

## S3-1 Spreadsheets

- using spreadsheets to store data, to calculate and to produce graphs

[Learn](#) [Revise](#)

The structure of this module is a bit different. There aren't really any concepts to explain – just techniques to learn. In working through the module, you will build a number of spreadsheets, the idea being that, by the end, you will be familiar with how to use a spreadsheet to store data, to calculate and to draw graphs.

Of course, you may already have some familiarity with spreadsheets, in which case, you will be able to work through the module more quickly. But it is not assumed that you know anything about them: the instructions start from scratch.

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### Learn

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#### Introduction

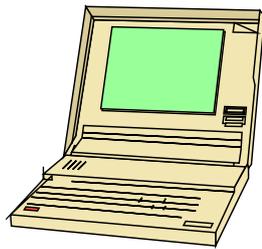
A spreadsheet is a program designed to store and organise data, to perform calculations on the data and to produce graphs from the data. Spreadsheets are very useful for performing some mathematical tasks, particularly ones that require lots of repetitive calculations.

Microsoft Excel is one of the most widely used spreadsheets. This module explains how to use Microsoft Excel. If you don't have Excel installed, but do have another spreadsheet, you can use that. Most other spreadsheets operate pretty much the same way as Excel and most of the same commands will work without modification on other spreadsheets. If you don't have any spreadsheet installed, there are free spreadsheet programs you can download. A quick Google search should find some.

In this module, you will be led through a number of tasks which require the techniques you need to learn. The best way to learn is to open your own spreadsheet and build it by following the given instructions. You should be able to follow the instructions (perhaps with minor modifications) on any spreadsheet.

As well as opening your own spreadsheet, you will need to open the spreadsheet, **S3-1 Spreadsheets.xlsx**, which can be opened from the home page by clicking the [xlsx](#) link under S3-1. It contains some examples to look at. To display properly, it will need to be downloaded and opened in Excel. If you don't have Excel, you should get a reasonable approximation, though some of the formatting may be lost.

This is only an introduction to the basic features of Excel. You may well want to go beyond this. You can do this by trial and error, using the Help in Excel, talking with other people who are using it, or googling what you need to know.



## Creating a Spreadsheet

To do this, just click on the Excel symbol on your start menu. Choose **Blank Workbook**. You should get a grid of cells.

The tab at the bottom should say **Sheet 1**. If you click the + sign to the right of it, Sheet 2 will open and so on. Open Sheet 2.

You can rename any sheet by double clicking the tab, typing the new name and then clicking elsewhere. Rename Sheet 1 as **Lunch**.

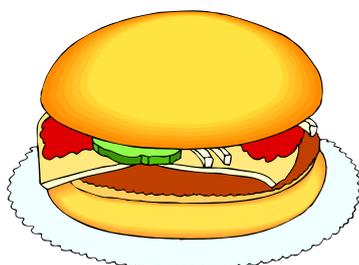
You can save the spreadsheet at any time by clicking the disk symbol in the top left corner. The first time you save it, you will need to specify a name for your file and a folder to store it in. Go ahead and save your spreadsheet as **Practice Spreadsheet** in a folder of your choice. Just make sure you will be able to find it again later.

When you've finished working for the session, just save and close it. Then you can re-open it when you want to use it again later. It might also be worth saving **S3-1 Spreadsheets.xlsx** in the folder with your spreadsheet.

## Entering Data

The columns on the spreadsheet are labelled across the top with letters. The rows are labelled down the side with numbers. The cell in column C and row 5 is called C5.

We are going to use the Lunch spreadsheet to store data on how much Rebecca's three sons spend on lunch and to calculate some statistics drawn from the data.



As a title, enter the following into Cell B2: **Amount spent each day on lunch by Rebecca's three sons**. Then click elsewhere. Note that, whenever you finish working on a cell, you can either click elsewhere or press **Enter** or **Tab**. Enter takes you to the cell below; Tab takes you to the cell to the right. This will be assumed from here on.

Not all the words in our title will fit into the one cell, but, as long as there is nothing in the cells to the right, they will continue across those cells. You might like to see what happens if you put something into D2.

Now suppose you make a mistake entering data into a cell or just change your mind. You can fix it by clicking on that cell, then editing the contents in the Formula bar at the top. Or you can double-click the cell and edit it right there in the cell. Change **her three sons** to **her four sons**.

In cells B4 to B7, enter the names of her sons: Herman, Igor, Vladimironibobsley and Shrimp. You will probably notice that Vlad's name doesn't fit in the cell and we will need to put data in the cell to its right shortly. We can widen the column by hovering over the line separating columns B and C on the header bar, then dragging it to the right. Do that so that all of Vlad's name fits in the cell.

