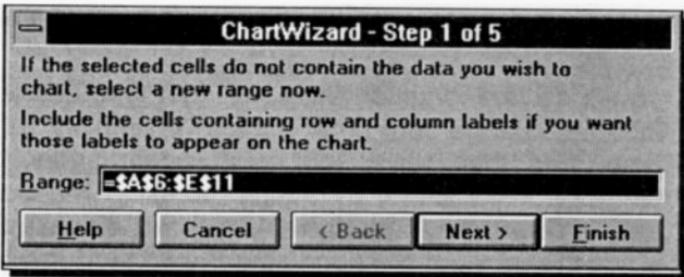
2. If the selected range contains more columns than rows of data, or the same number of columns and rows, Excel plots the data series by rows.



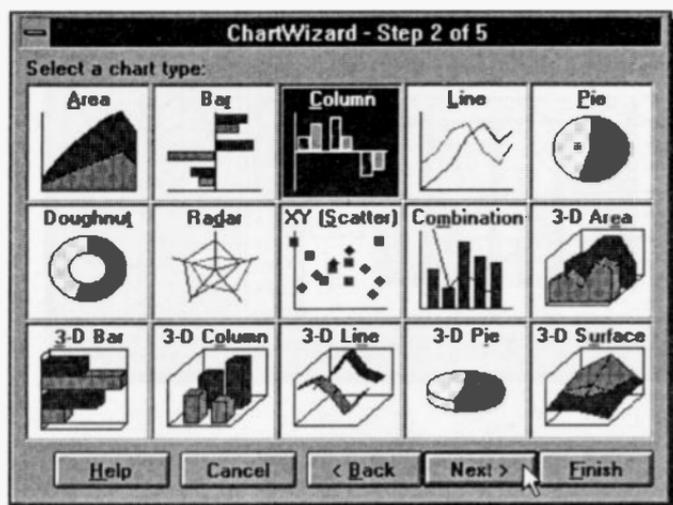
If you select a range to chart which includes column and row headings, and text above or to the left of the numeric data, Excel uses the text to create the axis labels, legends, and title.

If your data selection does not obey these rules, you must use the ChartWizard, and tell Excel how your data series is structured in the 4th displayed dialogue box. The ChartWizard opens 5 dialogue boxes altogether, as follows:

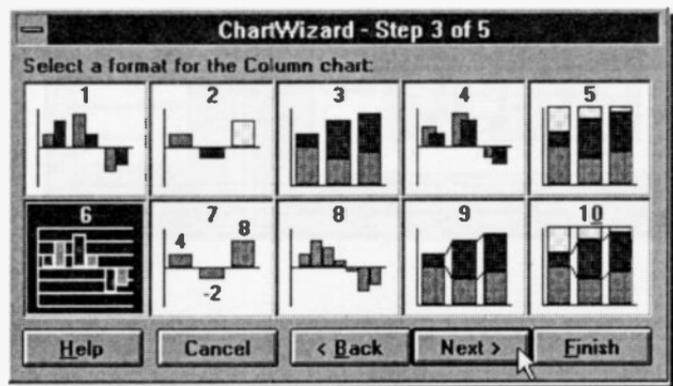
### 1. Range selection



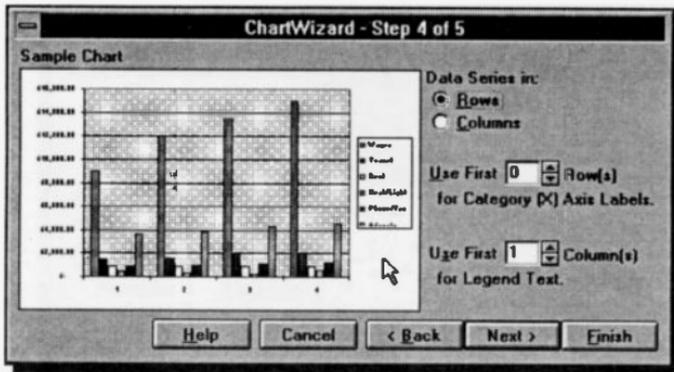
## 2. Chart type selection



## 3. Format selection for chosen chart



#### 4. Data series specification



#### 5. Legend and title selection



### Saving and Naming Charts:

When you save a worksheet, the chart or charts you have created are saved with it. Charts are numbered automatically as you create them and are given the default name Chart#, where # is a sequential number starting with 1. If you have created a chart and subsequently deleted it, the next chart created will be named one number above the deleted chart.

If you prefer, you can rename charts so that they have names more relevant to what they represent. To do so, select the chart by clicking within its boundaries, then click the Reference Indicator (which should display the name Chart#), and type a new name.

As we will be creating quite a number of charts, rename the existing Chart1 to Income\_bar.

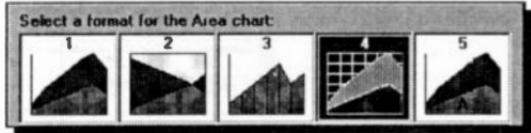
### Pre-defined Chart Types

To select a different type of chart, click the ChartWizard icon shown here, or select the **Insert, Chart** command.

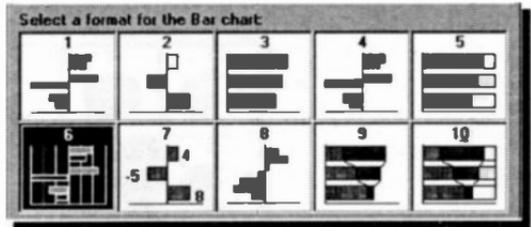


The 2nd ChartWizard dialogue box displayed below, lists 15 different chart options, but 6 of these are 3D versions of Area, Bar, Column, Line, Pie, and Surface charts. The nine main graph-types, are normally used to describe the following relationships between data:

**Area:** for showing a volume relationship between two series, such as production or sales, over a given length of time. The available pre-defined area charts are:

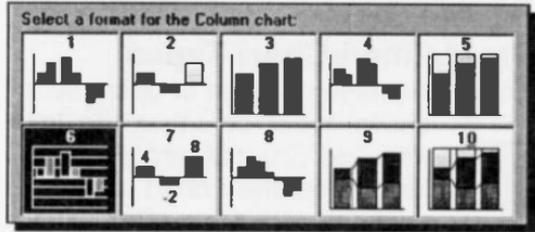


**Bar:** for comparing differences in data - non-continuous data that are not related over time - by depicting changes in horizontal bars to show positive and negative variations from a given position. The available pre-defined bar charts are:



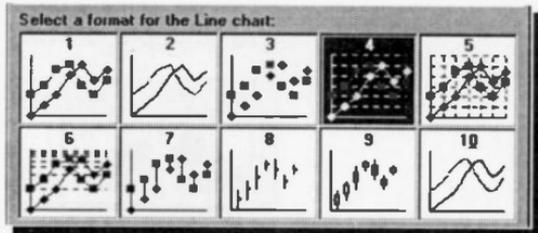
**Column:**

for comparing separate items - non-continuous data which are related over time - by depicting changes in vertical bars to show positive and negative variations from a given position. The available pre-defined column charts are:



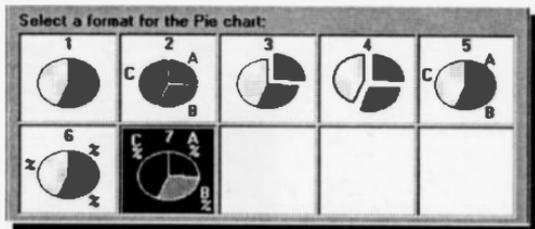
**Line:**

for showing continuous changes in data with time. The available pre-defined line charts are:

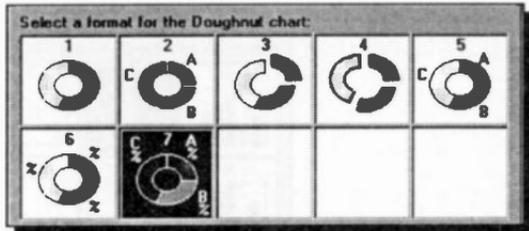


**Pie:**

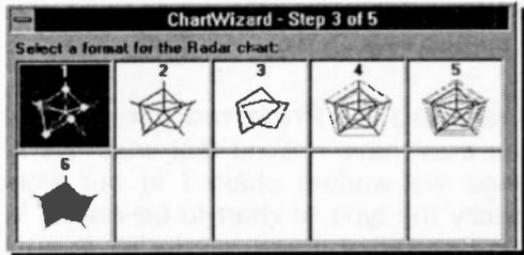
for comparing parts with the whole. You can use this type of chart when you want to compare the percentage of an item from a single series of data with the whole series. The available pre-defined pie charts are:



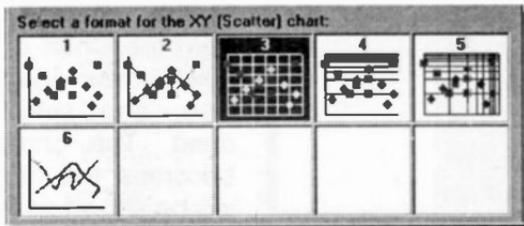
**Doughnut:** for comparing parts with the whole. Similar to pie charts, but can depict more than one series of data. The available pre-defined doughnut charts are:



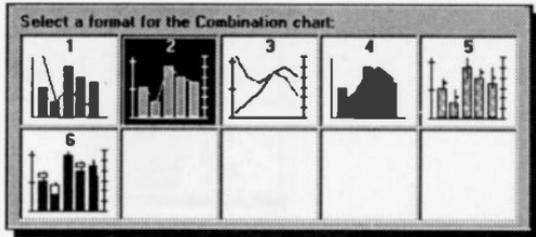
**Radar:** for plotting one series of data as angle values defined in radians, against one or more series defined in terms of a radius. The available pre-defined radar charts are:



**XY:** for showing scatter relationships between X and Y. Scatter charts are used to depict items which are not related over time. The available pre-defined XY charts are:



**Combination:** for comparing different chart types or different scaling systems by overlaying different type of charts (up to a maximum of four). The available pre-defined mixed charts are:

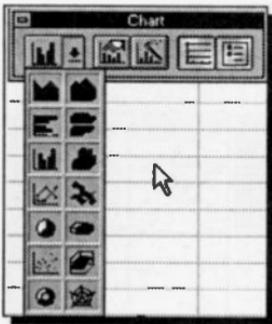


You can change the type of chart by selecting one of the fifteen alternate chart types (including the 3D variations of Area, Bar, Column, Line, Pie, and Surface) from the 2nd ChartWizard dialogue box, press the **Next** button and choosing one of the pre-defined charts from the displayed selection, provided your data fits the selection.

### Changing the Preferred Chart Format:

You must have noticed that when we first defined the data range we wanted charted in our worksheet, we did not specify the type of chart to be drawn. We simply clicked at the ChartWizard, or used the **Insert, Chart** command, specified the target area and Excel presented us with a Column chart.

If you usually work with a different chart type, then you will find it useful to change the default type. After selecting the data to be charted and having had the default column chart drawn, choose the type of chart you would like to change to from the Chart menu by clicking the down-arrow against the Chart type icon, and selecting the preferred chart. The chart type you select becomes the new default type and will be shown as the new Chart icon.

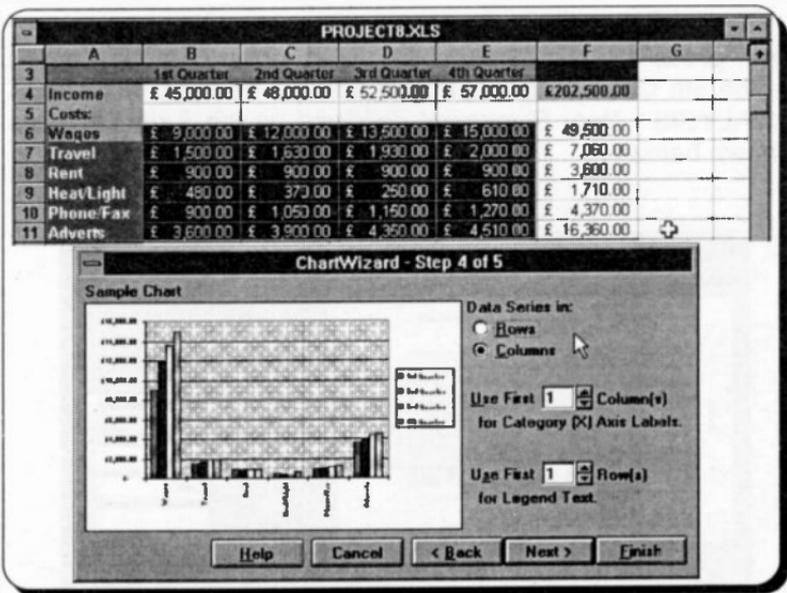


## Customising a Chart

In order to customise a chart, you need to know how to add legends, titles, text labels, arrows, and how to change the colour and pattern of the chart background, plot areas and chart markers, and how to select, move and size chart objects.

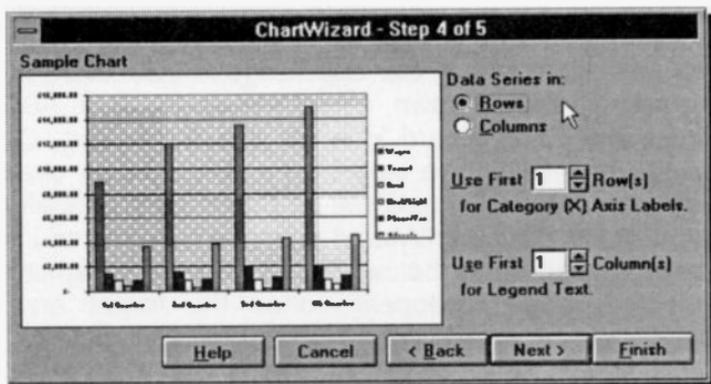
### Drawing a Multiple Column Chart:

As an exercise, we will consider a new column chart which deals with the quarterly 'Costs' of Adept Consultants. To achieve this, first select the cell range A3:E3 then, while holding the <Ctrl> key down, select the costs range A6:E11 and press the ChartWizard icon (or use the **Insert**, **Chart** command), and select the target area. The column chart of the 6 different quarterly costs will be drawn automatically, as displayed in the 4th ChartWizard dialogue box shown in the composite screen dump below. Note that the highlighting of the selected range disappears once the target area is defined.

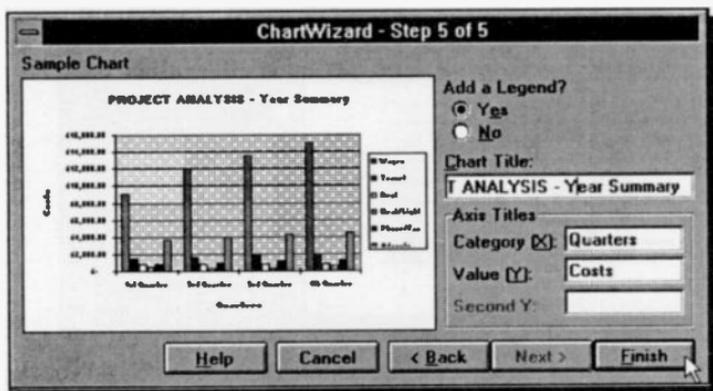


Because the selected range contains more rows than columns of data, Excel follows the 1st rule of data series selection which, however, might not be what we want.

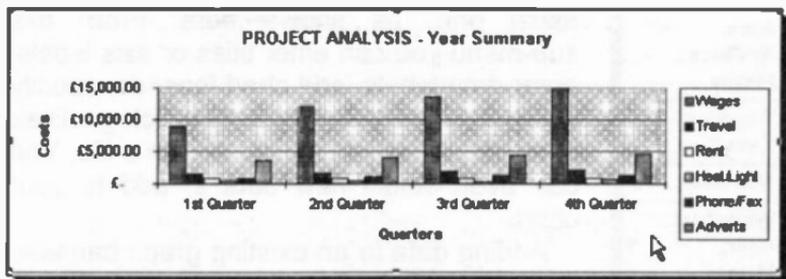
To have the 'quarters' appearing on the x-axis and the 'costs' as the legends, we need to tell Excel that our data series is in rows by clicking the **Row** button on the 4th ChartWizard dialogue box. Immediately this is done the column chart changes to:



Now press the **Next** button, and type in the **Chart Title** box of the 5th ChartWizard dialogue box the heading 'PROJECT ANALYSIS - Year Summary', followed by the **Axis Titles** as shown below.



