

# SumProduct

NEWSLETTER #61 - December 2017

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469 articles, 342 keyboard shortcuts,  
37 readers' questions and 535 pages later

we have made it to the grand old age of five years old! It will be time to go to school soon.

As usual, we note the Power BI Desktop and Service updates, and there's good news too for those who want to share Power BI externally and for those of us who hate AutoSave. There's the usual features (Power Query Pointers and Keyboard Shortcuts) too.

However, given it's our fifth birthday, we thought we'd dust off some of the articles we have previously shared. It's a subjective selection, but hopefully, it will strike a chord with our "Blast from the Past" articles.

Until next month.

Liam Bastick, Managing Director, SumProduct



## Goodbye CIMA / Hello CGMA

We start this month's newsletter with some sad news. After 102 monthly articles spanning nine years, SumProduct's *Spreadsheet Skills* articles for *CIMA Insight* (the magazine for Chartered Institute of Management Accountants, but freely available to all) has ceased. This is not due to the series being retired. Indeed, the articles remain as popular as ever. Unfortunately, the magazine has ended and has been subsumed by the American Institute of Certified Public Accountants' (AICPA's) *CGMA* (*Chartered Global Management Accountant*) Magazine.

CGMA  MAGAZINE

Powered by  
AICPA  CIMA 

The king is dead; long live the king!

All previous readers will be transferred to the new magazine, but it does mean we attract an ever-larger readership. So, if you have joined us as a result of discovering the Excel series in *CGMA Magazine*, welcome board and apologies for the inherent sense of humo(u)r. Sorry, we just can't bring ourselves 2 tipe in an Americum weigh (*sic*).

There is one associated, disappointing observation though. Due to the

timing of the transfer, it's too late to coordinate the usual Christmas Quiz that we have run for the past eight years. Hopefully, it will return in 2018.

You can read our first article for CGMA Magazine at [www.cgma.org/magazine/2017/nov/excel-if-function-201717851.htm](http://www.cgma.org/magazine/2017/nov/excel-if-function-201717851.htm).

## With a Little Help from Our Friends

Back in June, we noted that Microsoft had added a new feature to help users co-author files. Whether you are for or against this feature was not the point: it needed Excel's AutoSave switched on to work. That's fine. But we didn't want it to be the **default**. Whilst it is accepted that Office is trying to make various apps consistent, we observed that Excel has been and always will be used differently. What makes it the most popular software in the world is the ability to experiment without consequences. Made a mistake? No fear, close without saving and re-open. Accidentally delete a sheet? Don't worry, close without saving and re-open. Replaced all formulae with `=RAND()`? etc. etc.

For those working in the Cloud, yes you can restore earlier versions - when it works. But many don't. And some can't (no internet, company policies, etc.). All we asked was for the ability to switch AutoSave off at a global level, so we didn't get inadvertent date / time stamps or have to switch AutoSave off for every file as we open them.



It's not often we take action but we did resort to [Excel User Voice](#). The votes have steadily increased, but Microsoft has remained eerily silent. No matter – we held out for a hero and “Anonymous” delivered (probably some Microsoft employee presumably fed up with the mass whingeing!). We have a workable solution!!

Here's how to disable the AutoSave feature in Microsoft Office 365 ProPlus. As we have already stressed, this feature applies to each document. It can't be disabled on the application level.

## Backing Up the Registry

Windows 7	Windows 8, 8.1 or 10
<p>You may back up the registry manually or create a system restore point.</p> <p><b>Manually</b></p> <p>Click ‘Start’, type <b>regedit.exe</b> in the search box and then press <b>ENTER</b>. If you're prompted for an administrator password or for confirmation, type the password or provide confirmation.</p> <p>In the Registry Editor, locate and click the registry key or subkey that you want to back up.</p> <p>Click <b>File &gt; Export</b>.</p> <p>In the ‘Export Registry File’ dialog box, select the location to which you want to save the backup copy and then type a name for the backup file in the ‘File name’ field.</p> <p>Click ‘Save’.</p> <p><b>System Restore Point</b></p> <p>Right-click the ‘Start’ button, then select <b>Control Panel &gt; System and Maintenance &gt; System</b>. In the left pane, select ‘System protection’. Select the ‘System Protection’ tab, and then select ‘Create’. In the ‘System Protection’ dialog box, type a description and then select ‘Create’.</p> <p>Restore the information based on which backup method you used.</p> <p><b>Restoring from Manual Backup</b></p> <p>Click ‘Start’, type <b>regedit.exe</b> in the search box and then press <b>ENTER</b>. If you're prompted for an administrator password or for confirmation, type the password or provide confirmation.</p> <p>In the Registry Editor, locate and click the registry key or subkey that you want to back up.</p> <p>Click <b>File &gt; Import</b>.</p> <p>In the ‘Import Registry File’ box, select the location in which you saved the backup copy, select the backup file and then click ‘Open’.</p> <p><b>Restoring from Restore Point</b></p> <p>Right-click the ‘Start’ button, then select <b>Control Panel &gt; System and Maintenance &gt; Backup and Restore</b>.</p> <p>Select either ‘Restore my files or Restore all users' files’.</p>	<p>You may back up the registry manually or create a system restore point.</p> <p><b>Manually</b></p> <p>From the ‘Start’ menu, type <b>regedit.exe</b> in the search box, and then press <b>ENTER</b>. If you are prompted for an administrator password or for confirmation, type the password or provide confirmation.</p> <p>In the Registry Editor, locate and click the registry key or subkey that you want to back up.</p> <p>Click <b>File &gt; Export</b>.</p> <p>In the ‘Export Registry File’ dialog box, select the location to which you want to save the backup copy and then type a name for the backup file in the ‘File name’ field.</p> <p>Click ‘Save’.</p> <p><b>System Restore Point</b></p> <p>From the ‘Start’ menu, type create a restore point. Select ‘Create a restore point’ from the search results. Choose ‘Create’ and then follow the steps to create a restore point.</p> <p>After you've backed up the information, restore it based on the method you used.</p> <p><b>Restoring from Manual Backup</b></p> <p>From the ‘Start’ menu, type <b>regedit.exe</b>, and then press <b>ENTER</b>. If you are prompted for an administrator password or for confirmation, type the password or provide confirmation.</p> <p>In Registry Editor, click <b>File &gt; Import</b>.</p> <p>In the ‘Import Registry File’ dialog box, select the location to which you saved the backup copy, select the backup file and then click ‘Open’.</p> <p><b>Restoring from Restore Point</b></p> <p>From ‘Start’, type ‘Create a restore point’. Select ‘Create a restore point’ from the search results. Choose ‘System Restore’.</p>

### Disabling AutoSave

To disable AutoSave, you need to access the Windows registry. From ‘Start’, type **regedit** and then press **ENTER**. Through the opened Windows registry, add a **DWORD** value of 1 to each of the following registry subkeys for the indicated Office 2016 ProPlus (Subscription) application:

Application	Registry Subkeys
Excel	HKEY_CURRENT_USER\SOFTWARE\Microsoft\Office\16.0\Excel\DontAutoSave
PowerPoint	HKEY_CURRENT_USER\SOFTWARE\Microsoft\Office\16.0\PowerPoint\DontAutoSave
Word	HKEY_CURRENT_USER\SOFTWARE\Microsoft\Office\16.0\Word\DontAutoSave

The **DWORD** value of 1 disables AutoSave.

This approach requires you to modify the registry. However, serious problems might occur if you modify the registry incorrectly. Therefore, make sure that you follow these steps carefully and SumProduct will not be held responsible for any issues caused whatsoever. It is strongly recommended that for added protection, back up the registry before you modify it. Then, you can restore the registry if a problem occurs.

## Blast from the Past: Go Fourth and Multiply

Microsoft publishes various useful tricks and tips for Excel from time to time on its "Office Blogs" web site. Back in 2013, SumProduct's Liam Bastick was invited to write an article on summing data based on multiple criteria on multiple worksheets. The formula is pretty ugly, but it proved to be ranked the fourth favourite Excel blog of 2013:



```
=IFERROR(SUMPRODUCT(SUMIFS(INDIRECT("'"&Division_Table[Relevant Divisions]&"'!I:I"),INDIRECT("'"&Division_Table[Relevant Divisions]&"'!F:F"),$F12,INDIRECT("'"&Division_Table[Relevant Divisions]&"'!G:G"),$G12,INDIRECT("'"&Division_Table[Relevant Divisions]&"'!H:H"),$H12)),)
```

It is reproduced below here.

Working with multiple criteria on multiple Excel worksheets is a common problem. This has been quite a popular topic and it is clear that the answer to this particular question isn't that easy to come by. In fact, a lot of so-called experts say it can't be done in Excel alone. Well, we specialise in the impossible! Allow me to explain my solution using an illustration from an Excel file that may be downloaded from [www.sumproduct.com/thought/multiple-multiple-criteria](http://www.sumproduct.com/thought/multiple-multiple-criteria).

Let us imagine we run a car sales company with four divisions: North, South, East and West. Sales are reported in a similar fashion for each (North and South divisions are shown below):

North Report										South Report									
6	A	B	C	D	E	F	G	H	I	6	A	B	C	D	E	F	G	H	I
7	North Division Results									7	South Division Results								
8	Relevant Summary									8	Relevant Summary								
9										9									
10										10									
11										11									
12										12									
13										13									
14										14									
15										15									
16										16									
17										17									
18										18									
19										19									
20										20									
21										21									
22										22									
23										23									

The month, associated sales person, car colour and cash amount of each sale is recorded. Note that the reports of each division may not be of equal length, but **importantly** the column headings of each table are in the same column of each spreadsheet (e.g. the month is always recorded in column F, the salesperson is always in column G, etc.). This is necessary for my solution to work.

Let's build up the problem slowly.

### Single Criterion, Single Data Source

I appreciate many readers will find this trivial, but for completeness I shall start here.

Single Criterion, Single Source									
6	A	B	C	D	E	F	G		
7	Single Criterion for North Division Analysis								
8									
9	Results								
10									
11									
12									
13									
14									
15									

This is a simple use of the **SUMIF** function. For example, the formula in cell **G12** in the illustration above is:

**=SUMIF(North!\$F:\$F,\$F12,North!\$I:\$I)**

where **North** is the Excel worksheet containing North division's sales data. Alternative functions can be used but I am sticking with **SUMIF** as I will be using this and its sister function (**SUMIFS**) throughout this example. Essentially, all sales are added when the month of the sale matches the reporting month.

### Multiple Criteria, Single Data Source

The next logical step is to increase the number of criteria (but still focus on just the one data source):

Multiple Criteria, Single Source									
	A	B	C	D	E	F	G	H	I
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

Again, there are many ways to solve this conundrum, but the one I have chosen has the following formula in cell **I12**:

**=SUMIFS(North!\$I:\$I,North!\$F:\$F,\$F12,North!\$G:\$G,\$G12,North!\$H:\$H,\$H12)**

Here, I have used the **SUMIFS** function, which deals with multiple criteria, here only summing data where the month, salesperson and car colour match the required criteria. Some may be amused to see I do not recommend our company's namesake, **SUMPRODUCT**, here, but this function would not work on an entire column prior to its revision in Excel 2007.