Actually, it might be better to enter the names into B5 to B8. To move them, select the four cells by clicking on the top cell and dragging the cursor down to the bottom cell, then hover over the border of the selection until you get four arrows, then drag to where you want to put them.

Another way to move them down is to click on the header bar at the left of the sheet in Row 4, then, in the HOME menu, choose Insert, then Insert Sheet Rows. This will insert one row before the row you are on. If you select 5 rows by clicking and dragging down the header bar, then it will insert 5 rows before the ones you are on. The same works for columns. To undo a change, click the Undo arrow to the right of the Save button. Undo the move. Then move the four names by inserting a row instead.

Now enter the days, M, T, W, Th, F in cells C4 to G4.

Now we will enter some amounts in cells C5 to G8. Start by putting 4.50 in C5. This will probably show as 4.5. If you right click on the cell and choose the Format Cells... option, then Currency and choose 2 decimal places, you should get \$4.50. Alternatively, if you had entered \$4.50 in the first place, the format would have changed automatically to the one you wanted.

However, the dollar signs do make the numbers harder to read, so, as it is obvious that they are money, we might leave them off. Select the cells again, then Format Cells..., then Number and 2 Decimal places.

You will notice that the cells containing letters are left justified and those containing numbers are right justified. Let's change the justification of cells C4 to C8 to Centre. Select the cells, then click the Centre Justification symbol on the HOME menu.

Enter amounts of your choosing in the other cells for the four boys, Monday to Friday. If you change your mind about a number, just click off the cell, then back onto it and type the new amount. Your sheet should then look something like this:

	Amount spent each day on lunch by Rebecca's four sons						
		M	T	W	Th	F	
Herman		4.50	8.00	12.00	7.80	10.00	
Igor		21.00	23.50	16.25	18.00	18.00	
Vladimironibobsley		12.00	14.65	32.90	0.00	0.33	
Shrimp		2.20	0.00	3.00	1.75	4.00	

## Practice

Q1 Rename Sheet 2 of your spreadsheet to **Timetable** and use it to make a school timetable showing your lessons and breaks along with their start and finish times and what subject you have each lesson. Try to make it as presentable as possible so that anyone could understand it easily. If you're not at school, make it up.

Note that if you enter numbers with punctuation marks, they will sometimes be interpreted as times or dates and be presented in a different form from what you entered. If you want your entries to stay in the form in which you put them in, just put a single inverted comma (') before them. For example entering 12-13 might cause the spreadsheet to display Dec-13, whereas entering '12-13 will cause it to show 12-13. Note, however, that if you do this, the spreadsheet will not recognise what you entered as a number and so will not do calculations with it.

An example of a suitable response to Q1 is given on the Timetable sheet of **S3-1 Spreadsheets.xlsx**.

Some extra formatting has been used in that spreadsheet. You might like to try to apply similar formatting to your spreadsheet. A bit of trial and error with the menus should enable you to work out how to do it.

## Performing Calculations

Going back to the Lunch sheet, let's work out the total amount spent by the boys for each of the 5 days.



In B9, write **Total**. Then in C9, we need to write a formula so that the spreadsheet will calculate the total of the four cells above it. Any formula starts with =. That way the spreadsheet knows it has to calculate something.

Click on C9. Then type =sum(C5:C8). **sum()** tells the spreadsheet to work out the sum of the cells in the brackets. C5:C8 means all the cells from C5 to C8 inclusive. If you had written sum(C5:D8), it would have added all the cells from C5 to C8 and D5 to D8. When you press **Enter**, C9 should show the total spent by the four boys on Monday.

An alternative way to write the formula is to type =sum( , then select the cells you want to add, then type ). Delete the formula and try doing it that way instead.

Now we will do the same for the other four days. You could do each the way we did Monday, but there is a much quicker way: Select C9 again, then drag the little green square at the bottom right corner of the cell to the right until the five cells for Monday to Friday are selected. If you look at the formula for each of the five cells, you will notice that the spreadsheet changes it to fit each new column.

SUM is a spreadsheet function which tells it to perform a certain kind of calculation. There are hundreds of other functions, some of which you may learn later. For now, let's put the average amount spent by Herman per day in H5. The formula for average is =average(). Use this in H5. Then copy it into H6 to H9 to find the averages for the other boys. Finally, write Average in H4 and do any tidying up necessary. You might like to make the heading bold and increase its font size slightly. Click on B2, then use the features in the HOME menu. You can do some other formatting too if you would like. Play around.

