



ACCESS ANALYTIC

52 Easy Ways to Prevent Spreadsheet Problems

White Paper

Introduction

Thank you for downloading this invaluable report.

This guide contains our distilled, concise wisdom regarding the many common problems we've encountered, observed, and fixed over the years.

In the pages that follow, you'll find details of 52 specific problems, why each item is important, plus examples and advice on how to avoid the pitfalls.

This white paper contains extensive explanations, worked examples, screenshots and illustrations.

We've assumed an intermediate level of prior knowledge but even if you're new to Excel, you'll still find plenty of useful tips.

Take your time in reading the guide and ensure you keep it handy for future reference.

By avoiding the problems we've noted below, your spreadsheets will be MILES ahead of those around you and your productivity will absolutely SOAR!

Enjoy your superior spreadsheets!

The Access Analytic Team

About the Author

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Qualifications and Background

B.Comm (Accounting & Information Systems), CISA, AFin, AIMM, Excel Expert

Jeff Robson is the Principal Consultant of Access Analytic Solutions, a Perth-based consulting company that provides financial modelling services in model development, audit/review, and training.

Jeff holds a Certified Information Systems Auditor from the Information Systems Audit and Control Association. He has 15 years experience with Microsoft Excel, 6 years experience in Information Systems Audit, and worked for 4 years in external audit.

He has been involved in many Excel development projects for clients around the world including sophisticated financial modelling, auditing and review, and advanced macro programming.

Access Analytic is the Information Systems audit partner for a number of chartered accounting firms in Perth and performs IT system reviews, Information Systems audit and control reviews, and systems selection and implementation for a wide variety of clients.

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About Access Analytic

OVERVIEW

Established in 2000 (originally under the name "Mailbarrow"), Access Analytic Solutions is a leading provider of services in financial modelling, management reporting, data analysis and financial model auditing.

We are based in Perth, Western Australia and provide financial modelling, management reporting and data analysis services to businesses so they can make decisions with confidence.

We specialise in financial modelling and have developed, re-developed, and audited financial Excel models for a wide variety of medium and large organisations around the world.

We also provide training in financial modelling, company valuations and advanced Excel for finance and accounting professionals.

ACCESS ANALYTIC			
products and services	modelling - financial modelling - management reporting - business analysis	training - financial modelling - excel & vba for accountants - best practice excel	review - model auditing - model review - risk analysis & controls

Figure 1: Access Analytic Solutions Overview

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Using this Guide

SPREADSHEET PROFESSIONAL

In this guide, you'll see many references to Spreadsheet Professional, a powerful Excel add-in for testing and documenting spreadsheets.

For more information about this product and how it can benefit you, visit

http://www.accessanalytic.com.au/services_spro.php

MORE HELP

Access Analytic provides Financial Modelling, Management Reporting and Training services for companies that need to make decisions with confidence. We have provided solutions to companies all over the world and have worked with spreadsheets for over 15 years.

To read a sample of testimonials from our clients, visit

<http://www.accessanalytic.com.au/success.php>

To learn more about the points discussed in this guide or how Access Analytic can assist your business by developing customised solutions for you, visit

http://www.accessanalytic.com.au/services_excel.php

KNOWLEDGE BASE

We have a fully-searchable Knowledge Base available with hundreds of articles that we've written over many years. This is a great resource for getting insights on Excel and financial modelling that you won't find anywhere else on the web!

<http://www.accessanalytic.com.au/kb.php>

52 Easy Ways to Prevent Spreadsheet Problems

FORMULAS & FUNCTIONS

1. Avoid hard-coding values in formulas – enter the data in cells then reference these in your formulas.

Hard-coding values in formulas is often a “quick and dirty” fix for changing the way a formula works and is commonly a source of error.

Formulas should use a value stored in another cell rather than placing the value directly into the formula. This way, you can always see the values being used in the formula and when you change the input data, the formula updates correctly.

C12		=		=B12*(1+\$B\$9)		
	A	B	C	D	E	
1	WRONG:					
2		Price ex Tax	Price inc Tax			
3	Widget	100	110	←	=B3*1.1	
4		What if the tax rate changes? What tax rate has been applied?				
5						
6						
7	RIGHT:					
8						
9	Tax Rate:	10%				
10						
11		Price ex Tax	Price inc Tax			
12	Widget	100	110			
13						

Both “Price inc Tax” numbers look the same but if you had 1000 items and the tax rate changes, it would be time consuming to change every formula and check this was correct if each formula contains “*1.1”. It’s much easier and more readable to place the tax rate in a different cell and reference this.

This type of error is identified by “Spreadsheet Professional”, a powerful Excel add-in for documenting and testing spreadsheets that is sold by Access Analytic.

2. Don't mix formula and data entry areas together. Consider having separate areas that are readily distinguishable for data entry, calculations, and output.

Mixing formulas and data together is another very common source of errors.

By having separate areas (or ideally separate sheets) for data entry, calculations, and output, your spreadsheet is more organised, and you know what a cell contains just by looking at it. It's often useful to shade all data entry cells a particular colour (eg light yellow, or grey, etc) to show users exactly where they can and can't enter data.

Then, when you need to update your spreadsheet, each area can be updated without affecting the other areas that depend on it. In addition, you won't accidentally overwrite a value or formula because you didn't know it was there.

Spreadsheet Professional helps to identify these types of errors via its "Spreadsheet Painter", and "Spreadsheet Map" tools.

Acme Widgets Ltd - Annual accounts

Period	Q1	Q2	Q3	Q4
Sales	2800	3000	4000	5000
Cost of sales	1200	1000	1200	1300
Net cost of sales	1600	2000	2800	3700
Overheads	1600	1200	1200	1200
Profit before tax and interest	0	800	1600	2500
Opening cash balance	200	200	764	1895
Average cash balance	200	600	1564	3145
Qtrly interest rate upto \$100	1.0%	1.0%	1.0%	1.0%
Qtrly interest rate over \$100	1.5%	1.5%	1.5%	1.5%
Qtrly interest rate over \$200	2.0%	2.0%	2.0%	2.0%
Interest	2	6	16	31
Profit before tax	2	806	1616	2531
Tax rate	30%	30%	30%	30%
Tax	1	242	485	759
Profit after tax	1	564	1131	1772

Which of these cells contain formulas and which contain numbers?
Spreadsheet Professional shows you automatically:

Acme Widgets Ltd - Annual accounts

Period	Q1	Q2	Q3	Q4
Sales	2800	3000	4000	5000
Cost of sales	1200	1000	1200	1300
Net cost of sales	1600	2000	2800	3700
Overheads	1600	1200	1200	1200
Profit before tax and interest	0	800	1600	2500
Opening cash balance	200	201	765	1896
Average cash balance	200	601	1565	3146
Qtrly interest rate upto \$10000	1.0%	1.0%	1.0%	1.0%
Qtrly interest rate over \$10000	1.5%	1.5%	1.5%	1.5%
Qtrly interest rate over \$20000	2.0%	2.0%	2.0%	2.0%
Interest	2	6	16	31
Profit before tax	2	806	1616	2531
Tax rate	30%	30%	30%	30%
Tax	1	242	485	759
Profit after tax	1	564	1131	1772

KEY: Dark Blue = label, Light Yellow = Number, Light Blue = Formula

3. Use absolute cell references and/or named ranges when copying formulas that refer to a particular cell or range. Try to design formulae that will apply to a block of data, this makes it easier to copy. Hence you may have to use mixed references eg \$A1 or A\$1.

If you use absolute cell references (eg “\$A\$1”) or named ranges (eg “TaxRate”) your formulas will always refer to the correct cell when you copy them and you won’t need to retype cell references after copying.

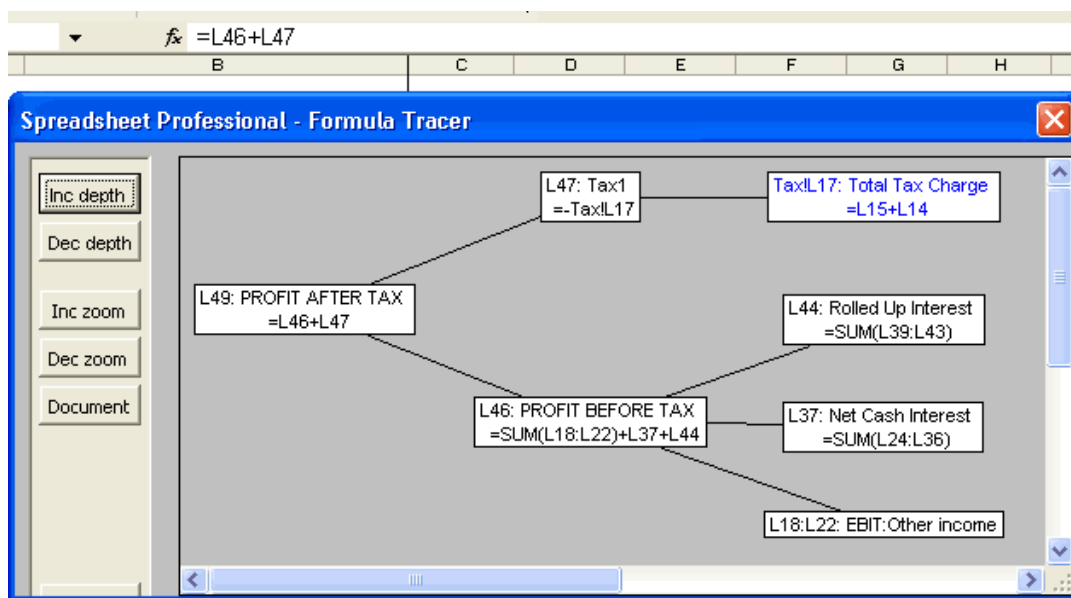
4. Always document long formulas so you (and others) can remember what the formula does – especially those formulas with multiple nested functions and numerous layers of brackets.

