Making a **date**

Supplying a pensions provider with precise dates to retirement is trickier than it sounds. Stephen Wells cogitates possible spreadsheet solutions.

It is singularly unfortunate that the world wobbles about in its path around the sun. Life would be much simpler for many spreadsheet users if there were a constant number of days in a month and a year.

Take the case of pensions consultant Richard Jones of Forest Hill. As I understand it, when a client of his wants to sensibly prepare for old age, R.J. has to calculate how long they have to wait for their gold watch.

Other clients have been paying premiums since bath-water was heated in kettles and similarly he has to advise the insurance company as to what he thinks they are now entitled. Richard gathers his data in Access, then for calculations transfers it to Excel 5.

Over at the insurance company, these matters are in the hands of the actuaries — people who practice a strange art not far removed from astrology. They use historic tables based on algorithms.

Whether looking backwards or forwards, when defining the life of a pension Richard has to supply the companies with the number of years and the precise number of calendar months between two dates. This is trickier than it sounds: for a period ending on 30th April or September for instance, the company would count April and September as months. But a period ending on 30th May or July wouldn't count May or July. A calendar year ending on 30th December is only 11 months to them. Not that there is anything unfair in this. As long everybody is subject to exactly the same rules then it's "perfectly equitable, Henry".

Fig 1 *The pension programme as presented. The actual years and months of the period are calculated using an intermediary step*

	A	B	C	D	E	F
1	START DATE	END DATE	TEMP YEARS	TEMP MONTHS	ACTUAL YEARS	ACTUAL MONTHS
2	1-Mar-82	20-May-96	14	2	14	2
3	1-Sep-23	1-Jan-97	74	-8	73	4
4	6-Jan-35	13-Apr-96	61	3	61	3
5	30-Sep-46	7-Jan-96	50	-8	49	3
6	1-Sep-49	1-Jul-99	50	-2	49	10
7						

Richard's solution is shown in *Fig 1*. Column A shows the start date of the pension programmes and column B the end date. The range A2:A6 is named START_DATE, and the range B2:B6 is named END_DATE.

Columns C and D are initial temporary calculations.

```
C2 to C6 has =YEAR(END_DATE)-
YEAR(START_DATE)
```

and

```
D2:D6 has =MONTH(END_DATE)-
MONTH(START_DATE)
```

In Row 2, C2 and D2 hold the right answer. But in Row 3, where the period starts in a September and ends in a January, D3 is wrong because it shows minus eight months.

So Richard has named the range C2:C6 TEMP_YEARS and the range D2:D6, TEMP_MONTHS and pressed on to solve the problem with some complicated IF and AND function formulas (see *Fig 3*). Trying to focus on that is too much for me, but I'll take his word for it that the answers in Columns E and F are actuality for the actuaries.

I've talked to Richard on the phone and he obviously is not sending this in as a solution to share but almost a moan that Excel doesn't offer a simple way of doing this.

• *There is a book token in this for anyone who can find a shorter solution.*

I've come up with three ways of doing it but none of them offer exactly the same answer for every date combination.

Fig 2 *Three new ways of solving the pension programme problem. But will the actuaries be happy?*

	A	B	C	D	E	F	G
1	STARTS	ENDS	PERIOD	YEARS	MONTHS	YEARS	MONTHS
2	1-Mar-82	20-May-96	14 years 3 months	14	3	14	3
3	1-Sep-23	1-Jan-97	73 years 5 months	73	5	73	5
4	6-Jan-35	13-Apr-96	61 years 4 months	61	4	61	4
5	30-Sep-46	7-Jan-96	49 years 4 months	49	4	49	4
6	1-Sep-49	1-Jul-99	49 years 10 months	50	10	50	10
7							

Fig 3 Complicated function formulas

```
E2 to E6 is
=IF(MONTH(END_DATE)<MONTH(START_DATE),
TEMP_YEARS-1,IF(AND(MONTH(END_DATE)=MONTH(START_DATE),
DAY(END_DATE)<DAY(START_DATE)),TEMP_YEARS-1,TEMP_YEARS))

F2 to F6 is
=IF(AND(MONTH(END_DATE)<MONTH(START_DATE),
DAY(END_DATE)=DAY(START_DATE)),TEMP_MONTHS+12,
IF(AND(MONTH(END_DATE)=MONTH(START_DATE),
DAY(END_DATE)<DAY(START_DATE)),TEMP_MONTHS+11,
IF(AND(MONTH(END_DATE)>MONTH(START_DATE),
DAY(END_DATE)<DAY(START_DATE)),
TEMP_MONTHS-1,IF(AND(MONTH(END_DATE)<MONTH(START_DATE),
DAY(END_DATE)<DAY(START_DATE)),TEMP_MONTHS+11,TEMP_MONTHS))))
```


Fig 4 The numbers you've entered

	B	C	D
1	1998	1997	1996

	E	F	G	H	I	J
1	1995	1994	1993	1992	1991	1990
2	£393,233	£311,878	£453,987	£292,111	£323,876	£234,567

Fig 2 uses the same dates as in Richard's example. My first solution is simply to use formatting. Column A is named STARTS and Column B is named ENDS. Column C is simply =ENDS-STARTS. But the column has this custom format: yy "years" m "months"

Excel stores the answer to the subtraction formula as a date serial number. The years in that number are displayed by the yy in the format definition (followed by any label you like — I've used "years"), and the months are displayed by the m in the format definition (followed here by "months").