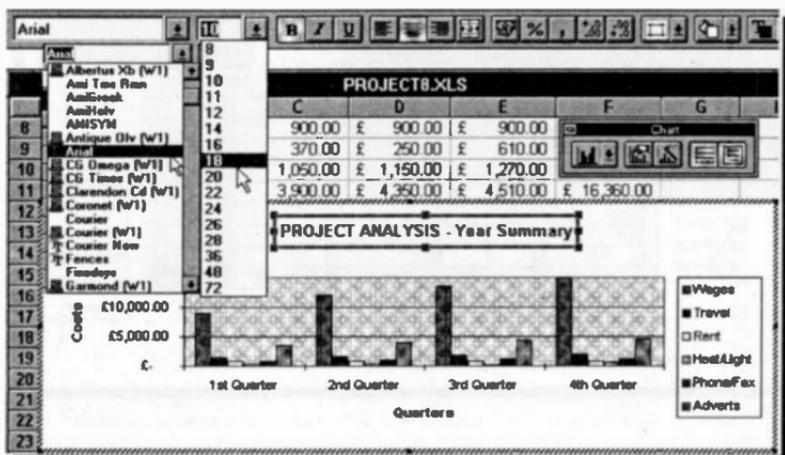
When you press the **Finish** button, the following chart appears on the screen:



If you make a mistake and you want to try again, make sure the unwanted chart is selected, then press the <Del> key. Once you are satisfied with your efforts, name your chart **Costs\_bar** and save your work under the filename **PROJECT8**.

### Changing a Title and an Axis Label:

To change a title or an axis label within a chart, double-click inside the chart. Once this is done, clicking at the title, the X- or Y-axis label, or the legends, reveals that these are individual objects (they are surrounded by small black squares) and you can re-position them, change their font and their point size easily, as shown in the composite below:

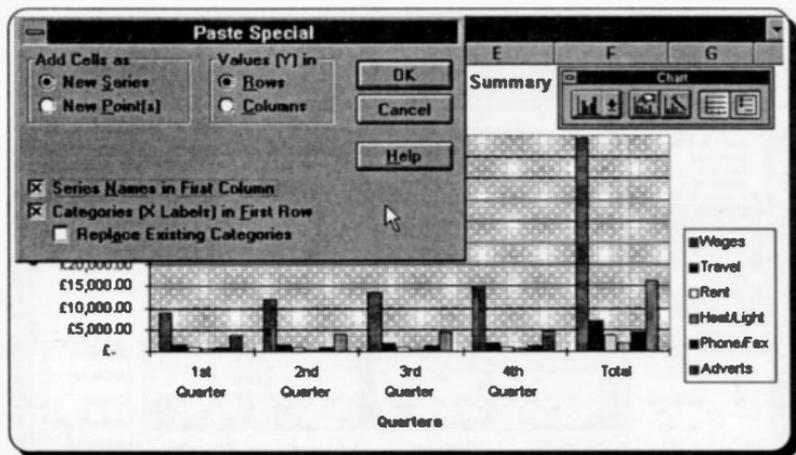




After you double-clicked inside a chart, selecting the **I**nsert command reveals a changed drop-down sub-menu from the usual one, as shown here. From this sub-menu you can enter titles or axis labels, enter data labels, add chart legends, specify which axis to display, specify which gridlines to display, or insert a picture from a file. You can even select new data to add to your chart.

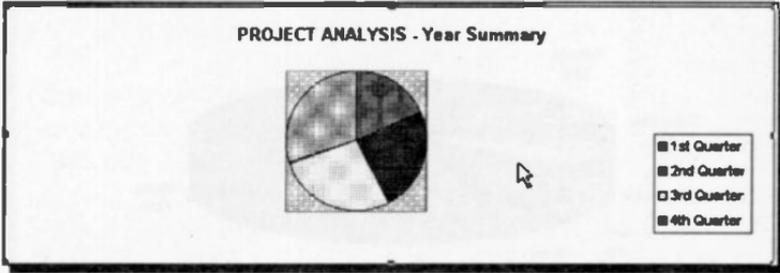
Adding data to an existing graph can also be done very easily with the mouse. Simply select a range, copy it to the clipboard, double-click the chart, then paste the new data to it.

As an example, select cell F3 then, while holding down the <Ctrl> key, select the cell range F6:F11, and use the **E**dit, **C**opy command to copy the selected range to the clipboard. Next, double-click the Costs\_bar chart, use the **E**dit, **P**aste **S**pecial command, click the **N**ew **S**eries and **N**ames in **F**irst **C**olumn buttons on the displayed dialogue box, shown below, and press the **O**K button. Finally, select the destination object by clicking the actual columns of the chart and press <Enter>. The result is displayed below together with the dialogue box that caused this result.

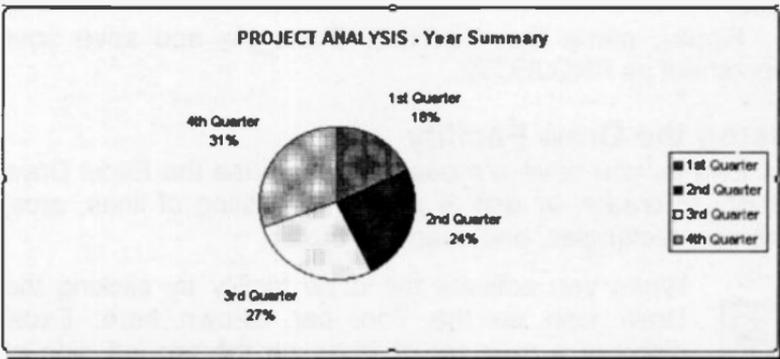


## Drawing a Pie Chart:

To change the chart type, simply select the chart, then click the Chart Type icon on the Chart Tool bar and choose the pie picture from the displayed drop-down list. If the selected chart was the 'quarterly costs' chart, then on pressing the OK button the chart would be redrawn to the following:



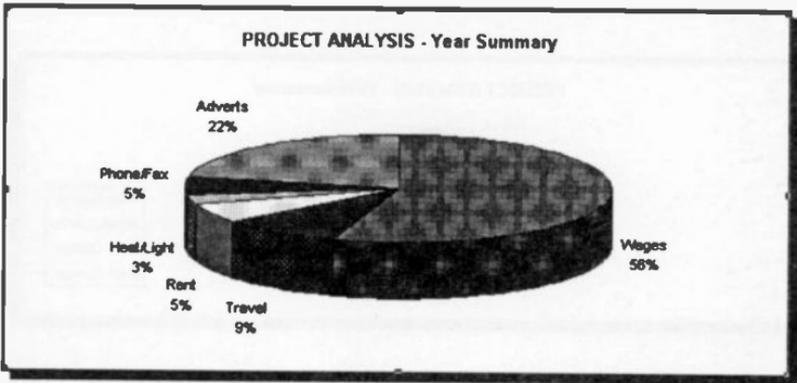
To obtain a different pie chart, you must select the data range again, then click the ChartWizard, choose the pie chart from the displayed chart types, then select the specific pie chart that best fits your data, specify the type of series data as 'rows', and give the chart a title. For example, you could choose the following:



This chart tells us that the costs have been increasing from 18% for the 1st quarter to 31% for the 4th quarter, in a clockwise manner, but it doesn't tell us much more.

As a last example in chart drawing, we will use the same data range of the costs from the worksheet to plot a 3-D pie chart.

The steps are the same as before, but for the 3-D option and specifying the type of series data as 'columns'. The result should be as follows:



It is now obvious that the information contained in this chart is much more than in the 2-D version.

If you want to explode an individual pie slice, you can do so by simply dragging it. This is possible as each slice is treated as a separate object, but you must increase the size of your chart before you can pinpoint accurately the required slice.

Finally, name the pie chart `Costs_pie` and save your worksheet as `PROJECT9`.

## Using the Draw Facility

As long as you have a mouse, you can use the Excel Draw facility to create, or edit, a picture consisting of lines, arcs, ellipses, rectangles, and even text boxes.



When you activate the draw facility by clicking the Draw icon on the Tool bar, shown here, Excel displays a new set of icons on the top left side of



your workspace as shown here. These can be moved to form a 3rd Tool bar.

The Drawing icons allow you to carry out the following tasks:



Draw a line

Draw a rectangle

Draw an ellipse

Draw an arc

Draw in freeform

Draw a text box

Draw an arrow

Draw freehand

Draw a filled rectangle

Draw a filled ellipse

Draw a filled arc

Draw a filled freeform

Create a button

Make a drawing selection

Bring an object to front

Send an object to back

Group objects

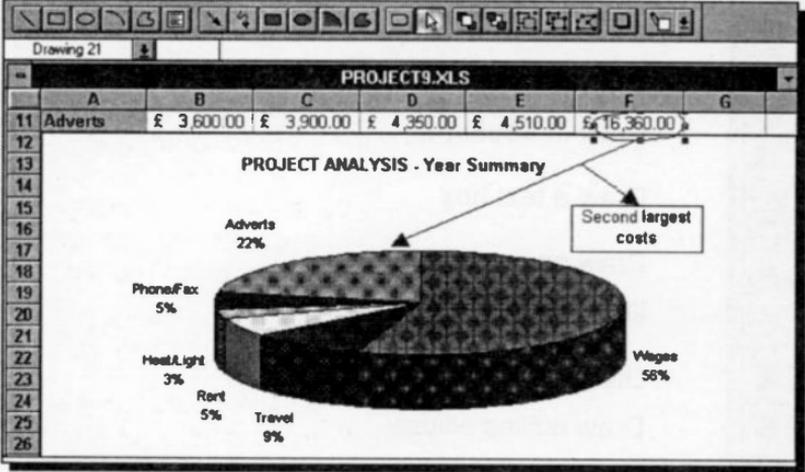
Ungroup objects

Reshape objects

Include a drop shadow

Select a pattern

The effects of these drawing tools can be superimposed on either the worksheet area or the chart area. The result is that you can annotate a worksheet to your total satisfaction, as shown below:



In the screen dump above, the drawing icons were moved to the top of the page, to form a 3rd Tool bar, out of the drawing area.

## 8. THE EXCEL DATABASE

An Excel database table is a worksheet range which contains related information, such as 'Customer's Names', 'Consultancy Details', 'Invoice No.', etc. A phone book is a simple database table, stored on paper. In Excel each record is entered as a worksheet row, with the fields of each record occupying corresponding columns.

A database table is a collection of data that exists, and is organised around a specific theme or requirement. It is used for storing information so that it is quickly accessible. To make accessing the data easier, each row (or **record**), of data within a database table is structured in the same fashion, i.e. each record will have the same number of columns (or **fields**).

We define a database and its various elements as follows:

Database table	A collection of related data organised in rows and columns in a worksheet file. A worksheet file can contain many different database tables.
Record	A row of information relating to a single entry and comprising one or more fields.
Field	A single column of information of the same type, such as people's names.

### Creating a Database

In order to investigate the various database functions, such as sorting, searching, etc., we first need to set up a database table in the form shown overleaf.

Note that in creating a database table, the following rules must be observed:

1. The top row of the database table must contain the field labels, one per column, which identify the fields in the database table. The second and subsequent rows of such a database table must contain records; no blank rows should be inserted between the field labels and the records.

- Field labels must be unique within a given database table.
- Entries under each field must be of the same type.
- A database table can contain a maximum of 256 fields and 16,384 records.

We assume that the 'Invoice Analysis' of Adept Consultants is designed and set out as shown below with the listed field titles and field widths. Formatting information is given below. To see all the rows of this database on your screen at once, either select the **View, Zoom** command and set the zoom level to 90%, or toggle off the **Formula Bar, Status Bar**, and only show the **Standard and Formatting Toolbars**.

	A	B	C	D	E	F	G	
1		INVOICE ANALYSIS, ADEPT CONSULTANTS LTD AT						8/1/94
2								
3		NAME	DETAILS	No	ISSUED	PAID?	VALUE	
4		VORTEX Co. Ltd	Wind Tunnel Tests	93001	10/4/93	N	£120.84	
5		AVON Construction	Adhesive Tests	93002	14/4/93	Y	£103.52	
6		BARROWS Associates	Tunnel Design Tests	93003	2/5/93	N	£98.32	
7		STONEAGE Ltd	Carbon Dating Tests	93004	25/5/93	N	£55.98	
8		PARKWAY Gravel	Material Size Tests (00)	93005	16/6/93	N	£180.22	
9		WESTWOOD Ltd	Load Bearing Tests	93006	28/6/93	N	£68.52	
10		GLOWORM Ltd	Luminescence Tests	93007	10/7/93	N	£111.55	
11		SILVERSMITH Co	X-Ray Diffraction Test	93008	22/7/93	Y	£123.45	
12		WORMGLAZE Ltd	Heat Transfer Tests	93009	13/8/93	N	£35.87	
13		EALING Engines Design	Vibration Tests	93010	25/8/93	N	£58.95	
14		HIRE Service Equipment	Network Implementation	93011	8/9/93	N	£280.00	
15		EUROBASE Co. Ltd	Project Control	93012	18/9/93	N	£150.00	
16		FREEMARKET Dealers	Stock Control Package	93013	23/9/93	N	£660.00	
17		OILRIG Construct.	Metal Fatigue Tests	93014	2/10/93	N	£96.63	
18		TIME & Motion Ltd	Systems Analysis	93015	16/10/93	N	£120.35	
19		AVON Construction	Cement Fatigue Tests	93016	13/11/93	N	£111.89	
20		PARKWAY Gravel	Material Size Tests (ZZ)	93017	1/12/93	N	£190.35	

Use the **Format, Column, Width** command (or use the mouse to drag the vertical separators of the column borders) to change the width of the various columns to those given on the next page, and then enter the abbreviated titles, centrally positioned, in row 3, as shown in the worksheet above. These widths were chosen so that the whole worksheet could be seen on the screen at once.

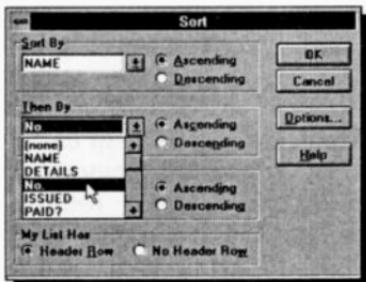
Column	Title	Width	Type
A	NAME	21	Default
B	DETAILS	20	Default
C	No.	6	Number, code 1
D	ISSUED	9	Date, code 1
E	PAID?	7	Default
F	VALUE	8	Currency, code 3

Use the **Format**, **Cells** command to format column C to a **Number** format, column D to a **Date** format, and column F to a **Currency** format, before entering the numeric information. Finally, save the worksheet under the filename INVOICE1.

### Sorting a Database List:

The records within the above database list are in the order in which they were entered, with the 'Invoice No' shown in ascending order. However, we might find it easier to browse through the information if it was sorted in alphabetical order of 'Customer's Name'. Excel has an easy way to do this.

To use it, highlight the database list (data range A4:F20; don't include the field names in the range to be sorted) and, either press the 'Sort Ascending' button, shown here, or select the



### Data, Sort

command, and choose in the **Sort By** list of the Sort dialogue box the name of the field on which you want to sort the database (in this case NAME). This will be the primary sort key.

The second method of sorting allows you more control over the sorting options, such as the choice of a secondary sort key (in this case No.). This is selected in the **Then By** list of the Sort dialogue box, shown above, which ensures that the lowest number invoices appear first, if a company has been issued with more than one invoice. You even have the choice of a third sort key, if you needed one.

Pressing the OK button produces the display shown below.

NAME	DETAILS	No	ISSUED	PAID?	VALUE
AVON Construction	Adhesive Tests	93002	14/4/93	Y	£103.52
AVON Construction	Cement Fatigue Tests	93016	13/11/93	N	£111.89
BARROWS Associates	Tunnel Design Tests	93003	2/5/93	N	£99.32
EALING Engines Design	Vibration Tests	93010	25/6/93	N	£58.95
EUROBASE Co Ltd	Project Control	93012	19/9/93	N	£150.00
FREEMARKET Dealers	Stock Control Package	93013	23/9/93	N	£560.00
GLOWWORM Ltd	Luminescence Tests	93007	10/7/93	N	£111.55
HIRE Service Equipment	Network Implementation	93011	8/9/93	N	£290.00
OILRIG Construct.	Metal Fatigue Tests	93014	2/10/93	N	£96.63
PARKWAY Gravel	Material Size Tests (00)	93005	16/6/93	N	£180.22
PARKWAY Gravel	Material Size Tests (22)	93017	1/12/93	N	£190.35
SILVERSMITH Co	X-Ray Diffraction Test	93008	22/7/93	Y	£123.45
STONEAGE Ltd	Carbon Dating Tests	93004	25/5/93	N	£55.98
TIME & Motion Ltd	Systems Analysis	93015	16/10/93	N	£120.35
VORTEX Co Ltd	Wind Tunnel Tests	93001	10/4/93	N	£120.84
WESTWOOD Ltd	Load Bearing Tests	93006	28/6/93	N	£68.52
WORMGLAZE Ltd	Heat Transfer Tests	93009	13/8/93	N	£35.87

The easiest way to return the database to its original sort order is either by selecting the **Edit, Undo Sort** command or by re-sorting the database in ascending order of invoice No.