In general, the longer a formula is, the more likely it is that it will contain errors since it becomes increasingly difficult and time-consuming to test all possible permutations. In addition, long formulas are particularly difficult to read and understand – even if you wrote them yourself.

Instead, break long formulas into a series of shorter ones wherever possible and/or document the logic used via a cell comment.

=IF(OR(O12="",ISNUMBER(O12)),0,INDEX(BusinessUnits,B\$2,VLOOKUP(O12,AllocationCodes,3)))					
A	L	M	N	O	P
Compensation penses	-	Formula: IF 'SectionCode' = 0 OR 'SectionCode' IS NUMBER THEN Result = 0 ELSE Result = INDEX(BusinessUnitRefTbl, BusinessUnitID, ColumnNum) ENDIF			
	-				
	-				
	-				
	-				
	-				

Spreadsheet Professional assists with understanding complex formulas via its Formula Tracer “bubble diagrams” and Translation Toolbar.



5. Check the offset you use in Vlookup, Hlookup, or other reference functions and be careful when you insert rows or columns in your Vlookup or Hlookup range.

Vlookup and Hlookup are very useful and powerful functions however if you insert a new column of data into a Vlookup table and don't amend your offset number your result will be totally incorrect (the same applies inserting a row of data into a Hlookup table).

Assuming your lookup table starts in Column A, one way around this is to use the COLUMN function to get the correct offset rather than keying it manually.

B15 = =COLUMN()				
	A	B	C	D
13				
14	Key Investment Variables (per Year)			
15	LineID	2		
16				
17	Age	Year		
18	(years)			
19	0	2003		
20	1	2004		
21	2	2005		
22	3	2006		
23	4	2007		
24	5	2008		
25	6	2009		
26	7	2010		
27	8	2011		
28	9	2012		
29	10	2013		
30				
31	Age	1		
32	Year	2004	=VLOOKUP(B31,Invest1LookupTable,B15)	

Spreadsheet Professional prompts you about Vlookup and Hlookup offsets.

6. Be careful when inserting a new row or column of data just before a function such as Sum, Subtotal, Average etc – be sure to amend the function's range.

Spreadsheet Professional Build Test Document				
B8 = =SUM(B2:B6)				
	A	B	C	D
1	Year	Sales		
2	1	1600		
3	2	1400		
4	3	1700		
5	4	2000		
6	5	1400		
7				
8	Total	8100		
9				

A new row has been inserted ready to enter Year 6 data but the SUM formula still only refers to the previous data range. This must be changed manually.

Spreadsheet Professional identifies data that has not been used in calculations and flags this as a potential error.

7. Watch out for circular references.

Circular references are formed when a cell formula refers to itself (either directly or indirectly). In some circumstances, this can be useful (eg if you need to perform multiple iterations) but most of the time it means an error has occurred.

Recent versions of Excel provide a toolbar that automatically pops up to assist you in locating the error. In older versions, you can use the Auditing toolbar to track this down.

Spreadsheet Professional Build Test Document

B7 = =SUM(B2:B7)

	A	B	C	D
1	Year	Sales		
2	1	1600		
3	2	1400		
4	3	1700		
5	4	2000		
6	5	1400		
7	Total	0		
8				
9				
10				
11				
12				

Circular Reference

\$B\$7

8. Never clear a cell using the space bar, use the Delete key instead.

If you use the space bar to clear a cell's contents, the cell will appear empty on your screen but Excel doesn't consider it to be empty. For Excel, the cell still contains a single character of text.

This causes problems when you use the cell in number calculations.

Spreadsheet Professional Build Test Document US

C3 = =(B2+B3)/2

	A	B	C
1	Year	Sales	Moving 2 Yr Average
2	1	1600	
3	2		#VALUE!
4	3	1700	#VALUE!
5	4	2000	1850
6	5	1400	1700
7	Total	6700	

Errors occur because B3 contains a space rather than being cleared by pressing "Delete".

- Take care when using data of different units in formulas (eg m and km, l and ml etc). Ensure correct conversion is used or ideally perform the conversion in a separate calculation.

When setting up your data entry variables, always be sure to include a description of what they are as well as the units.

configStartYe...	=	StartYear:				
	A	B	C	D	E	F
1	CONFIGURATION INFORMATION					
2	Administration Configuration Data					
3						
4	Application Variables					
5	Name	Value	Units	Description		
6	configStartYear	2003	year	Start Year		
7	configInvestSheetPrefix	Invest_	N/A	Investment Worksheet Prefix		
8	configCashReserveRqmt	5%	%	% of total investment value re		
9	configInvestmentTitle	Project Name:	N/A	Label for investment name field		

Spreadsheet Professional includes functions that setup a data entry sheet in this standard format.

- Ensure your spreadsheet can handle unusual situations such as zero or text values in cells (particularly where formulas use division).

If your spreadsheet is going to be used by others (particularly people who aren't computer literate) you need to make it as "idiot-proof" as possible.

Some of the ways you can achieve this include:

- Data validation (under Excel's menus: Data > Validation). You can apply this to a cell to specify that the data entered will only be accepted if it falls within a certain range eg a percentage must be between 0% and 100% (ie 1.00), or a product code must have 10 alphanumeric characters etc. This also allows you to set your own custom error alerts that are displayed if data entered doesn't meet the required criteria.

Sample screen for validating a percentage entry.

- Error messages that only appear if an incorrect entry is detected. This could be achieved with formulas such as =IF(A1>1000,"Error Detected","").

- Handle the error values within your formulas eg =IF(A1=0,0,B1/A1) This will avoid any “#DIV/0!” errors that would otherwise appear if you try to divide by a cell containing zero.

11. Don't use SUM to calculate subtotals – use SUBTOTAL.

If you need subtotals, SUM functions are a very inefficient and error-prone way to calculate these. A far better way is to use the SUBTOTAL function.

Spreadsheet Professional					
B8 =SUBTOTAL(9,B4:B7)					
	A	B	C	D	E
1					
2		Q1	Q2	Q3	Q4
3	Sales				
4	- Widgets 1	1,380	1,540	1,620	1,360
5	- Widgets 2	1,810	1,030	1,560	1,630
6	- Widgets 3	1,140	1,020	1,290	1,120
7	- Widgets 4	1,680	1,360	1,690	1,990
8	Total Sales	6,010	4,950	6,160	6,100
9	Cost of Goods Sold	(1,800)	(1,700)	(1,770)	(1,350)
10	Gross Profit	4,210	3,250	4,390	4,750
11					
12					
13		=SUBTOTAL(9,B4:B9)			
14					

Even though there is a subtotal at B8, we can apply another subtotal function to the entire range B4:B9. Excel recognises the other subtotal and doesn't re-add this in the result at B10.

This will work no matter how many previous subtotals there are and it is so much easier and simpler than using multiple SUM functions then adding each of these cells together.

In addition, be wary of numbers with leading '. This causes the number to be treated as text and will not be included in calculations – even though it's in a column of numbers.

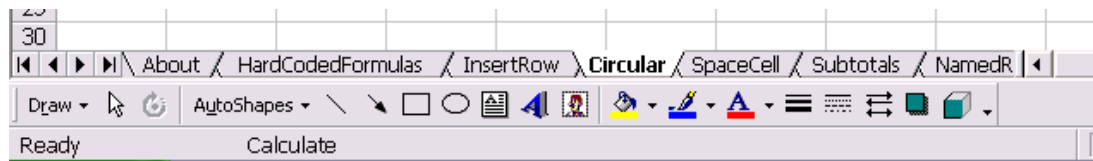
PRINTING

12. If you're using manual recalculation, ensure you re-calculate before printing.

If your file has automatic recalculation set (ie the default) you don't need to worry about this point.

However, if your file is set to manual recalculation and you don't recalculate (by pressing F9, or going to "Tools > Options > Calculation > Calc Now") before printing, your printout will show incorrect results.