I would maintain that this is the "correct" answer. But if the insurance companies are not satisfied by anything less than complete calendar months, they're going to have to take a month off in most cases.

Column D uses the YEARFRAC function. It returns the fraction of the year which represents the number of days between a start date and an end date. So cell D2 has =YEARFRAC(A2,B2).

If you can't find this function listed, you probably don't have the Analysis ToolPak installed. You'll find this useful macro on your original Excel installation disks or CD.

E2 has the formula:

```
=(PERIOD/30.416666667)-INT(D2)*12
```

I've named the block C2:C6 PERIOD. So in E2, cell C2 is divided by the average number of days in a month and from this is deducted the integer of the number of years in cell D2, multiplied by 12.

F2 uses the CONVERT function which converts a number from one unit to another. The formula is:

```
=CONVERT(C2,"day","yr")
```

All it does is convert the number of days in C2 to whole years.

G2 works like E2 and is

```
=(PERIOD/30.416666667)-INT(F2)*12
```

I look forward to receiving readers' solutions to this problem.

Future perfect

Past is prologue, said The Bard in The Tempest, and once you've collected a lot of data on a spreadsheet it can be very tempting to project future results from it.

Whether this extensibility is plausible is a determination which can only be made by somebody skilled in the pertinent profession or industry. But if it is, then I can suggest the functions to use.

If all you need is a chart and you have Excel 7, then you can project data lines automatically with a few mouse clicks.

As an example, let's use some annual sales figures for a product. In 1990 the total was £234,567. Sales go up and down and were £393,233 in 1995. We'll put the years in row 1 (formatted as a custom Date, yyyy), with the most recent year to the left, and the amounts in row 2.

If you feel it's reasonable to project from these figures for three years in the future, then insert three columns with the years labelled in B1:D1 and blank cells in B2:D2.

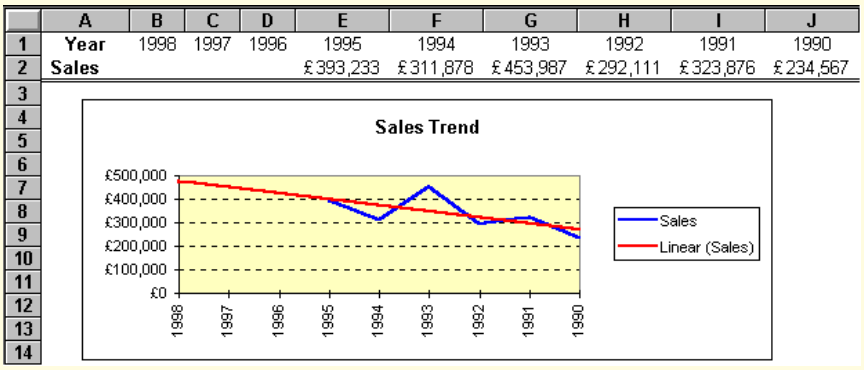
Now select the complete block (in our example this is A1:J2) and click the Chart Wizard button. Pick a Line chart in Step 2, and Type 4 in Step 3; Data Series in Rows, in Step 4; and add a chart title in Step 5.

Select the resultant drawn line and then click the right mouse button. This will now offer a changed list of options. Select

Stuffed dates

As a pensions consultant, Richard Jones' life isn't made any easier by two other Excel idiosyncrasies. If you enter a date prior to 1/1/20 Excel will add a century. In other words, if you enter 31/12/19 Excel initially assumes you mean 31/12/2019, not 31/12/1919. At least you can correct this on the edit line. But the other problem requires a bigger work-around. Excel only recognises dates between Jan. 1st. 1900 and Dec. 31st. 2078. It stores them as the equivalent serial date numbers 1 to 65380.

I'm not going to live to 2078 myself but somebody born this year quite likely will and Richard could well be asked to think about lifetime financial investment plans for them. Fortunately VBA (Visual Basic for applications) for Excel 7 recognises date values from Jan. 1st 100 (which was before Hadrian started his wall) to Dec. 31st. 9999 (when the Chunnel debt will have been paid off). So Richard could put all his dates in a macro.



