



Discovering spreadsheets

SPREADSHEETS CAN SEEM DAUNTING FOR THE NOVICE, BUT A BIT OF EFFORT SPENT DISCOVERING HOW THEY WORK CAN REAP ENORMOUS TIME-SAVING REWARDS. STEPHEN WELLS EXPLORES THE WONDER OF CELLS, MACROS AND FORMULAE

Her Majesty's navy would be all at sea without it. Your favourite TV weatherman, courier service and dating agency use it. Hospitals, schools, city traders and local authorities can depend on it. Ironically, some folk in these services, professions and institutions would claim ignorance of the spreadsheet. But they use applications overlaying it every day.

The progression from the typewriter to the word processor, and the card file's metamorphosis into the database, was the work of hundreds of unrecognised people. But the spreadsheet was invented and developed by two men, Dan Bricklin and Bob Franckston.

Bricklin was a Harvard Business School student who realised the PC offered a breakthrough for the bookkeeper's traditional worksheet. He saw if one figure in a column had to be changed, the total at the bottom of the column would have to be erased, recalculated and replaced. But with the computer you could have a formula instead of a fixed value for a total, so when a figure was changed the total automatically changed. Bricklin's notion, coupled with Franckston's computer programmer skills, resulted in them both writing a program for the Apple II in 1978 called VisiCalc.

By 1984 VisiCalc had disappeared from the market, although vestiges of it remain in Lotus 1-2-3. Microsoft

meanwhile issued its own spreadsheet, Multiplan, the first spreadsheet for Windows. From that grew Excel. So today the PC owner has five main choices of spreadsheet: Microsoft's Excel, Lotus 1-2-3, Corel Quattro Pro, Sun's StarCalc and the spreadsheet module in Works.

All spreadsheets contain cells, which are small, rectangular boxes arranged in numbered rows and lettered columns. For example, cell address C3 on a spreadsheet refers to column C, row 3. And any cell can have text, a number, a date or a formula entered in it. The root concept is if any fixed value is changed, the cells containing formulae instantly update. This easily lets you project hypothetical situations, such as what would happen to a supermarket's bottom line if its bakery department increased sales by five per cent.

Spreadsheets also contain lots of built-in formulae, called functions; Excel 2000 has 329. Many of them are common to all spreadsheets, although entry patterns vary. For example, to total cells in Excel you would enter =SUM(A1:A20) and in Lotus 1-2-3 @SUM(A1..A20). Quattro Pro understands either entry. You can nest up to seven functions within functions, too. So to calculate the number of days until Christmas, not including weekends, you would enter in Excel =NETWORKDAYS(TODAY(),"25/12/2001").

How the data in a cell is displayed is affected by the formatting of the cell: the font specified, its colour, the colour

The ubiquitous spreadsheet



Over the past decade, spreadsheet applications have become an integral part of working life. In many cases, the underlying spreadsheet, usually Excel, Lotus 1-2-3 or Quattro Pro, is not seen. The application runs on top of them.

Builders and developers use spreadsheets to estimate construction costs. These can be based on a company's own database or, as in the US, extrapolated from official National Average Construction Costs. United Design Associates, at www.uniteddesign.com/cos_estimating.html, offers gauging tools that produce detailed cost estimates suitable for preliminary budgeting, project quotes or obtaining construction loans.

Synopsis Scientific Systems publishes the Accord for Excel CombiChem add-in, which is used by chemists for calculating molecular

properties or producing chemical diagrams. See www.synopsys.co.uk/products/software/accordxl/addons/combichem/index.html.

Institutional investors use spreadsheets for calculating stock option prices and risk parameters. J&E Research (www.jeresearch.com) offers many Excel add-ins for this and publishes other add-ins to help investors price and manage forward contracts and futures. Managing and evaluating often complex test results is important in a clinical laboratory. Analyse-it Software specialises in statistical add-in software for Excel (www.analyse-it.com). Analyse-it adds over 30 statistical functions to Excel, specifically for evaluation and validation of clinical methods.