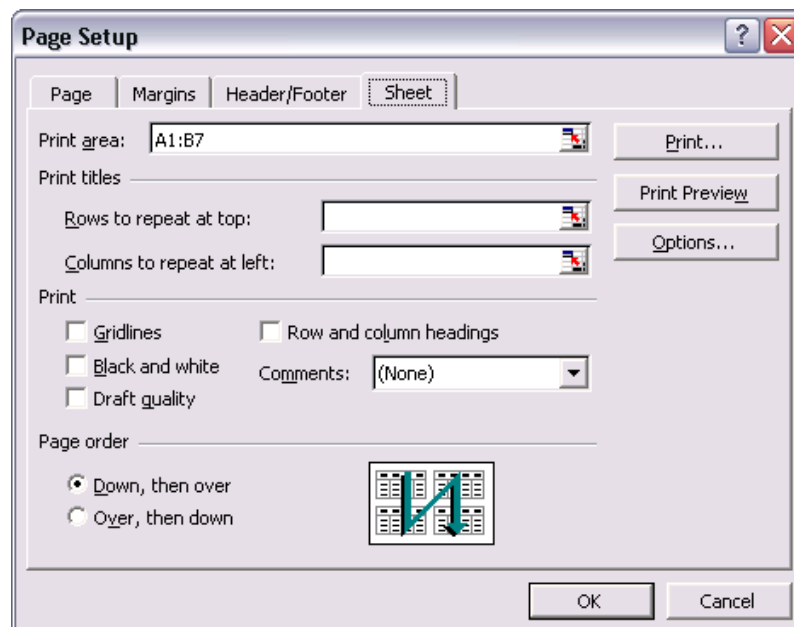
Your spreadsheet needs recalculating if you see the word "Calculate" in the status bar at the bottom left hand side of Excel's screen.



13. If you set a print area to show one portion of the sheet, don't forget to change/clear this when trying to print the full sheet.

A very common printing mistake is to set a print area then wonder why your printout doesn't show everything you see on your screen.

You can check if a print area is set by going to "File > Page Setup > Sheet". If a range has been set it will show in the "Print area" box. You can then choose to clear this box or amend it as required.



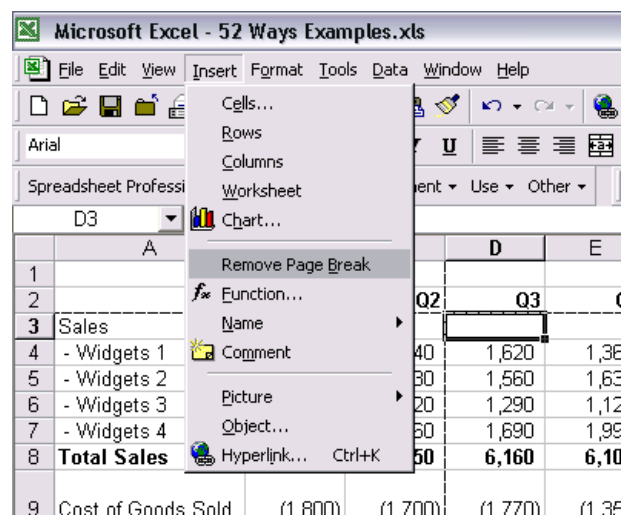
14. If you use the print option “Fit to x pages wide by y tall”, your manual page breaks will be ignored.

Another very common printing problem is to set manual page breaks (using “Insert > Insert Page Break”), but then select the option “Fit to x pages wide by y tall”, (under “File > Page Setup > Page > Scaling”) and wonder why your page breaks don’t work.

If you want to use your manual page breaks, you must use the “Adjust to x% normal size” option.

If you want to use the “Fit to x pages wide by y tall” option, you must accept Excel’s automatically generated page breaks. Note that choosing this option doesn’t actually delete manual page breaks – they are still there and will re-appear if you choose the “Adjust to x% normal size” option.

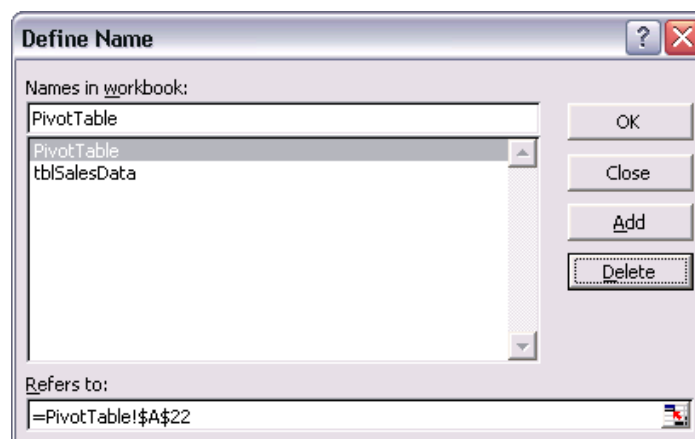
Note that to remove a manual page break, you need to go back to the Insert menu (yes, you read correctly!). Click the cell in the top left hand corner of your page break and go to “Insert > Remove Page Break”.



NAMED RANGES

15. When deleting range names or rows/columns containing these, ensure the names aren't used in any functions or macros.

If you delete a cell containing a named range (eg "TaxRate"), all the cells that refer to this will show the "#REF!" error. This result will also be produced if you delete the range name itself (via "Insert > Name > Define > Delete").



Before deleting, use the Auditing tools (under "Tools > Auditing" or the Auditing toolbar) to look for any cells that still use the named range via "Trace Dependents".

16. When adding rows or columns at the end of named data tables, be sure to amend the range name.

Spreadsheet Professional		Build	Test	Document
tblSalesData		=	1	
	A	B	C	D
1	Year	Sales		
2	1	1600		
3	2	1400		
4	3	1700		
5	4	2000		
6	5	1400		
7	6	1500		
8				
9	1400	=VLOOKUP(6,tblSalesData,2)		

As this example shows, there is a named range called "tblSalesData" which refers to A2:B6. An additional row has been added but the named range has not been updated to include this.

This then causes an incorrect result when the Vlookup function is used in A9.

Another way to detect this type of error would be to amend the formula in A9 to =VLOOKUP(6,tblSalesData,2,FALSE). By including the optional argument "FALSE", the formula will only show a result if Excel finds an exact match for "6" in the lookup range. In this case, an "#N/A!" error would be produced.

17. Avoid copying a formula that includes a named range from one spreadsheet to the other as this creates a hidden link between the workbooks.

One of the most frustrating things is a file with links that you can't find! You can see what files are linked by going to "Edit > Links" but Excel doesn't tell you which cells actually contain these links!

There are a number of add-ins, that will seek these hidden links out and tell you where they are. Spreadsheet Professional also includes this information as standard on one of its reports.

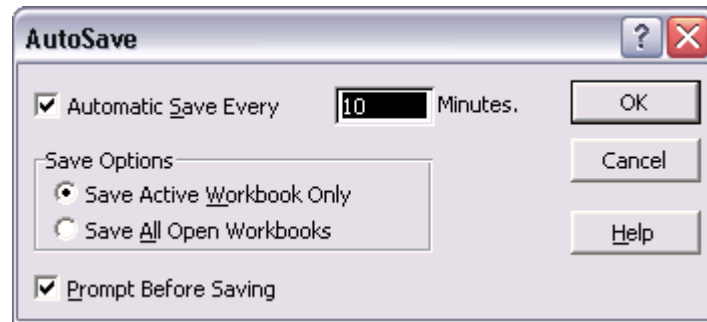
In addition, when creating a range name use proper capitalisation such as "TaxRate" instead of "taxrate". The reason for this is that if you enter all your range names in lowercase, Excel will automatically convert them to uppercase if they are valid. If Excel doesn't recognise your range names you will see a #NAME? error displayed. Any range names that are still in lowercase must have either been misspelled or haven't been created yet.

FILES

18. Use the Autosave add-in to avoid losing your work.

This is relevant for Excel 2000 and below. You can activate or check the status of the Autosave add-in under “Tools > Add-Ins”.

Once installed, you can customise it under “Tools > Autosave”.



In Excel 2002 (Office XP), the Autosave add-in has been replaced by Autorecovery which does a much better job and simply backs your files up rather than overwriting them accidentally (see below).

19. When you use the Autosave add-in, do “Save As” with a new filename as soon as you open the file. This will avoid accidentally over-writing the original file.

Autosave is great in that it regularly prompts you to save your file (or just saves it automatically, depending on your settings). However, Autosave overwrites the original file each time it saves and you don’t always want this.

For example, you may have opened up a file you’re going to use as the basis for creating a new file, but you still want to retain the original one. If you don’t do a “File Save As” as soon as you open the original file, you may accidentally overwrite it via Autosave.

20. Make sure you save changes before quitting.

The importance of this one is obvious! If you click “No” when Excel asks if you want to save changes, your amendments are gone forever!

