

# Spreadsheets\*

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The spreadsheet is barely twenty years old. Invented by Dan Bricklin and Bob Franckston as VisiCalc for the Apple II, it was soon copied by SORCIM (read backwards to see where they got the name from) for CP/M computers and then Lotus for the IBM PC. When Lotus produced their spreadsheet, they had to buy up Bricklin & Franckston's company, Software Arts, to prevent any lawsuits.

Lotus 'made' the IBM PC; produced as an 'executive toy' to give away to people buying their much more expensive, and more profitable, mainframe computers, the IBM PC was never intended to become the world standard for PCs. IBM didn't even bother to offer a decent operating system; instead the nephew of one of their board members, who had shown some flair for developing programs for the Apple II, bought up QDOS (or 'Quick and Dirty Operating System'), tidied it up slightly and sold it on to IBM.

Lotus worked so well on the IBM PC because it largely bypassed this operating system and the accountants who had to authorise purchases of large computers were entranced by the program and bought thousands of this 'executive toy', much to IBM's surprise.

But I digress. Every other program you could get on a computer recognisably replaced something else — the word-processor replaced the typewriter; accounting programs replaced account books; databases replaced card indexes. But the spreadsheet was completely new; there had been nothing like it before in history — not even on a mainframe.

As the name Visi(ble) Calc(ulator) suggests, Bricklin and Franckston's vision had been of a program where, if you had to change any figure in a list of figures, the totals and any other number that depended on those totals would change at the same time, replacing the extensive recalculations, and liberal use of correcting fluid, then needed. The accountants who bought Lotus thought it was brilliant that they could put some projected figures into their accounts and work out 'instantly' what the effect of a particular financial decision would be on their company.

So what is a spreadsheet? You can think of it as a rectangular stack of pigeon holes like the ones which are used for sorting mail. Each pigeon hole is called a 'cell' and has a name — usually A1, B2, F36, etc. depending on which row or column in the stack it occupies. Normally, the letters for the columns appear across the top of the spreadsheet and the numbers for the rows down the left hand side. So A1 is the top left hand cell (or HOME cell), B2 is the second cell across in the second row and F36 is the sixth cell across in the 36th row. You can put numbers, formulae or text in a cell; if you put a number or some text in the cell, it normally displays a number or some text; if you put a formula in a cell, it shows the results of the formula.

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The distinction between the ‘contents’ (what you put in the cell) and the ‘display’ (what the cell shows) is fundamental to how spreadsheets work. For example, if you put 3.456 into a cell, your spreadsheet may display 3 if it has been set to display whole numbers only, 3.46 if it has been set to display two decimal places or 3.456 if the display has been set to three or more decimal places or has not been set at all. If a cell is too narrow to display a number in the way it has been set to display numbers, the spreadsheet will display something which tells you that you have to alter the width of the cell or the setting of the display to allow the result to be displayed.

If the text in a cell is longer than the width of the cell, you will see all the text if the cells to the right are empty because excess text is allowed to run across empty cells. But even if the next cell is occupied and the spreadsheet does not display all the text, it is normally all still in the cell.

The distinction between ‘contents’ and ‘display’ is easier to understand in a formula. If you put  $3.456*79$  in a cell, the spreadsheet will display 273, 273.02 or 273.024 depending on how it has been told to display the result. But, except in Mini-Office II, the contents will remain  $3.456*79$ .

The distinction between ‘contents’ and ‘display’ is important when you start using the ‘contents’ for calculations. Whatever the display, if you don’t tell it otherwise, the spreadsheet will use 3.456 in every calculation. So, for example, if the spreadsheet shows 3.46 and you multiply the contents by 79, the spreadsheet will show 273.02 but, if you thought you were multiplying 3.46 by 79, you should have 273.34. In a large, or complicated, spreadsheet, these slight differences between the ‘contents’ and the ‘display’ of a spreadsheet can build up into sizeable ‘inaccuracies’ if you are not aware of them. When the Euro becomes official currency, there will be a precise number of digits in the rate so that everyone can set their spreadsheets to the correct number of digits and everyone will get the same answer.