	A	B	C	D	E	F	G	H	I	J
1	Year	1998	1997	1996	1995	1994	1993	1992	1991	1990
2	Sales				£393,233	£311,878	£453,987	£292,111	£323,876	£234,567

Fig 5 *Excel looks at six years' sales results and projects the trend for a further three years*

Trendline, Linear. (There are also five other types: Logarithmic, Polynomial, Power, Exponential and Moving Average). You can now double-click on any item (the axis labels, lines, plot area, and so on) and change colours or weights to suit. You'll now have a chart as shown in *Fig 5*.

This gives you the big picture but it doesn't tell you exactly what the projected sales are for '96 to '98. You can see from the chart that all three years are expected to have sales of the product between £400,000 and £500,000; and '97 looks like it will repeat the peak of '93. Of course, Excel knows what the numbers are because it has used the TREND function to calculate them. You can, too. The numbers you've entered so far are shown in *Fig 4*.

The TREND function has the syntax (Known y's, Known x's, New x's). Referring to the chart, it's the sales amounts which rise up the vertical or y scale, and the years which are along the horizontal or x scale. So the known y's are in the range E2:J2 and the known x's are in the range E1:J1. The new x's (1996, 1997, 1998) are in cells D1, C1, B1.

Understanding this, we can now enter in cell D2 the completed function:

```
=TREND(E2:J2,E1:J1,D1).
```

Similarly,

```
=TREND(E2:J2,E1:J1,C1)
```

goes in cell C2 and

```
=TREND(E2:J2,E1:J1,B1)
```

is entered in B2.

This produces the exact figures and confirms our rough guesses:

	B	C	D
1	1998	1997	1996
2	£479,643	£453,321	£426,926

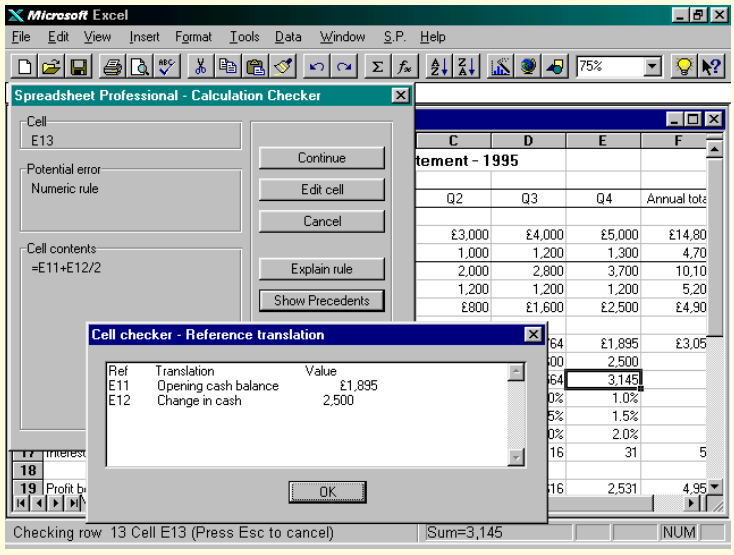


Fig 6 *Spreadsheet Professional is an add-in for Excel or Lotus 1-2-3 which checks worksheets for potential errors*

TREND is probably the most useful function in this area, to business people, but readers with scientific or statistical problems to solve might also use some of Excel's related built-in formulas.

The LINEST function also calculates a line but provides the parameters of the line instead of one or more y values. The GROWTH function creates an exponential curve instead of a straight line. And the LOGEST function provides the parameters of an exponential trend. In other words, LOGEST is to GROWTH what LINEST is to TREND.

Having a check-up

I have come across a spreadsheet add-in, called Spreadsheet Professional, designed to test worksheets and document the results. I looked at Version 2.07 for Excel 7 but there are variations available for Excel 5 and any version of Lotus 1-2-3 which produces .wk3 files.

It is easy to install and adds a new "S.P." option to the menu bar. Once the worksheet(s) you wish to check have been loaded, you click on the additional menu item and are offered a new drop-down menu with all the program's tools.

The first is the Calculation Checker, *Fig 6*. If you start at cell A1, the Checker will go through the sheet, stopping at each "potential error". This doesn't mean there's necessarily an error in a formula. It could be a harmless matter, or a number in a formula which was a quick-fix that wasn't corrected later. When the suspicious cell is pointed out, a dialogue box offers several buttons including a Show Precedents option which displays the Reference Translation box (also *Fig 6*). Another button in the Calculation Checker offers a full explanation of the rule being contravened. A third lets you look at all the rules and choose which ones to ignore.

The second main menu option is a toggle to enable or disable the Cell Translator. Another major tool is the Documentation Generator which offers you a huge variety of ways of testing your range, worksheet or workbook and producing a comprehensive report and full explanation of the audit.

Finally, another tool lets you make a comparison between two worksheets. This can be very useful when you're developing a worksheet and want to check on the differences between various versions.

Compared with the cost of Excel, the price of £295 (plus VAT) for a single user copy seems a bit steep, but Spreadsheet Innovations is not selling to chaps like me but to institutions which have massive spreadsheets and short development deadlines.

PCW Contacts

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