FORMATTING

21. When cutting and pasting cells that have border formatting, ensure you reinstate the correct borders.

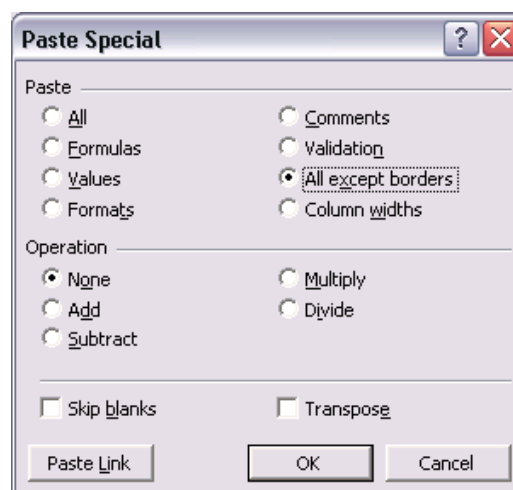
If you copy and paste a formula, the default setting in Excel is to copy all formats and the formula to the destination cell(s).

If you have special borders, and you use the normal copy and paste formulas, you may end up with breaks in your borders, which are painful to constantly reinstate.

In the following example, the “Total Sales” formula was updated for Q1 then copied across to Q4. However, when this occurred, the outline surrounding the data was broken.

A	B	C	D	E	F
	Acme Widgets Corporation				
		Q1	Q2	Q3	Q4
	Sales				
	- Widgets 1	1,420	1,940	1,000	1,720
	- Widgets 2	1,950	1,700	1,660	1,020
	- Widgets 3	1,430	1,170	1,850	1,690
	- Widgets 4	1,230	1,090	1,560	1,700
	Total Sales	6,030	5,900	6,070	6,130
	Cost of Goods Sold	(1,450)	(1,150)	(1,650)	(1,930)
	Gross Profit	4,580	4,750	4,420	4,200

A better way of handling this is to use “Paste Special” then select “All except borders”. This will copy the formula and all the other formats that have been set but will leave your existing borders in place.



Another alternative is to use the Format Painter (the paintbrush icon near the copy and paste buttons) to easily copy all the formats from a correctly formatted cell/range to another cell/range.

22. Consider using “Center Across Selection” rather than “Merge Cells” – merged cells can cause issues during certain operations.

In Excel versions prior to 97, the “Merge and Center” button  simply centered text across the range selected. From Excel 97 onwards, it defaulted to merging the underlying cells and centering the text within the newly created merged cell.

While merged cells are great for many applications they also cause problems in many situations including:

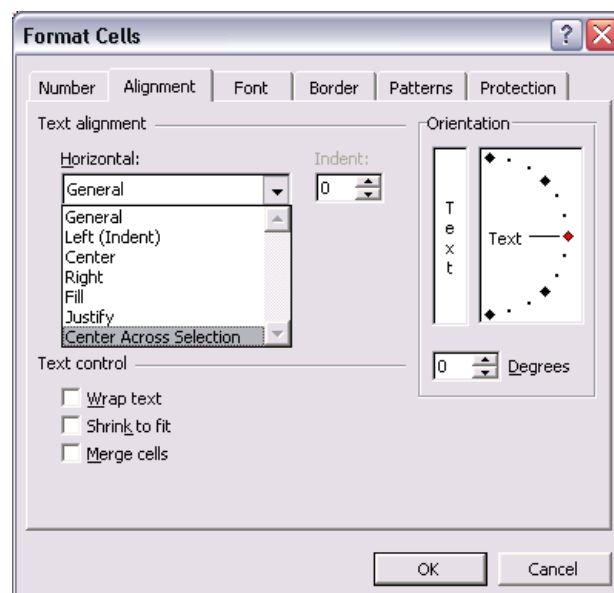
- You cannot use the AutoFit feature on a column that contains a cell merged with cells in other columns. Likewise, you cannot use AutoFit on a row that contains a cell merged with cells in other rows.
- If you try to select cells and your selection includes a merged cell, you won’t be able to select just the cells you want.

	A	B	C	D	E	F	G
1		Acme Widgets Corporation					
2							
3			Q1	Q2	Q3	Q4	
4		Sales					
5		- Widgets 1	1,430	1,990	1,210	1,460	
6		- Widgets 2	1,850	1,360	1,310	1,260	
7		- Widgets 3	1,440	1,680	1,020	1,170	
8		- Widgets 4	1,580	1,600	1,140	1,330	
9		Total Sales	6,300	6,630	4,680	5,220	
10		Cost of Goods Sold	(1,270)	(1,450)	(1,910)	(1,710)	
11		Gross Profit	5,030	5,180	2,770	3,510	
12							
13							

In this example, the “Acme Widgets Corporation” heading is in a merged cell (B2:F2). If you try to select only the cells from C1:C9, this is what you get.

- Copying and pasting merged cells can cause errors and unexpected results.

Often, the advantages provided by merged cells are outweighed by the disadvantages. As such, you may be better off using “Center Across Selection” if this is all you require because you will avoid all the problems noted above.



23. Watch out for long text entries that disappear under data cells but should be wrapped text.

Spreadsheet Professional Build ▾ Test ▾ Document ▾ Use ▾ Other ▾					
A8 ▾		= Cost of Goods Sold			
	A	B	C	D	E
1		Q1	Q2	Q3	Q4
2	Sales				
3	- Widgets 1	1,240	1,400	1,940	1,360
4	- Widgets 2	1,730	1,880	1,820	1,510
5	- Widgets 3	1,410	1,820	1,030	1,610
6	- Widgets 4	1,960	1,280	1,400	1,910
7	Total Sales	6,340	6,380	6,190	6,390
8	Cost of Good	(1,180)	(1,650)	(1,060)	(1,120)
9	Gross Profit	5,160	4,730	5,130	5,270
10					

As this example shows, A8 actually contains the text “Cost of Goods Sold” but is only displaying “Cost of Good” because either the column is too narrow, or text wrapping has not been turned on (under “Format > Cells > Alignment” and check the “Wrap text” box).

This could be deceptive if we were not aware the problem existed.

24. Applying formatting to a sheet that has Auto Filter turned on can lead to some unexpected results when you remove the Auto Filter. Best to turn it off first.

If Auto Filter has been applied to a list of data, and formatting is done, only those cells that are currently visible will be formatted.

F12 ▾		=			
	A	B	C	D	
1					
2	FirstName ▾	LastName ▾	Age ▾	Income ▾	
3	Joe	Finklestein	25	22506	
4	Mary	Cottonball	31	\$ 31,500	
5	Jane	Munt	46	\$ 36,508	
6	Ashley	Aimer	19	14958	
7	Joan	McDougal	27	\$ 56,093	
8	Gertrude	Wigglesworth	62	\$ 95,238	
9					

In this example, a filter was applied to show only those records with Income > \$30,000. Then, with the filtered list, Column D was formatted in currency format.

As you can see when the filter is removed, the two records that were not showing when the filter was applied have not been reformatted.

25. Ensure your PC has the correct international settings – especially for dates.

If your PC’s international settings have the date format of “mm/dd/yyyy” and you enter “31/12/2003”, Excel will not recognise the entry as a date and will automatically enter this as plain text. As such, you won’t be able to use the date value in calculations and errors may arise.

If your dates aren’t being recognised as dates by Excel, check your PC’s international settings under Control Panel to ensure these are correct.

CHARTS

26. Limit the number of data series on a chart to 5 or less, otherwise it becomes too cluttered and cannot be easily understood.

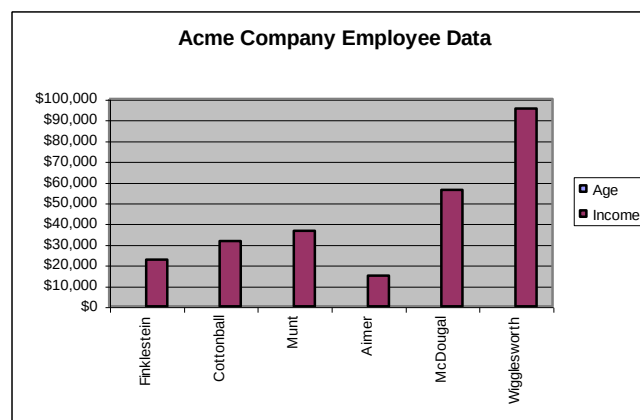
If you have too many data series on a single chart, you can't really see what is going on.

If you have more than about 5 data series to plot, consider creating 2 or more charts and splitting your series between these. Maybe there are logical groupings that help in deciding which series belong on what charts.

Alternatively, you may be able to sum a few data series and just plot the total. You could always create further charts that show the detail of the summed series.