Now, it gets more fun...

### Single Criterion, Multiple Data Sources

Rather than make the jump to multiple criteria and multiple data sources all in one go, I thought it would be better to introduce one complication at a time:

Single Criterion, Multiple Sources									
	A	B	C	D	E	F	G	H	
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Before explaining the formula in **G12** here, I would like to recommend an interim step. If I am to refer to multiple datasheets, I need to know the names of these worksheets. I suggest storing the worksheet names in a Table:



## Suggested Table

### Relevant Divisions (To Be Included)

#### Table Summary

Relevant Divisions
North
South
East

In the associated Excel file, this Table has been named **Division\_Table** as this lists the divisions relevant for the analysis. It is intentional that I have not included all four divisions, but it is also important to note that the three divisions named (North, South and East here) must have identical names to the sheet tab names – otherwise, this solution will not work.

Tables represent a useful functionality, first introduced into Excel 2007. Essentially, by listing data this way it allows users to add to the list (by putting, say, 'West' on the next line in my illustration) such that any referencing formulae will update the referenced list automatically.

Returning to this third example, namely multiple criteria based upon a single data source, the formula in cell **G12** of my illustration is a little more sophisticated than the first two solutions:

**=IFERROR(SUMPRODUCT(SUMIF(INDIRECT("'"&Division\_Table[Relevant Divisions]&"!F:F"),\$F12,INDIRECT("'"&Division\_Table[Relevant Divisions]&"!I:I"))),)**

You know you have created a monster when you nest three Excel functions inside a fourth. To work out what is going on, I will explain from the inside out (as this is how Excel will calculate this formula):

- **INDIRECT** – This function produces an array of references such as 'North' column F, 'South' column F, etc. which can be used by the other functions. Note carefully that "'" in the formula is inverted commas followed by an apostrophe (the syntax required in general for sheet names) followed by inverted commas
- **SUMIF** – This function now applies the single criterion to the summation analysis. However, since it is not an array function, this will only report on one worksheet at a time (in my example, there are three sheets: 'North', 'South' and 'East')
- **SUMPRODUCT** – This function is necessary as this function is often referred to as a "pseudo array function". What this means in practice here is that it will allow the **SUMIF** function to be performed across all three worksheets. **SUMPRODUCT** cannot be used without **SUMIF**; however, as this function does not appear to work with multiple rows of data on multiple sheets (it only seems to consider the first cell of each selection on each sheet).
- **IFERROR** – This error trap ensures that if a worksheet listed in the **Division\_Table** does not exist and / or there is a blank row, the formula will not produce an #REF! error for example.

Simple, *n'est-ce pas..?*

### Multiple Criteria, Multiple Data Sources

So we now get to *la pièce de résistance*. If you have overcome the last hurdle this is a *pièce de cake*:

#### Multiple Criteria, Multiple Sources

	A	B	C	D	E	F	G	H	I	J
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

#### Multiple Criteria for Relevant Divisions

##### Results

Month	Sales Person	Car Colour	Total Divisional Results (\$k)
Jan	Albert	Blue	-
Jan	Albert	Red	52
Jan	Albert	White	-
Jan	Beattie	Blue	-
Jan	Beattie	Red	15
Jan	Beattie	White	33
Jan	Charlie	Blue	25
Jan	Charlie	Red	-
Jan	Charlie	White	27
Jan	Delta	Blue	25
Jan	Delta	Red	-
Jan	Delta	White	10

The formula in cell **I12** here is just an extension of the last example:

**=IFERROR(SUMPRODUCT(SUMIFS(INDIRECT("'"&Division\_Table[Relevant Divisions]&"!I:I"),INDIRECT("'"&Division\_Table[Relevant Divisions]&"!F:F"),\$F12,INDIRECT("'"&Division\_Table[Relevant Divisions]&"!G:G"),\$G12,INDIRECT("'"&Division\_Table[Relevant Divisions]&"!H:H"),\$H12))),)**

Whilst the formula may look even more horrible upon first glance, essentially the **SUMIFS** function has merely replaced the **SUMIF** function, similar to the difference between the first two examples discussed above.

It's not pretty, but it's effective.

### Word to the Wise

Given this solution uses Tables, **IFERROR** and the **SUMIFS** functions, this will only work in Excel 2007 and later versions of Excel.

Also, there are several other possible solutions to consider:

- PivotTables using data from multiple worksheets
- creating a master data sheet as an interim step, where all data is recorded on one worksheet
- use Power Pivot or Power Query / Get & Transform.

I have produced this result as a “pure” answer.

However, I would like to stress the age-old rule: Keep It Simple Stupid (KISS). Having data on multiple worksheets complicates the problem and may not be a necessary complexity. Before writing opaque formulae such as the ones discussed above, always consider simplifying the model (structure) first.

## Blast from the Past: Avoiding Circularity When Modelling Circularity

*Back in the early days of the SumProduct website, this article was one of the most popular topics and is still requested by many. We thought we'd give it another airing here.*

When a formula refers back to its own cell, either directly or indirectly, it is called a circular reference. Microsoft Excel cannot automatically calculate all open workbooks when one or more of them contains a circular reference and usually will put zero as the default value in the cell(s) instead.

You can remove a circular reference, or you can have Excel calculate each cell involved in the circular reference using the ‘calculate iterations’ feature. This requires you enabling iterations:

- Go to Excel Options (**ALT + T + O**)
- Choose ‘Formulas’ from the list in the left-hand column
- In the first section, ‘Calculation options’, ensure the check box ‘Enable iterative calculation’ is checked
- Amend the Maximum Number of Iterations (maximum is still 32,767) as required
- Amend the Maximum Change as required (the smaller the number, the longer it will take for Excel to calculate the answer)
- Click ‘OK’.

Various problems may arise with circular references:

- Many users will agree that circular arguments can cause the Excel file to become unstable and even crash;
- When solved, Excel may give one solution when there may be several, only one of which is correct in the given circumstances. If the problem is not fully understood, the danger is an incorrect solution may be accepted;
- If Excel stops calculating after a given number of iterations / when the difference between iterations becomes miniscule, users expect the resulting values to be a solution when it may not be (you must always verify that the value reported provides the result required).

Therefore, circular arguments are not recommended, although it is conceded on occasion there may be no alternative viable solution.

### Calculating interest without circularity

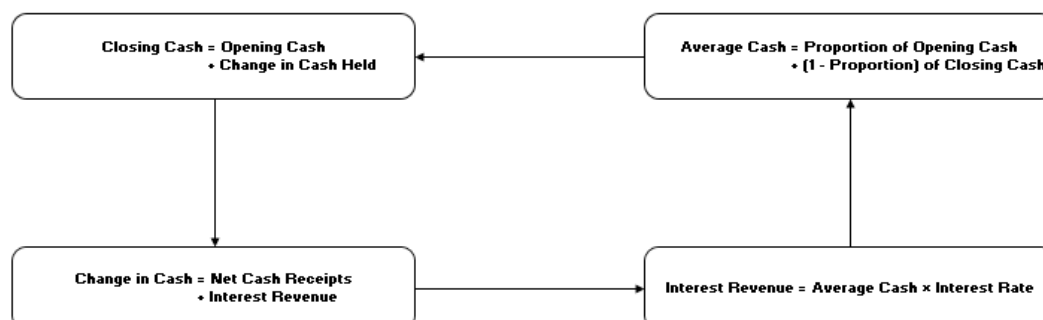
Given this solution uses Tables, **IFERROR** and the **SUMIFS** functions, this will only work in Excel 2007 and later versions of Excel.

Also, there are several other possible solutions to consider:

- PivotTables using data from multiple worksheets
- creating a master data sheet as an interim step, where all data is recorded on one worksheet
- use Power Pivot or Power Query / Get & Transform.

I have produced this result as a “pure” answer.

In a financial model, it is commonplace to have to calculate interest. For this illustration, let's assume we are calculating interest received on the business's average cash balance for certain periods of time (it could just as simply be interest paid on a debt balance, etc.). This gives rise to a perceived circular logic:



This problem can be solved algebraically in, er, a relatively straightforward manner without creating circularities – and is therefore our recommended approach.

In a newsletter, we wouldn't normally publish the following, but the derivation of the formula has proved to be one of our most popular web pages (see [www.sumproduct.com/thought/interest-received](http://www.sumproduct.com/thought/interest-received)). Therefore, we apologise for the following mathematical assault (for those not interested in the derivation, simply skip to the end) – unfortunately, Excel modelling sometimes boils down to solving simultaneous equations!

Let:

- OB** = opening cash balance for the period  
**CB** = closing cash balance for the period  
**M** = non-interest cash movement for the period  
**I** = interest cash movement for the period  
**r** = interest rate  
**t** = tax rate (it is assumed this cannot equal 100%)  
**x** = proportion into the period that the non-interest cash movements are assumed to occur, e.g.
- If  $x = 0\%$ , this means the movement occurred at the start of the period
  - If  $x = 100\%$ , this means that the movement occurred at the end of the period
  - If  $x = 50\%$ , this means that the movement occurred midway through the period

So,

$$\begin{aligned} \text{CB} &= \text{OB} + \text{M} (1 - t) + \text{I} (1 - t) \quad \text{and} \\ \text{I} (1 - t) &= (x \cdot \text{OB} + (1 - x) \cdot \text{CB}) \cdot r \cdot (1 - t) \quad \text{so (as } t \neq 100\%) \\ \text{I} &= (x \cdot \text{OB} + (1 - x) \cdot \text{CB}) \cdot r \\ &= (x \cdot \text{OB} + (1 - x) \cdot (\text{OB} + \text{M} (1 - t) + \text{I} (1 - t))) \cdot r \\ &= \text{OB} \cdot r + (1 - x) \cdot \text{M} \cdot (1 - t) \cdot r + (1 - x) \cdot \text{I} \cdot (1 - t) \cdot r \end{aligned}$$

Therefore,

$$\begin{aligned} \text{I} \cdot (1 - (1 - x) \cdot (1 - t) \cdot r) &= \text{OB} \cdot r + (1 - x) \cdot \text{M} \cdot (1 - t) \cdot r \\ \Leftrightarrow \text{I} &= \frac{\text{OB} \cdot r + (1 - x) \cdot \text{M} \cdot (1 - t) \cdot r}{(1 - (1 - x) \cdot (1 - t) \cdot r)} \end{aligned}$$

Hence, we can calculate interest from this final equation and have no circular references or goal seek.