A Geographic Information System (GIS) called GeoConcept, which graphically depicts data listed in spreadsheet tables into maps,

has been developed by Kingswood. This can prove invaluable to property management companies that need to display statistical information in map form.

Kingswood's GeoConcept is also used to calculate delivery routes. Spreadsheet-based routing and scheduling software can produce an optimised solution that no scheduler with a pencil and a calculator could accomplish in the time. See www.kingswood.ltd.uk.

GIS plays a vital role in international development and humanitarian relief. International aid agencies need to map the vast amount of tabular data received from multiple agencies. Organisations such as The Environmental Systems Research Institute (www.esri.com/industries), provide software that takes spreadsheet-listed figures and overlays them on national or regional maps.

of the background, how many decimal points are used and so on. Excel uniquely offers Conditional Formatting so that the highest or lowest value in a range can be displayed in a different colour, for example. Excel also offers a Validation feature. You can restrict a cell to only accept dates or times within certain parameters.

Except for Works, all modern spreadsheet files are workbooks, containing several worksheets. A formula on one worksheet can refer to a cell in another. In fact, it can refer to another cell, row or column in another worksheet in another workbook file. So if you are making a list of temperatures in a file for 2001, and you want to include a column of comparable temperatures from the year 2000 file, then in Excel you might enter into a cell at the top of a column: `=[Temps2000.xls]January!$D:$D`.

Assuming the other file is also open, the selected cell in row 1 will display whatever is in cell D1 in the worksheet named January, from the file named Temps2000.xls. If you then point the mouse to the bottom right-hand corner of the cell until it turns into a cross, you can drag down this column and all the data will appear from the other file. That's because `$D:$D` means include all the data in the column.

Within an Excel workbook you can use formulae in 3D. In other words, you could find the total of all the totals in cell AA40 on all the worksheets named January to December using the formula: `=SUM('January:December'!AA40)`.

Works is popular because it's bundled in the UK with so many PC brands. You could think of it as a cut-down version of Excel, and it's more than adequate for family use. It comes with so many finished templates for sports schedules, household expense budgeting and measurement conversions, for example, that all of the design work is done for most people.

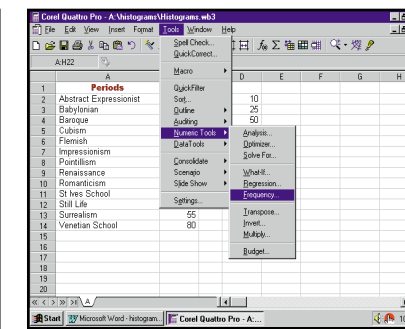
StarCalc is currently on version 5.2 and can import files from Excel 2000 and the latest versions of Lotus 1-2-3 and Quattro Pro, but its main claim to fame is that it is free and will run on Unix workstations and on PCs, including all recent versions of Windows, Solaris or Linux.

The best known spreadsheets currently, though, are Excel, Lotus 1-2-3 and Corel Quattro Pro. As the principal R&D costs were written off years ago, Microsoft, Lotus and Corel can afford to sell them in suites: Office, SmartSuite and WordPerfect Suite, respectively. Word processors such as Word are included with pre-installed suites such as Works.

Creating a frequency distribution table

Periods	Number						
1	Abstract Expressionist	10	10	0			
2	Baroque	66	26	0			
3	Baroque	50	50	5			
4	Cubism	40	75	4			
5	Flemish	30	100	3			
6	Impressionism	75	75	1			
7	Impressionism	35	35				
8	Renaissance	90	90				
9	Renaissance	70	70				
10	Romanticism	100	100				
11	Still Life	45	45				
12	Still Life	55	55				
13	Surrealism	90	90				
14	Venetian School	60	60				

Bin	Frequency	Cumulative %
10	0	00%
25	0	00%
50	5	36.46%
75	4	69.23%
100	3	92.31%
More	1	100.00%