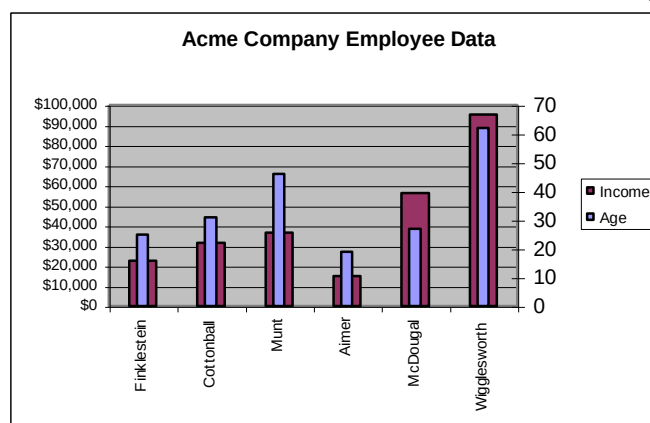
27. Where chart data series have different scales, plot them on different axes.

To allow for meaningful analysis, you need to be able to see the relationships between data and any trends that are apparent. You can't do this if one data series is many times larger than the other(s) as it will overpower your chart.



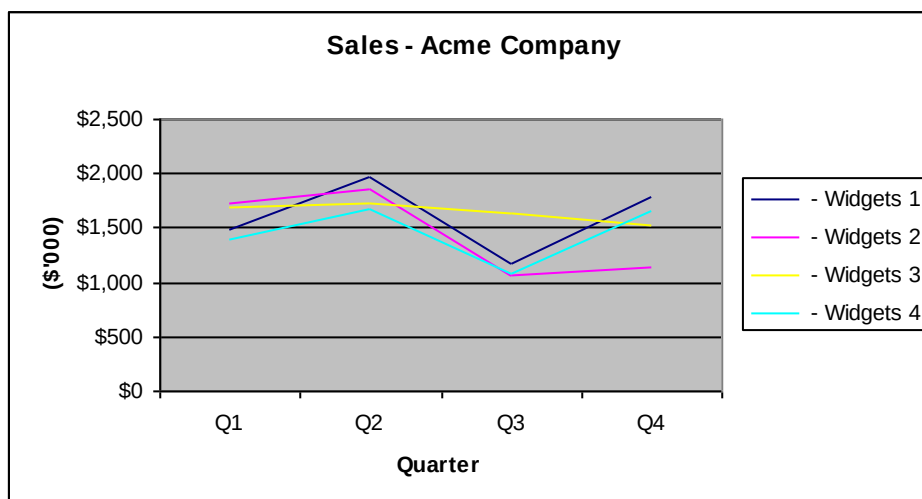
In this example, Income is so much larger than Age that the Age data doesn't appear on the chart at all.

This was fixed by plotting Age on the secondary axis (accessed by selecting the Age data series, then going to "Format > Selected Data Series > Axis" and choosing "Secondary Axis").



Note: in this example, the "Gap Width" (under the Format Chart Series "Options" tab) was increased to 500 to make the Age columns thinner.

28. Ensure your axes scale and titles are correct. Consider linking them to a cell.

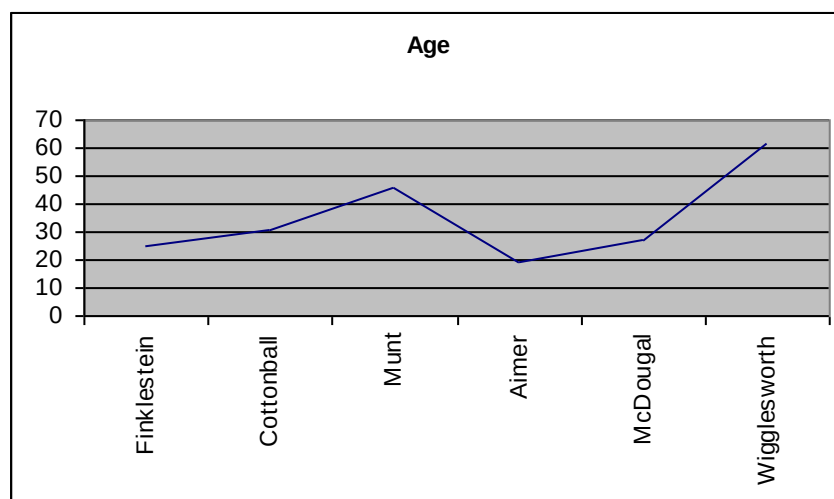


In this example, sales are stated in thousands of dollars as noted by the Y-Axis title. If this wasn't there, we would have no way of knowing whether sales were dollars, thousands of dollars, or even millions of dollars. Unless we already knew the company's business, it would be impossible to tell.

To link a chart title to a cell, first create the titles under Chart > Chart Options > Titles. Then, click on a title, press "=" then click the cell you want to link to and press Enter. The title is now dynamically linked to this cell.

29. If you're using a chart type such as "line" ensure there is a logical relationship between the data.

Line charts are very useful when there is a relationship between the items being analysed as you may be able to identify a trend. But data in a series is not always related this way.

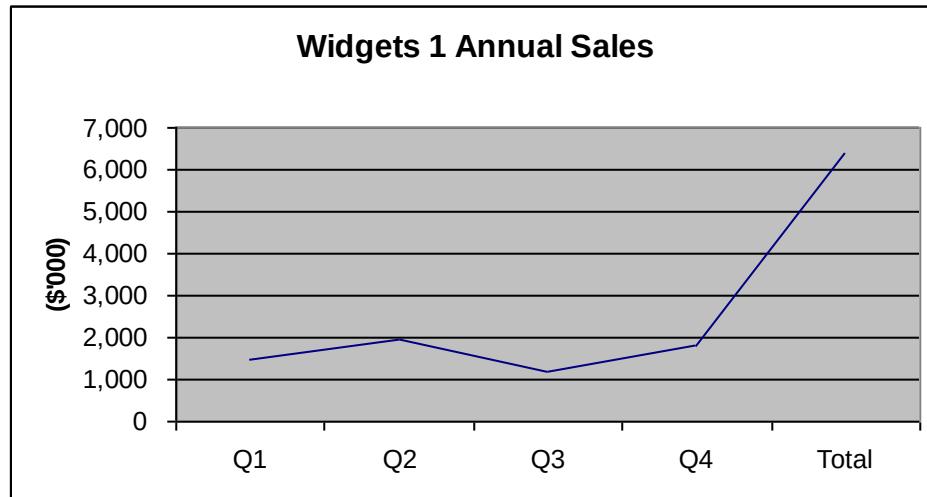


A line chart showing employee ages makes no sense because there is no relationship between their name and their age. If we re-arranged the names (eg sorted them alphabetically), the shape of our chart would be completely changed.

Better chart types for this situation include Column, Bar, or even XY Scatter.

30. Don't include series totals in chart data series.

If you accidentally include the total of a series in the series itself, the last data point will be incorrect and the chart will be distorted.



In this example, the data series should stop at Q4 but the total has been included accidentally, causing a large distortion.

DATABASE TABLES

31. Don't use the same field name in a database table more than once.

If you use the same field name (ie column heading) more than once in a database table, Excel will still function correctly however the table is more difficult to work with because you have to manually keep track of which field is which.

Instead, make sure each heading is unique and your life will be much easier.

	A	B	C	D	E	F
1						
2	Contact	Contact			Next of Kin	Next of Kin
3	FirstName	LastName	Dept	Income	FirstName	LastName
4	Joe	Finklestein	Sales	\$ 22,506	Jerry	Finklestein
5	Mary	Cottonball	Sales	\$ 31,500	Leon	Cottonball
6	Jane	Munt	Accounting	\$ 36,508	Abigail	Dolores
7	Ashley	Aimer	Sales	\$ 14,958	Simon	Arrow
8	Joan	McDougal	Accounting	\$ 56,093	Michael	McDougal
9	Gertrude	Wigglesworth	Executive	\$ 95,238	Abraham	Sidebottom

In our sample database, because some field names span 2 lines, Excel thinks the headings "FirstName" and "LastName" have been used twice (the database range selected by Excel has been highlighted).

So when we come to sort our database, which field is which? Similarly, if we generate a pivot table, which LastName field has been included?



The Sort dialog box shows 'Income' as the primary sort criterion. Under 'Then by', '(1) FirstName' and '(2) LastName' are listed. The 'Header row' option is selected.

Dept	LastName	Income
Accounting	McDougal	56093
Accounting	Munt	36508
Accounting Total		92601
Executive	Wigglesworth	95238
Executive Total		95238
Sales	Aimer	14958
Sales	Cottonball	31500
Sales	Finklestein	22506
Sales Total		68964
Grand Total		256803

Without unique names, you can still figure it out but there is much more chance of making a mistake.

32. Don't try to use your spreadsheet as a relational database – it won't work!

It has been said that the most common database in the world is an Excel spreadsheet!

Whilst Excel is fine for very simple databases, it really struggles when you try to mimic the functionality of a relational database because that's not what it is intended for.

A relational database such as Access is able to easily link multiple records in one database table to a single record in another table because it keeps track of the relationships between data records (eg one customer can have many shipping addresses etc).

Excel on the other hand just keeps everything in one big table, so it isn't very good at relating a record in one table to other records in another table.