Please see [www.sumproduct.com/thought/interest-received](http://www.sumproduct.com/thought/interest-received) for an example Excel file that illustrates this technique:

	Circular	Goal Seek	Formulae
<p><b>Cash Flow Statement (\$000)</b></p> <p><input checked="" type="checkbox"/> Calculate Circular with Iterations? <small>This check box affects calculations in columns H and I only. Having the check box switched on enables the macro activated by the first macro button in cell I19 (i.e. macro-created circular argument). Having the check box switched off makes Excel use the built-in circular argument calculation instead (macro not necessary).</small></p> <p>Macro Iterations: <input type="text" value="10"/> <small>Governs the number of iterations employed in both macros</small></p>			
<b>Revenue</b>			
<b>Net Cash Receipts (Pre-Tax and Interest)</b>	100.0	100.0	100.0
- Interest Revenue (Circular Calc.)	4.3		
- Interest Revenue (Goal Seek)	3.4	Solve	Solve
- Illustrative Difference	0.9		
Interest Revenue	4.3	4.3	4.3
<b>Pre-tax Cashflow</b>	104.3	104.3	104.3
Cash Tax Paid	(31.3)	(31.3)	(31.3)
<b>Change in Cash Held</b>	73.0	73.0	73.0
<b>Balance Sheet (\$000)</b>			
<b>Cash at Bank</b>			
Opening Balance	50.0	50.0	50.0
Change in Cash Held	73.0	73.0	73.0
<b>Closing Balance</b>	123.0	123.0	123.0

# Best Excel Tip Ever – The Top Five

Back in 2015, we were “very unimpressed” with the result of the Institute of Chartered Accountants in England and Wales’ (ICAEW’s) competition to find the Best Excel Tip Ever. The winning entry suggested **F5 + Special** to select blanks in order to paste in missing formulae. Our readership was underwhelmed. So we asked the audience for your best Excel tips. Aside from, “Get someone else to do it”, we present below the five most popular ones received from back in May 2015...

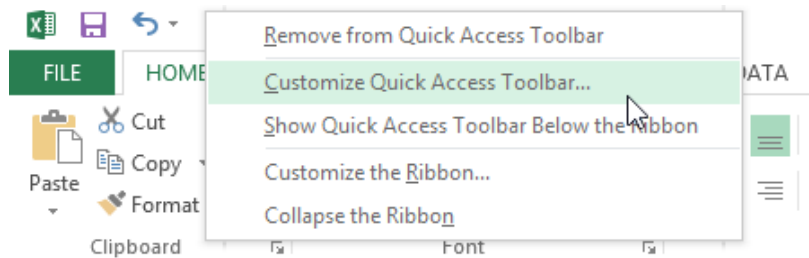


*Is this a top tip..?*

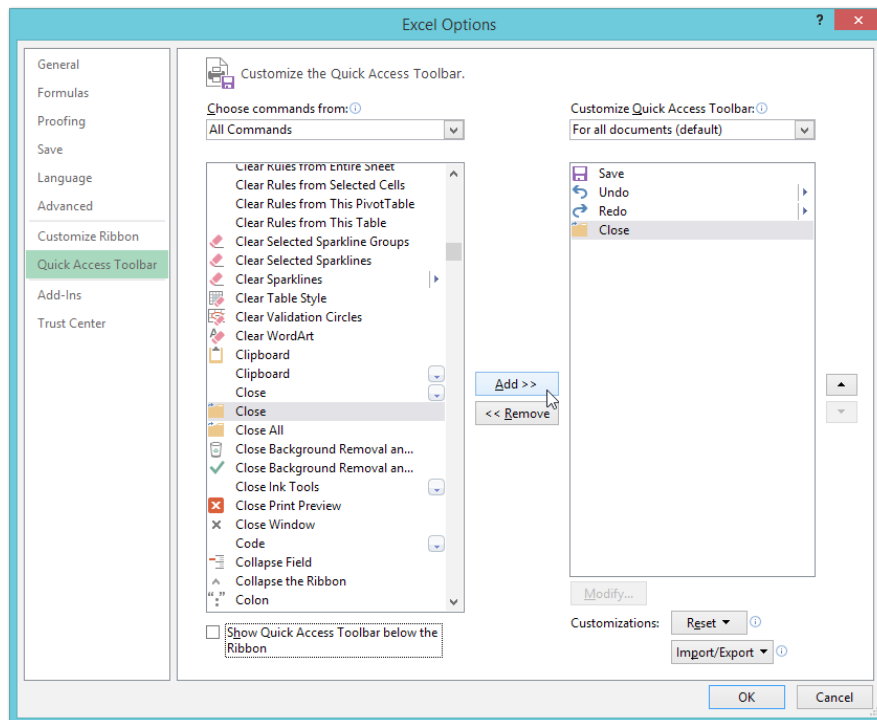
## Number 5: Close Files, Not Excel 2013

Ever closed that final file in Excel 2013 or Excel 2016 only for the application to close down as well? This is the Excel 2013+ way of the world but there is a workaround and we thank recent MVP awardee **Wyn Hopkins** once more of Access Analytic for bringing this to our attention.

In Excel 2013 / 2016, simply right-click on the Quick Access Toolbar and select ‘Customize Quick Access Toolbar...’ viz.



In the subsequent dialog box, select ‘All Commands’ in the ‘Choose commands from’ drop down box and then select ‘Close’ (with the folder icon, please see the illustration below). Next, click on the ‘Add>>’ button to add it to the Quick Access Toolbar and finally click on ‘OK’ to exit the dialog box.



From now on, simply click on this ‘Close’ icon in the Quick Access Toolbar and you will never have to say goodbye to Excel 2013 or Excel 2016 again. Breaking up can just be so very hard to do!



#### Number 4: Finding Inconsistent Formulae Easily

Kim Ho and Minh Lee were two that suggested this one. Consider the following block of data:

	A	B	C	D	E	F	G	H	I	J	K	L
1	16	80	79	80	17	12	46	20	63	67	28	
2	64	58	72	39	63	90	73	15	29	36	45	
3	94	79	30	21	1	49	63	66	85	49	97	
4	87	73	36	88	44	27	59	0	1	21	19	
5	88	74	87	16	78	39	56	98	40	84	21	
6	96	98	15	63	59	89	70	36	99	25	50	
7	6	65	10	27	12	4	55	32	71	74	72	
8	64	0	51	1	14	34	18	81	46	62	94	
9	18	67	18	89	23	8	52	51	17	48	0	
10	7	47	57	31	24	38	30	5	90	75	37	
11	60	1	67	62	89	41	10	99	10	36	72	
12	12	53	3	0	53	58	29	95	28	7	65	
13	99	70	28	81	10	25	14	31	47	7	25	
14	42	82	51	46	18	79	33	63	9	53	20	
15	49	63	47	95	95	25	82	49	76	1	58	
16	55	88	77	95	73	60	25	37	20	87	48	
17	59	97	20	68	12	82	3	23	90	69	78	
18												

Let's assume this data is supposed to refer to a similar block of data elsewhere. How can we tell if the formula has been copied across and down correctly? Inspection by eye achieves nothing here.

One option is to use the keyboard shortcut **CTRL + `** (the character is the key to the left of the 1 on a standard QWERTY keyboard):

	A	B	C	D	E	F	G	H	I	J	K	L
1	=A23	=B23	=C23	=D23	=E23	=F23	=G23	=H23	=I23	=J23	=K23	
2	=A24	=B24	=C24	=D24	=E24	=F24	=G24	=H24	=I24	=J24	=K24	
3	=A25	=B25	=C25	=D25	=E25	=F25	=G25	=H25	=I25	=J25	=K25	
4	=A26	=B26	=C26	=D26	=E26	=F26	=G26	=H26	=I26	=J26	=K26	
5	=A27	=B27	=C27	=D27	=E27	=F27	=G27	=H27	=I27	=J27	=K27	
6	=A28	=B28	=C28	=D28	=E28	=F28	=G28	=H28	=I28	=J28	=K28	
7	=A29	=B29	=C29	=D29	=E29	=F29	=G29	=H29	=I29	=J29	=K29	
8	=A30	=B30	=C30	=D30	=E30	=F30	=G30	=H30	=I30	=J30	=K30	
9	=A31	=B31	=C31	=D31	=E31	=F31	=G31	=H31	=I31	=J31	=K31	
10	=A32	=B32	=C32	=D32	=E32	=F32	=G32	=H32	=I32	=J32	=K32	
11	=A33	=B33	=C33	=D33	=E33	=F33	=G33	=H33	=I33	=J33	=K33	
12	=A34	=B34	=C34	=D34	=E34	=F34	=G34	=H34	=I34	=J34	=K34	
13	=A35	=B35	=C35	=D35	=E35	=F35	=G35	=H35	=I35	=J35	=K35	
14	=A36	=B36	=C36	=D36	=E36	=F36	=G36	=H36	=I36	=J36	=K36	
15	=A37	=B37	=C37	=D37	=E37	=F37	=G37	=H37	=I37	=J37	=K37	
16	=A38	=B38	=C38	=D38	=E38	=F38	=G38	=H38	=I38	=J38	=K38	
17	=A39	=B39	=C39	=D39	=E39	=F39	=G39	=H39	=I39	=J39	=K39	
18												

This shortcut toggles cell values with their content (*i.e.* formulae). This will show formulae which have not been copied across properly, but this is still fraught with user error (can you spot the relevant cells?) and would be cumbersome with vast arrays of data.

Instead, there is a simpler, automatic approach. Select all of the data (click anywhere in the range and press **CTRL + \*** – see below for more on this shortcut). Then use the keyboard shortcut **CTRL + \** viz.

	A	B	C	D	E	F	G	H	I	J	K	L
1	16	80	79	80	17	12	46	20	63	67	28	
2	64	58	72	39	63	90	73	15	29	36	45	
3	94	79	30	21	1	49	63	66	85	49	97	
4	87	73	36	88	44	27	59	0	1	21	19	
5	88	74	87	16	78	39	56	98	40	84	21	
6	96	98	15	63	59	89	70	36	99	25	50	
7	6	65	10	27	12	4	55	32	71	74	72	
8	64	0	51	1	14	34	18	81	46	62	94	
9	18	67	18	89	23	8	52	51	17	48	0	
10	7	47	57	31	24	38	30	5	90	75	37	
11	60	1	67	62	89	41	10	99	10	36	72	
12	12	53	3	0	53	58	29	95	28	7	65	
13	99	70	28	81	10	25	14	31	47	7	25	
14	42	82	51	46	18	79	33	63	9	53	20	
15	49	63	47	95	95	25	82	49	76	1	58	
16	55	88	77	95	73	60	25	37	20	87	48	
17	59	97	20	68	12	82	3	23	90	69	78	
18												

This automatically selects all of the cells whose contents are different from the comparison cell in each row (for each row, the comparison cell is in the same column as the active cell).

**CTRL + SHIFT + \** selects all cells whose contents are different from the comparison cell in each column (for each column, the comparison cell is in the same row as the active cell). In this example, where a formula is supposed to be copied across and down, there will be no difference.

These cells can now be highlighted and reviewed at leisure.