## Date Arithmetic

There are several date functions which can be used in Excel to carry out date calculations. For example, typing the function `=DATE(94,1,8)` or `=DATEVALUE("8/1/94")`, returns the date 8/1/94, even though in the latter case the date was written as text. Typing the function `=NOW()`, returns the current date and time as given by your computer's internal clock. Furthermore, you don't even have to format the cell in advance to a date format before entering such information. If the cell is in 'General' (the default) format, Excel changes this automatically to agree with the format of the date entered.

Unlike Lotus 1-2-3, with Excel you don't need to use the `DATE` and `DATEVALUE` functions when entering dates. You could, for example, write in a cell the formula:

=NOW()-D4

which allows Excel to calculate the difference in days (in integral number, **if the appropriate cell is formatted for integer numbers**) between now and the mentioned date.

We could use this formula to work out the number of overdue days of the unpaid invoices in our example, by typing it in cell G4. However, if you want to compare the numbers you get with those displayed in this book, use instead the following formula:

=\$G\$1-D4

where \$G\$1 causes an 'absolute' reference to be made to the contents of cell G1.

If the record in row 4 of the worksheet refers to the data of VORTEX Co. Ltd., then the result should be 273 days. However, before we proceed to copy the above formula to the rest of the G column of the database list, we should take into consideration the fact that, normally, such information is not necessary if an invoice has been paid. Therefore, we need to edit the above formula in such a way as to make the result conditional to non-payment of the issued invoice.

## The IF Function

The IF function allows comparison between two values with the use of special 'logical' operators. The logical operators we can use are listed below.

<i>Logical</i>	<i>operators</i>
=	Equal to
<	Less than
>	Greater than
<=	Less than or Equal to
>=	Greater than or Equal to
<>	Not Equal to

The general format of the IF function is as follows:

IF(Comparison,Outcome-if-true,Outcome-if-false)

which contains three arguments separated by commas.

The first argument of the IF function is the 'logical comparison', the second is what should happen if the outcome of the logical comparison is 'true', while the third is what should happen if the outcome of the logical comparison is 'false'.

Thus, we can incorporate the IF function in the formula we entered in cell G4 to calculate the days overdue only if the invoice has not been paid, otherwise the string 'N/A' should be written into the appropriate cell, should the contents of the corresponding E column of a record be anything else but N. Either edit the formula in cell G4, by double-clicking the cell, or retype it. The final version of the formula in cell G4 should now correspond to what is shown below.

=IF(E4="N", \$G\$1-D4, " N/A")

Now copy this formula to the rest of the appropriate range (G5:G20) and compare your results with those shown below.

INVOICE ANALYSIS. ADEPT Consultants Ltd							8/1/94
NAME	DETAILS	No	ISSUED	PAID?	VALUE	OVERDUE	
VORTEX Co. Ltd	Wind Tunnel Tests	93001	10/4/93	N	£120.84	273	
AVON Construction	Adhesive Tests	93002	14/4/93	Y	£103.52	N/A	
BARROWS Associates	Tunnel Design Tests	93003	2/5/93	N	£99.32	251	
STONEAGE Ltd	Carbon Dating Tests	93004	25/5/93	N	£55.96	228	
PARKWAY Gravel	Material Size Tests (00)	93005	16/6/93	N	£180.22	206	
WESTWOOD Ltd	Load Bearing Tests	93006	28/6/93	N	£68.52	194	
GLOWORM Ltd	Luminescence Tests	93007	10/7/93	N	£111.55	182	
SILVERSMITH Co	X-Ray Diffraction Test	93008	22/7/93	Y	£123.45	N/A	
WORMGLAZE Ltd	Heat Transfer Tests	93009	13/8/93	N	£35.87	148	
EALING Engines Design	Vibration Tests	93010	25/8/93	N	£58.95	136	
HIRE Service Equipment	Network Implementation	93011	8/9/93	N	£290.00	122	
EUROBASE Co. Ltd	Project Control	93012	18/9/93	N	£150.00	112	
FREEMARKET Dealers	Stock Control Package	93013	23/9/93	N	£560.00	107	
OILRIG Construct	Metal Fatigue Tests	93014	2/10/93	N	£95.63	98	
TIME & Motion Ltd	Systems Analysis	93015	16/10/93	N	£120.36	84	
AVON Construction	Cement Fatigue Tests	93016	13/11/93	N	£111.89	56	
PARKWAY Gravel	Material Size Tests (Z)	93017	1/12/93	N	£190.35	38	

Your results might differ substantially from the ones shown above, if you have used the NOW( ) function in cell G1. After checking your work, save it under the filename INVOICE2.

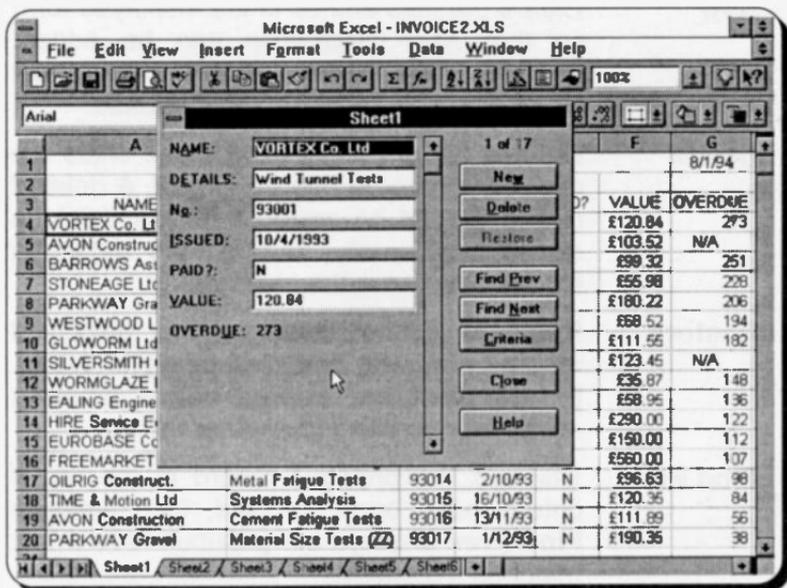
## Searching a Database

A database can be searched for specific records that meet certain criteria. We will use the database of worksheet INVOICE2 to illustrate the method.

Assuming that the database is on your screen, we need only place the cell pointer within the data list (we put it on cell A4, although anywhere within the range A4:G20 would do), for Excel to instinctively know the range of your data.

## Using the Database Form:

After the cell pointer is placed within the database list, Excel creates automatically a database form, as shown below, which is accessed by selecting the **Data, Form** command. The database form can be used to add, delete, edit, and search for specific records.



Note that the field names at the top row of the database appear on the left side of the form. On the top right corner of the form (above the **New** button) the entry '1 of 17' is displayed to indicate that this is the first of 17 records.

Most of the field names within the database form have one letter underlined, which can be used to access the corresponding box in the middle of the form in which the value of each field of the particular record is shown. To select fields or buttons, press the <Alt> key plus the underlined letter or use the mouse and click on field text or button. As with dialogue boxes, the <Tab> key moves the highlighter forwards through fields and buttons, while the <Shift+Tab> key combination moves the highlighter backwards.

With the help of the database form, adding new records is made easy. On pressing the **New** button, an empty form is displayed for you to fill in. Editing a displayed record is even easier; that is why the **Restore** button is included. The function of the form buttons is as follows:

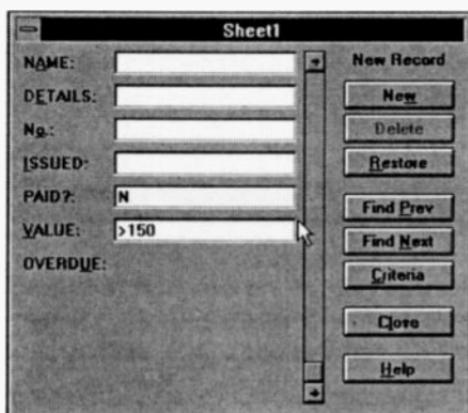
<b>Button</b>	<b>Function</b>
<b><u>N</u>ew</b>	Clears the field entries in the displayed form so that new information can be added. Pressing <b><u>N</u>ew</b> again, adds the data just typed as a new record in the database.
<b><u>D</u>elete</b>	Deletes the displayed record and shifts the remaining records one up the list. A deleted record cannot be restored. If you delete a record accidentally, re-open the database file without saving the changes.
<b><u>R</u>estore</b>	Restores edited fields in the displayed record, removing the changes just made. Entries must be restored before pressing <Enter> or scrolling to another record.
<b><u>F</u>ind <u>P</u>rev</b>	Displays the previous record in the list. If criteria have been selected, then pressing <b><u>F</u>ind <u>P</u>rev</b> displays the previous record that matches the criteria.
<b><u>F</u>ind <u>N</u>ext</b>	Displays the next record in the list. If criteria have been selected, then pressing <b><u>F</u>ind <u>N</u>ext</b> displays the next record that matches the criteria.

- Criteria**      Displays a dialogue box in which you can enter comparison criteria with comparison operators to find records that meet these restrictions.
  
- Close**        Closes the data form.
  
- Clear**         Available after pressing the **Criteria** button. It removes existing criteria from the Criteria dialogue box.
  
- Form**           Available after pressing the **Criteria** button. It returns you to the default data form.

### Finding Records:

There are two ways of finding specific records from within a database. The first method involves the use of the database form, while the second method involves the filtering of data by using a criteria range within the worksheet to display only the rows that meet all the specified criteria.

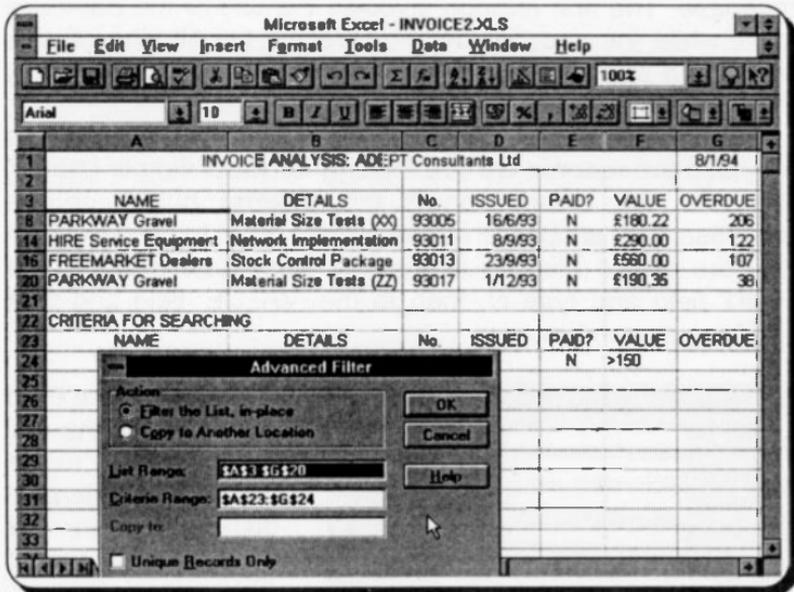
Excel's database form can be used to find records provided the records we are looking for meet simple criteria. To enter the criteria, press the **Criteria** button on the database form which will cause a blank form to be displayed, with the cursor blinking in the first field. Now move to the 'PAID?' field and type N, then to the 'VALUE' field and type >150, as shown below.



On pressing the **Find Next** button, the first record that meets both these criteria is displayed - in this case, the 5th record (PARKWAY Gravel). Pressing the **Find Next** button again three more times, displays the 11th, 13th and 17th record in succession.

To use Excel's second method for finding and extracting data, we need to specify an area of the worksheet for setting our criteria for the search. To do this, first copy the field names of the database (A3:G3) to an empty area of the worksheet, say, A23:G23 which will form the first line of the 'criteria range'. Label this area CRITERIA FOR SEARCHING in cell A22.

Now type in cells E24 and F24 the actual criteria which is N and >150, respectively, then use the **Data, Filter, Advanced Filter** command and specify in the displayed dialogue box the **List Range** and **Criteria Range** as A3:G20 and A23:G24 (it includes the field names in both cases). On pressing the OK button, Excel filters the data **In-Place** by hiding the rows that do not meet the criteria, as shown below.



Do not specify an empty line as part of the criterion range, as this has the effect of searching the database for all records. The criteria must be entered in the second and subsequent rows of the criterion range, with each entered below the copy of the appropriate field name. A label (text) or a value may be entered exactly as it appears in the database.

In the case of searching a database for label (text), such as under the fields 'NAME' and 'DETAILS' in our example, you can use the two special characters ? and \* (known as 'wildcard characters') to match any single character of a label or all characters to the end of the label.

To search a database for values, either enter the value as the exact criterion or use a simple numeric comparison, such as >90, in which the logical operators (<, <=, >, >=, <>) can be used. The logical formula generates a value of 1 if the condition is TRUE or a value of 0 if the condition is FALSE.

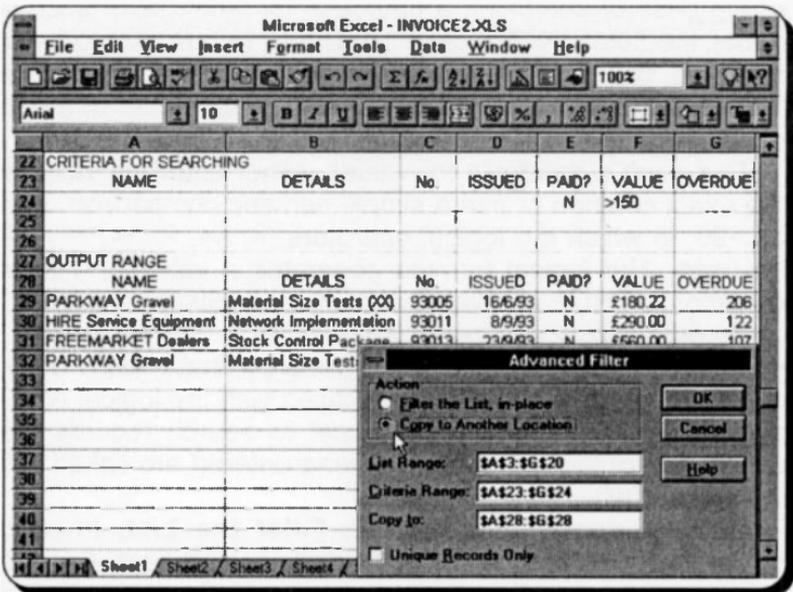
Several criteria can be entered, either in the same row, if you want Excel to search for records that match every criterion (i.e. criteria entered are linked with the logical AND), or one per row, if you want Excel to search records that satisfy any of the criteria (i.e. criteria entered are linked with the logical OR).

As seen above, selecting the **Filter the List, in-place** option in the Advanced Filter dialogue box, causes Excel to hide the rows that do not meet the specified criteria. To see the full database list again, use the **Data, Filter, Show All** command.

## Extracting Records

To extract records and have them copied into another area of the worksheet, we need to select the **Copy to Another Location** option in the Advanced Filter dialogue box. But first, we need to set-up a second area - the 'output range'. To do this, copy the field names to the cell range A28:G28 and label it as 'OUTPUT RANGE' in cell A27, as shown on the next page.

Note that we chose to put the criteria and output ranges in rows below the actual database (perhaps not the best position), rather than on the side of it. This avoids the errors that might ensue should we later decide to insert a row in our database, which will also insert a row in the criteria/output range. For a more structured worksheet layout, see end of chapter.



Save this worksheet under the filename INVOICE3.