You can do it in a rather awkward fashion using Vlookups, Pivot Tables, and other functions, but the chances of making an error and losing data integrity are extremely high.

It's a case of using the right tool for the job so if your application needs multiple database tables, use Access and don't try to do it in Excel.

33. If you have tens of thousands records in your database table, it's probably time to think about using Access.

The absolute maximum number of rows in an Excel worksheet is 65,536 (ie 2^{16}). With Access and other database systems, the upper limit is often only defined by the amount of disk space you have available.

So if your application has tens of thousands of database records, you may want to start thinking about using Access or another database system as these will provide greater scalability, and better data integrity.

34. Don't allow blank rows and/or columns in database tables.

When Excel encounters a blank row, it thinks it has reached the end of your database table.

In our example below, Excel doesn't realise we have more data in rows 7-9.

	A	B	C	D	E
1					
2	FirstName	LastName	Dept	Age	Income
3	Joe	Finklestein	Sales	25	\$ 22,506
4	Mary	Cottonball	Sales	31	\$ 31,500
5	Jane	Munt	Accounting	46	\$ 36,508
6					
7	Ashley	Aimer	Sales	19	\$ 14,958
8	Joan	McDougal	Accounting	27	\$ 56,093
9	Gertrude	Wigglesworth	Executive	62	\$ 95,238
10					
11					\$ 256,803
12					

This is obviously a bad thing if you wanted Excel to include the full database range (eg if you're re-sorting, doing lookup's, filtering, pivoting etc).

However, knowing this, you can place rows at the bottom of your table that provide totals of the data above but won't be included in database operations.

With our example, if we remove the blank row and filter the list, the total at the bottom will not be filtered out because it is separated from the data by a blank row. Because we've used

SUBTOTAL, rather than SUM, the total shown will only add up the values that are visible.
 Note: SUM will always show the total of the cells regardless of whether they're visible nor not.

Spreadsheet Professional Build ▾ Test ▾ Document ▾ Use ▾ Other ▾ Aa ab					
E10 = =SUBTOTAL(9,E3:E8)					
	A	B	C	D	E
1					
2	FirstName ▾	LastName ▾	Dept ▾	Age ▾	Income ▾
3	Joe	Finklestein	Sales	25	\$ 22,506
4	Mary	Cottonball	Sales	31	\$ 31,500
6	Ashley	Aimer	Sales	19	\$ 14,958
9					
10					\$ 68,964
11					

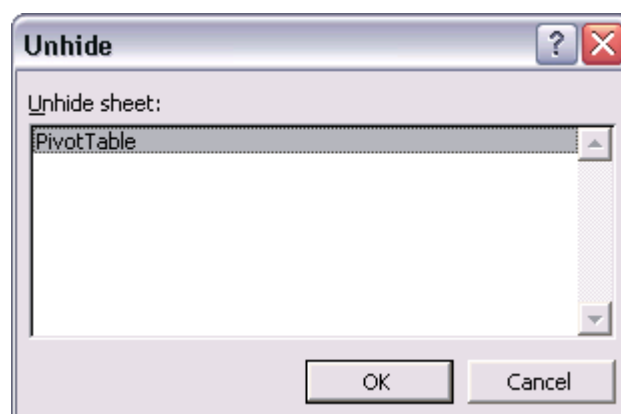
MISCELLANEOUS

35. Don't try to GOTO hidden cells.

By pressing F5, you can go directly to a cell reference or a named range (amongst many other things).

However, if your intended destination is on a hidden sheet, it won't work. You won't get an error – just nothing will happen.

So if this happens, check whether there are any sheets that are hidden by going to “Format > Sheet > Unhide”.



In addition, it's possible to hide a sheet using VBA so its “Very Hidden”. This means that you can't unhide it via the Format menu – the only way to make it visible again is via more VBA code (lookup the “Visible” property in Microsoft Visual Basic online help). This is useful when you want to prevent all users from accessing a particular sheet.

36. Use manually calculated test data that can independently verify your calculations.

Just because it's in a spreadsheet doesn't mean it's right! There could be errors in the data or formulas that produce an incorrect result.

Some of the ways to guard against this type of problem include:

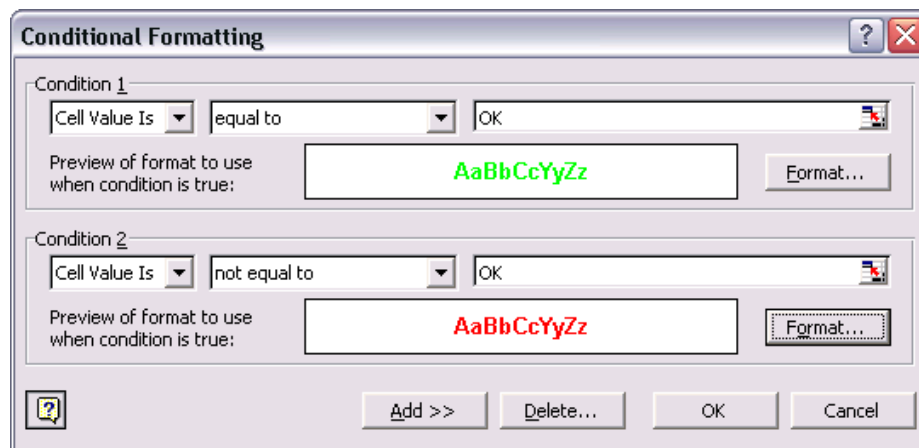
- Perform the calculations manually for some data sets and compare Excel's results to these. In this way, you can design test data that covers various scenarios and tests as many different parts of your spreadsheet as possible.
- Wherever possible, calculate the results in different ways and compare the results.

Spreadsheet Professional Build Test Document Use Other							
G10 =IF(INT(F10-F9)=0,"OK","Error")							
	A	B	C	D	E	F	G
1							
2	Sales	Q1	Q2	Q3	Q4	Total	
3	- Widgets 1	1,490	1,970	1,180	1,790	6,430	
4	- Widgets 2	1,730	1,850	1,060	1,140	5,780	
5	- Widgets 3	1,700	1,720	1,640	1,530	6,590	
6	- Widgets 4	1,400	1,670	1,080	1,660	5,810	
7	Total Sales	6,320	7,210	4,960	6,120	24,610	
8	Cost of Goods Sold	(1,030)	(1,740)	(1,680)	(1,080)	(5,530)	
9	Gross Profit	5,290	5,470	3,280	5,040	19,080	=SUM(B9:E9)
10					Crosscheck	19,080	OK
11							
12							
13						=SUM(F3:F6)+F8	

In this example, we have a crosscheck total calculated in F10 that recalculates the total using a different formula. In addition, the formula at G10 will show either a green “OK” or a red “Error” message depending on whether the crosscheck is OK or not.

Even if very small differences occur (such as those from variations in rounding) our formula in G10 will still be fine because we have used the INT function, which rounds the result to the closest integer (whole number).

We’ve applied conditional formatting (under “Format > Conditional Formatting” in Excel 97 onwards) to G10 to achieve this as per below:



37. Layout your spreadsheet in a logical manner and avoid spaghetti referencing (where formulas use cells from all over the spreadsheet).

As much as possible, spreadsheets should be laid out so they read like a book ie from top to bottom and from left to right.

As such, avoid referencing cells to the right or below your formula because this will make your spreadsheet more difficult to follow.

In general, formulas should always reference cells above them or to their left.

This is one of the potential problem areas identified by Spreadsheet Professional.

38. If your spreadsheet will be used in multiple locations/environments, make sure you test it using all possible international settings, Excel versions, and PC environments and possibly on a Mac.

Although your spreadsheet works fine on your system, if it’s going to be used on systems that have different international settings, it may not function correctly.

The different date formats between the US (mm/dd/yyyy) and UK (dd/mm/yyyy) is a well-known issue but there are many others as well. For example, in some locales, dates are written as dd.mm.yyyy and the number 1234.56 is displayed as “1.234,56”.

Another example is that the US uses Letter sized paper for most printing, while the UK uses A4. While the page sizes are similar, they vary by a significant margin (excuse the pun!).

Different versions of Excel have introduced new features. If you’re using features that are only available in the latest version, you may find errors occur if you use the file on an earlier version (assuming you can actually open it!).

Similarly, if your spreadsheet will need to run on a Mac, you can’t hardcode file paths (such as “C:\My Documents\”) because a Mac uses “.” instead of “\” as its file path separator.

Discussing how to get around all these issues is beyond the scope of this guide – just ensure you are aware of the potential problems that can arise and always test your spreadsheet's operation on the intended systems prior to release.

39. Watch out for hidden rows or columns when copying, pasting, inserting, deleting or moving.

Hiding rows and/or columns you don't want to see is a very useful feature however, it can also lead to problems if you forget they're there.