However, the real power of the spreadsheet comes not from its ability to perform ‘instant’ calculations but from the use of cell names in formulae. For example, if we already have 3.456 in cell C5 and 79 in cell B3, we don’t have to enter  $3.456*79$ ; we can instead enter  $C5*B3$  in any other cell in the spreadsheet and the spreadsheet (including Mini-Office II) will leave the formula in the cell and display the result in the way it has been set to do so. If, for any reason, we wanted to change 79 to 78 or 159, we don’t have to change the formula; we simply put 78 or 159 in cell B3 and the result displays in the cell which contains the formula  $C5*B3$ .

By putting individual calculations in separate cells and then using the cell names to build up links between different cells, someone with no knowledge of programming can gradually build up a really sophisticated ‘program’ for working out a problem they have. They never realise they are programming because, usually, the individual links they make between cells only require primary school maths; but they can end up with a spreadsheet which solves a problem which would otherwise need secondary school maths or higher to solve.

This ‘cell by cell’ approach to programming has the further advantage that you can see every step in the calculation if you want and so avoid the problems that can be created by obscure programming code. If a sequence of calculations produces nonsense, it is usually quite easy to see and put right the step that has caused the nonsense result.

So much for the theory. I will now build up a simple practical example using Mini-Office II and Supercalc2.

Load the spreadsheet program and, in the case of Mini-Office II, choose ‘New spreadsheet’ and move down to ‘Number of rows’; type  $30<RETURN>$  and then press ESC. Next select ‘Alter screen display’ and press  $<RETURN>$  over ‘40/80 chr screen’ so that 80 shows; move down

to 'Single spacing' and press <RETURN> so that Yes shows. Press ESC and then select 'Edit spreadsheet'

In the case of Supercalc, press <RETURN> if you have not already done this to get into the spreadsheet.

First, we need to format our columns. Make sure you are in column A (you should be) and, in M-O II, enter J 10<RETURN> 0<RETURN> L; then move to column B and enter J 18<RETURN> 0<RETURN> L; in Supercalc, enter /FC<RETURN>11<RETURN> in column A; then move to column B and enter /FC<RETURN>18<RETURN>.

You may find that Supercalc hesitates after a key press; there are several reasons why Supercalc may hesitate which I will not explain here. I have set down the correct sequence of key presses in each case but, sometimes, if you get ahead of Supercalc, it may not respond as you expect. In this case, if you cannot work out what needs to be done next, press <CONTROL>Z and start again.

Now enter /FCc:e<RETURN>\$8<RETURN>. [The \$ sign does not result in dollar signs appearing in the display; it is shorthand for 'two decimal places' or 'money format'.]

Move to cell A1 and, in M-O II, enter S; in Supercalc2, enter "; then type CLUB ACCOUNTS<RETURN>. Though Supercalc treats text the same whatever its length, M-O II treats text differently depending on whether or not it will fit in the display. You enter text that will fit with the prefix T and longer text with the prefix S.

You will see in M-O II that the third line down lists the 'Contents' of the current cell. In Supercalc it appears on the third line up. With M-O II, press M until 'Right' appears above 'Text' at the top of the screen.

Use the arrow keys to move down to cell A3. In M-O II enter T; in Supercalc, enter "; then type DATE<RETURN>. Continue along row 3 as in the example prefixing each entry with T or " as appropriate and completing each with <RETURN>.

DATE	ITEM	CREDIT	DEBIT	BALANCE
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You may, or may not, find that Supercalc starts to move automatically to the next cell after each entry. If it doesn't, make sure you are on row 3, move one cell to the left and then to the right and it will carry on moving right after each entry.

Once you have entered BALANCE, move the cursor back to E4 and enter F, if you are using M-O II, followed by C4-D4<RETURN> or just C4-D4<RETURN> if you are using Supercalc. The capitals are essential in M-O II but not in Supercalc. In you make a mistake in M-O II, <ESC> will usually get you out of the problem; <CONTROL>Z does the same in Supercalc but <ESC> is used for different functions and normally won't get you out of trouble.