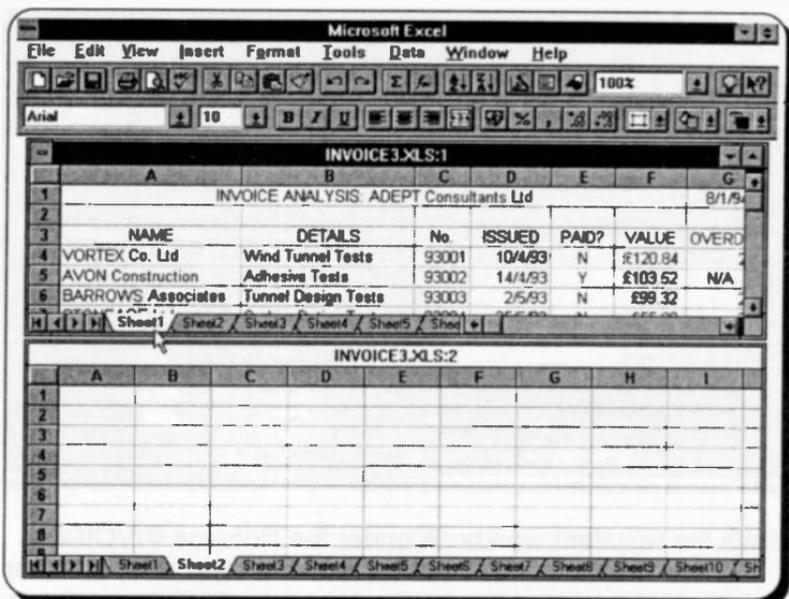
## Structuring a Workbook

In a well designed worksheet, areas of calculations using formulae which we call reports, must be kept on a separate sheet from the data entry sheet. The reason for this is to prevent accidental overwriting of formulae that might be contained within the data entry sheet. Indeed, one should use a separate worksheet altogether, if so inclined.

As an example, we will use the INVOICE3 file, but instead of extracting data into the same sheet, we will use another sheet into which to copy the extracted records.

To do this, first open file INVOICE3, and size it to fit on the top half of the screen. Then click on the Sheet2 tab and size it to fit in the bottom half of the screen.

Next, activate the top window by clicking anywhere inside it, then click the Sheet1 tab to display the database list, as shown in the screen dump on the next page.



Now use the **E**dit, **C**ut and **E**dit, **P**aste commands to transfer cell range A22:G28 of Sheet1 to a range starting at cell A1 of Sheet2 and adjust the widths of the various columns to match those of Sheet1. Finally, use the **D**ata, **F**ilter, **A**dvanced Filter command and enter the information shown on the next page in the displayed dialogue box. Pressing the OK button causes the records that match the specified criteria to be extracted from Sheet1 and copied into Sheet2, as shown overleaf.

**Note:** Excel only extracts data into an active sheet. Therefore, you must make Sheet2 the active sheet, and since the program also requires to know which are the database field labels, place the cell pointer in cell A7, before you use the **D**ata, **F**ilter, **A**dvanced Filter command. The address in the **L**ist Range box of the Advanced Filter dialogue box must be changed to indicate the correct address for the database list which is

Sheet1!\$A\$3:\$G\$20

The **C**riteria Range and the **C**opy to address locations should be prefixed with Sheet2! for correct data extraction.

INVOICE4.XLS:1							
	A	B	C	D	E	F	G
3	NAME	DETAILS	No.	ISSUED	PAID?	VALUE	OVERDUE
4	VORTEX Co. Ltd	Wind Tunnel Tests	93001	10/4/93	N	£120.84	273
5	AVON Construction	Adhesive Tests	93002	14/4/93	Y	£103.52	N/A
6	BARROWS Associates	Tunnel Design Tests	93003	2/5/93	N	£99.32	251
7	STONEAGE Ltd	Carbon Dating Tests	93004	25/5/93	N	£55.98	228
8	PARKWAY Gravel	Material Size Tests (XX)	93005	16/6/93	N	£180.22	206

INVOICE4.XLS:2		Advanced Filter	
A	B		
2	NAME	Action	
3	DETAILS	<input type="radio"/> Filter the List, in-place <input checked="" type="radio"/> Copy to Another Location	
4		<input type="button" value="OK"/> <input type="button" value="Cancel"/>	
5		<input type="button" value="Help"/>	
6	OUTPUT RANGE	List Range:	Sheet1!\$A\$3:\$G\$20
7	NAME	Criteria Range:	Sheet2!\$A\$2:\$G\$3
8	PARKWAY Gravel	Copy to:	Sheet2!\$A\$7:\$G\$7
9	HIRE Service Equipment	<input type="checkbox"/> Unique Records Only	
10	FREEMARKET Dealers		

Save the resultant workbook under the filename INVOICE4.

Another aspect of structuring is the provision of a screen with technical information about the contents of the particular workbook; a kind of an overview of the function of the worksheet application. This area must also contain instructions for the use of the particular application at hand. Such information can help others to learn and use an application easily and effectively. If you use range names, then include a range name table in your information screen(s).

Finally, provide a separate sheet within a workbook, or a separate worksheet altogether, for macros (the subject of the next chapter), which are in a programming language that allows you to chain together menu commands. Sensitive sheets or indeed whole workbooks can be protected using the **Tools, Protection** command and either select the **Protect Sheet** or the **Protect Workbook** option, according to your application needs, to restrict cell entries to unprotected cells. This prevents accidental changes being made to cells containing formulae.

## 9. USING MACROS

In Excel, you can automate tasks or create complete applications by writing macros. A macro is a sequence of commands and instructions that can control Excel.

Excel 5 supports two types of macros; those written using Visual Basic - a true programming language, and those written under earlier versions of Excel using the command and/or function macro language, which in Excel 5 terminology is known as the Excel 4.0 macro language. Although the instructions of the Excel 4.0 macro language have been enhanced to accommodate all the new features of Excel 5, it will not be supported in future Excel releases.

Understanding Visual Basic makes it easier to also program with MS-Word, MS-Project, MS-Access, and other Microsoft applications that use, or will soon use, the language. However, you don't really have to learn to program in Visual Basic, as Excel provides you with a Macro Recorder. The Macro Recorder stores the actions you take and the commands you use while working with Excel, which can then be played back (run) to repeat the recorded actions and commands.

The Excel 5 Macro Recorder can be instructed to record either in Visual Basic or in the Excel 4.0 macro language. Both of these methods will be examined, starting with the macro command language so that those who have macros written in that language can see the differences between it and Visual Basic. If you are new to Excel, then you only need to use the Visual Basic method, as this is the only programming language that Microsoft will support in the future.

### Using the Macro Recorder

We will now use the worksheet saved under PROJECT3 (see the middle of Chapter 5) to show how we can use Excel's Macro Recorder to create a macro to perform 'what-if' type of projections by, say, increasing the 'Wages' bill by 15%.

If you haven't saved PROJECT3 on disc, it will be necessary for you to enter the information shown on the next page into Excel so that you can benefit from what is to be introduced at this point.

If you have saved PROJECT3, then use the **File, Open** command to display the worksheet as shown below.

PROJECT3.XLS							
	A	B	C	D	E	F	G
1	<b>PROJECT ANALYSIS: ADEPT CONSULTANTS LTD</b>						
2							
3		Jan	Feb	Mar	1st Quarter		
4	Income	£ 14,000.00	£15,000.00	£ 16,000.00	£ 45,000.00		
5	Costs:						
6	Wages	£ 2,000.00	£ 3,000.00	£ 4,000.00	£ 9,000.00		
7	Travel	£ 400.00	£ 500.00	£ 600.00	£ 1,500.00		
8	Rent	£ 300.00	£ 300.00	£ 300.00	£ 900.00		
9	Heat/Light	£ 150.00	£ 200.00	£ 130.00	£ 480.00		
10	Phone/Fax	£ 250.00	£ 300.00	£ 350.00	£ 900.00		
11	Adverts	£ 1,100.00	£ 1,200.00	£ 1,300.00	£ 3,600.00		
12	Total Costs	£ 4,200.00	£ 5,500.00	£ 6,680.00	£ 16,380.00		
13	Profit	£ 9,800.00	£ 9,500.00	£ 9,320.00	£ 28,620.00		
14	Cumulative	£ 9,800.00	£19,300.00	£ 28,620.00			
15							

What we would like to do now is to edit the entries under 'Wages' so that this part of the costs can be increased by 15%. One way of doing this would be to multiply the contents of each cell containing the 'wages' value by 1.15. To do this, we would start by changing the contents of cell B6 into a formula, by pressing the F2 function key to 'Edit' the value in it by adding an equals sign at the beginning of the entry and then typing '\*1.15' at the end of it, which has the effect of multiplying the contents of the cell by 1.15, thus increasing its contents by 15%. We would then press the <Enter> key which would cause the cell pointer to drop to B7, press the ↑ arrow key to move back to cell B6, then press the → arrow key to move to cell C6 and repeat the whole procedure. The exact steps, after highlighting cell B6, are:

### Manual Procedure

Press F2 to 'Edit' cell

Press the <Home> key to move to beginning of entry

Type = to change entry to formula

Press <End> to move to the end of the entry

Type \*1.15

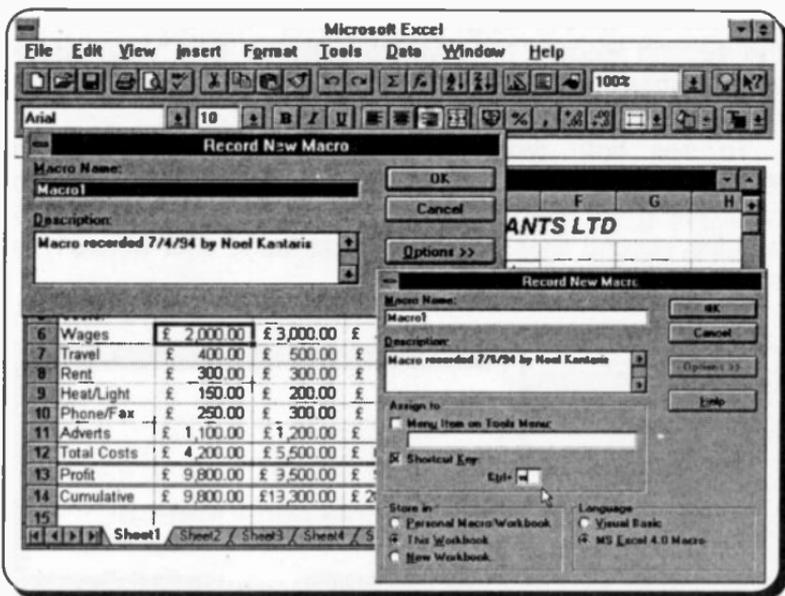
Press the <Enter> key

Press ↑ arrow key

Press → arrow key.

## Recording an Excel 4.0 Macro:

Having opened the PROJECT3 file, highlight cell B6 - the first cell we want to operate on. Then, select the **T**ools, **R**ecord Macro, **R**ecord New Macro command which displays the Record New Macro dialogue box with the default **M**acro Name given as Macro1. This can be changed by you to some more meaningful name, if you so wished. Next, press the **O**ptions button on this dialogue box to reveal the additional dialogue box, as shown in the composite screen dump below.



In this second dialogue box we choose the **L**anguage and **S**hortcut **K**ey as 'MS Excel 4.0 Macro' and 'Ctrl+W', respectively.



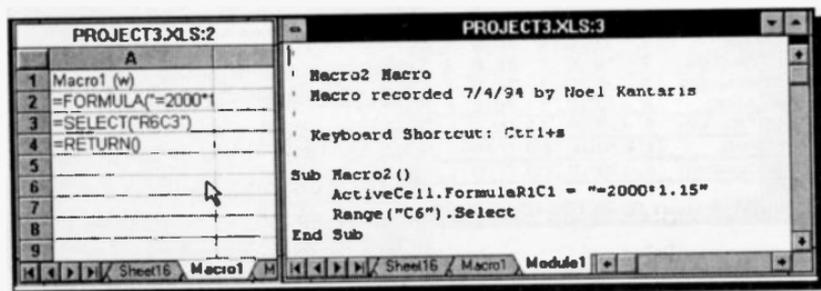
On pressing the OK button, Excel displays the Macro Stop button, shown here. Everything you type from now on becomes part of the macro. To start recording our macro, press/type the appropriate key/information, as shown overleaf.

F2  
 <Home>  
 =  
 <End>  
 \*1.15  
 <Enter>  
 Press ↑ arrow key  
 Press → arrow key.

followed by clicking the Macro Stop button (or by choosing **Tools, Record Macros, Stop Macros** command).

Next, change the entry in cell B6 back to 2000, and repeat the process of recording a new macro, but this time select in the second Record New Macro dialogue box 'Visual Basic' and 'Ctrl+s' for the **Language** and **Shortcut Key**, respectively.

To see both types of macros side-by-side, use the **Window, New Window** command twice, the first time highlighting the Macro1 tab (to be found beyond Sheet16), and the second time Module1 (to be found after Macro1), as shown below.



Before executing either of these macros, activate worksheet PROJECT3 and change the entry in cell B6 back to its original value of 2000 (it was changed by 15% while you were typing the latest macro commands), then save the macros with the worksheet, but giving your workbook the filename AUTOPRO1. This is a simple precaution because, should things go wrong and your macro does unpredictable things to your worksheet, it will be easier to reopen the original worksheet than it would be to correct it!

To run the first macro, place the cell pointer on cell B6, then press **Ctrl+w**, while to run the second macro, press **Ctrl+s**. In both cases the shortcut key starts the appropriate macro and changes automatically the entry in B6 by 15%.

## Programming Advantages with Visual Basic

From our simple example, the differences between the two ways of writing macros are almost indistinguishable. However, there are many advantages in using Visual Basic when the macros you write become more complicated.

In Visual Basic you can assign values directly to variables instead of storing a value in a name as you would have to do in the macro command language. Variables can be made available to all procedures, to just the procedure in a module, or to just a single procedure, thus being far more flexible than names. In addition, in Visual Basic you can define constants to hold static values that you refer to repeatedly.

### Reading Visual Basic Code:

Referring to our simple example, you can see that Visual Basic has created a macro that is preceded by comment statements (that start with an apostrophe (')) in which you are informed of the name of the macro, who created it and when, and the keyboard shortcut.

The macro commands are placed in between the two keywords **Sub** and **End Sub** which mark the beginning and end of a macro. In general, keywords, variables, operators, and procedure calls are referred to as statements which are the instructions to Excel to perform some action.

The statement

```
ActiveCell.FormulaR1C1 = "=2000*1.15"
```

is the way that Visual Basic enters the formula **=2000\*1.15** into the active cell. In Visual Basic terminology; it uses the **Range** object to identify the range you want to change and sets the **Formula** property of the range to assign a formula to the range.

An 'object' is something you control in Visual Basic. Each object has characteristics called 'properties' which control the appearance of the object. Objects also have 'methods' which are actions that they can take.

In Visual Basic, you use:

- Objects (such as Workbooks, Worksheets, Ranges, Charts) to perform a task. Each object has characteristics, called properties, that make that object useful by controlling the appearance or behaviour of an object.
- Properties (such as ActiveCell, ActiveSheet, Value, Selection, ColumnWidth, RowHeight), to examine the condition of an object by returning the value of one of the object's properties (such as a character string for Value, a numeric value for ColumnWidth, True, or False).
- Methods which are actions that objects can do (such as Calculate, Clear, Copy, Justify, or Table). Methods are a part of objects just like properties. The difference between them is that properties have values which are set or returned, while methods are actions you would like an object to perform.

Your Microsoft Excel package comes with a 334 page manual on Visual Basic which gives detailed explanation of how the language can be used effectively. The program, itself, also contains code samples (located in the EXAMPLES directory) which you can open, examine, and run. You can even copy parts of this code into your own applications.

## Editing a Macro

A macro can be edited by either double-clicking in the macro window or choosing the **Tools, Macro** command, then selecting the **Edit** button on the displayed dialogue box.

Since each of the three months are to be changed, we can replicate the first two entries of our macro, edit them appropriately so that reference is made to the correct amount of wages in the **ActiveCell.Formula** command and the correct cell reference in the **Range( ).Select** command and insert these before the **End Sub**. This is then repeated for the last month. The complete macro is shown on the next page.

	A	B	C	D	E	F	G	H
3		Jan	Feb	Mar	1st Quarter			
4	Income	£ 14,000.00	£ 15,000.00	£ 16,000.00	£ 45,000.00			
5	Costs:							
6	Wages	£ 2,300.00	£ 3,450.00	£ 4,600.00	£ 10,350.00			

AUTOPRO2.XLS:2

```

Sub Macro2 ()
  ActiveCell.FormulaR1C1 = "=2000*1.15"
  Range("C6").Select
  ActiveCell.FormulaR1C1 = "=3000*1.15"
  Range("D6").Select
  ActiveCell.FormulaR1C1 = "=4000*1.15"
  Range("E6").Select
End Sub

```

Now save this workbook under the filename AUTOPRO2 before attempting to run the changed macro. If your macro is correct, activating cell B6 and pressing **Ctrl+s** runs it and changes the values of the wages entries for the three months to those shown on the worksheet window above.

We could use the same macro to find out the effect of increasing wages by different percentages by editing it, but this would be rather inefficient. A better method is to allocate a cell for the % increase, say cell G5, and edit the macro so that reference to that cell is made in the R1C1 absolute format. In this example, from cell B6 we would have to refer to R[-1]C[5] (Row 1 above present position, Column 5 from present position) which is the reference to cell G5 from B6.