Your sheet should now look something like this:

Amount spent each day on lunch by Rebecca's four sons							
	M	T	W	Th	F	Average	
Herman	4.50	8.00	12.00	7.80	10.00	8.46	
Igor	21.00	23.50	16.25	18.00	18.00	19.35	
Vladimironibobsley	12.00	14.65	32.90	0.00	0.33	11.98	
Shrimp	2.20	0.00	3.00	1.75	4.00	2.19	
Total	39.70	46.15	64.15	27.55	32.33		

You can find a ready-made copy of this completed spreadsheet on the Lunch sheet of **S3-1 Spreadsheets.xlsx**.

## Practice

Q2 Rename Sheet 3 of your spreadsheet to **TV** and use it to record the number of minutes you spend watching TV each day of the week for 4 weeks. Arrange the 28 days in a rectangular array rather than a long column. Just estimate or make up the numbers. (Don't spend 4 weeks collecting the data.) Include on the spreadsheet the total number of minutes for each week and the average amount on Mondays, the average amount on Tuesdays etc.



A possible response to this question is given on the TV sheet of **S3-1 Spreadsheets.xlsx**.

## Another Sheet - Loan

Go to Sheet 4 and change its name to **Loan**. Imagine that you have your first full-time job as a travelling sales rep and you need to buy a decent car. So you get a \$25 000 loan from the bank at 9% p.a. reducing interest. That means that, at the end of each month, the bank adds a month's interest onto what you still owe. One month's interest is  $\frac{1}{12}$  of 9%, i.e. 0.75%, of the balance, or the balance multiplied by 0.0075. But also each month you make a repayment and they subtract that from the loan balance.



We will produce a spreadsheet to track the paying off of the loan for different monthly payments. We will also be able to easily change the spreadsheet to see what happens for different amounts borrowed and different interest rates.

Put the heading **Loan** in A1. Put the heading **Month** in A3 and the heading **Balance** in B3. Put the number **0** in A4.

Then select the 61 cells from A4 to A64, select Fill from the HOME menu and select Series... Put **1** in Step value, then press **OK**. The resulting numbers from 0 to 60 are the number of months since you took out the loan.

Select the whole of Column A by clicking on the header and change the justification to **Centre**.

Now we want to be able to easily change the initial loan amount, the interest rate and the monthly repayments, so we will put these three amounts separate from the main table. Type **Loan amount** in D4, **Interest rate** in D5 and **Monthly repayment** in D6. Then widen the column to accommodate them.

Now enter **25000** in E4, **9%** in E5 and **400** in E6.

In B4, type **=E4** or type **=** and click on E4.

Now, in B5, we want the amount owed after 1 month. This will be the balance after zero months plus a month's interest minus the monthly repayment. The formula will be **=B4\*(1+E5/12)-E6**. Note we use **\*** for multiply and **/** for divide. Also we use **^** for 'to the power of'. You should notice that the cell now says 24787.5. Reformat cells B5 to B64 to Number with 2 decimal places and a thousands separator. B5 should then say 24,787.50. This seems reasonable for the balance owed after one month.

Now we want to fill this formula down into the next 60 cells. But first, just fill down into the next cell, by dragging the green square. You will notice that the result is somewhat ridiculous. It gives \$851,037.50. This is because, as we drag down, the spreadsheet changes B4 to B5 in the formula as we want, but it also changes E5 to E6 and E6 to E7, which we don't want.

To get around this, we go back to the formula in B5 and change E5 to **\$E\$5** and E6 to **\$E\$6**. The **\$** signs tell the spreadsheet to keep the cell reference the same as we fill down the formula. These are called absolute references. Do this, then fill down to B6 again. You should get the more reasonable result of \$24,573.41. Now we can fill down to B64.

The top part of your sheet should then look like this:

<b>Loan</b>				
Month	Balance			
0	25000		Loan amount	25000
1	24,787.50		Interest rate	9%
2	24,573.41		Monthly repayments	400
3	24,357.71			
4	24,140.39			
5	23,921.44			
6	23,700.85			

You will notice that there is still about \$9000 owing at the end of the 60<sup>th</sup> month. To pay the loan off within 5 years, we will need to increase the monthly repayments.

Change the monthly payment in E6 to \$600 and you will see that the loan is paid off in 51 months.

You can probably see now why we put the monthly repayment in a cell separate from the table. If we had just included the \$400 in every formula, we would have had to change every formula in order to try a different repayment amount. As we can use the spreadsheet for different loan amounts and interest rates, you can see why it is better to have these in cells separate from the table too.

Use a bit of guess and check to find out what the loan repayments would have to be to pay off the loan in exactly 60 months. Then try different loan amounts and/or interest rates to see what the repayments need to be to pay off the loan in exactly 60 months.