Move to E5 and, after again entering F in M-O II, enter E4+C5-D5<RETURN> in either program; now in M-O II press D, move down to E6 and press COPY; continue this process for another 22 boxes until you get to cell E27. You will see that each time you copy the formula, M-O II adjusts it for the cell you have chosen.

It is a little easier in Supercalc; make sure you are in E5 and press /R<RETURN>E6:E27. You should see the bottom line of your screen reading /Replicate,E5,E6:E27. If it doesn't, press <CONTROL>Z, go back to E5 and start again. Now press <RETURN> and, hey presto!, all the cells from E6 to E27 have formulae in them.

If you go down the column in Supercalc, you will see that each formula, which is shown after 'Form=' in the third line up, has been adjusted to suit its own row as in M-O II.

Move to C29 and, in M-O II, enter F, C4#C27<RETURN>; in Supercalc enter, SUM(C4:-C27)<RETURN>. Make sure you are in cell C29: in M-O II, press D, move to D29 and press <COPY>; in Supercalc, enter /R<RETURN>D29<RETURN>.

Our spreadsheet is now ready to receive data; so we need to save it. Press Q in M-O II and, if you are using drive B: for data, enter |B<RETURN><ESC> to change the logged drive; then select 'Save spreadsheet'; when prompted for a name call it something like CLUBACTS. In Supercalc, enter /Sb:clubacts<RETURN>A. With M-O II you will now have to select 'Edit Spreadsheet'; with Supercalc, you just carry on where you left off.

In M-O II press R and you should see 'Manual' at the top of the screen change to 'Auto'. Move to A4 and press T; then enter 01/01/1998<RETURN>. M-O II does not have any way of working with dates; so we have to hold dates as Text. You should be in cell B4 now; if so press T and enter Brought forward<RETURN>; then in C4 just enter 25.34<RETURN>. You should see column E come alive as all the formulae are recalculated. Carry on following the example for a few more lines to see how each entry affects the balance; remember to use T in columns A and B but just enter the figures in columns C and D. You won't be allowed to enter anything in column E as it is Locked.

In Supercalc press /GA to put you in Auto-Recalculate Mode; move to A4 and enter "01/01/1998<RETURN>. Move to cell B4 and enter 'Brought forward<RETURN>; then in C4 just enter 25.34<RETURN>. Carry on following the example for a few more lines to see how each entry affects the balance; remember to use " in columns A and B but just enter the figures in columns C and D. Anyone who knows that Supercalc can handle dates may wonder why I have entered them as text in this example; all will be revealed in due course.

As the spreadsheet fills up, you will realise that automatic recalculation takes up time; so most people keep the spreadsheet on 'Manual' and just update it when they want to using U in M-O II or ! in Supercalc. You can change back to 'Manual' by pressing R in M-O II or entering /GM in Supercalc.

Before you leave this example completely, go down to row 29 to see how the totals in C29 and D29 are adding up. When you are satisfied, press Q, select 'Save spreadsheet' and enter the details as before in M-O II; in Supercalc, enter /Sb:clubacts<RETURN>BA. Note that, because you have already saved one version of the spreadsheet, Supercalc asks you whether you want to make a backup, overwrite the earlier spreadsheet or change the file name.

To exit M-O II, select 'Mini Office II Menu'; to exit Supercalc, enter /QY.

## Copying and dates

Like calculators, spreadsheets come with different facilities. Mini-Office II can do slightly more than a basic calculator; Supercalc2 can do as much as most GCSE calculators; the PC spreadsheets (Supercalc, Lotus and Excel) can do A level maths, statistics and scientific calculations.

All spreadsheets can produce graphics data and some can produce their own graphs but with Mini-Office II and Supercalc2 you have to use a separate program, albeit within the same package in M-O II. The Mini-Office II graphics package can take up to three sets of 20 data values from its own spreadsheet or, via SDI on the reverse of the Supercalc2 disc, from Supercalc2 (see WACCI 79 for an explanation of how to do this). Alternatively, DR Graph can take even more data and treat it more flexibly than M-O II provided you use SDI on the reverse of the Supercalc2 disc to convert it to a suitable format.