### Number 3: The 39 Steps of Range Names

Excel MVP **Bob Umlas** was a great proponent of the following tip for identifying range names quickly. We first brought this to your attention in last July's newsletter.

An interesting quirk relating to range names is what happens if you actually reduce the scale of Zoom View (**ALT + W + Q**) to 39% or below:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
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100															

It can be a simple way of tracking down some of those pesky critters.

### Number 2: Selecting an Active Range

Interestingly, this one was most popular with the Excel MVPs, including **Ken Puls** and **Frederic le Guen**. Consider you have been working with an Excel range.

	A	B	C	D	E	F
1	1	2	3	4	5	6
2	7	8	9	10	11	12
3	13	14	15	16	17	18
4	19	20	21	22	23	24
5	25	26	27	28	29	30
6	31	32	33	34	35	36
7						

Clicking anywhere in this range and then pressing **CTRL + \*** will then select the whole range,

	A	B	C	D	E	F
1	1	2	3	4	5	6
2	7	8	9	10	11	12
3	13	14	15	16	17	18
4	19	20	21	22	23	24
5	25	26	27	28	29	30
6	31	32	33	34	35	36
7						

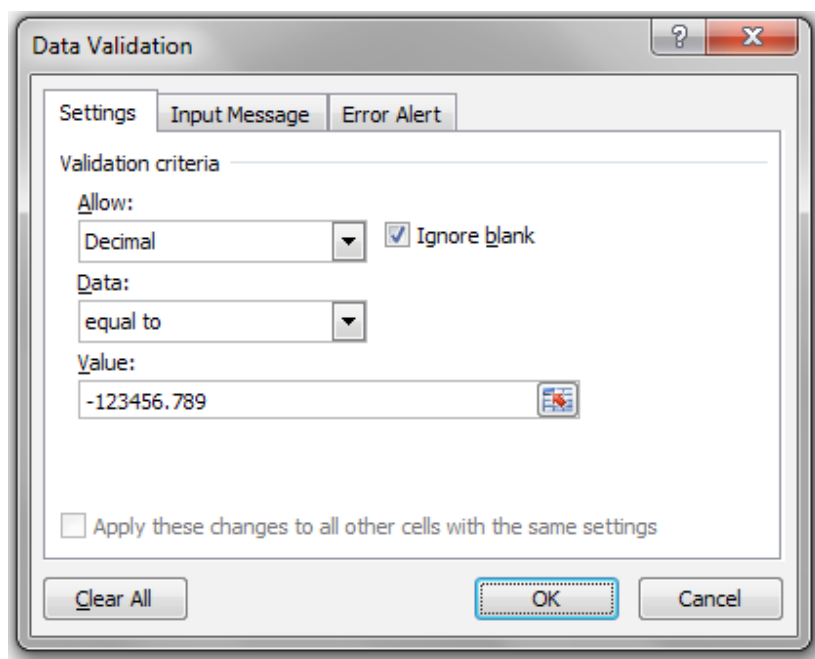
### Number 1: Demonic Data Validation

We have some twisted individuals reading this newsletter! By far and away the most popular 'trick' (in all sense of the word!) was this monster first divulged in our very first newsletter by our own resident MVP **Liam Bastick**. We have elected not to name all the people who suggested this – partly to save printing costs and partly to protect the guilty. You know who you are!!

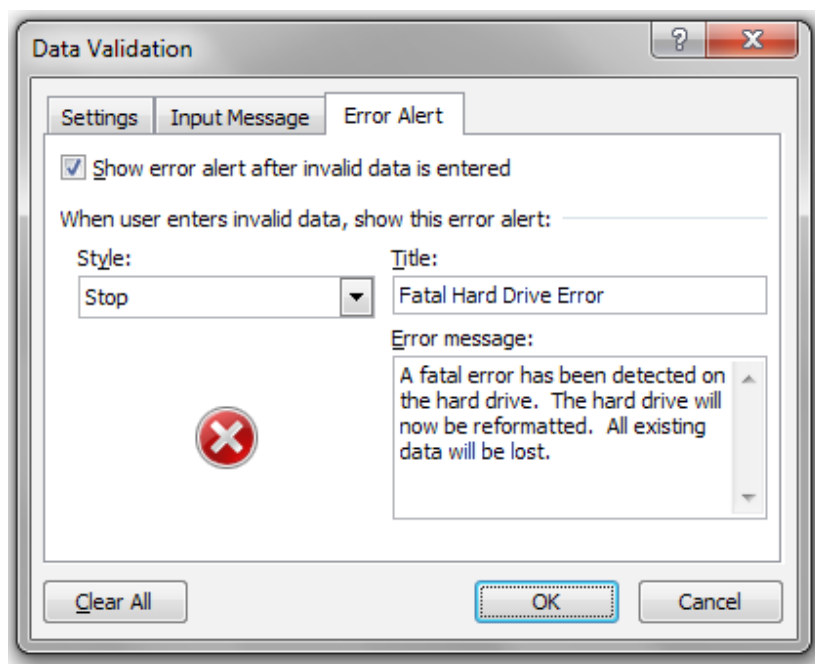
Data Validation is a useful way to control what end users can type into a worksheet cell (see [www.sumproduct.com/thought/data-validation](http://www.sumproduct.com/thought/data-validation)).

You can use this functionality to play a trick. Please use this at your own risk: if you get fired, you will get no sympathy here and we will disown all knowledge: this article will self-destruct in five seconds...

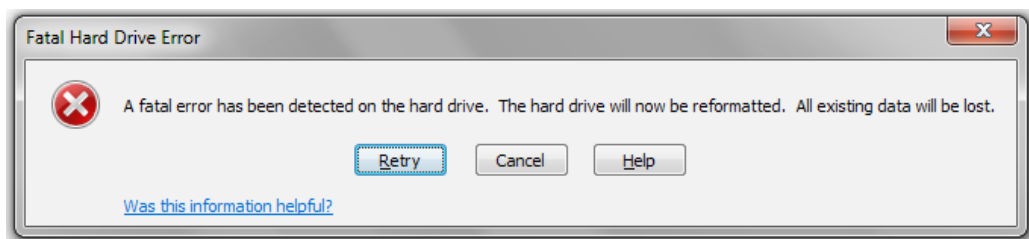
If someone is unfortunate to leave a spreadsheet unprotected, simply highlight the whole worksheet and then activate Data Validation (**ALT + D + L**). In the 'Settings' tab, select settings similar to the following (the aim is to pick a number the user won't use):



Then, select the 'Error Alert' tab:



If you are feeling particularly horrible, add "Press any key to continue" to this message for maximum effect. Now, de-select the range and wait for your victim to use the worksheet. As soon as they type an invalid entry, they will be greeted with the following error alert:



Who says spreadsheets can't be fun..?

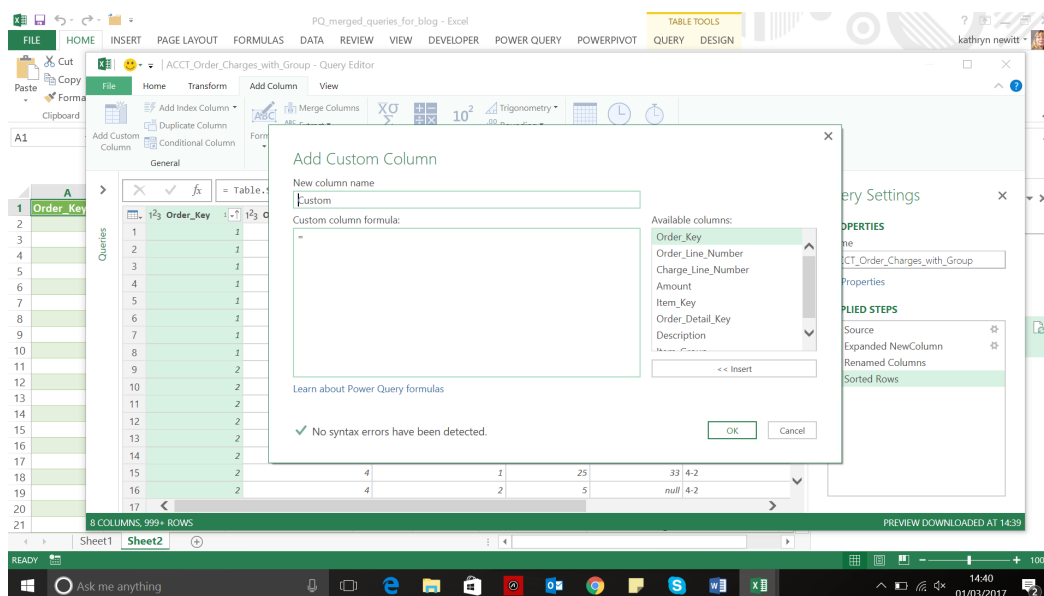
# Power Query Pointers

Each month we'll reproduce one of our articles on Power Query (Excel 2010 and 2013) / Get & Transform (Excel 2016) from [www.sumproduct.com/blog](http://www.sumproduct.com/blog). If you wish to read more in the meantime, simply check out our Blog section each Wednesday. This month we delve into **M**, the programming language behind Power Query.

For users already familiar with Power Pivot and Data Analysis eXpressions (**DAX**, the associated programming language), it might seem logical that Power Query would use a similar language and perhaps even the same formulae. Not so. Power Query has its own language, **M**, and its own formula syntax. There's not even a clever reason why the language is called **M**, it was just the next available letter. So, having abandoned any expectation of familiarity, let's find a good place to start looking at **M**

language (after L?). To begin with, let's create a custom column and look at a formula that can be associated with that new column.

In this example, I'll start out in the worksheet for the merged query I created in an earlier article and open **ACCT\_Order\_Charges\_with\_Group** to access the query editor. On the 'Add Column' tab I choose to 'Add Custom Column':

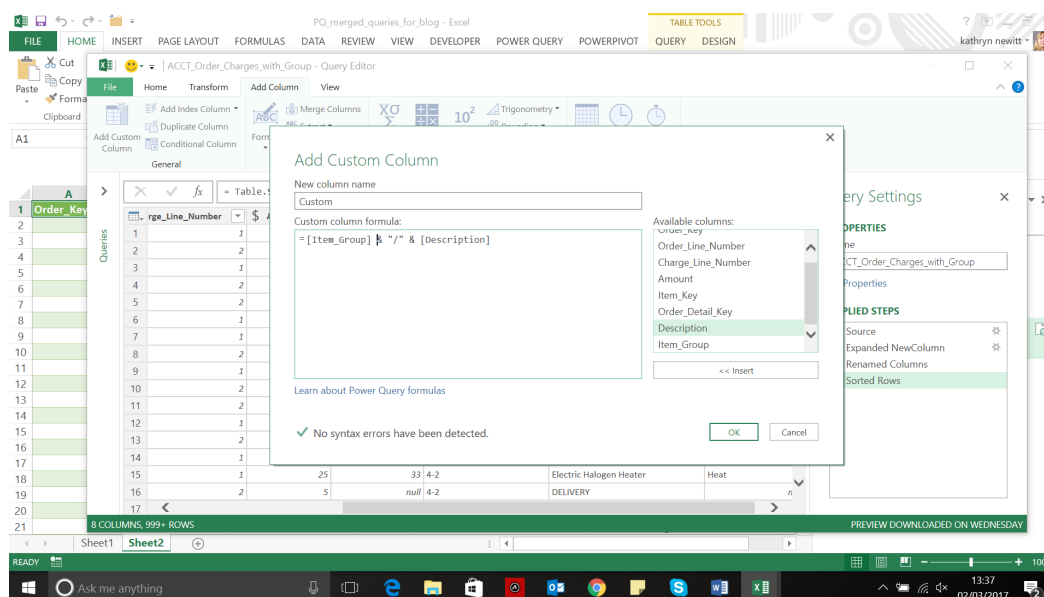


The dialog box has a large section for the formula beneath the name you may choose for the new custom column. Available columns in the query are shown and double clicking them adds them to the formula (or you can select and then choose to 'Insert' them).