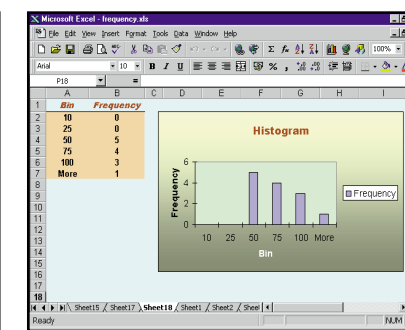
1 All the major spreadsheets can create frequency distribution tables for you. Some professions call a resulting chart of the table a histogram. In its simplest form a frequency distribution table looks like this example. Quattro Pro has split the quantities of paintings a gallery has in each listed period into ranges called bins. For illustrative purposes we've colour-keyed the results for each bin range to the quantities of paintings in each period.

2 Whichever spreadsheet package you're using, enter the item descriptions in column A. Then, in column B, enter the appropriate quantities of each item. In column D enter your bin ranges. This example pretends you're a curator of a gallery with 817 paintings. The art schools, or periods, are listed in column A, with the number of paintings in each period in column B. We'll calculate the order of popularity of the periods within the gallery.

3 In Quattro Pro all you do now is open the Tools menu and choose Numeric Tools and then Frequency. In Lotus 1-2-3 you open the Range menu and choose Analyse, then Distribution. In Excel, open the Tools menu, choose Data Analysis and then Histogram. In each case you're led to a dialog box in which you enter the ranges of the values (A2:B14; in Excel use B2:B14) and the bin values (D2:D6).

Bin	Frequency	Cumulative %
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25	0	00%
50	5	36.46%
75	4	69.23%
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4 At this point Quattro Pro and Lotus 1-2-3 display the result shown in Step 1 and that's it. Excel offers a little more. The Excel histogram dialog box in Step 3 provides a number of options. One of them is called a Pareto (sorted histogram). Columns A and B show the same results as the other two spreadsheets, but columns C and D show the bins sorted in descending (or optionally ascending) order of frequency.

5 Another option in the Excel histogram dialog box is cumulative percentage. Columns A and B are the same as before, but column C is extremely useful when creating statistics. Here, for example, it shows that over 38 per cent of the art periods are represented by 26 to 50 paintings. Looked at another way that's five over 13 (the total of column B) per cent. Additionally, over 69 per cent of the periods have up to 75 paintings.

6 Finally, Excel automatically creates a real histogram of the table if you check the option in the Excel histogram dialog box. Although we've taken an ultra-simple example for this workshop, you can see how, in more elaborate usages of a frequency distribution table, a chart would aid understanding. As this histogram offers the full range of Excel charting facilities, you can reformat it, as here, or change it to a different chart type altogether.

Only companies and institutions need to build large databases, so increasingly it's for the spreadsheet that people are buying suites. And familiarity with spreadsheets can be an employment prerequisite, as recruitment ads for PAs and secretaries often state 'knowledge of Excel required'.

Given your own free choice, which spreadsheet you choose tends to depend on your experience. If your employer uses Lotus 1-2-3 you're likely to have that spreadsheet on your

personal laptop. Quattro Pro had a huge following for years, but Excel is probably the top seller today, despite being the most expensive. Actually, with each updated edition of these three popular spreadsheets they tend to copy each other. When one introduced tabs on worksheets, to simulate a personal organiser, they all did it.