	A	B	C	D	E	F	G	H
5	Costs:					Inc=	1.15	
6	Wages	£ 2,300.00	£ 3,450.00	£ 4,600.00	£ 10,350.00			

AUTOPRO3.XLS:2

```

Sub Macro3 ()
  Range("B6").Select
  ActiveCell.FormulaR1C1 = "=2000 * R[-1]C[5]"
  Range("C6").Select
  ActiveCell.FormulaR1C1 = "=3000 * R[-1]C[4]"
  Range("D6").Select
  ActiveCell.FormulaR1C1 = "=4000 * R[-1]C[3]"
  Range("E6").Select
End Sub

```

Save the newly edited Macro(3) as Module3, and the worksheet as AUTOPRO3.

## Macro Interaction with Keyboard:

A further addition to the above macros could be made to allow for user entry of the 'increment' value from the keyboard, rather than having to edit cell G5. This can be achieved by the use of the **InputBox()** macro command, which creates a dialogue box and returns the information entered into it. The general format of this macro command is:

```
Variable = InputBox("message")
```

and returns the value typed on the keyboard into the *variable*.

In the macro shown overleaf, we have tried to show the power of Visual Basic without making the example too complicated. First you are asked to give a percentage rate, then the macro calculates the increment and places the value of rate in G5, and stores the original contents of B6:D6 into the three variables, Xjan, Xfeb, and Xmar.

Next, the calculations take place and the results are entered in cell range B6:D6. Finally, a dialogue box is displayed (it can be moved out of the way) asking you to press the OK button in order to restore the original contents to the 'Wages' cell range, and changes the contents of G5 to 0 (zero).

The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H
5	Costs:						% Change =	0
6	Wages	£2,000.00	£3,000.00	£4,000.00	£ 9,000.00			

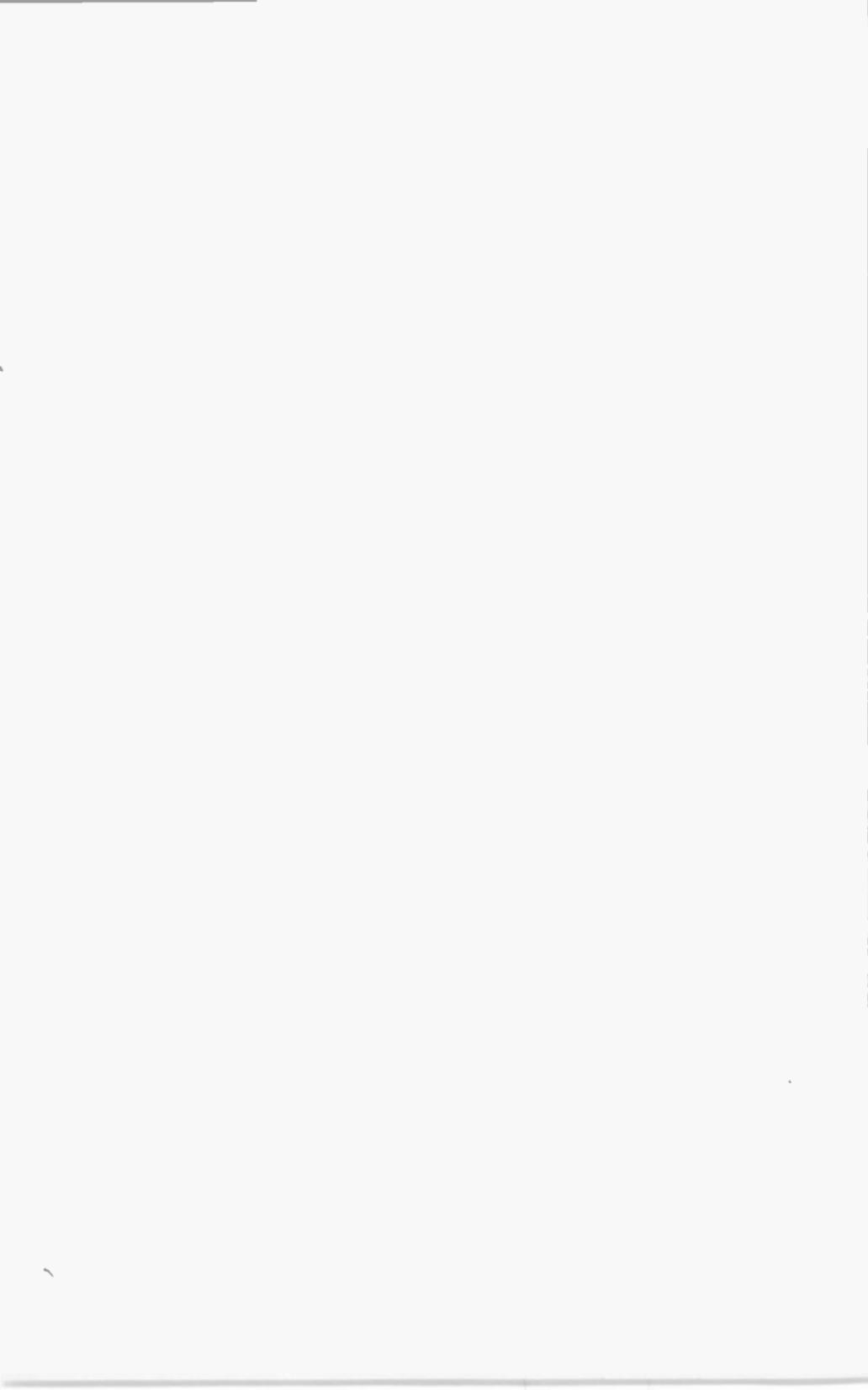
The VBA macro editor shows the following code:

```
Keyboard Shortcut: Ctrl+3  
Sub Macro4()  
Rate = InputBox("What percentage?") 'ask for an input value  
Inc = (Rate / 100) + 1 'calculate the multiplier  
Cells(5, 7).Value = Rate 'put Rate in cell G5  
Row = 6  
Col = 2  
Xjan = Cells(Row, Col) 'Read cell contents into variable  
Xfeb = Cells(Row, Col + 1)  
Xmar = Cells(Row, Col + 2)  
Cells(Row, Col).Value = Xjan * Inc 'Calculate new cell contents  
Cells(Row, Col + 1).Value = Xfeb * Inc  
Cells(Row, Col + 2).Value = Xmar * Inc  
MsgBox "To restore values press OK: "  
Cells(Row, Col).Value = Xjan 'Restore original values in cells  
Cells(Row, Col + 1).Value = Xfeb  
Cells(Row, Col + 2).Value = Xmar  
Cells(5, 7).Value = 0  
End Sub
```

This macro only works if the active worksheet is AUTOPRO4.XLS:1 when you start the macro. If the active sheet is the macro module, then a run time error is encountered.

Save this Macro(4) as Module4 and the worksheet as AUTOPRO4 before running it.

Visual Basic has many more statements, commands and functions which can be used to build and run your application in special ways. What we have tried to do in this chapter of the book is to introduce you to the subject and give you some overall idea of the power of this new programming language. A fuller explanation of Visual Basic is beyond the scope of this book.



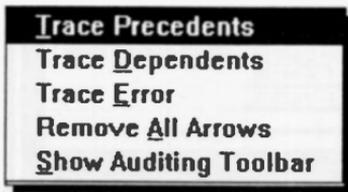
## 10. OTHER TOOLS AND CAPABILITIES

Apart from the **S**pelling tool, to be found under the **T**ools menu option, Excel comes with integrated Auditor, and tools to solve what-if type of problems such as the Goal Seek, What-if Tables, Solver and Scenarios. A short description of each of these is given below.

### The Auditor

You use the Auditor to analyse the way your worksheet is structured, or for locating the source of errors in formulae.

When you invoke the Auditor by selecting the **T**ools, **A**uditing command, the options sub-menu is displayed, as shown here.

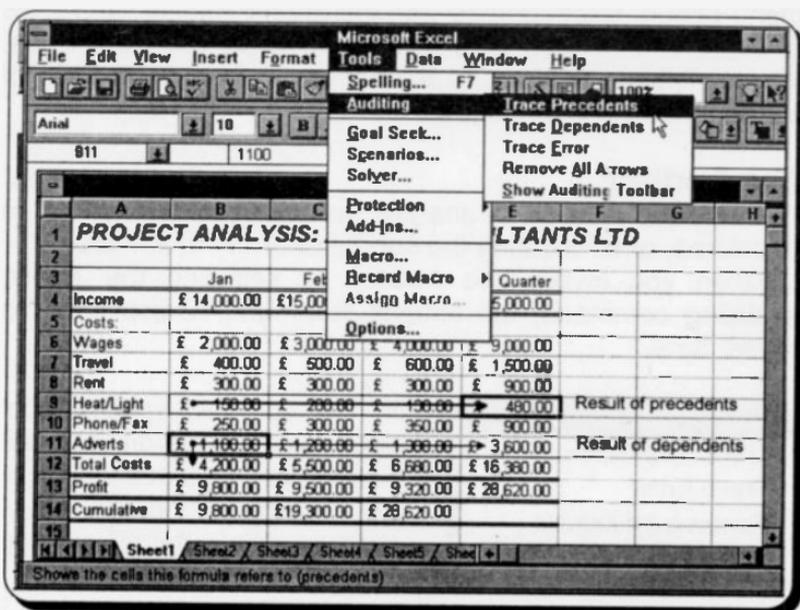


In this you can specify what you want to audit on the current file (for a description of the various options see below), the default being **T**race Precedents.

The Audit options have the following functions:

<i>Option</i>	<i>Function</i>
Trace precedents	Identifies all cells in the audit file that provide data for a particular formula.
Trace dependents	Identifies all formulae in the audit file that refer to a particular cell.
Trace Error	Identifies all cells involved in the production of an error, such as a circular reference.
Remove All Arrows	Removes the identifying arrows placed on the worksheet as a result of invoking the previous options.
Show Auditing Toolbar	Toggles the display of the Auditing Toolbar on and off.

As an example, we show below an audit on the file PROJECT3, for the first two options.



Save this file under the filename TOOLS1, as we will be using it to illustrate the next Excel Tool.

## The Goal Seek

You use the **Goal Seek** to fine-tune a formula that gives you the required result by changing one of the variables that affect the final value. As an example, we will use the information in the TOOLS1 file. If you don't have this file, use the PROJECT3 file and save it as TOOLS2.

To effectively use Goal Seek, you must adhere to the following procedure:

- Type the formula to be fine-tuned by Goal Seek in a cell. We will use the `=sum(B4:D4)` formula in cell E4 of our example.
- Invoke Goal Seek, by using the **Tools, Goal Seek** command which displays the Goal Seek dialogue box shown on the next page.

TOOLS1.XLS								
	A	B	C	D	E	F	G	H
1	<b>PROJECT ANALYSIS: ADEPT CONSULTANTS LTD</b>							
2								
3		Jan	Feb	Mar	1st Quarter			
4	Income	£ 14,000.00	£15,000.00	£ 16,000.00	£ 45,000.00			
5	Costs:							
6	Wages	£ 2,000.00	£ 3,000.00	£ 4,000.00	£ 9,000.00			
7	Travel	£ 400.00	£ 500.00	£ 600.00	£ 1,500.00			
8	Rent	£ 300.00	£ 300.00	£ 300.00	£ 900.00			
9	Heat/Light	£ 150.00	£ 200.00	£ 250.00	£ 600.00			
10	Phone/Fax	£ 250.00	£ 300.00	£ 350.00	£ 900.00			
11	Adverts	£ 1,100.00	£ 1,200.00	£ 1,300.00	£ 3,600.00			
12	Total Costs	£ 4,200.00	£ 5,500.00	£ 6,800.00	£ 16,500.00			
13	Profit	£ 9,800.00	£ 9,500.00	£ 9,200.00	£ 28,500.00			
14	Cumulative	£ 9,800.00	£19,300.00	£ 28,500.00				
15								

In this dialogue box you can specify in the **Set cell** box the address or range name of the cell that contains the formula you want to fine-tune, as shown above. In the **To value** box you type the value you want the formula in the formula cell to equate to when Goal Seek solves the problem, while in the **By changing cell** box the address of the cell whose value Goal Seek can change.

- Click the **OK** button to find an answer to the problem, displayed below. If it can't be done, you will be told.

	Jan	Feb	Mar	1st Quarter
Income	£ 15,000.00	£15,000.00	£ 16,000.00	£ 46,000.00
Costs:				
Wages				
Travel				
Rent				
Heat/Light				
Phone/Fax				
Adverts				
Total Costs				
Profit				
Cumulative				

If you don't want to lose the original values in the adjustable cell, then press the **Cancel** button.

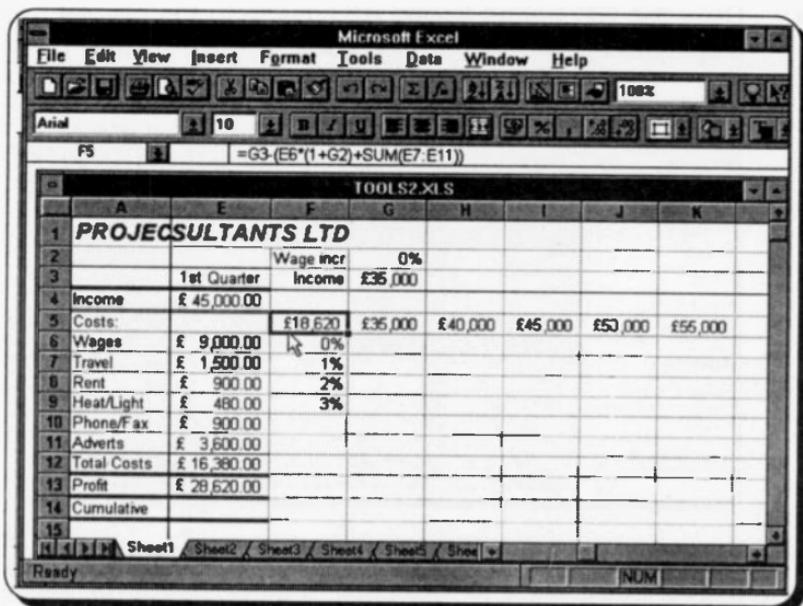
## What-if Tables

What-if tables are used if you require to calculate and display the results of substituting different values for one or more (up to three) variables in a formula.

For example, suppose we wanted to examine the effect to the quarterly profits of ADEPT Consultants if we varied the quarterly income from £35,000 to £55,000, in steps of £5,000. This problem is, of course, rather trivial, but suppose at the same time we expected a wage award increase of between 0% to 3%, while all other costs were tied to inflation which could change from 3% to 5%. This becomes rather difficult to analyse. However, using what-if tables reduces the problem to something more manageable.

### A Two-Input What-if Table:

To illustrate the above problem, but simplifying it by forgetting inflation for the moment, we will use the TOOLS1 file (you could use PROJECT3 instead). Use the **Window, Freeze Panes** command, then fill in the range F2:K9, as shown below:



The screenshot shows a Microsoft Excel window titled 'TOOLS2.XLS'. The spreadsheet contains the following data:

	A	E	F	G	H	I	J	K
1	<b>PROJECTSULTANTS LTD</b>							
2			Wage incr	0%				
3		1st Quarter	Income	£35,000				
4	Income	£ 45,000.00						
5	Costs:		£18,620	£35,000	£40,000	£45,000	£50,000	£55,000
6	Wages	£ 9,000.00	0%					
7	Travel	£ 1,500.00	1%					
8	Rent	£ 900.00	2%					
9	Heat/Light	£ 480.00	3%					
10	Phone/Fax	£ 900.00						
11	Adverts	£ 3,500.00						
12	Total Costs	£ 16,360.00						
13	Profit	£ 28,620.00						
14	Cumulative							
15								

The formula bar shows the formula for cell F5:  $=G3-(E5*(1+G2))+SUM(E7:E11)$ .

**Note:** A two-input what-if table has two input cells - in our example these are: Input 1 in cell G2 (which refers to the rows) and input 2 in cell G3 (which refers to the columns), representing 'Wage increases' and 'Income', respectively. The value in each of these cells is the first value in their respective ranges, which are F6:F9 and G6:K5. Thus, income varies from £35,000 to £55,000, while wage increases vary from 0% to 3%. Finally, a formula is required in cell F5 which represents profits and which refers to the two inputs cells defined above. The formula used is:

$$=G3 - (E6 * (1 + G2 + \text{SUM}(E7:E11)))$$

To verify that this formula is correct, change the input in the 'Income' cell (G3) to £45,000, which should give you the same profit in cell F5 as that shown in cell E13.