## Inserting a Graph

Let's produce a graph of balance vs time. Select cells A3 to B64. Then from the INSERT menu select the scatter graph icon, the one with scattered dots, then choose the first option – the one with dots but no lines. The graph will appear. You can move it to where you want it on the sheet, change its size and make various formatting changes. You can explore these yourself. One thing you will need to do is to add the axis titles to the graph. To do this, click anywhere on the graph, then click the green + sign to the top right of the graph. Tick **Axis Titles**, then over-write what's in them with **Month** and **Balance**. Your sheet might now look something like this:

Loan								
Month	Balance							
0	25000	Loan amount	25000					
1	24,787.50	Interest rate	9%					
2	24,573.41	Monthly repayments	400					
3	24,357.71							
4	24,140.39							
5	23,921.44							
6	23,700.85							
7	23,478.61							
8	23,254.70							
9	23,029.11							
10	22,801.83							
11	22,572.84							
12	22,342.14							
13	22,109.70							
14	21,875.53							
15	21,639.59							
16	21,401.89							
17	21,162.40							

Month	Balance
0	25000
1	24787.50
2	24573.41
3	24357.71
4	24140.39
5	23921.44
6	23700.85
7	23478.61
8	23254.70
9	23029.11
10	22801.83
11	22572.84
12	22342.14
13	22109.70
14	21875.53
15	21639.59
16	21401.89
17	21162.40

Note, that if you make any changes to the numbers in the spreadsheet, the graph will change automatically. Try it.

You can find a ready-made copy of this completed spreadsheet on the Loan sheet of **S3-1 Spreadsheets.xlsx**.

## Practice

- Q3 Use Sheet 5 of your spreadsheet to work out the squares of all numbers from 0 to 3 going up in steps of 0.2. Then insert a graph of the squares against the original numbers.
- Q4 At the start of 2020, you put \$200 into a savings account. At the start of 2021, 5% of your balance is added to the account as interest and then you deposit another \$200. The same happens again at the start of every year from 2022 to 2030. Use Sheet 6 to track the balance of your account for the 10 years, then show the information on a graph.

Possible responses to these questions are provided on the Squares and Savings sheets of **S3-1 Spreadsheets.xlsx**.

## Losing Weight

This is an example of a more involved spreadsheet. It is quite complicated. You won't be expected to make one this complicated, but you can have a look at it if you are interested.

Harry has a tendency to put on weight. He finds keeping track of his food consumption and energy use a good way to lose weight and to keep it down. It provides motivation by allowing him to see his progress and predict the effect of what he eats and what exercise he does, especially as every good or bad day has a lasting effect.

He uses the spreadsheet on the Harry sheet of **S3-1 Spreadsheets.xlsx**.

He counts his steps each day with a Fitbit and records the number in Column C. If he does other exercise, he estimates the number of steps it is equivalent to and enters this in Column D. Column E then works out the total.

Column F works out how many calories he used to do that exercise as well as for normal living. Harry had to use a bit of guess and check initially to get these figures, but he uses a base rate of 1840 per day plus 0.024 per step. As he needs to use more energy when he is heavier, he multiplies this by his weight the previous day divided by his target weight of 60 kg.

He keeps track of the calories he eats each day and enters this in Column G. Column H is then the excess calories consumed (hopefully negative so he loses weight).

In Column I he records his target weight. It assumes that he weighed 67.6 kg on September 13 and that he hopes to lose 0.1 kg per day. In column J is his calculated weight based on the information in Column H and the previous day's weight. In column K is his actual weight when he gets up the next morning.

He has formatted some of the cells to give himself a quick view of how he is doing. In general, red is bad, blue is good.

Finally, he has a graph of his target weight, his calculated weight and his actual weight. From this he gets an instant impression of his progress. As you can see, he kept pretty much to his target of 0.1 kg/day until the beginning of November, then lost weight at a lower rate after that, but still got close to his target of 60 kg by early December.

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## Revise

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### Revision Set 1

Q61 Plumstead Used Cars employs four sales staff. Their sales for January were:

Sarah	\$152 200
Ben	\$98 900
Barbie	\$109 300
Ken	\$111 000
Hashim	\$137 100

Matilda, the sale manager wants everyone's sales to increase by 6% each month for the rest of the year.

Construct a spreadsheet to enter this data and to show the required sales for each of the four staff each month for the rest of the year. Also get it to show the total sales for each staff member for the year and the total for the company for each month. Make sure it is possible to change the 6% figure by changing just one cell.

Insert a graph of total company sales for each month.

A suitable response to this task is presented in the Sales sheet of **S3-1 Spreadsheets.xlsx**.