Mini-Office II can cope with around 300 cells in use though that number will vary depending on how much text you use in the spreadsheet as text takes up most space. Its 'free space' figure is for the number of formulae you can use; so you can run out of memory on a M-O II

spreadsheet while it still shows 'free space' for formulae. M-O II is quick and easy to use and, together with the accompanying graphics package, could provide all many people need. I have used it for years to keep track of various household expenditure and to calculate the effects of interest rates over several years.

However, to use dates, logical operations or statistical calculations as well as over 1,000 cells at a time, you need Supercalc2. Supercalc2 has the added advantage that, if you upgrade, you can transfer all your data (and in some cases your formulae) straight into your new spreadsheet. It is also possible to export data from M-O II but only 40 cells at a time and only as graphics data.

Most spreadsheet manuals refer to 'functions'; these are built in formulae that allow you to do certain things more easily. For example, date functions allow you to calculate using dates; whenever you enter a date using a date function, the spreadsheet applies a special formula to it that allows it to work out that 5 December 1998 is only ten days later than 25 November 1998. This means, for example, that, if interest is applied to your account on a daily basis, you can use Supercalc2 to calculate the interest payable over any period simply by entering the relevant dates. (Supercalc2 is internally Year 2000 compliant; only the TODAY function will cease to work on 1 January 2000 though you can even get round this by replacing TODAY with TODAY+36524 which Supercalc will recognise as a valid 21st century date).

Mini-Office II has two functions — minimum and maximum. If you press F and enter <{C4C9}<RETURN>, M-O II will display the lowest figure in the cells C4 to C9; if you enter >{C4C9}<RETURN>, it will display the highest. In Supercalc, you enter MIN(C4:C9)<RETURN> or MAX(C4:C9)<RETURN> to get the same result. Unfortunately, there is a bug in some versions of M-O II which means these functions may only work reliably in rows 1-9 of the spreadsheet.

There is one more feature of all spreadsheets which is worth looking at before leaving M-O II to concentrate on Supercalc — absolute copying.

In the CLUB ACCOUNTS example, the formula we copied was adjusted with each copy. But what if you don't want the formula, or part of it, adjusting? For example, you might have a price list showing ex-vat and vat inclusive prices. If the ex-vat prices were in column B, you could show the vat inclusive prices in column C by using the formula B4\*1.175, B5\*1.175, etc. But, when the Chancellor changed the vat rate, you would have to go down every cell in column C changing the vat rate.

It would be much easier to store the vat rate in another cell, say D1, and reference that cell. Then, when the Chancellor changed the vat rate, you would only need to change D1 and every price would be changed to reflect the new vat rate.

Create a new M-O II spreadsheet as described in the earlier piece; if you have a Supercalc spreadsheet loaded, save it if you need to and enter /ZY to clear the screen.

Make sure you are in A1 and, in M-O II, enter J 18<RETURN> 0<RETURN> L followed by T and PRICE LIST. In Supercalc enter /FC<RETURN>18<RETURN> followed by "PRICE LIST; then enter /FCb:c<RETURN>\${<RETURN>.

Move to cell C1 and, after entering T in M-O II, enter VAT RATE; in Supercalc, enter "VAT RATE. Move to cell D1 if you are not already there and, in M-O II, enter J 8<RETURN> 3<RETURN> L; then press C and enter 17.5/100<RETURN> and you should see 0.175 displayed in D1. Enter 17.5/100<RETURN> in Supercalc and you should see .175 displayed in D1.

Supercalc provides you with several standard formats and eight User-Defined formats. The standard formats include Integer, \$ ('money format' or two decimal places) and General. If you do not apply any formatting to a cell, Supercalc uses General format which displays decimals with as many places as are necessary. If you want to fix the number of decimal places, you have

to use I for no decimal places and \$ for two decimal places or create a User-Defined format with /FD for any other number of places.

If Supercalc is not showing .175, check that you entered the vat rate correctly or format D1 with /FE1<RETURN>G<RETURN>.

We need to add one extra step in M-O II because M-O II cannot handle complex formulae; move to E1 and enter J 8<RETURN> 3<RETURN> L; then press F and enter 1+D1<RETURN>. You should see 1.175 in E1

Now go to row 3 and, beginning in cell A3, enter

ITEM	EX-VAT	PRICE
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using T in M-O II or " in Supercalc.