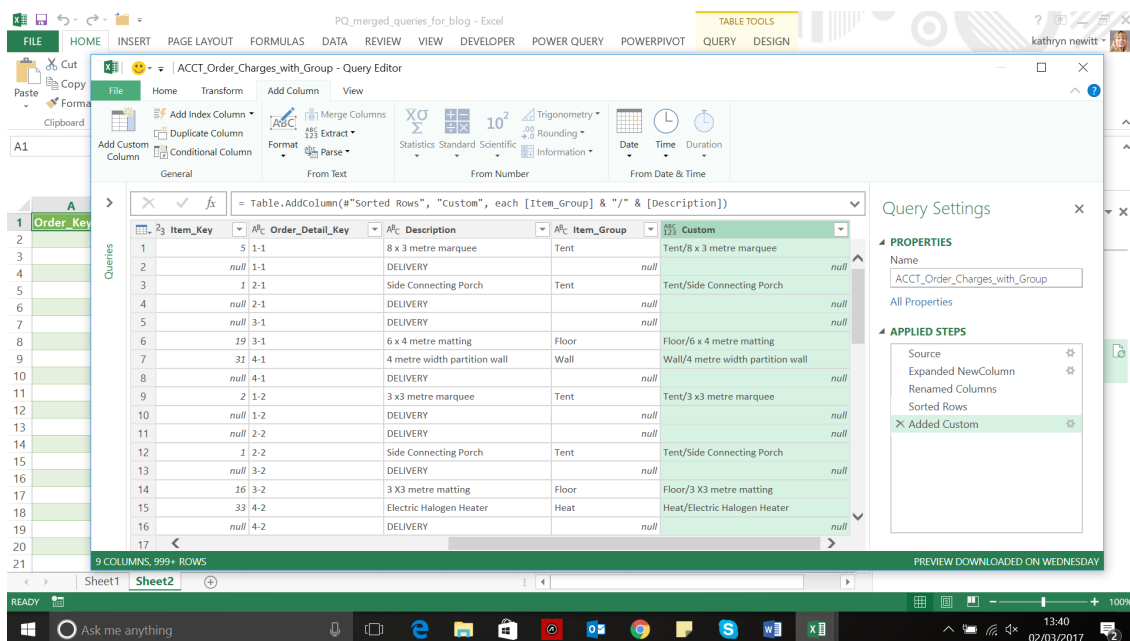
Notice the option to 'Learn about Power Query formulas' at the bottom of the dialog box. This is the best place to find out what formulae are available in Power Query. Clicking here will take you to the Microsoft help page, which has a links to find out lots about Power Query **M** language and the functions available.

Having said that, the formulae do not tend to match those for Power Pivot, although there are some functions that are reassuringly familiar from Excel, as I will show now by concatenating two existing columns.

I'll create a column that combines the **Item\_Group** and the **Description** columns by double clicking each column (or using 'Insert'). I type in an '&' between the columns, which is the same as I would do in an Excel formula, and include a '/' to separate the data in the column to make it easier to read:



Click 'OK' and the custom column is generated, ready to be loaded to the worksheet.



There are other similarities with Excel: the symbols '+', '-', '\*' and '/' are used for add, subtract, multiply and divide respectively too.

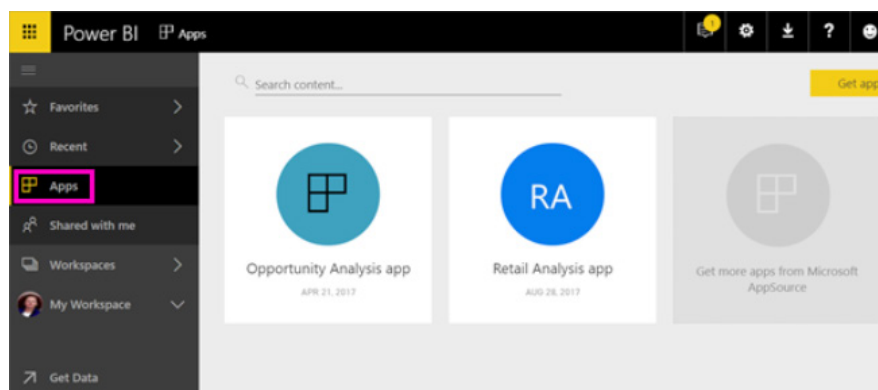
There are however some points to bear in mind when comparing Power Query formulae with Excel:

- Excel formulae are not case sensitive, but Power Query formulae are
- Excel counts using a base of 1 (e.g. the first letter in a string is at position 1), but Power Query uses a base of 0 (zero) (so the same letter would be at position 0)
- Excel will automatically convert data (e.g. concatenating a text column to a numerical column will work as Excel converts them to text automatically). Power Query will not (e.g. trying to concatenate text to a value will give errors in the new column – the value must be converted to text first). This is why I picked two text columns for my example above.

Having imparted some good news and some bad news about the way that Power Query and **M** language compares with Excel, next month we will look in more detail at how **M** language is constructed.

## Power BI Expands Access to Business Intelligence for External Guest Users

If you are using Power BI, then this may be of interest to you. In Power BI, “apps” bring related dashboards and reports together. People throughout your business / organisation may create and distribute apps with key business information. External services, such as Google Analytics and Microsoft Dynamics CRM, also offer Power BI apps.



Apps are located in and installed from the Power BI service ([powerbi.com](https://powerbi.com)). After you have installed an app, you don't have to remember the names of a lot of different dashboards because they're all together in said app, either in your browser or on your mobile device.

The recent general availability of Power BI Premium in June broadened the service's reach, allowing organisations to distribute BI content broadly without requiring recipients to be licensed individually. Accessibility has been extended further: now, Power BI users can seamlessly distribute

Power BI apps and dashboards to guest users outside of their organisation – recipients are able to securely sign into the service using their own organisation's security credentials or personal email address, while the content owner is able to maintain control over the internal data.

This new feature is the result of Power BI integration with something called Azure Active Directory (AD) business-to-business (B2B) collaboration.



For example, consider a scenario where an automotive manufacturer working with many diverse suppliers wants to streamline its supply chain logistics: all the components, materials and services necessary to run its manufacturing operations. The company plans to use Power BI to monitor key supply chain performance metrics by building a BI portal its employees and partners can access. Previously, this would mean that the manufacturer would have needed to create duplicate identities for users belonging to partner organisations, requiring those users to remember multiple sets of credentials, and creating challenges for governance enforcement and identity management. Alternatively, the automaker could have invested the time and cost of building an app with Power BI Embedded that employs custom authentication.

In this latter instance, Power BI's integration with Azure AD B2B enables seamless, secure access for guest users from partner organisations: the automaker can create a Power BI app in the service, invite guest users,

and distribute the BI content to them to access by authenticating via their organisation's Azure AD credentials.

External users can be licensed to receive BI content in two ways:

1. the content is allocated to Power BI Premium capacity
2. the external user is assigned a Power BI Pro license. In this instance, this can be done by either the external user's administrator or, as a new capability, by the sharing organisation's administrator.

Power BI integration with Azure AD B2B provides allows entities to employ established Azure AD authorisation policies to protect their data, including conditional access policies and risk-based authentication. Administrators are also able to set policies for external B2B invites, such as the ability to turn off or restrict the ability for users to send invitations.

No more dual email addresses!

## Power BI Desktop November Update

November's update saw conditional formatting getting a major update, with the ability to control the color based on rules. Further, if you have a slow data source, there are now report options that help restrict the number of queries that are sent to the source. Finally, there's also several formatting features added, including cell alignment for table and matrix and precise control over the order of overlapping charts on your report.

In summary, the list of updates are as follows:

### Reporting

- Rule-based conditional formatting for table and matrix
- Cell alignment for table and matrix
- Control visual ordering through the selection pane
- Lock objects on your report
- Esri Plus Subscription available for ArcGIS Maps for Power BI
- Report options for slow data sources
- Filtering performance improvements
- Recently released custom visuals:
  - o Image Timeline
  - o Social network graph
  - o Venn diagram by MAQ Software
  - o HTML viewer

### Analytics

- Cell-level formatting for multidimensional AS models for multi-row card

### Query editing

- Add Column From Examples improvements.

Let's take a look at each of these in turn.

### Rule-based conditional formatting for table and matrix

This latest update saw conditional formatting include rule-based conditional formatting. Now, if you have specific business logic to reflect in your table or matrix, you may create rules to conditionally colour the background or font color of a column (yes, the missing "u" is deliberate!).

To start formatting based on your rules, simply open the 'color scales' dialog and check the 'Color by rules box'. This enables you to choose colours by your required logic.



In each rule, you can pick a colour to use when a cell value is between two values, is equal to a specific value or is blank:

Font color scales

Format the font color based on the value.

Base value:

Sales Amount

☒ Color by rules

Rules

+ Add

Condition 1	Operator 1	Value 1	Operator 2	Value 2	Then Color
If value is greater than or equal to	Minimum	and	is less than or equal to	100	Red
If value is greater than or equal to	101	and	is less than	1000	Yellow
If value is greater than or equal to	1001	and	is less than	Maximum	Green
If value is		450			Purple
If value is blank					Black

OK Cancel

When finished, click 'OK' to apply your rules. Each rule is applied in order, top to bottom. This means that if a value meets the criteria of two different rules, the bottom rule applies. It should be noted that this is different to how it works in Excel.