The formula in a two-input what-if table must be placed in the top-left corner of the table. Which cell is declared as a 'row input' and a 'column input' in the Table dialogue box is very important. In the case of a one-input what-if table, Excel expects the input range to be either in one column, with the formula placed at the top of the next column to the right of the input column, or in one row, with the formula placed at the top of the next row to the left of the input row.

Before proceeding with the analysis of our problem, save your work under the filename TOOLS3, then select the effective table range F5:K9 by highlighting it. Next, use the **Data, Table** command and enter in the displayed dialogue box the information shown below:

	A	E	F	G	H	I	J	K	
1	<b>PROJECULTANTS LTD</b>								
2			Wage incr	0%					
3		1st Quarter	Income	£35,000					
4	Income	£ 45,000.00							
5	Costs:		£18,620	£35,000	£40,000	£45,000	£50,000	£55,000	
6	Wages	£ 9,000.00	0%						
7	Travel	£ 1,500.00	1%						
8	Rent	£ 900.00	2%						
9	Heat/Light	£ 480.00	3%						
10	Phone/Fax	£ 900.00							
11	Adverts	£ 3,600.00							
12	Total Costs	£ 16,380.00							
13	Profit	£ 28,620.00							

Selecting the OK button, displays the following results:

TOOLS3.XLS								
A	E	F	G	H	I	J	K	
1	<b>PROJEC</b>							
2		Wage incr	0%					
3	1st Quarter	Income	£35,000					
4	Income	£ 45,000.00						
5	Costs:		£18,620	£35,000	£40,000	£45,000	£50,000	
6	Wages	£ 9,000.00	0%	£18,620	£23,620	£28,620	£33,620	
7	Travel	£ 1,500.00	1%	£18,530	£23,530	£28,530	£33,530	
8	Rent	£ 900.00	2%	£18,440	£23,440	£28,440	£33,440	
9	Heat/Light	£ 480.00	3%	£18,350	£23,350	£28,350	£33,350	
10	Phone/Fax	£ 900.00						
11	Adverts	£ 3,600.00						
12	<b>Total Costs</b>	<b>£ 16,360.00</b>						
13	Profit	£ 28,620.00						

### Editing a Data Table:

The input values and formula in the top leftmost column of a data table can be edited at any time. However, the actual results calculated within the data table cannot be edited individually, because they are an array. Some editing operations require you to select the entire data table, while others require you to select only the resulting values. For example:

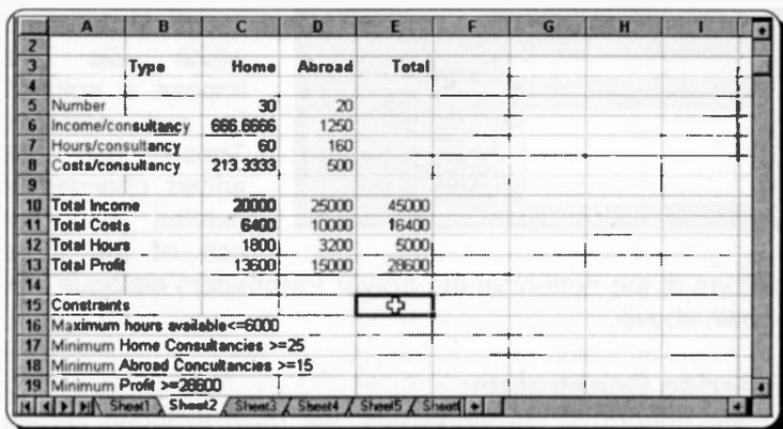
- To clear the resulting values from a data table, select the resulting values only (G6:G9 in our example) and press the <Del> key. Individual resulting values cannot be cleared separately.
- To copy resulting values from a data table, select them and use the **Edit, Copy** command. Doing this results in copying the values only, not the formulae for those values. Subsequent use of the **Past Special** command converts the resulting values array into a range of constant values.
- To move, delete, or modify a table, first select the entire data table (F5:K9 in our example). If you are moving the table, having selected it, then click the border of the selection and drag it to a new location on your worksheet.

## The Solver

You use the Solver if you want to analyse data in a worksheet and solve 'what-if' type of problems. Solver is ideal for problems that have more than one answer. It can investigate different options and present you with alternative solutions, including the best match to your requirements.

To use Solver, you start with a worksheet model. Solver problems can be set up in one or more worksheet files in memory, by selecting which cells to adjust, adding logical formulae, and defining the limits of the required answers.

As an example, let us analyse more closely ADEPT Consultants' 1st Quarter results. We use the information held in Sheet1 of the TOOLS1 file (you could use the PROJECT3 file instead). On a Sheet other than Sheet1 of either file, we add the following information:



The screenshot shows an Excel spreadsheet with the following data and constraints:

	A	B	C	D	E	F	G	H	I
2									
3		Type	Home	Abroad	Total				
4									
5	Number		30	20					
6	Income/consultancy		666.6666	1250					
7	Hours/consultancy		60	160					
8	Costs/consultancy		213.3333	500					
9									
10	Total income		20000	25000	45000				
11	Total Costs		6400	10000	16400				
12	Total Hours		1800	3200	5000				
13	Total Profit		13600	15000	28600				
14									
15	Constraints								
16	Maximum hours available		<=6000						
17	Minimum Home Consultancies		>=25						
18	Minimum Abroad Consultancies		>=15						
19	Minimum Profit		>=28600						

What we assume here is that ADEPT Consultants operate both at home and abroad. In the first quarter they undertook 30 consultancies at home and 20 consultancies abroad. The range C5:D8 holds numerical information on the income, hours taken, and the costs per consultancy, respectively.

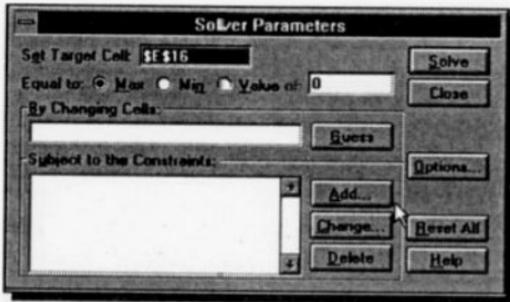
In range C10:D13 we have entered formulae to calculate the total income, costs, hours spent, and profit made from each type of consultancy from information held in range C5:D8, while range E10:E13 summates the two types of consultancies.

Cells E12 and E13 hold the total time spent in consultancies and the total profit made, respectively, which is very important information.

What we would like to do now is to increase the consultancies to make up the maximum available time in the three month period, which is 6000 hours, while maximising the profit. The question is 'what mixture of consultancies (home or abroad) is more profitable given two more constraints'?

### Starting the Solver:

To start Solver use the **Data, Solver** command, which displays the following Solver Parameters dialogue box:

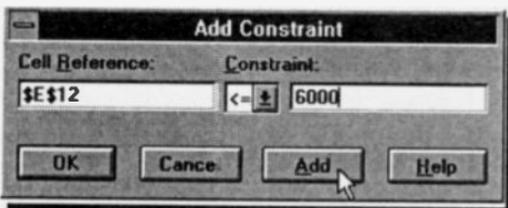


Next, we would like to enter the constraints under which we will impose a solution to our problem. These can be added, changed or deleted with the use of the three

buttons at the bottom of the Solver Parameters dialogue box shown above.

### Entering Constraints:

At the bottom of the worksheet, we have included certain constraints, discussed on the next page, which are entered as logical formulae. These are entered in the Add Constraint dialogue box, shown here, by clicking the **Add** button on the



Solver Parameters dialogue box. After entering each one of these, press the **Add** button so that you can enter the next one.

The logic behind these constraints is as follows:

- Since the maximum available hours in a quarter must remain less than or equal to 6000 hours, we enter in cell E16 the formula  $E12 \leq 6000$ .
- Since a long term contract with the government requires that at least 25 consultancies are undertaken at home, we enter in cell E17 the formula  $C5 \geq 25$ .
- Since a similar long term contract with a foreign government requires that at least 15 consultancies are undertaken abroad, we enter in cell E18 the formula  $D5 \geq 15$ .
- Since we would like to maximise profits, we enter in cell E19 the formula  $E13 \geq 28600$ .

After entering these logical formulae using the Add Constraint dialogue box, and before going any further, save your work as TOOLS4.

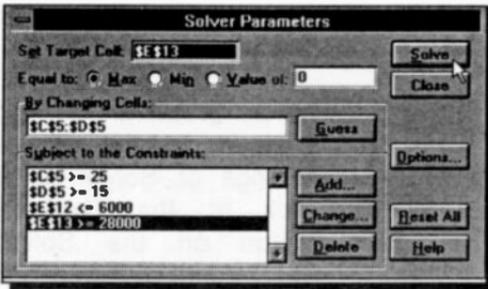
### Solving a Problem:

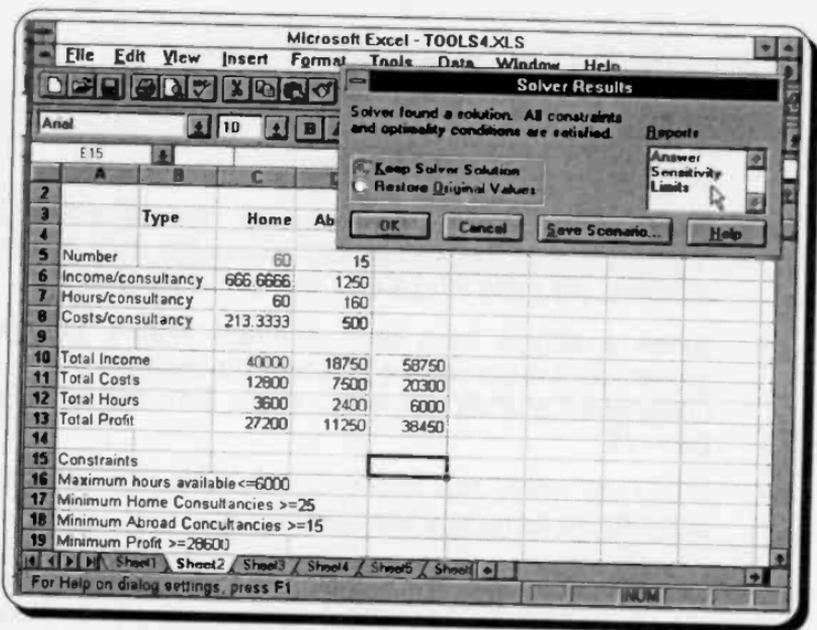
Once the last constraint is inserted into the Add Constraint dialogue box, pressing the OK button causes the return of the Solver Preferences box.

Next, specify the **Set Target Cell**, as shown, then the adjustable cells in the **By Changing Cells** box - these

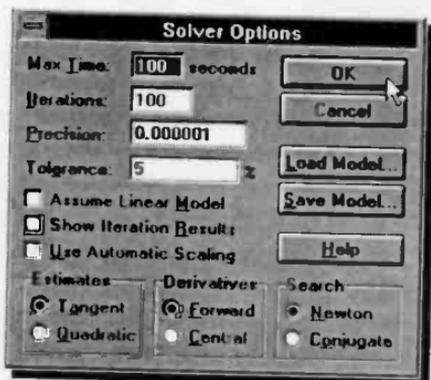
are cells that contain values that Solver can adjust when it searches for an answer, and finally, press the **Solve** button.

When Solver finds a solution, it places the answer in the worksheet and displays the Solver Results dialogue box, as shown on the next page.





You now have a choice of either keeping the values found by Solver, or reverting to the original worksheet values. Also from the **Reports** section of the dialogue box you can choose to display one of three report types: Answer, Sensitivity, and Limits. Selecting one of these causes Excel to produce an appropriate report and place it in a separate Sheet.



If a problem is too complex for the default settings of Solver, then click at the **Options** button on the Solver Parameters dialogue box to display the Solver Options dialogue box. From within this dialogue box you can change the time limit for solving a problem, the maximum iterations allowed, and

even select the type of model to be used.

## Managing What-if Scenarios

There are times when we would like to examine different what-if scenarios created from a single spreadsheet model. Normally, managers tend to copy the model to different parts of the spreadsheet so as to examine and display different assumptions. However, keeping track of all the different assumptions can become extremely problematic, mostly confusing, and indeed wasteful of spreadsheet space and, therefore, computer memory.

With Excel you can use the Scenario Manager to keep all the different versions of the same worksheet model together. In addition, you can also give each version a meaningful name, such as 'Original Case', 'Best Case', and 'Worst Case'.

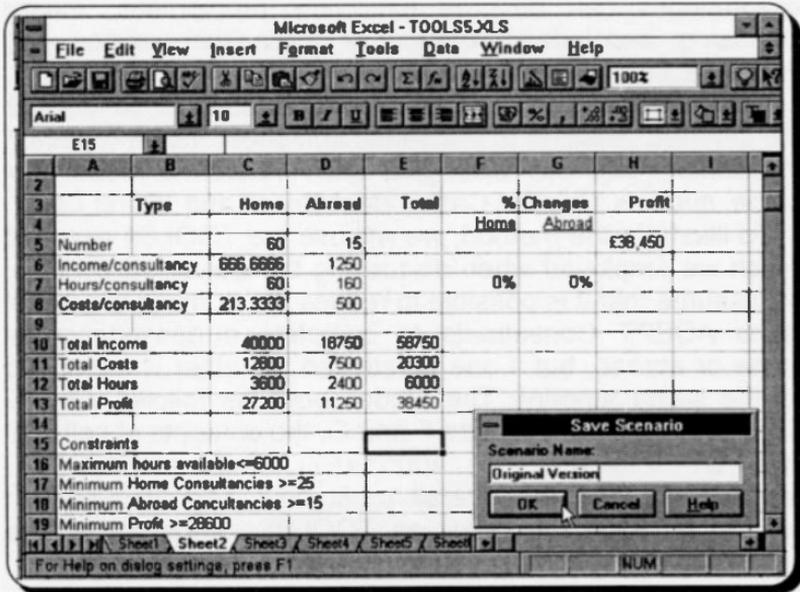
To illustrate the method, we will use the TOOLS4 example which we employed when discussing the Solver. In addition, we assume that it is possible to reduce the number of hours it takes ADEPT Consultants to complete a consultancy at home or abroad, but if one is reduced the other is increased by the same amount. The model looks as follows with '% Changes' added in columns F and G, the contents of cells C7 and D7 changed to  $=60*(1+F7)$  and  $=160*(1+G7)$ , respectively, and the overall profit now also displayed in column H. Save the result as TOOLS5. Since we will be optimising our solutions, you must learn to use Solver first.

	A	B	C	D	E	F	G	H	I
2									
3		Type	Home	Abroad	Total	% Changes		Profit	
4						Home	Abroad		
5	Number		30	20				£28,600	
6	Income/consultancy		666.6666	1250					
7	Hours/consultancy		60	160		0%	0%		
8	Costs/consultancy		213.3333	500					
9									
10	Total Income		20000	25000	45000				
11	Total Costs		6400	10000	16400				
12	Total Hours		1800	3200	5000				
13	Total Profit		13600	15000	28600				
14									
15	Constraints								
16	Maximum hours available		≤6000						
17	Minimum Home Consultancies		≥25						
18	Minimum Abroad Consultancies		≥15						
19	Minimum Profit		≥28600						

Now enter 0% change on the hours per consultancy on both the home and abroad input cells, then run the Solver for an

optimum answer on profits using the already defined constraints. This gives us a profit of £38,450, which is in fact our no change scenario.

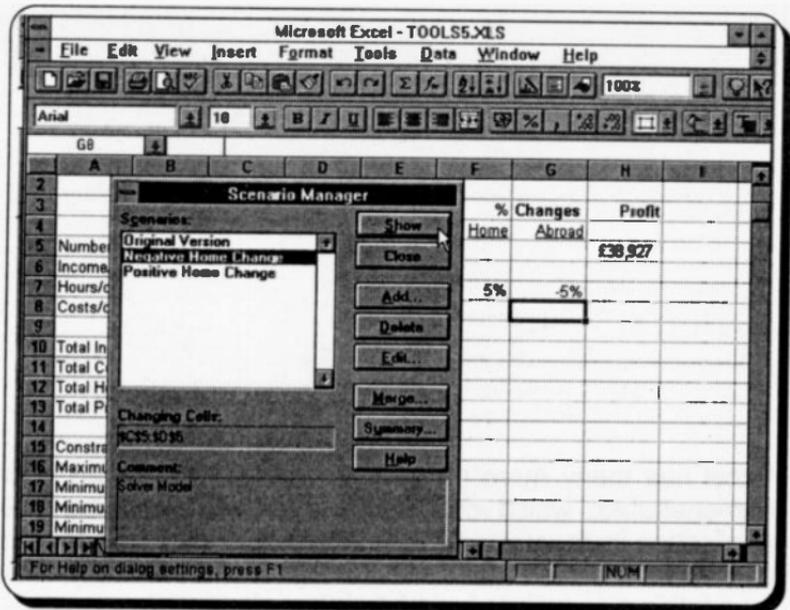
Next, click the **Save Scenario** button on the Solver Results dialogue box to activate the Scenario Manager which displays the Save Scenario dialogue box, as shown below.