Excel's best exclusive built-in feature is the ability to easily handle an array formula. It means you can enter one formula (using Ctrl & Shift & Enter) for all the operations you want to perform

QUICK TIP

To sum values in non-contiguous cells in Excel and Quattro Pro enter `=SUM(, hold Ctrl, and click on each cell. Then type the final bracket. For ranges, hold Shift and click the first and last cell.`

Creating forms in Excel

Symbol	Price	Change	Volume	Market Cap
Apple	145	0.00	0	0
Microsoft	145	0.00	0	0
Amazon	145	0.00	0	0
Google	145	0.00	0	0
Facebook	145	0.00	0	0
Twitter	145	0.00	0	0
LinkedIn	145	0.00	0	0
Slack	145	0.00	0	0
Dropbox	145	0.00	0	0
Zoom	145	0.00	0	0
Zoom	145	0.00	0	0

Item	Men	Women	WPrice
Overcoat	200	100	200
Blazer	150	100	150
Leather jacket	200	100	100
Wool jacket	150	100	100
Blazer - casual	200	100	100
Wool trousers	40	50	50
Long sleeve shirt	30	20	20
Short sleeve shirt	20	10	10
Old school	15	10	10
Blazer	12	10	10
Full sweater	40	50	50
Blazer	10	10	10
Wool trousers	10	10	10
Black shoes	60	70	70
Leathers	60	70	70
Slippers	10	10	10
Slacks	40	50	50
Slippers	10	10	10
Scarf - red	10	10	10
Scarf - blue	10	10	10
Handkerchiefs	7	10	10
Leather watch band	5	10	10
Wallet	14	10	10

1 A form, in spreadsheet terms, is a dialog box for viewing, changing, adding or deleting records in a database. Usually that means a spreadsheet flat-file database or list (as opposed to an indexed, relational software application such as Microsoft Access). Excel includes several forms like this one for automatically downloading a choice of current currency rates. Choose Run Saved Query on the Data menu and select Microsoft Investor Currency Rates.iqy.

2 Before creating a form you need a list. Here's a simple example. Certain rules must be followed when creating a list in Excel and they're all explained in the Help file under 'Guidelines for creating a list on a worksheet'. Strictly speaking, we've broken one rule here as it could be argued this is two lists on one worksheet. But it'll work fine with forms, as we'll show.

3 Click anywhere within the list and choose Form on the Data menu. This form will appear. You can add records using the Add button, or delete them. Using Criteria, go through the list, using the Find Next button, look for men's or women's items, say, over £200. You could also select the range E2:F25 on the list, so when you open the form, only the women's items and prices will be shown.

4 But let's press on and create a custom form. Open a new sheet. Highlight the range C2:H3 and format with a dark background colour. Then on the Format menu choose Cells, Alignment and Centre, for both horizontal and vertical. Check the Merge cells box. Then select Font, Ariel Black, Regular, 18pt and White. Similarly, format C4:H14 in a light background colour. Add For Men and For Women labels and format the Font, Ariel Bold, 10pt and Red.

5 Add the labels Item, Qty, Price and Total and format to choice. In this example they're in Ariel, 10pt, Bold and Italic. Choosing Tools, Options, Colour Modify and Custom lightens background colour. You can restore your original colour palette shade later by clicking the Reset button. Now adjust the column widths and row depths to approximate the illustration or to suit your own form.

6 Press Ctrl & PageUp (or Ctrl & PageDown) to return to your list of items. Highlight C3:D26 (the men's items and their prices, plus the cells in the next row). Choose Name on the Insert menu, then Define. Type in 'TableA'. Similarly, name the range E3:F26 'TableB'. That's the women's items and their prices, plus the cells in the next row. Including the extra row guarantees that items added later will be included in the Named ranges.

7 Names are a simple and efficient way to abbreviate range addresses in formulae. You've finished with the list for now. In fact, you can hide it from the casual user by choosing Format, Sheet and Hide. Return to your Form and choose View, Toolbars and Form. Drag the Forms toolbar to a convenient location near your new form. Hover the mouse over the tools to display their names. Then select the Combo Box tool.

8 Draw a box over cell F8. Right-click and choose Format Control. In the dialog box enter TableA as the Input Range, L1 as the Link Cell, and 4 as the dropdown lines. Click OK. Enter the formula =INDEX(TableA,L1,2)*G8 in cell H8. The Link cell in L1 will indicate the item selected in the Men's Combo Box and the price will be selected from the second column of TableA. The Link cell can be anywhere out of the way.