Year	Sales Amount
2011	\$27,310.03
Qtr 4	\$27,310.03
October	\$523.70
Contoso USB Data Link - direct connect adapter E600 Grey	\$33.80
Contoso Dual USB Power Adapter - power adapter E300 Grey	\$39.90
Contoso Bluetooth Notebook Mouse X305 Grey	\$450.00
November	\$5,245.58
Contoso Optical Wheel OEM PS/2 Mouse E60 Grey	\$26.00
Contoso Smart Battery M901 Grey	\$46.00
Contoso Optical USB Mouse M45 Grey	\$50.99
Contoso Optical USB Mouse M45 White	\$50.99
Contoso 8GB Super-Slim MP3/Video Player M800 White	\$109.95
Contoso 4GB Portable MP3 Player M450 White	\$287.85
Contoso 16GB Mp5 Player M1600 Black	\$399.80
Contoso 16GB New Generation MP5 Player M1650 White	\$696.00
Contoso Home Theater System 4.1 Channel M1410 Brown	\$987.00
Contoso Home Theater System 2.1 Channel E1220 Silver	\$995.00
Contoso Home Theater System 5.1 Channel M1530 Black	\$1,596.00
<b>Total</b>	<b>\$8,551,349.34</b>

### Cell alignment for table and matrix

This update has added cell alignment control to table and matrix visuals. You can specify left, right, or centre alignment for your row and column header or you can set the alignment for one specific field in the 'Field formatting' card:

Field formatting

Sales Amount

Font color

Background color

Alignment: Center

Apply to: Auto

Apply to: Left

Apply to: Right

Apply to: On

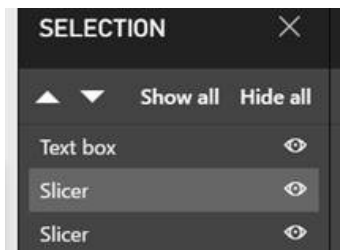
Apply to: Off

Revert to default

Conditional formatting

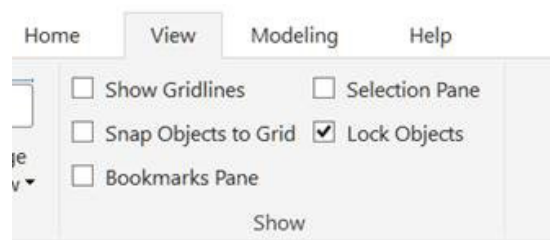
### Control visual ordering through the selection pane

The October update introduced the selection pane, which allowed users to easily select all the objects on their report page. It also allowed control if the object were visible. This pane is now enhanced to let you easily change which overlapping objects show on top on the canvas. The selection pane is sorted so the objects higher in the list show in front of objects lower in the list. You can drag and drop to change the order or use the arrows on the top of the pane to move things up and down.



### Lock objects on your report

When you're interacting with a report, either to test it out or as part of the analysis process, it's easy to accidentally nudge a chart a little to the left or right. To help with this problem, Microsoft has added a button to the 'View' tab to lock all the objects on the report. This will turn off resize and move, so you no longer have to worry about messing with your layout as you interact with your report. Unfortunately, this setting isn't saved with the report, so you'll need to enable it any time you want to use it. Great.



### Esri Plus Subscription available for ArcGIS Maps for Power BI

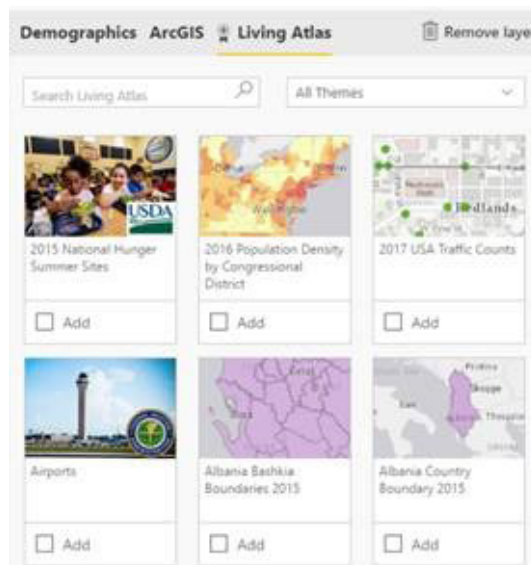
Esri's ArcGIS Maps for Power BI was announced at Ignite 2016 and became generally available in June this year. Now, Esri is releasing a new subscription service called 'Plus' that enables ArcGIS Maps for Power BI users to do more with their geospatial data.

Using Plus, there are richer mapping capabilities than the 'usual' map, including:

- More street address geocodes - up to 5,000 data points per map
- Additional basemaps, including:
  - o Imagery
  - o Imagery with labels
  - o National Geographic

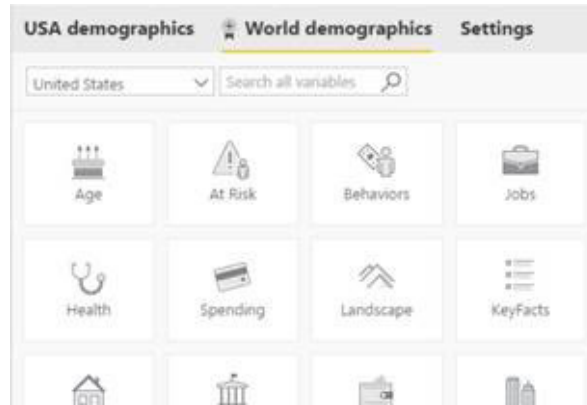


- Living Atlas reference layers that help add more context to your maps

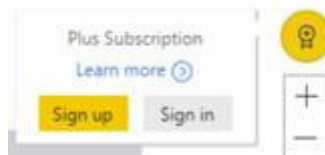


- o Oceans, Terrain with labels
- o Topographic
- o USA Topo Maps
- o USGS National Map (USA)

- World Demographics within the Infographics feature for categories like Education, Population, Income, or even Segmentation.



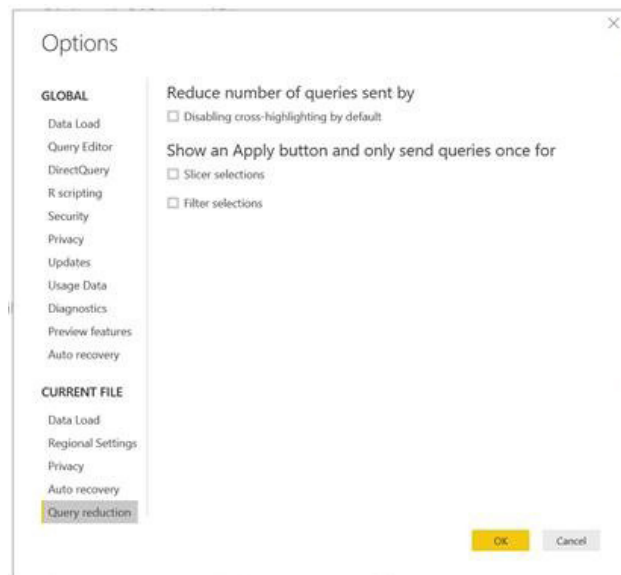
To start using Plus, all you need to do is sign up for a subscription or sign into an existing one through the plus button on the top right of the screen:



You can try the Plus subscription for 60 days at no charge and after that you can subscribe for US\$5 per user per month. There is an issue here though: when you use Plus features within the map, any user you share the report with needs to also have a Plus subscription to view the content. We can see this being a problem.

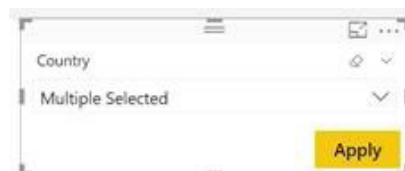
### ***Report options for slow data sources***

If you are working with either a very large or very slow data source in DirectQuery, some actions will take a while to get a response from the underlying data source. To help with that, the latest update provides some options in the report to send fewer queries, making it easier to interact with the report. To access these options, go to the 'Options' dialog under **File > Options and settings > Options**, and select 'Query reduction':



From here, you can turn off cross highlighting automatically throughout your whole report. (You may still manually turn it on for specific visuals using the Visual interactions feature, but the default will be off.)

You can also add an 'Apply' button to slicers and filters. Depending on what you select, the 'Apply' button is added to slicers, filters or both. You can make as many selections as you want, but no queries will be sent until you select the 'Apply' button. Your selections will then be used to filter all of your data.



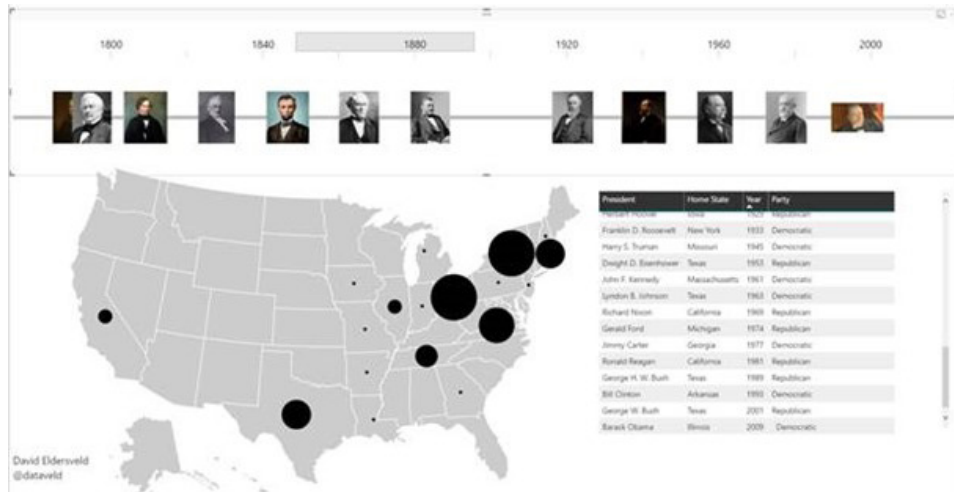
These changes will apply to your report while you interact with it in Power BI Desktop as well as when your users consume the report in the Power BI service.

## Filtering performance improvements

There are also some updates in Power BI's filtering implementation, which improves performance for certain scenarios, such as when using strings. It's worth noting that Microsoft has now removed the 500-value limit on how many values you may match when filtering for all data sources, except for Live connections to analysis services models.

## Image Timeline

As always, there's new custom visuals recently released to the custom visuals store. These may be imported directly from the store in Desktop or you can individually download visuals from the custom visuals store. The first custom visual here, Image Timeline, displays events along a horizontal timeline. These events can either be represented as a circle or a custom image. You can then click on events to filter down your report to that event. If you have lots of events on your timeline, it also has an interactive date "brush" that lets you zoom in on the timeline.



## Social network graph

The Social network graph custom visual can be used for visualising connections between people. One common scenario for this is visualising an organisation structure where employees report to managers in a hierarchy. You create the visual by giving it the source and target for each connection, and then you can format it with size and color based on other fields in your model.