Now add the description 'Original Version' and press the OK button, which returns you to the Solver Results dialogue box. Next, press the OK button to 'Keep the Solver Solution' then change the contents of cells F7 and G7 to -5% and 5%, respectively, and activate the Solver for an optimum answer on profits, saving the scenario as 'Negative Home Change'.

Finally, change the contents of cells F7 and G7 to 5% and -5%, respectively, and then repeat the above procedure, but saving this version as 'Positive Home Change'.

To see and select any one of the defined scenarios, use the **Tools, Scenarios** command which displays the Scenario Manager dialogue box, shown on the next page, with all the different versions of our solutions listed. To look at the results of one of these, simply highlight it and press the **Show** button.



Save the above work as TOOLS6, if you plan to work with it.

Last but not least, Scenario Manager allows you to merge several versions together and define them as a scenario, and create a summary report - you have a choice of two. The first report is a 'scenario summary', while the second is a 'scenario pivot table'. With the pivot table you get an instant what-if analysis of different scenario combinations.

\* \* \*

Excel has many more commands and functions than those demonstrated, which can be used to build and run your application in special ways. What this book has tried to do is to introduce you to the overall subject and provide a solid foundation on which to build future knowledge.

\* \* \*

## APPENDIX A - FUNCTIONS

Excel's functions are built-in formulae that perform specialised calculations. Their general format is:

`name(arg1,arg2,...)`

where 'name' is the function name, and 'arg1', 'arg2', etc., are the arguments required for the evaluation of the function. Arguments must appear in a parenthesized list as shown above and their exact number depends on the function being used. However, some functions do not require arguments and are used without parentheses. Examples of these are: FALSE, NA, NOW, PI, RAND, TODAY and TRUE.

There are four types of arguments used with functions: numeric values, range values, string values and conditions, the type used being dependent on the type of function. Numeric value arguments can be entered either directly as numbers, as a cell address, a cell range name or as a formula. Range value arguments can be entered either as a range address or a range name, while string value arguments can be entered as an actual value (a string in double quotes), as a cell address, a cell name, or a formula. Condition arguments normally use logical operators or refer to an address containing a logic formula.

### **Types of Functions**

There are several types of functions in Excel 5, such as mathematical and trigonometric, logical, financial, statistical, text, date and time, information, database, lookup and reference, and commands. Each type requires its own number and type of arguments. These are listed on the next few pages under the various function categories. This release of Excel includes a number of completely new functions, which in fact are not detailed on paper. To find out in detail how these functions can be used, use the Function Wizard, locate the function of interest and press the Help button.

## Mathematical and Trigonometric Functions:

These functions evaluate a result using numeric arguments. The various functions and what they return are as follows:

<i>Function</i>	<i>Returns</i>
ABS(X)	The absolute value of X.
ACOS(X)	The angle in radians, whose cosine is X (arc cos of X).
ACOSH(X)	The arc (inverse) hyperbolic cosine using the hyperbolic cosine X of an angle.
ASIN(X)	The angle in radians, whose sine is X (arc sin of X).
SINH(X)	The hyperbolic sine of angle X.
ATAN(X)	The angle in radians, between $\pi/2$ and $-\pi/2$ , whose tangent is X (arc tan of X - 2 quadrant).
ATAN2(X,Y)	The angle in radians, between $\pi$ and $-\pi$ , whose tangent is Y/X (arc tan of Y/X - 4 quadrant).
ATANH(X)	The arc (inverse) hyperbolic tangent using the hyperbolic tangent X.
CEILING(N,Sig)	The rounded value of N to nearest integer or nearest multiple of significance.
COMBIN(N,Obj)	The number of combinations N for a given number of objects Obj.
COS(X)	The cosine of X (X in radians).
COSH(X)	The hyperbolic cosine of X.
COUNTBLANK(Rg)	The number of blank cells within range Rg.

COUNTIF(Rg, Cr)	The number of non-blank cells within a range Rg.
DEGREES(X)	The value in degrees in X radians.
EVEN(X)	The rounded value of X away from 0 to the nearest even integer.
EXP(X)	The value of e raised to the power of X.
FACT(X)	The factorial of X.
FLOOR(N, Sig)	A number N down towards zero by nearest multiple of significance Sig.
INT(X)	The integer part of X.
LN(X)	The natural log (base e) of X.
LOG(X,N)	The log of X to a specified base N.
LOG10(X)	The log (base 10) of X.
MDETERM(Ar)	The matrix determinant of an array.
MINVERSE(Ar)	The matrix inverse of an array.
MMULT(Ar1,Ar2)	The matrix product of two arrays.
MOD(X,Y)	The remainder of X/Y.
ODD(X)	The rounded value of X away from 0 to the nearest odd integer.
PI()	The value of $\pi$ (3.1415926).
POWER(X,N)	The value of X raised to the power of N.
PRODUCT(Ls)	The result of multiplying the values in list Ls.

RADIANS(X)	The value in radians of X degrees.
RAND()	A random number between 0 and 1.
ROMAN(N,Fm)	The Roman format (as text) of number N.
ROUND(X,N)	The value of X rounded to N places.
ROUNDDOWN(X,N)	The rounded value of X down to the nearest multiple of the power of 10 specified by N.
ROUNDUP(X,N)	The rounded value of X up to the nearest multiple of the power of 10 specified by N.
SIGN(X)	The value of 1 if X is a positive, 0 if X is 0, and -1 if X is negative.
SIN(X)	The sine of angle X (X in radians).
SINH(X)	The hyperbolic sine of angle X (X in radians).
SQRT(X)	The square root of X.
SUBTOTAL(Ls)	The subtotal in a list Ls or a database.
SUM(Rg)	The sum of values in range Rg.
SUMIF(Rg,Cr)	The sum in range Rg that meet a given criteria Cr.
SUMPRODUCT(Ar1,Ar2)	The sum of the products of array components.
SUMSQ(N1,N2)	The sum of the squares of the arguments.

SUMX2MY2(Ar1,Ar2)	The sum of the difference of squares of corresponding values in two arrays.
SUMX2PY2(Ar1,Ar2)	The sum of the sum of squares of corresponding values in two arrays.
SUMXMY2(Ar1,Ar2)	The sum of squares of differences of corresponding values in two arrays.
TAN(X)	The tangent of angle X (X in radians).
TANH(X)	The hyperbolic tangent of angle X (X in radians).
TRUNC(X,N)	The truncated value of X to N decimal places.

### Logical Functions:

Logical functions produce a value based on the result of a conditional statement, using numeric arguments. The various functions and what they return are as follows:

<i>Function</i>	<i>Returns</i>
AND(N1,N2,N3,..)	The logical value 1 (TRUE) if all its arguments are TRUE.
FALSE()	The logical value 0.
IF(Cr,X,Y)	The value X if Cr is TRUE and Y if Cr is FALSE.
NOT(N)	The reverse logic of its argument N.
OR(N1, N2, ..)	The logical value 1 (TRUE) if any argument is TRUE.
TRUE()	The logical value 1.

## Financial Functions:

Financial functions evaluate loans, annuities, depreciation and cash flows over a period of time, using numeric arguments. Where an optional parameter [Tp] is given the function will calculate for either an ordinary annuity or an annuity due, depending on the value you specified for type Tp. Percentages should be entered either as a decimal (for example, 0.155) or with a percent sign (for example, 15.5%). The various functions and what they return are as follows:

<i>Function</i>	<i>Returns</i>
DB(Ct,Sg,Lf,Pd)	The depreciation allowance of an asset with an initial value of Ct, life Lf, a final salvage value Sg for a specified period Pd, using the declining balance method.
DDB(Ct,Sg,Lf,Pd)	The double-declining depreciation allowance of an asset, with original cost Ct, predicted salvage value Sg, life Lf, and period Pd.
FV(Rt,Tm,Pt)	The future value of a series of equal payments, each of equal amount Pt, earning a periodic interest rate Rt, over a number of payment periods in term Tm.
IPMT(Rt,Pr,Tm,Pv)	The interest payment for a given period Pr (which must be between 1 and Tm) of a total term Tm of a loan with present value Pv at a constant interest rate Rt.
IRR(Rg,Gs)	The internal rate of return of the series of cash flows in a range Rg, based on the approximate percentage guess Gs.

MIRR( $R_g, F_r, R_r$ )	The modified internal rate of return for a series of cash-flows, in a range $R_g$ , with interest rates, $F_r$ , paid on money used in cash flows and $R_r$ received on reinvested cash flows.
NPER( $R_t, P_t, P_v, F_v$ )	The number of periods required for a series of equal payments $P_t$ , with a present-value $P_v$ , to accumulate a future-value $F_v$ , at a periodic interest rate $R_t$ .
NPV( $R_t, R_g$ )	The net present value of the series of future cash flows in range $R_g$ , discounted at a periodic interest rate $R_t$ .
PMT( $R_t, T_m, P_v, F_v$ )	The payment on a loan with present value $P_v$ , at interest rate $R_t$ , for $T_m$ number of payments and future value $F_v$ .
PPMT( $R_t, P_r, T_m, P_v, F_v$ )	The principal portion of the periodic payment on a loan of present value $P_v$ , at interest rate $R_t$ for payment periods $P_r$ (between 1 and $T_m$ , the number of payment periods in an annuity), leading to a future value $F_v$ .
PV( $R_t, T_m, P_t$ )	The present value of a series of payments, each of amount $P_t$ , discounted at a periodic interest rate $R_t$ , over a number of payment periods in term $T_m$ .
RATE( $T_m, P_t, P_v, F_v$ )	The periodic interest rate necessary for a present value $P_v$ to grow to a future value $F_v$ , over the number of compounding periods in term $T_m$ at $P_t$ payments per period.

SLN(Ct,Sg,Lf)	The straight line depreciation of an asset of cost Ct for one period, given its predicted salvage value Sg, and life Lf.
SYD(Ct,Sg,Lf,Pd)	The sum-of-the-years' digits depreciation of an asset of cost Ct, given its predicted salvage value Sg, life Lf, and period Pd.
VDB(Ct,Sg,Lf,S,E,d,s)	The depreciation of an asset of cost Ct, salvage value Sg, life Lf, over a period from start S to end E. Depreciation-factor <i>d</i> and switch <i>s</i> , are optional. If <i>s</i> is 1 it returns declining balance depreciation for life, else straight-line is used after E.

### Statistical Functions:

Statistical functions evaluate lists of values using numeric arguments or cell ranges. The various functions and what they return are as follows:

<i>Function</i>	<i>Returns</i>
AVEDEV(Ls)	The average of the absolute deviations of values in list Ls.
AVERAGE(Rg)	The average of values in range Rg.
BETADIST(X,AI,Bt,A,B)	The cumulative beta probability density function.
BETAINV(Pb,AI,Bt,A,B)	The inverse of the cumulative beta probability function.
BINOMDIST(Sc,Tr,Pb,Tp)	The cumulative distribution function if Tp is TRUE, else the probability mass function, with Tr independent trials and Sc successes in trials and Pr probability of success per trial.

CHIDIST(X,Fr)	The chi-square distribution, evaluated at X and Fr degrees of freedom for the sample.
CHINV(X,Fr)	The inverse of the one-tailed probability of the chi-squared distribution.
CHITEST(Rg1,Rg2)	The chi-square test for independence on the data in range Rg1, or a chi-square test for goodness of fit on the data in ranges Rg1 and Rg2.
CONFIDENCE(AI,Sd,Sz)	The confidence interval for a population mean.
CORREL(Rg1,Rg2)	The correlation coefficient of values in ranges Rg1 and Rg2.
COUNT(Ls)	The number of values in a list.
COUNTA(Rg)	The number of non-blank values in a range Rg.
COVAR(Rg1,Rg2)	The sample covariance of the values in ranges Rg1 and Rg2.
CRITBINOM(Tr,Pb,AI)	The largest integer for which the cumulative binomial distribution is less than or equal to AI, with Tr Bernoulli trials and a probability of success for a single Bernoulli trial Pb.
DEVSQ(Ls)	The sum of squared deviations of the values in list Ls, from their mean.
EXPONDIST(X,Lm,Ds)	The exponential distribution.
FDIST(X,Fr1,Fr2)	The F-distribution at value X with Fr1 and Fr2 degrees of freedom for the first and second samples.

FINV(Pb,Fr1,Fr2)	The inverse of the F probability distribution.
FISHER(X)	The Fisher transformation.
FISHERINV(Y)	The inverse of the Fisher transformation.
FORECAST(X,Yo,Xo)	The value along a linear trend.
FREQUENCY(Rg,Bin)	The frequency distribution as a vertical array Bin.
FTEST(Rg1,Rg2)	The associated probability of an F-test on data in ranges Rg1 and Rg2. Used to determine if two samples have different variances.
GAMMADIST(X,AI,Bt,Cm)	The gamma distribution.
GAMMAINV(Pb,AI,Bt)	The inverse of the gamma cumulative distribution.
GAMMALN(X)	The natural logarithm of the gamma function.
GEOMEAN(Ls)	Returns the geometric mean of the values in list Ls.
GROWTH(Yo,Xo,Xn,Ct)	The values along an exponential trend.
HARMEAN(Ls)	The harmonic mean of the values in list Ls.
HYPGEOMDIST(Ns,Ssiz,Pp,Psiz)	The hypergeometric distribution probability of a given number of successes Ns, given the sample size Ssiz, population success Pp and population size Psiz.
INTERCEPT(Yo,Xo)	The intercept of the linear regression line.

<b>KURT(Rg)</b>	The kurtosis of the values in range Rg.
<b>LARGE(Arr,K)</b>	The largest value in a data set.
<b>LINEST(Yo,Xo,Ct,St)</b>	The parameters of a linear trend.
<b>LOGEST(Yo,Xo,Ct,St)</b>	The parameters of an exponential trend.
<b>LOGINV(Pb,Mn,Sd)</b>	The inverse of the lognormal distribution with parameters mean Mn and standard deviation Sd.
<b>LOGNORMDIST(X,Mn,Sd)</b>	The cumulative lognormal distribution with parameters mean Mn and standard deviation Sd.
<b>MAX(Rg)</b>	The maximum value in a range.
<b>MEDIAN(Ls)</b>	The median value in list Ls.
<b>MIN(Rg)</b>	The minimum value in a range.
<b>MODE(Ls)</b>	The most common value in a data set.
<b>NEGBINOMDIST(Nf,Ns,Pb)</b>	The negative binomial distribution that there will be a number of failures Nf before the number of successes Ns, when the constant probability of success is Pb.
<b>NORMDIST(X,Mn,Sd)</b>	The normal cumulative distribution function for X, with a distribution mean Mn and optional standard deviation Sd.
<b>NORMINV(Pb,Mn,Sd)</b>	The inverse of the normal cumulative distribution.

NORMSDIST(X)	The standard normal cumulative distribution.
NORMSINV(Pb)	The inverse of the standard normal cumulative distribution.
PEARSON(Ar1,Ar2)	The Pearson product moment correlation coefficient.
PERCENTILE(Rg,K)	The Kth sample percentile among the values in range Rg.
PERCENTRANK(Ar,X,Sg)	The percentage rank of a value in a data set.
PERMUT(N,Nc)	The number of ordered sequences (permutations) of Nc chosen objects that can be selected from a total of N objects.
POISSON(X,Mn,Cm)	The Poisson distribution (depending on cumulative factor Cm) of X observed events and Mn expected number of events.
PROB(Rgx,Pb,LI,UI)	The probability that values in Rgx range are within lower limit LI and upper limit UI of probability Pb.
QUARTILE(Ar,Qrt)	The quartile of a data set.
RANK(It,Rg,Od)	The relative size or position of a value It in a range Rg, relative to other values in the range, ranked in order Od.
RSQ(Yo,Xo)	The square of the Pearson product moment correlation coefficient.
SKEW(Rg)	The skewness of the values in range Rg.
SLOPE(Yo,Xo)	The slope of the linear regression line.