	A	B	C	D	E	F
1						
2	Sales	Q1	Q2	Q3	Q4	Total
3	- Widgets 1	1,490	1,970	1,180	1,790	6,430
4	- Widgets 2	1,730	1,850	1,060	1,140	5,780
5	- Widgets 3	1,700	1,720	1,640	1,530	6,590
6	- Widgets 4	1,400	1,670	1,080	1,660	5,810
7	Total Sales	6,320	7,210	4,960	6,120	24,610
9	Gross Profit	5,290	5,470	3,280	5,040	19,080
10						
11						
12	Sales	Q1	Q2	Q3	Q4	Total
13	- Widgets 1	1,490	1,970	1,180	1,790	6,430
14	- Widgets 2	1,730	1,850	1,060	1,140	5,780
15	- Widgets 3	1,700	1,720	1,640	1,530	6,590
16	- Widgets 4	1,400	1,670	1,080	1,660	5,810
17	Total Sales	6,320	7,210	4,960	6,120	24,610
18	Cost of Goods Sold	(1,030)	(1,740)	(1,680)	(1,080)	(5,530)
19	Gross Profit	5,290	5,470	3,280	5,040	19,080
20						

In this example, we've hidden row 8 then copied cells A2:F9 down to A12. Note that even though the "Cost of Goods Sold" row was hidden in the source range, it re-appeared when we copied it.

Similar issues can arise when pasting data into cells that include hidden rows or columns.

H13					
	A	B	C	G	H
1					
2	Sales	Q1	Q2		
3	- Widgets 1	1,490	1,970		
4	- Widgets 2	1,730	1,850		
5	- Widgets 3	1,700	1,720		
6	- Widgets 4	1,400	1,670		
7	Total Sales	6,320	7,210		
9	Gross Profit	5,290	5,470		
10					

In this example, we've hidden Columns D-F which contain Q3, Q4, and Total data. If we copied in a new set of 4 sales figures for Widgets 1, we would overwrite the two columns of visible sales figures, but we would also overwrite the two columns of hidden figures – the data wouldn't be placed into columns G-H.

This may not be what we expected so care must be taken to ensure hidden data is not changed in error.

40. Even if your spreadsheet will only be used by you, include instructions, details regarding the workbook's purpose, author, version, and updates.

The reason for this is that you may not always be the only person who uses the file. Eventually through promotion, resignation, job re-allocation, holidays, sickness or whatever, someone else may need to use the spreadsheet you've made.

Combined with:

- ... the person taking over the spreadsheet will come up to speed with it far quicker than if these measures were neglected.

As you can see, it is not elaborate or particularly lengthy in this case since the purpose of the file is very straightforward. However, if someone else ever needs to refer back to it, they will know exactly what the file was used for, who made it, and what version amendments have been made.

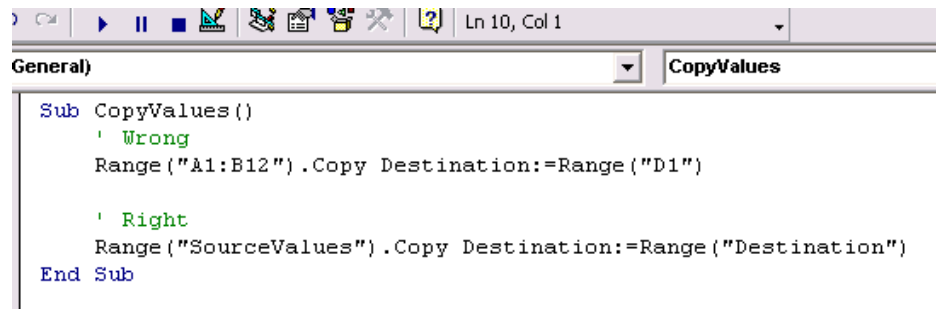
	A	B	C	D	E	F	G	H	I
1	52 Ways Examples - About This Spreadsheet								
2									
3	Summary								
4	This file contains examples used in the "52 Ways to Prevent Spreadsheet Problems" guide. Each sheet relates to a different point in the guide. The data has been generated randomly and any relationship to any person or business is purely coincidental.								
5									
6									
7									
8									
9									
10									
11	Contacts								
12									
13	Jeff Robson								
14	Mailbarrow								
15	PO Box 6284								
16	East Perth WA 6892								
17	Australia								
18	ph +61 4 1258 1486								
19	fax +61 8 6210 1662								
20	jrobson@mailbarrow.com								
21									
22	Version								
23	Version:	1.0							
24									
25	Revision History								
26	Changes:								
27	v1.0								
28	Spreadsheet created								Author
29									Jeff Robson
30									

VBA MACROS

41. Don't hardcode cell or range addresses in VBA macros.

Hardcoding cell references can cause errors to occur and other unexpected behaviours if an additional row or column is inserted because your macro now refers to incorrect cell addresses.

A better way is to use named ranges in VBA macros as these can be moved, and/or resized without affecting your macros.

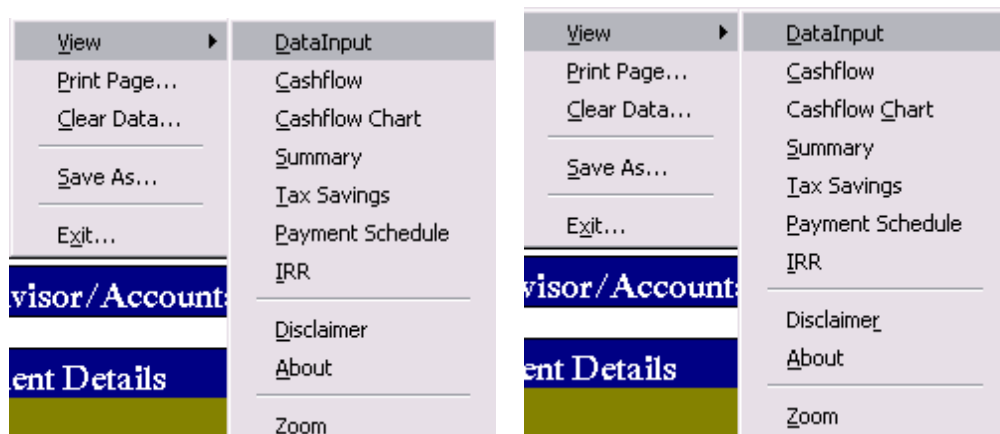


```
Sub CopyValues()  
    ' Wrong  
    Range("A1:B12").Copy Destination:=Range("D1")  
  
    ' Right  
    Range("SourceValues").Copy Destination:=Range("Destination")  
End Sub
```

42. Ensure your custom menus don't use the same initial letter more than once.

If you use custom menus, you have the option of making a keyboard shortcut that will access each menu item. Your custom menus can be setup in the same way as Excel's standard menu bar, which has File Edit etc accessible via ALT-F, ALT-E etc.

The difficulty for Excel arises where there are two menu items with the same keyboard shortcut. When this happens, Excel doesn't know what to do.

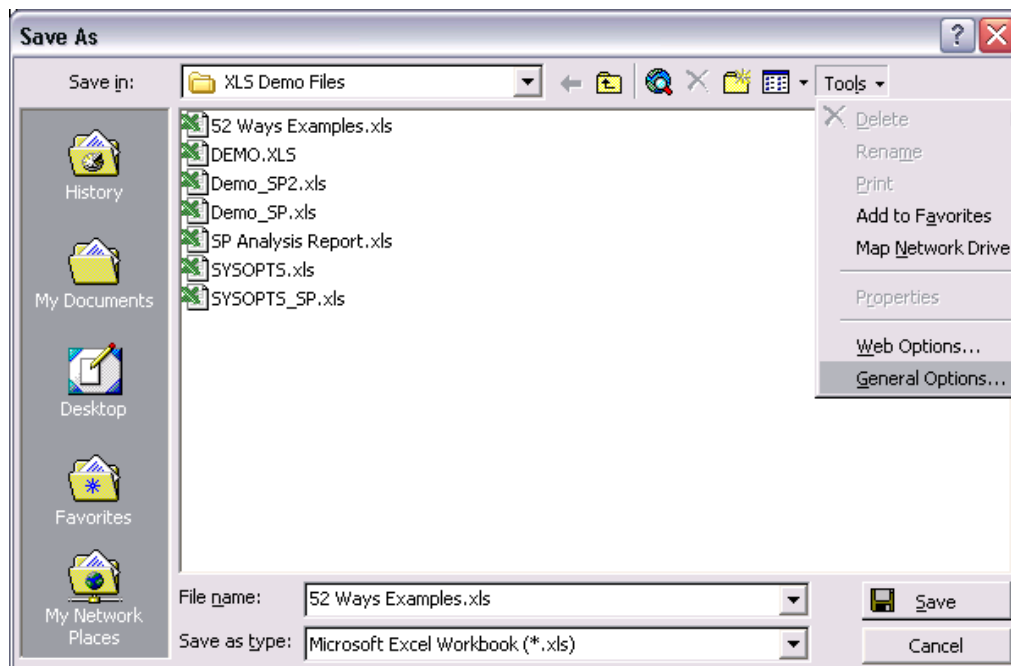


In the first example, both "Cashflow" and "Cashflow Chart" have been setup to use the ALT-C shortcut, while both "DataInput" and "Disclaimer" are accessed via ALT-D. Both these errors have been fixed in the second example.