Salary and Salary by ManagerName, EmployeeName, ManagerPhotoUrl, EmployeePhotoUrl, Department, Department, ManagerJobTitle a

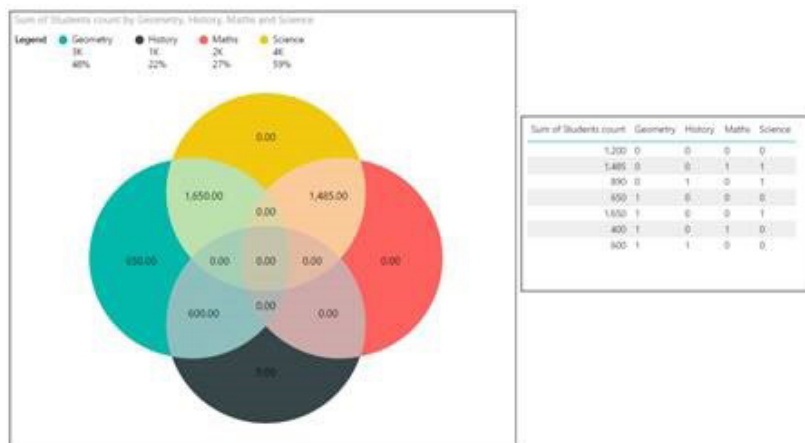


We might start using it for our debtors list and publish it each month in our newsletter along with home addresses and any embarrassing facts we've unearthed...



## Venn diagram by MAQ Software

This one will keep our MD happy. Venn diagrams are good for finding commonality between different categories. Each circle is a collection of data points for a given category and where the circles intersect, there are data points that represent both categories.



## HTML viewer

This one could be very useful. The HTML viewer visual lets you display your HTML text strings in its original formatting. You can also do some basic formatting of alignment, colour and size for the text.

Here's an example comparing the HTML text in a Power BI table and the HTML viewer visual:

### Before HTML Viewer:

Table
Content
<h1>HTML Ipsum Presents</h1> <p><strong>Pellentesque habitant morbi tristique</strong> senectus et netus et malesuada fames ac tur...
<h2>Header Level 2</h2> <ol> <li>Lorem ipsum dolor sit amet, consectetur adipiscing elit.</li> <li>Aliquam tincidunt mauris eu risus...
<h3>Header Level 3</h3> <ul> <li>Lorem ipsum dolor sit amet, consectetur adipiscing elit.</li> <li>Aliquam tincidunt mauris eu risus...
<H3>Line Breaks</H3> Lorem ipsum dolor sit amet, consectetur adipiscing elit.<P>
<H3>This is a size "3" heading</H3> <H4>This is a size "4" heading</H4> <H5>This is a size "5" heading</H5> <H6>This is a size "6" he...
<H4>HTML Tags</H4> Most HTML commands come in pairs: The closing tag is always the same as the opening tag except for the addition ...

### After HTML Viewer:

HTML Viewer
<b>HTML Ipsum Presents</b>
<b>Pellentesque habitant morbi tristique</b> senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, commodo vitae, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. In turpis pulvinar facilisis. Ut felis.
<b>Header Level 2</b>
<ol style="list-style-type: none"><li>1. Lorem ipsum dolor sit amet, consectetur adipiscing elit.</li><li>2. Aliquam tincidunt mauris eu risus.</li></ol> <p> Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vivamus magna. Cras in mi at felis aliquet congue. Ut a est eget ligula molestie gravida. Curabitur massa. Donec eleifend, libero at sagittis mollis, tellus est malesuada tellus, at luctus turpis elit sit amet quam. Vivamus pretium ornare est.</p>
<b>Header Level 3</b>
<ul style="list-style-type: none"><li>• Lorem ipsum dolor sit amet, consectetur adipiscing elit</li></ul>

## Cell-level formatting for multidimensional AS models for multi-row card

The latest update extends cell-level formatting support to multi-row cards. This means that for table, matrix, single value card, and multi-row cards, cell-level formatting defined in the multi-dimensional Analysis Services (AS) model will automatically flow through and be applied.

## Impala connector – support for Windows Authentication

Support has also now been added for Windows Authentication to the Impala connector. Apparently, this was a common request from existing Impala connector users. Microsoft has further promised that they will soon add support for Windows authentication to the On-premises data gateway, as well as Kerberos-based Single Sign-On support for the Impala connector via the Gateway too.

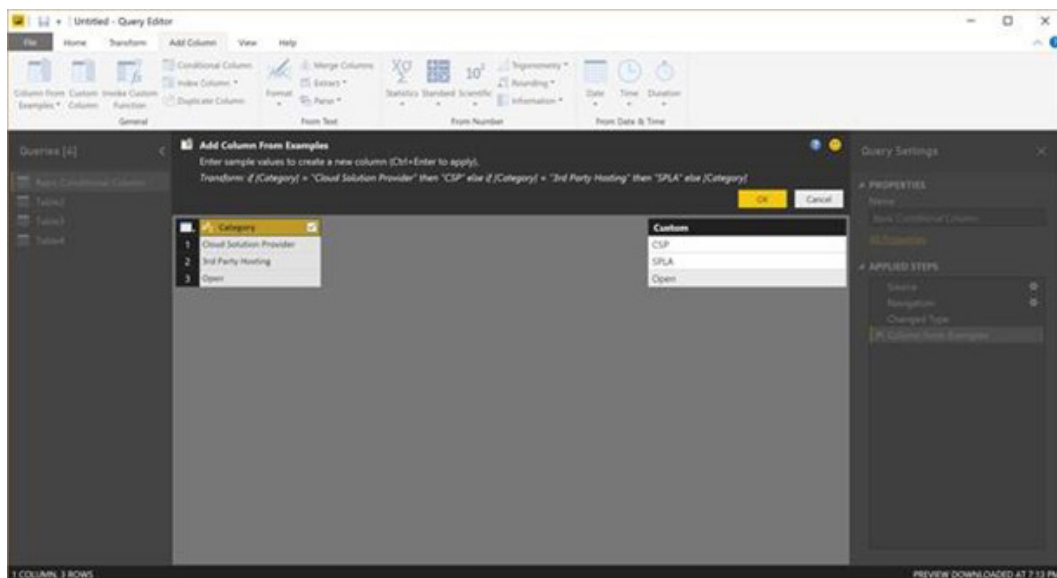
After specifying an Impala cluster to connect to from Power BI Desktop, users may now select Windows as the authentication type in the 'Credentials' dialog. Within the Windows authentication option, users may select whether to use the "current Windows user" or impersonate (!?) a different user.



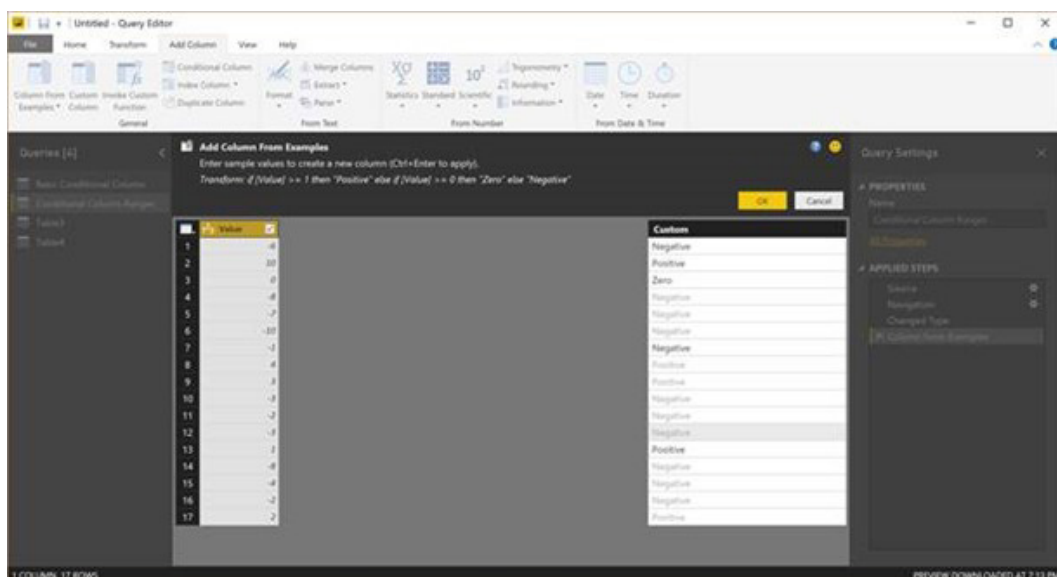
### Add Column From Examples improvements

Now this is one of our favourite toys in Power BI. Microsoft has now added support for generating “Conditional Columns” transformations as part of the “Add Column From Examples” experience. This addition opens up a lot of additional scenarios for “Add Column From Examples”:

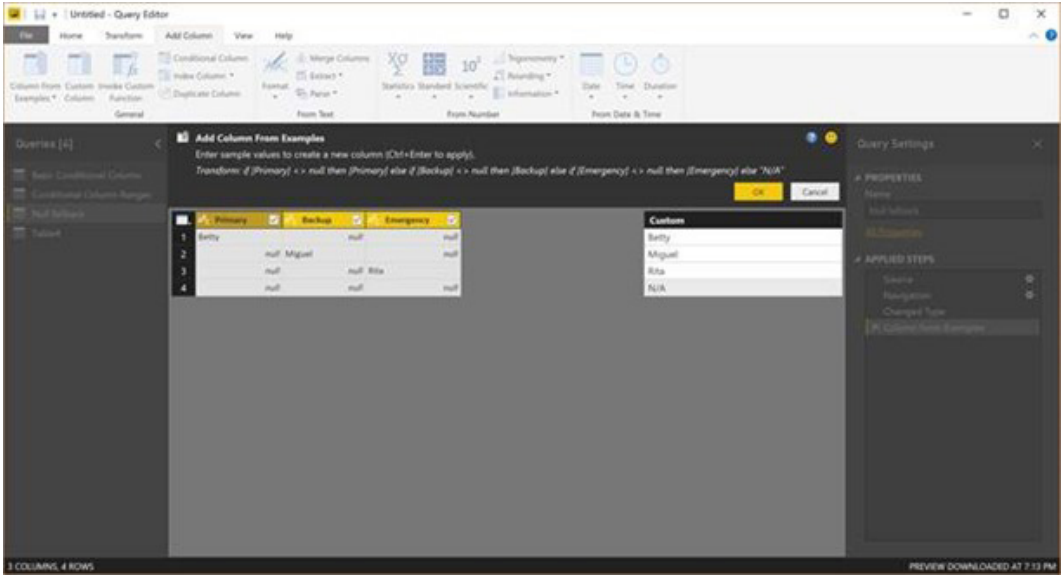
- **Basic Conditional Column:** It is now possible to define a mapping between values in an input column and the desired output by providing a set of examples