Go to C4; in M-O II press F and enter B4\*E1<RETURN>; make sure you are still in C4 and press D; move to C5 and press <ENTER> (or <RETURN>). You will be asked (A)bsolute or (R)elative. We want C5 to hold B5\*E1; so we press R to change B4 relatively and then A to keep E1 absolutely. The result is shown in the 'Contents' on the third line. Now press D, followed by the down arrow and then <ENTER>RA again and carry on as long as you want!

Supercalc works in a very similar way except that <ENTER>/<RETURN> makes a relative copy. Go to C4 and enter B4\*(1+D1)<RETURN>. Because Supercalc allows brackets in formulae, we can miss out a step we needed in M-O II.

Make sure you are in C4 and enter /R<RETURN>c5:c20, AYN. In nearly all situations, you can use the , (comma) as an alternative to <RETURN> in Supercalc and, in several cases, it makes options available which are closed off once you press <RETURN>. In this case, pressing , after the list of cells to which you want the formula copied opens up several choices. You can copy without adjustment (No adjust) or Supercalc will Ask you whether to adjust each part of the formula or not. In this case, Supercalc offers you a Yes or No choice for each cell reference in the formula.

Now put some items in column A prefixed by T or " as appropriate and some ex-vat prices in column B; when you have done that, change the vat rate in D1 and see what happens.

I hope I have shown how competent and flexible M-O II is; it offers all the basic facilities of larger spreadsheets; its main limitations are that you need to specify the size of each spreadsheet when you start, the number of cells you can use before running out of memory is fairly small, you can only copy one formula at a time and you may have to split some formulae over several cells; but in many departments, it is just as flexible as larger spreadsheets.

In the CLUB ACCOUNTS example I used text to represent dates in both M-O II and Supercalc and, if all you need to do is record the date of a payment, this may be enough. But, if you want to use dates in a calculation, you are stuck with US (MM/DD/YYYY) format dates in Supercalc which you enter as date(m,d,y).

This strange format hints at the way Supercalc does arithmetic on dates. For example, if you enter date(1,1,98)<RETURN>, you get what you expect on screen — 1/ 1/1998. But, if you enter date(29,1,98)<RETURN>, you get 5/ 1/2000 on screen because Supercalc has divided the months by 12, carried two years into the years column and left the remainder, 5, in the months.

But on with the example. If you have another spreadsheet already loaded, save it if you need to and enter /ZY to clear the screen. Enter "PENALTY INTEREST CALCULATION<RETURN> in cell A1 and then format the columns with /FCa:f<RETURN>\$11<RETURN>. Go to A3 and enter "INVOICED<RETURN>; continue along row 3 as below:

INVOICED	AMOUNT	DUE DATE	DATE PAID	INTEREST	TOTAL
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remembering to prefix each entry with " and end it with <RETURN>.

Go to C4 and enter `A4+30<RETURN>`; in D4 enter `TODAY<RETURN>` (don't worry if you get a nonsense answer for the moment); in E4 enter `IF(C4>=D4,0,B4*8/100*(D4-C4)/365)<RETURN>` and you will get ERROR. Don't worry! It's just to tell you that it cannot work out a meaningful result. If you have entered the formula incorrectly, you will get a 'Formula error' message in the third line up; then you need to check that you really have got the formula right.

The formula needs some explaining. Supercalc uses an `IF(CONDITION,THEN,ELSE)` format. The condition `C4>=D4`, or 'C4 is greater than or equal to D4', means in this context 'the date in C4 [DATE DUE] is later than or the same as the date in D4 [DATE PAID]' since Supercalc assigns a number to every date between 1 January 1990 and 28 February 2100. So, if the DUE DATE is later than or the same as the DATE PAID (or TODAY), there is no interest and 0 appears in E4. If the DATE PAID or TODAY is later than the DUE DATE, Supercalc works out how much interest is payable and places it in E4. F4 then totals the amounts in B4 and E4; simply enter `B4+E4<RETURN>` in F4. You will get another ERROR because E4 is already displaying ERROR.