9 Click on the Spinner tool in the Forms toolbar and draw a box over cell G8. Right-click and choose Format Control. In this dialog box accept 0 as the Minimum value, and 12 as the maximum value, so people can buy a dozen handkerchiefs. Enter 1 in the Incremental value. The cell link is where you want the result displayed. Enter G8. Under the Protection and Properties tabs you can accept the defaults.

10 Under the Size tab, make the Width 0.5cm. Right-click on cell F8, Copy and Paste a new Combo Box in cell F10. Right-click on the new Combo Box and select Format Control and change the Input to TableB and the Link cell to M1. Click on the worksheet to release the control. Copy the Spinner from G8 and Paste in G10. Change the cell Link to G10. In cell H10 enter =INDEX(TableB,M1,2)*G10. In cell H12 enter =SUM(H8:H10).

11 To check everything works, return to the data worksheet and click anywhere in the list. Choose the Form option on the Data menu. Click the New button and enter 'Hat', in the Men box and a price in the box below. Click Close. Return to your new custom-made form and select the new item. Spin the quantity of it up to 2. The form will recalculate the new amount for these items and the new total.

12 For your form to always show the current date, enter =TODAY() in cell D13. To move the form down, increase the depth of row 1. Using Insert, Clip art, you can add a decorative graphic. If you'd like your form to lose its spreadsheet environment, choose Tools, Options View and uncheck every box under Window options including scroll bars, tabs, headers and gridlines. On the View menu, deselect the tool bars and Formula bar.

QUICK TIP

Open an address book text file in Lotus 1-2-3 and it'll divide the first and last names, street addresses, towns and so on, into different columns. Simply use the Parse command on the Range menu.

on a range of cells, instead of having to change and enter it repeatedly to refer to different cells. And Excel's PivotTables quickly summarise large amounts of data. You can rotate rows and columns to see different summaries of the source data, filter the data by displaying different pages, or display the details of areas of interest. Excel also has superior charting facilities.

Its current edition is Version 9, which is best known as Excel 2000. Excel 10, which comes in the Office 10 suite, is on the way and most of its

new features will be to increase web integration. It will support XML as a native format.

Lotus 1-2-3 has always featured the most easily understood Help files and the most functions and, with its Millennium Edition, it added 50 new ones. Since IBM's acquisition of Lotus, the SmartSuite developers have progressed with voice recognition. Using IBM ViaVoice you can enter data and format your spreadsheet by talking to it. Like Excel 10, it also lets live data from the web appear on your worksheet for analysis.

Quattro Pro offers more templates than the other spreadsheets, so layouts have already been designed for all the most common business and personal applications of a spreadsheet. Also, if you want to open an Excel worksheet in Quattro Pro, you are more likely to retain more formatting than if you were to open it in Lotus 1-2-3.

But Quattro Pro's main advantage over the other leading spreadsheets is its ability to handle dates prior to 1900. Microsoft and Lotus obviously underestimated the number of people

needing that facility, especially in the UK, which needs to computerise so much historical data.