SMALL(Ar,K)	The Kth smallest value in a data set.
STANDARDIZE(X,Mn,Sd)	The normalised value of X from a distribution characterised by mean Mn and standard deviation Sd.
STDEV(Rg)	The population standard deviation of values in range Rg.
STDEVP(Rg)	The standard deviation based on the entire population.
STEYX(Yo,Xo)	The standard error of the predicted y-value for each X in the regression.
TDIST(X,Fr,Tr)	The Student's t-distribution, evaluated at X and Fr degrees of freedom for the sample, with test direction Tr.
TINV(Pb,Fr)	The inverse of the Student's t-distribution.
TREND(Xo,Yo,Xn,Cn)	The values along a linear trend.
TRIMMEAN(Ar,Pb)	The mean of the interior of a data set.
TTEST(Rg1,Rg2,Tl,Tp)	The probability associated with a Student's t-test.
VAR(Rg)	The sample variance of values in range Rg.
VARP(Rg)	The variance of values in range Rg based on entire population.
WEIBULL(X,AI,Bt,Cm)	The Weibull distribution.
ZTEST(Arr,X,Sg)	Returns the two-tailed P-value of a z-test.

## **Text Functions:**

String functions operate on strings and produce numeric or string values dependent on the function.

<i><b>Function</b></i>	<i><b>Returns</b></i>
CHAR(X)	The character that corresponds to the code number X.
CLEAN(Sg)	The specified string having removed all non-printable characters from it.
CODE(Sg)	The code number for the first character in string Sg.
CONCATENATE(Sg1,Sg2)	One string made up of several strings.
DOLLAR(N,Dm)	A number in text form, using currency format.
EXACT(Sg1,Sg2)	The value 1 (TRUE) if strings Sg1 and Sg2 are exactly alike, otherwise 0 (FALSE).
FIND(Ss,Sg,Sn)	The position at which the first occurrence of search string Ss begins in string Sg, starting the search from search number Sn.
FIXED(N,Dm,Nc)	A number N formatted as text with a fixed number of decimals Dm. Nc is a logical value and if TRUE prevents the inclusion of commas.
LEFT(Sg,N)	The first (leftmost) N characters in string Sg.
LEN(Sg)	The number of characters in string Sg.

LOWER(Sg)	A string with all the letters in Sg converted to lowercase.
MID(Sg,Sn,N)	The N characters from string Sg beginning with the character at Sn.
PROPER(Sg)	A string with all words in string Sg changed to first letter in uppercase and the rest in lowercase.
REPLACE(O,S,N,Ns)	A string with N characters removed from original string O, starting at character S and then inserts new string Ns in the vacated place.
REPT(Sg,N)	A repeated string Sg, N times. Unlike the repeating character (\), the output is not limited by the column width.
RIGHT(Sg,N)	The last (rightmost) N characters in string Sg.
SEARCH(Sg1,O,S)	String Sg1 in original string O, starting at character S.
SUBSTITUTE(Sg,O,Ns,N)	A new string Ns substituted for old string O in a string Sg. N specifies which occurrence of the old text you want to replace.
T(X)	A value X converted into text.
TEXT(X,Fm)	A number X formatted into text.
TRIM(Sg)	A string Sg with no leading, trailing or consecutive spaces.
UPPER(Sg)	All letters in string Sg converted to uppercase.
VALUE(Sg)	The numeric value of string Sg.

## **Date and Time Functions:**

These generate and use serial numbers with dates having integer serial numbers between 1 and 65380 to represent dates between 1 January, 1900 and 31 December 2078, and time having decimal serial numbers starting with 0.000 at midnight and ending with 0.99999 next midnight. Thus the value 0.5 indicates midday. The various functions are:

<i><b>Function</b></i>	<i><b>Returns</b></i>
DATE(Yr,Mh,Dy)	The date number of argument Yr,Mh,Dy.
DATEVALUE(Ds)	The date number of date string.
DAY(Dn)	The day of the month number (1-31) of date number Dn.
D360(Sn,En)	The number of days between Sn and En, based on a year of 12 months, each of 30 days.
HOUR(Tn)	The hour number (0-23) of time number Tn.
MINUTE(Tn)	The minute number (0-59).
MONTH(Dn)	The month number (1-12).
NOW()	The serial number for the current date and time.
SECOND(Tn)	The second number (0-59).
TIME(Hr,Ms,Ss)	The time number of argument Hr,Ms,Ss.
TIMEVALUE(Ts)	The time number of string Ts.
TODAY()	The current date number.
WEEKDAY(Dn)	The day of the week from date number Dn in integer form; 0 (Monday) through 6 (Sunday).
YEAR(Dn)	Returns the year number (0-199) of date number Dn.

## Information Functions:

Information functions perform a variety of advanced tasks, such as looking up values in a table, returning information about cells, ranges or the Excel environment. The various functions and what they return are as follows:

<i>Function</i>	<i>Returns</i>
CELL(At,Rg)	Returns the code representing the attribute At of range Rg.
ERROR.TYPE(X)	The error value.
INFO(At)	Returns system information based on the attribute At.
ISBLANK(X)	The value 1 (TRUE), if true.
ISERR(X)	1 (TRUE), if X is an error value except #N/A.
ISERROR(X)	1 (TRUE), if X is any error.
ISLOGICAL(X)	1 (TRUE), if X is a logical value.
ISNA(X)	1 (TRUE), if X contains #N/A.
ISNONTEXT(X)	1 (TRUE), if X is not text.
ISNUMBER(X)	1 (TRUE), if X contains a numeric value.
ISREF(X)	1(TRUE), if X is a reference.
ISTEXT(X)	1 (TRUE), if X is text.
N(X)	A value converted to a number
NA()	The error value #N/A.
TYPE(X)	A number indicating the data type value of X.

## Lookup and Reference Functions:

The group of function return values specified by a range reference of array reference. The various functions available and what they return are as follows:

<i>Function</i>	<i>Returns</i>
ADDRESS(Rn,Cn)	The cell address specified by row Rn and column Cn.
AREAS(Rf1,Rf2,...)	The number of areas in the list of references.
CHOOSE(K,V0,...,Vn)	The Kth value in the list V0,...,Vn.
COLUMN(Rf)	The column number of a reference.
COLUMNS(Rg)	The number of columns in the range Rg.
HLOOKUP(X,Ar,Rn)	The value of indicated cell by performing a horizontal array look-up by comparing the value X to each cell in the top index row in array Ar, then moves down the column in which a match is found by the specified row number Rn.
INDEX(Rg,Rn,Cn)	The value of the cell in range Rg at the intersection of row-offset Rn, and column-offset Cn.
INDIRECT(Rf)	The cell reference specified in reference Rf in A1-style.
LOOKUP(Lv,Vr,Rv)	The value in a result vector Rv by looking up a value Lv in a vector Vr and moving to the corresponding position in the vector Rv.

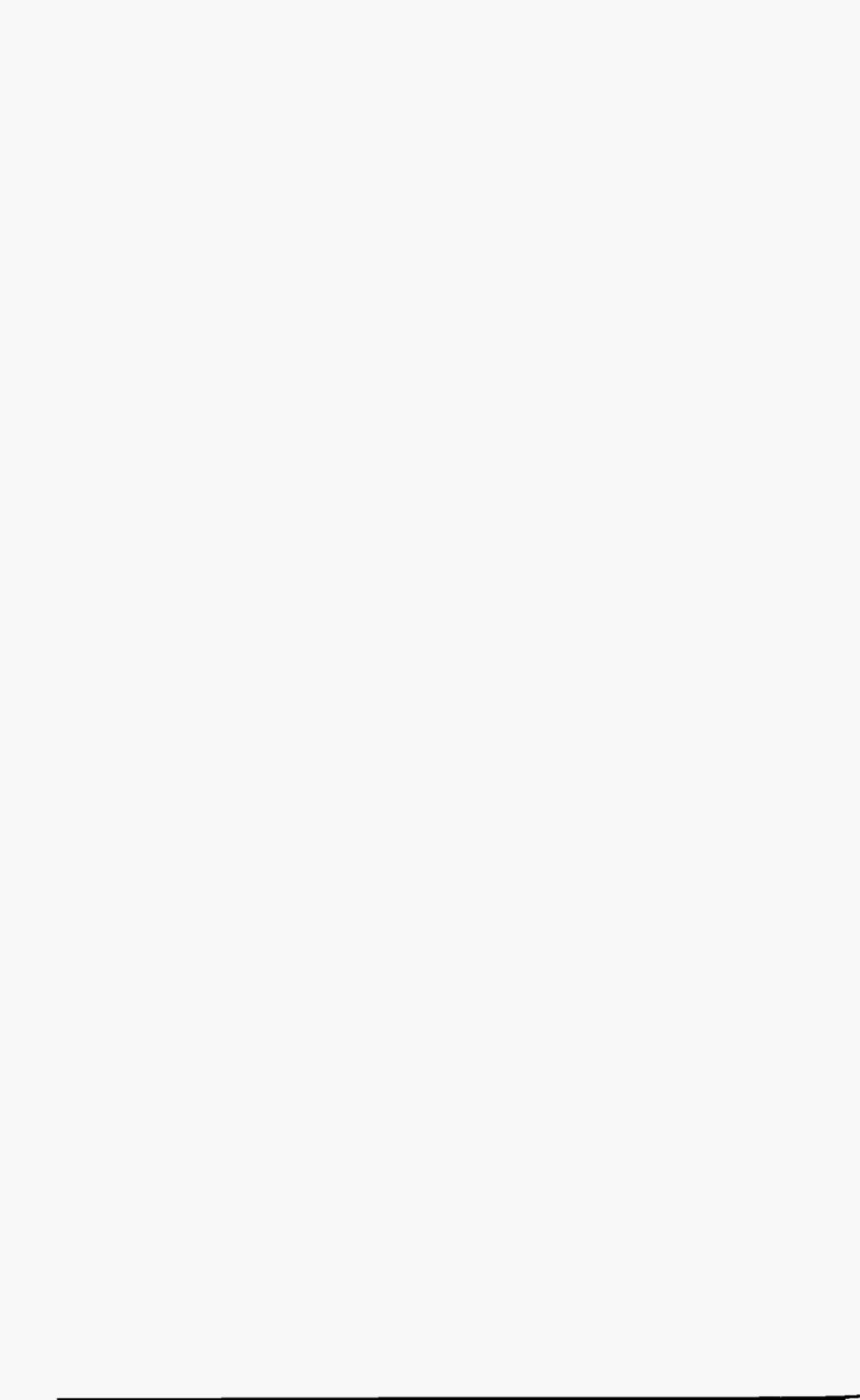
LOOKUP(Lv,Ar)	The value in an array cell by looking in the first row or column of an array Ar for the specified lookup value Lv and moving down or across to the last cell.
MATCH(Lv,Ar,Mtc)	The relative position of an element in an array Ar that matches the specified value Mtc of a lookup value Lv.
OFFSET(Rf,Rn,C,Ht,Wh)	A reference of a specified height Ht and width Wh offset from another reference Rf by a specified number of rows Rn and columns Cn.
ROW(Rf)	The row number of a reference.
ROWS(Rg)	The number of rows in a range.
TRANSPOSE(Ar)	The transpose of an array.
VLOOKUP(X,Ar,Cn)	The value of indicated cell by performing a vertical table look-up by comparing the value X to each cell in the first index column, in array Ar, then moves across the row in which a match is found by the specified column number Cn.

## Database Functions:

Database functions perform calculations on a database. The database, called the input range, consists of records, which include fields and field names, like Fd below. A criterion range must be set up to select the records from the database that each function uses. The various functions and what they return are as follows:

<i>Function</i>	<i>Returns</i>
DAVERAGE(Db,Fd,Cr)	The average of the values in the field Fd that meet the criteria Cr in a database Db.
DCOUNT(Db,Fd,Cr)	The number of non-blank cells in the field Fd that meet the criteria Cr in a database Db.
DGET(Db,Fd,Cr)	The single value in the field Fd that meet the criteria Cr in a database Db.
DMAX(Db,Fd,Cr)	The maximum value in the field Fd that meet the criteria Cr in a database Db.
DMIN(Db,Fd,Cr)	The minimum value in the field Fd that meet the criteria Cr in a database Db.
DPRODUCT(Db,Fd,Cr)	The result of the product of the values in the field Fd that meet the criteria Cr in a database Db.
DSTDEV(Db,Fd,Cr)	The standard deviation based on the values in the field Fd that meet the criteria Cr in a database Db.
DSTDEVP(Db,Fd,Cr)	The standard deviation based on the entire population of the values in the field Fd that meet the criteria Cr in a database Db.

<b>DSUM(Db,Fd,Cr)</b>	The sum of the values in the field Fd that meet the criteria Cr in a database Db.
<b>DVAR(Db,Fd,Cr)</b>	The estimated variance based on the values in the field Fd that meet the criteria Cr in a database Db.
<b>DVARP(Db,Fd,Cr)</b>	The variance based on the entire population of the values in the field Fd that meet the criteria Cr in a database Db.



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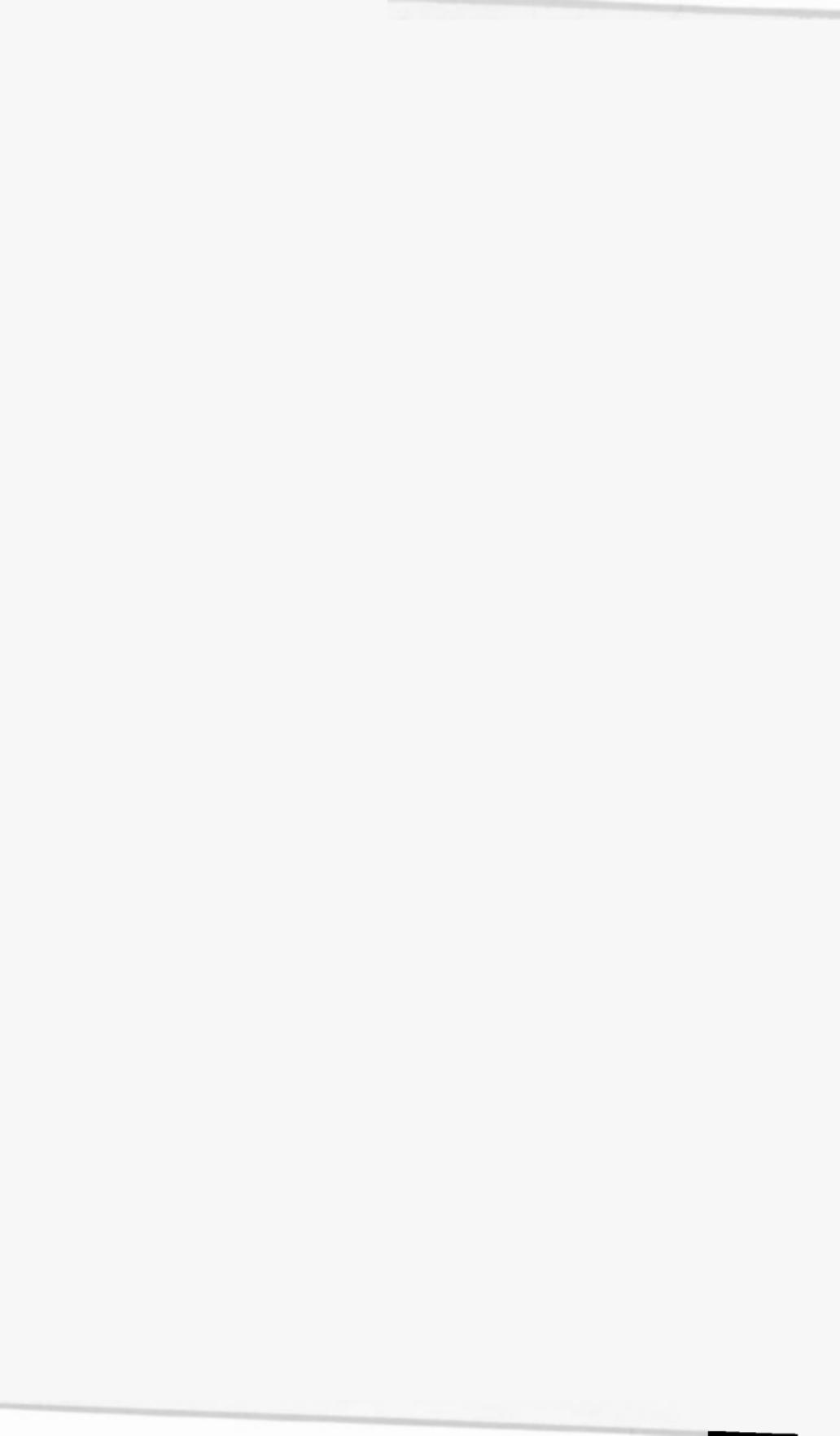
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