The amount of interest payable is calculated as follows: B4 (the amount due) is multiplied by 8/100 (the interest rate payable under the Late Payments of Commercial Debts (Interest) Bill) and then multiplied by the difference in days between the DATE DUE and the DATE PAID (or TODAY) divided by 365 to give the interest due.

To replicate all these formulae in one fell swoop, enter `/Rc4:f4,c5:c20<RETURN>`. Replicate is unique to Supercalc in allowing you to copy successive rows or columns as well as single cells and can be a little confusing. If you are replicating more than one cell, the first part must be a single row or column that makes up one side of the rectangle you want to fill; the second part must be a column or a row at right angles to it. If you want to copy more than one row or column at a time, that is, a block, you must use the Copy command and repeat it as often as you need to. But for copying one row or column of formulae to adjacent rows or columns, Replicate is brilliant. It's also available, though totally undocumented, in the later versions of Supercalc.

To see how our spreadsheet works, enter `date(8,26,1998)<RETURN>` in A4 and `4000-<RETURN>` in B4. If the TODAY function is not working, enter the date in D4 in the `date(m,d,y)` format. If nothing happens, you must have Recalculate set to Manual; so press ! to see the result in F4.

Experiment with a few more examples using different dates and amounts and you will see how little this measure is likely to encourage large companies to pay their bills on time!

To get the TODAY function to work in Supercalc you need to use `DATE.COM`, or `XDATE.COM` after 1 January 2000, and `SC2DATE.COM` from PD disc 82 before you load Supercalc2. `DATTIM.COM`, which comes with Supercalc2, may still work even though it displays nonsense on the screen (try it if you don't have access to `SC2DATE.COM`).

In the earlier example, CLUBACTS, I suggested entering the date as Text because, otherwise, you would be stuck with the US (MM/DD/YYYY) format which Supercalc uses. In fact, you can get round this by using three of Supercalc's date functions to reverse the order of the months and days. Save the current spreadsheet with `/Sb:penalty<RETURN>A`; then enter `/ZY` to clear it followed by `/Lb:clubacts<RETURN>A`.

Enter `/ICb:e<RETURN>` to create four new columns. If you move to I4, you will see that the formula has been adjusted to take account of the four new columns. Format the columns as follows: `/FCb:c<RETURN>3<RETURN>` `/FCd<RETURN>5<RETURN>` `/FCe<RETURN>1<RETURN>`.

Go to A4 and enter `date(1,1,98)<RETURN>`; go to B4 and enter `day(A4)<RETURN>`; in C4 enter `month(A4)<RETURN>`; in D4 enter `year(A4)<RETURN>`. You now have the date in

DD MM YYYY format but column A is still showing the date in US format. So enter /FCa<RETURN>0<RETURN>. Column A is still there as you can see from the fact that the old text in A5 to A12 spills over into columns B, C and D. DATE is also still showing over columns B and C because it has spilled over from A3. Column E is empty but its one space separates the year in column D from the entry in column F. Unfortunately, the date functions always display on the right of the cell; so you always have to put in a single space column after a date function if the next column contains text that displays on the left of the cell.

To complete the job, enter /Rb4:d4<RETURN>b5:b27<RETURN>. You will get a lot of ERROR messages some of which you can get rid of by going down column A and converting all the dates in column A to Supercalc's date format.

You can leave the ERROR messages in the rows you have not used or you can hide them with /FEb13:d27<RETURN>H<RETURN>. If you do this, you have to 'unhide' them with /FEb13:d13<RETURN>D<RETURN> and so on when you put a date in A13 and so on.

You can go one step further if you want to display the months written out in full by setting up a look up table to convert the numbers in column C to the names of the months. This is described in WACCI 79 so I will not repeat it here.

To round this example off, you may recall that M-O II automatically 'Locked' any cell with a formula in. Supercalc leaves this up to you. In this example, it would be useful to 'lock' or 'Protect', as Supercalc calls it, columns B-D and I which we can do with /Pb3:d30<RETURN> and /Pi3:i30<RETURN>. You 'Unprotect' with /U etc. You can now save this example with /S<ESC><RETURN>BA. After Save or Load, <ESC> always recalls the last file loaded.