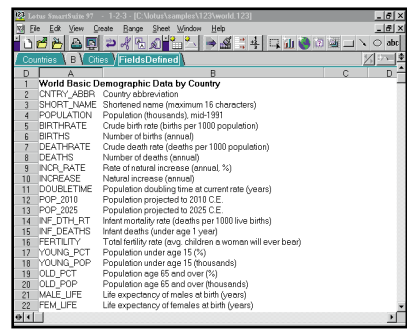
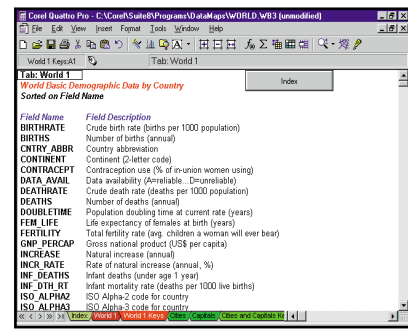
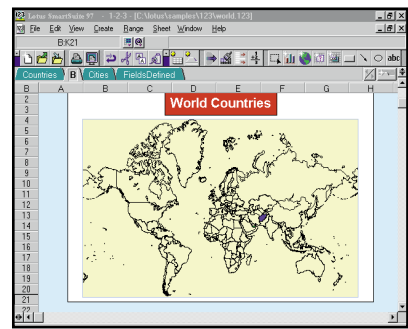
Quattro Pro recognises dates from 1 Jan 1600 to 31 Dec 3199, whereas Excel and Lotus 1-2-3 start their dates at 1 Jan 1900. To get around the Excel dating limitation, though, you could use the shareware add-in, XDATE. See www.j-walk.com/ss/excel/files/xdate.htm.

If you find yourself making repetitive entries on a spreadsheet you can save time by writing a macro. Excel, Lotus 1-2-3 and Quattro Pro all

QUICK TIP

To jump to the same cell in the next worksheet in Excel, right-click on the current tab and choose Select All Sheets. Then press Ctrl & PageDown (or Ctrl & PageUp to access the same cell on the previous sheet).

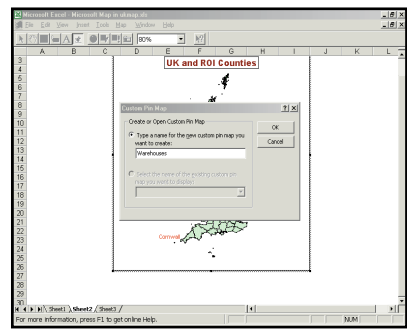
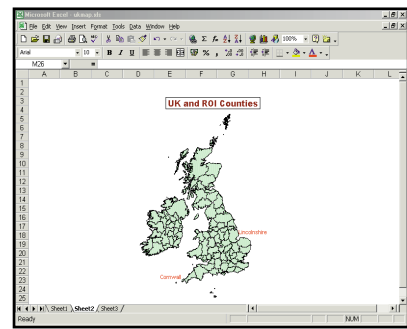
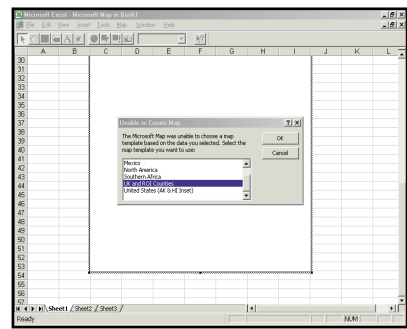
Putting it on the map



1 Using an add-in supplied with each spreadsheet, Excel, Lotus 1-2-3 and Quattro Pro can make maps. When you think about it, sailors are right to call maps charts because they just chart data. The spreadsheet can tabulate data and the mapping add-in graphically illustrates it. At a local level, once the usual demographic statistics have been colour-keyed, the map can be edited to even pinpoint your favourite family picnic sites.

2 The three leading spreadsheets all provide a certain amount of sample demographic data to get you started with mapping. Here's an example of the census statistics, which come with Quattro Pro. The data is provided in list form: the columns are fields, the rows are records. The mapping add-in knows where to put the information by the order of the fields or columns. Once you know the order you can create the tables you need.