43. If others will use your spreadsheet, protect your sheets and VBA modules via password – only allow others to make changes where you want them to.

Whilst it's a whole lot better than it used to be, Excel currently isn't huge on security and there are services around that will crack whatever passwords you place on your files ... if someone is really motivated.

However, you can make your files reasonably secure by implementing passwords to open the file (available under "File > Save As > Tools > General Options"), protect worksheets (under "Tools > Protection > Protect Sheet" or "Protect Workbook"), and view your VBA code (under "Tools > VBAProject Properties > Protection").



Implementing Open or Modify file passwords.

If you need ultimate security, place your code inside a COM Add-in (get a good book on Excel VBA in order to find out how to do this!).

44. Ensure your buttons and controls are linked to macros and/or cell references.

If your buttons aren't linked to macros, they won't work! When you click on the button, you'll start to edit it rather than run a macro.

Similarly, if controls such as drop down boxes don't have a source, they'll be blank.

45. If you use a custom status bar message, make sure you reset it.

Updating the status bar is a useful way of passing messages to a user while your macro is running. This is accessible via `Application.StatusBar = "My Message"`

However if your macro ends and it hasn't reset the status bar (via `Application.StatusBar = False`) the status bar will continue to show whatever message you last set it to – even after your macro has finished running.

```
' Wrong
Sub ProcessData()
    ' Set the status bar so the user knows what's happening
    Application.StatusBar = "Processing Data ..."

    ' processing data procedures go here
End Sub
```

```
' Right
Sub ProcessData2()
    ' Set the status bar so the user knows what's happening
    Application.StatusBar = "Processing Data ..."

    ' processing data procedures go here

    ' Reset the status bar
    Application.StatusBar = False
End Sub
```

46. Watch out for endless loops.

Sometimes you may inadvertently create an endless loop, which may keep going forever or until it creates an error.

Obviously you want to avoid this in most situations, however you can interrupt your code execution at any time by pressing Ctrl-Break or ESC.

47. Always document your code.

It sounds obvious but it's a step that is often ignored.

Well-documented code makes life so much easier when you have to maintain it or when someone else has to take over your work.

48. As much as possible, write code and functions that are modular and can be easily re-used.

Wherever possible, look for ways to reuse code and functions – think about ways in which the functions could be used in other spreadsheet files.

The advantages are that it saves you an awful lot of time if you don't need to reinvent the wheel and can simply copy and paste code segments between projects.

49. Always use "Option Explicit", but use "On Error Resume Next" and "GOTO" sparingly.

"Option Explicit" forces you to declare your variables via "Dim" statements (eg "Dim StartSalary as Integer" etc) before they are used.

The main benefits of this are:

- that spelling errors are automatically detected eg if you type "StarSalary = 20000" and try to run the macro, it will detect that this variable hasn't been declared rather than thinking that you're just referring to a new variable; and
- your code will run slightly faster because you have told Excel what type of variable "StartSalary" is (ie an Integer in this case).

Option Explicit

```
' This will produce a "Variable not defined" error
Sub GetStartSalary()
    StartSalary = InputBox(prompt:="Enter your Starting Salary")
    If StartSalary = 0 Then
        Exit Sub
    Else
        Range("configStartSalary").Value = StartSalary
    End If
End Sub
```

```
' This will work fine
Sub GetStartSalary()
    Dim StartSalary As Integer
    StartSalary = InputBox(prompt:="Enter your Starting Salary")
    If StartSalary = 0 Then
        Exit Sub
    Else
        Range("configStartSalary").Value = StartSalary
    End If
End Sub
```

Under "Tools > Options > Editor", you can check the "Require Variable Declaration" box and Excel will automatically add "Option Explicit" to all new modules you create (note that existing modules will not change).

"On Error Resume Next" is a very useful way of getting Excel to try and do something because even if it doesn't work, no error message will be produced and you can then test whether the action worked or not by using code.

This same usefulness can also be a hindrance if not implemented properly because important errors that occur in your code could go undetected resulting in unexpected behaviour.

As such, turn error reporting back on as soon as possible after an "On Error Resume Next" statement so any errors that occur are highlighted. To reset what happens when an error occurs, use "On Error Goto 0".

```
' attempt to open the selected file as text
On Error Resume Next
Workbooks.OpenText FileName:=vaFileName, DataType:=xlDelimited, textqualifier:=xlTe
Set wkbTempWorkbook = ActiveWorkbook
On Error Goto 0
|
If wkbTempWorkbook Is Nothing Or vaFileName = False Or vaFileName = "" Then
    vaDisplayName = "File Error"
    MsgBox prompt:="An error occurred opening file " + CStr(vaFileName), Buttons:=\
Else
    ' ensure data file selected matches with an existing data format
```

In this example, we use “On Error Resume Next” to skip any error messages that may result if Excel isn’t able to open the text file selected by the user. However, we then test whether an error occurred using our own code and handle this accordingly.

Error reporting is turned back on immediately after it is no longer required.

50. Use clear, systematic variable names.

Excel lets you call your variables and functions anything you want, apart from certain names that are used by VBA itself. However, your code is much easier to read if you have a system for naming variables and functions.

So instead of “Dim Count As Integer”, you could write “Dim intCount as Integer”. Then, every time you see intCount, you know that it contains an integer.

You can really adopt whatever system you want. So long as you’re consistent in applying it, you’ll get the benefits.

Gregory Reddick has developed a formalised VBA naming convention that has become a defacto standard. See <http://www.xoc.net/standards/rvbanc.asp>

You may also want to adopt a naming convention for range names used in your file eg all range names on your data configuration sheet have the prefix “config”.

51. Disable screen updating when running macros.

Your macros will run much faster and you’ll eliminate any distracting screen flickering if you disable screen updating in any macros that update components of your worksheet (eg copy, paste, insert, delete etc).

You can turn screen updating off via “Application.ScreenUpdating = False”.

52. Don't use the macro recorder alone to write all your code.

The macro recorder (under “Tools > Macro > Record New Macro”) is a great way of learning Visual Basic for Applications (“VBA”). However, like many automatic code generators, it doesn't always produce the most efficient code.

The macro recorder always hardcodes cell references and will often produce lengthy code that may be difficult to read.

You'll find that you can shorten a lot of the code it generates to make your code clearer. In any event, you'll want to add your own comments to it so you remember what is going on.

```
Sub Macro2()  
'  
' Macro2 Macro  
'  
    Range("B3:C9").Select  
    Selection.Copy  
    Range("H3").Select  
    Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _  
        False, Transpose:=False  
End Sub  
  
Sub Macro2Abbreviated()  
    Range("B3:C9").Copy  
    Range("H3").PasteSpecial xlPasteValues  
End Sub
```

In this example, the Macro Recorder was used to record Macro2 which simply copies the values from B3:C9 to H3. Macro2Abbreviated does exactly the same thing but was written by hand. As you can see, hand coding produces much simpler and shorter code.

Additional resources

Here is some additional information that you may find useful regarding financial modelling.

Area	Suggested Resources
Financial Modelling and Management Reporting	To see how we could help with your project or issue, call us on +61 8 6210 8500, e-mail consulting@accessanalytic.com.au or visit http://www.accessanalytic.com.au/services_excel_web.php
Financial model audit and review	We provide an independent model audit service to highlight any potential errors or inconsistencies. If you'd like to sleep better knowing that your key Excel models are giving you the right answer, call us on +61 8 6210 8500, e-mail consulting@accessanalytic.com.au or visit http://www.accessanalytic.com.au/services_excel_audit.php
Automated Spreadsheet Auditing Tools	We use and highly recommend Spreadsheet Professional as a great tool to use in-house if you are going to be reviewing spreadsheets on a regular basis. For more information, call us on +61 8 6210 8500, e-mail consulting@accessanalytic.com.au or visit http://www.accessanalytic.com.au/services_spro.php
Training	We provide high-powered training in Financial Modelling, VBA and advanced Excel for accounting and finance professionals throughout the Asia-Pacific region. For more information, visit http://www.accessanalytic.com.au/training
Excel Mentoring	Personalised mentoring in your office, using your files, solving your issues. http://www.accessanalytic.com.au/services_mentor.php

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Excel ® is a registered trademark of Microsoft

Further Reading

Additional information on spreadsheet modelling best practices:

Best Practice Modelling Standards, Spreadsheet Standards Review Board
<http://www.ssrb.org/>

Spreadsheet Modelling Best Practice, IBM & PwC <http://www.eusprig.org/smbp.pdf>

How do you know your Spreadsheet is Right <http://www.eusprig.org/hdykysir.pdf>