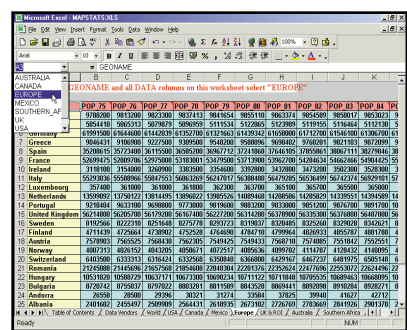
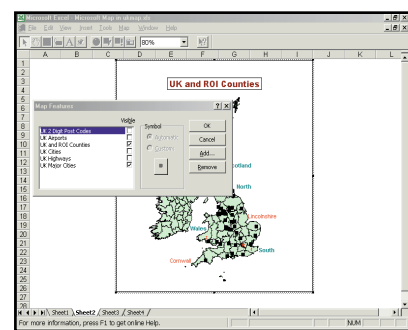
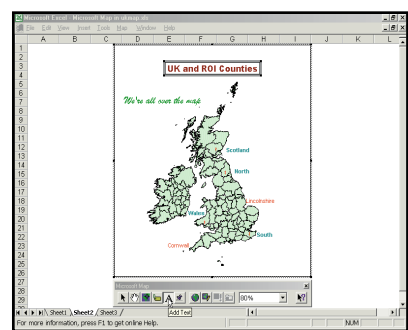
3 Lotus 1-2-3 offers the most extensive help files for mapping, and even an animated demo. We'll use Excel for this workshop but the Lotus 1-2-3 and Quattro Pro mapping procedures are quite similar. If you do the full Lotus 1-2-3 installation, by default, this file, called world.123, will be installed in the C:\lotus\samples\123 directory. Although the statistics may not be current, at least Lotus 1-2-3 offers more extended definitions of the succinct field names under one tab.



4 Open Excel and click on the Map tool or choose Insert, Object, Microsoft Map. Drag a rectangle on your worksheet and a dialog box appears headed 'Unable to Create Map'. It should say 'Choose the Map You Need' because a list of maps is offered. Pick UK and ROI (Republic Of Ireland) Counties. When that's drawn, right-click on the huge black default heading and reformat to a font, size and colour that's more pleasing.

5 Choose Tools, Options, View and uncheck the Gridlines box. Drag a corner of the map to make it a satisfactory size. Double-click on the map and the Map toolbar appears. Click on the tool that looks like a parcel label, and choose OK in the resulting dialog box. When you hover the mouse over the map, county names will appear. To display one permanently, click it, then drag it to the preferred position. Right-click to format it.

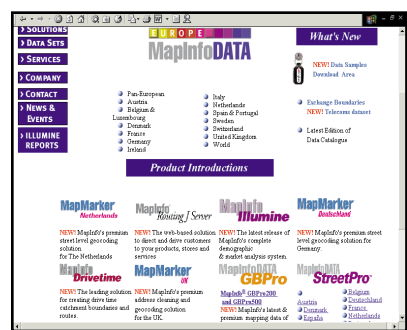
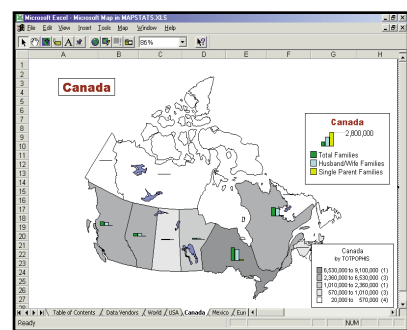
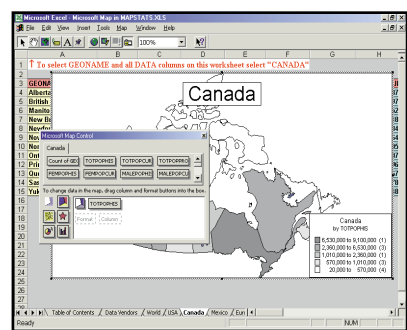
6 Click the Push Pin tool on the Map toolbar, then enter a name for a custom map in the resulting dialog box. Click OK and the cursor changes to a Push Pin. Click on the location where you want a Push Pin, and then fill in a descriptive name in the displayed dialog box. You can drag the Push Pin and the label separately to their preferred positions, and you can right-click and reformat the label.



7 If you want to move the map around in its frame, click on the Grabber tool in the Map toolbar then drag the map. To release the tool, click on another one. To add text, as here, click on the Text tool with the big A then enter the text. You can format the font and its colour with a right-click. You can also click and drag the Map toolbar itself to a preferred position.

8 When the Map is active (double-click on it) and the Map toolbar is showing, the regular Help menu changes to Map topics only. To return to the underlying Excel worksheet, click outside the map area. If you open the datainst.exe file (which by default is installed in the C:\Program Files\Comman Files\Microsoft Shared\Datamap\Data directory) more features are available for the UK. Choose Features in the Map menu and add Display major cities or airports.

9 Excel includes more maps in the mapstats.xls file, which by default is also installed in that directory. Click on the Europe tab to see all the data available. To select the data, use the dropdown box on the left of the Formula Bar. Hover the mouse over the pink field names. Displayed comments give a description of the statistics: male, female and total population numbers for each country from 1975 to 1993, and lots more.



10 For a simpler map click on the Canada tab and then Canada in the dropdown box. Click the Map tool and draw a large rectangle. This not only produces a map of Canada, but also displays the Map Control box. Drag the Bar Chart symbol into the main box over the Format square and two or three of the offered fields - such as Total Families, Single-Parent Families and Husband-Wife Families - over the Column square. Close the box.

11 The new Bar Chart legend box can now be dragged where you like. Right-click this object, and you can edit and reformat the text, add a subhead, change the bar colours - there are many options. The legend box gives the totals of each statistic for the country. Equivalent mini-charts for each of the heavily populated provinces are displayed on the map. A tool on the Map toolbar lets you re-display the Map Control dialog box.

12 You can obtain a variety of data sets for Excel maps from the MapInfo website at www.datasets.com. Mapping data sets for Lotus 1-2-3 and Quattro Pro are available from www.esri.com. You can make maps showing golf courses, hospitals, parks and pubs. Transportation maps show motorways, railway lines, canals and tunnels. Area boundaries include parishes or voting wards. Post-coded data can give expenditures on groceries or readership of newspapers.

QUICK TIP

In Lotus 1-2-3 97 and above, just type TOTAL or TOTALS at the left of a row and totals will automatically appear at the bottom of each column. But the cells below must initially be empty.

offer two programming languages. Their historical ones are very simple and still produce working macros. Each spreadsheet, however, has added a far more sophisticated programming language: VBA for Excel; LotusScript; and PerfectScript, respectively. VBA enables experienced developers to write applications which use the underlying spreadsheet engine but display only user-friendly dialog boxes to, say, dental receptionists, or website visitors. See the Creating forms workshop on the previous page.

If you haven't the time or patience to learn a new programming language, there's another option. Excel, Lotus 1-2-3 and Quattro Pro all allow you to record a macro. In Excel, for instance, you choose Record New Macro on the Tools menu and then enter the keystrokes you wish the macro to duplicate. A Stop Macro button will appear and when you're ready you just click on it. Simple. You can run the macro in future with a keyboard shortcut (such as Ctrl & Shift & M) or design a tool button and attach the macro to it.

All the leading spreadsheets enable you to depict your data graphically. It's rare for a newspaper or television news programme to show a table of statistics to illustrate a story. Instead, they'll present the same data as a graph, which clearly communicates the point that is being made.

The next generation of spreadsheets will even converse! You talk through the data to be entered, and it will reply with the solutions. So you'd better practice: 'The rain in Spain...'

Useful contacts

Excel: www.microsoft.com/catalog/display.asp?subid=22&site=797&x=28&y=18
 Lotus 1-2-3: www.lotus.com/home.nsf/tabs/lotus123
 Corel Quattro Pro: www.uk.corel.com/products/wpo2000.html#topic_4
 StarCalc: www.sun.com/products/staroffice/5.2

QUICK TIP

To toggle between the values and formulae on your Excel worksheet use Ctrl & ` (the key left of 1). In Lotus 1-2-3, choose the Range menu then go to the Current Format box select, Formula.