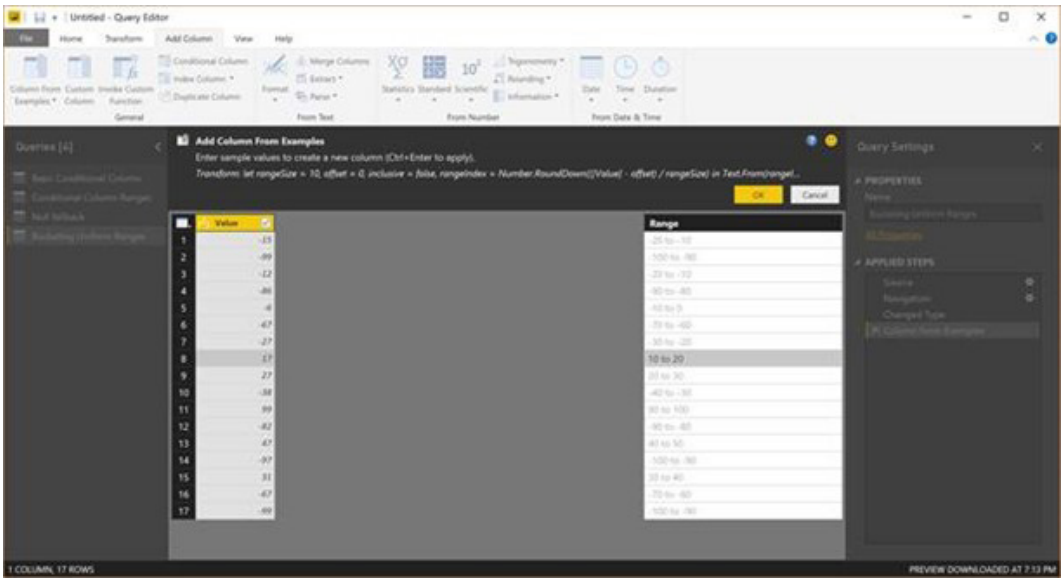
- **Conditional Column Ranges:** It's now possible to define a new column with non-uniform ranges based on an input column. This new capability is supported for columns where the output values don't encode the range boundaries



- **Null fall-back:** A very common scenario for “Conditional Column” is using a value from a given column, or the value from a fall-back column when the first column value is missing for a given row



- **Bucketing (uniform ranges):** “Bucketing” is now enabled via “Add Column From Examples”. Users may now specify the upper / lower boundaries of a range for a certain row and Power BI will automatically extrapolate to all other rows by using uniform ranges.



## November 2017 Updates for Power BI Report Server

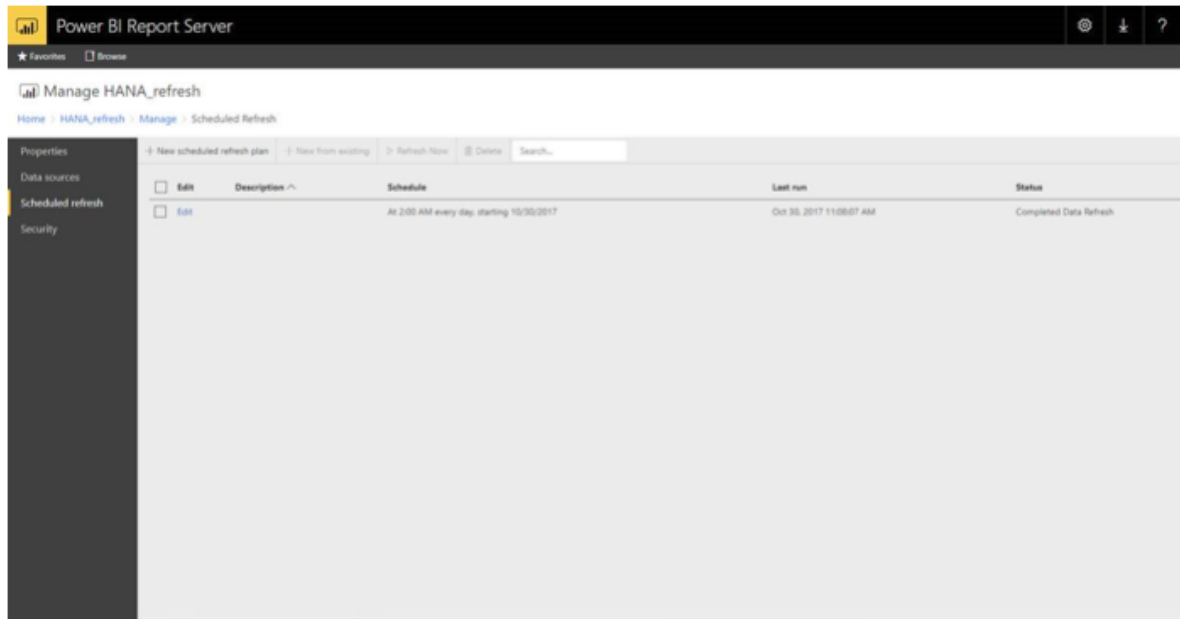
For those who require an on-premises solution for reporting (and may or may not move to the Cloud at a later date), Power BI Report Server is Microsoft’s on-premises solution. It’s included with Power BI Premium and you can download a free trial at [powerbi.microsoft.com/en-us/report-server/#](https://powerbi.microsoft.com/en-us/report-server/#).

November saw the release of a new version of Power BI Report Server. This release contained all of the features first introduced in the August Preview, as well as several new features:

- Scheduled data refresh
- Direct Query support available
- New REST API for developers
- Connection to shared datasets via OData
- Filter reports using URL parameters.

Let’s go through each of these updates.

## Scheduled data refresh



With the August 2017 Preview of Power BI Report Server, Microsoft introduced the capability to upload Power BI reports that didn't require an external connection to SQL Server Analysis Services. While this enabled the ability to view those reports on the server, it didn't yet allow you to refresh the data feeding that report. This has now been addressed. Now, users may set data refresh schedules for their Power BI reports that are using any of more than 20 data sources. This includes all the most popular data sources such as SQL Server, Oracle, Excel Workbooks, SAP HANA and many others. It's even possible to set multiple refresh schedules for each report, enabling even more control around how often you update your data.

In addition, the size of the files that may be uploaded to the server and scheduled for data refresh has been increased to 2 GB.

### Direct Query support available

For reports that always need to look at the live source data, support has now been added for Direct Query. It's still limited, but it's definitely a start. So far, Direct Query is enabled in this release for SQL Server, Azure SQL Database, Oracle, Teradata, SAP HANA and SAP BW.

All you need to do is choose the "Direct Query" option when creating

your report in Power BI Desktop and load your report to the server. Once loaded, you can set the credentials used when connecting to the data source for report viewers or if you'd prefer to connect as the user viewing the report to take advantage of row-level security that's also been set at the data level for certain data sources.

### New REST API for developers

First introduced in SQL Server 2017 Reporting Services, a new, modern REST API for Report Server is now available. Microsoft advises users to think of it as "...a RESTful successor to the legacy ReportingService2010 SOAP API...". It has been extended to account for the additional report types supported in Power BI Report Server.

The REST API provides programmatic access to the objects in a report server

catalogue: folders, reports, KPIs, data sources, datasets, refresh plans, subscriptions etc. For example, using the REST API, you may navigate the folder hierarchy, discover the contents of a folder or download a report definition. You can also create, update / delete objects, upload a report, execute a refresh plan, delete a folder, and so on.

### Connection to shared datasets via OData

Shared datasets in SQL Server Reporting Services have been used for years to enable the re-use of a single dataset across multiple reports and report types. The functionality of the new REST API has been extended to also make these datasets available for use in Power BI reports via

OData. To connect to a shared dataset in your Power BI Reports, you can use the OData data source in Power BI Desktop and connect to the proper URL for your data source.

### Filter reports using URL parameters

Imagine you've embedded a Power BI report into another app using an iframe and a URL like the following:

**https://reportserver/reports/powerbi/Store Sales?rs:Embed=true**

Now you may specify additional filters using the "filter" URL parameter:

**https://reportserver/reports/powerbi/Store Sales?rs:Embed=true&filter= Store/Territory eq 'NC' and Store/Chain eq 'Fashions Direct'**

The syntax is similar to one that is used with the Power BI service.

## Out and About in December



*Sometimes we feel like we live on a plane...*

We're not done for the year yet. December sees our global travels draw to a close with trips to Hong Kong, Johannesburg and New York. If you'd like us to meet up with you, drop us a line at [contact@sumproduct.com](mailto:contact@sumproduct.com) if you'd like to meet up. We'd be happy to discuss your modelling / training requirements.

## Blast from the Past: Most Useless Excel Function

*Long, long ago in Excel for a far, far away, a call went out to Excel users and gurus alike to vote for what they believed was the most useless function ever in Excel. We reproduce the winner below – ahead of this month's **A to Z of Excel Functions**.*

The crowd favourite was **FACTDOUBLE**, a function we are sure most readers will have used on less than zero occasions. This superstar of the modelling world returns the double factorial of a number (?).

Microsoft does like making terms up on occasion and we can't help thinking this might be one such instance. Mathematicians amongst you will know that the factorial function (denoted by '!') only works with integers and is the product of all non-negative integers less than or equal to integer selected, e.g.

$$3! = 3 \times 2 \times 1 = 6$$

$$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5,040$$

We thought **FACTDOUBLE** would therefore work as follows:

$$\text{FACTDOUBLE}(3) = 3!! = (3 \times 2 \times 1)! = 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$$

But no.

$$\text{If } n \text{ is odd, } \text{FACTDOUBLE}(n) = n (n-2) (n-4) \dots 3 \times 1$$

$$\text{If } n \text{ is even, } \text{FACTDOUBLE}(n) = n (n-2) (n-4) \dots 4 \times 2, \text{ e.g.}$$

$$\text{FACTDOUBLE}(7) = 7 \times 5 \times 3 \times 1 = 105$$

$$\text{FACTDOUBLE}(8) = 8 \times 6 \times 4 \times 2 = 384$$

$$\text{and therefore (!?) in Excel 2013, } \text{FACTDOUBLE}(\text{BITAND}(13,25)) = 945 \text{ (erm...)}$$

In fact, it will even work with non-negative decimals, the value is simply truncated so that it becomes a whole number.

Having said all this, since it was announced, various Excel users have been challenging each other to come up with a rationale for this function. Apparently, it is necessary to compute the odds of winning in Texas Hold 'Em (obviously!) so it isn't a function without use after all...





## The A to Z of Excel Functions: CHIDIST

In probability theory and statistics, the chi-squared distribution (also chi-square or  $\chi^2$ -distribution) with  $k$  degrees of freedom is the distribution of a sum of the squares of  $k$  independent standard normal random variables. It is one of the most widely used probability distributions in inferential statistics, *e.g.* in hypothesis testing or in construction of confidence intervals.

The chi-squared distribution is used in the common chi-squared tests for goodness of fit of an observed distribution to a proposed theoretical one, the independence of two criteria of classification of qualitative data, and in confidence interval estimation for a population standard deviation of a normal distribution from a sample standard deviation.

If  $Z_1, \dots, Z_k$  are independent, standard normal random variables, then the sum of their squares

$$Q = \sum_{i=1}^k Z_i^2$$

is distributed according to the chi-squared distribution with  $k$  degrees of freedom. This is usually denoted as

$$Q \sim \chi^2(k) \text{ or } Q \sim \chi_k^2$$

Thus, the chi-squared distribution has one parameter:  $k$  — a positive integer that specifies the number of degrees of freedom.

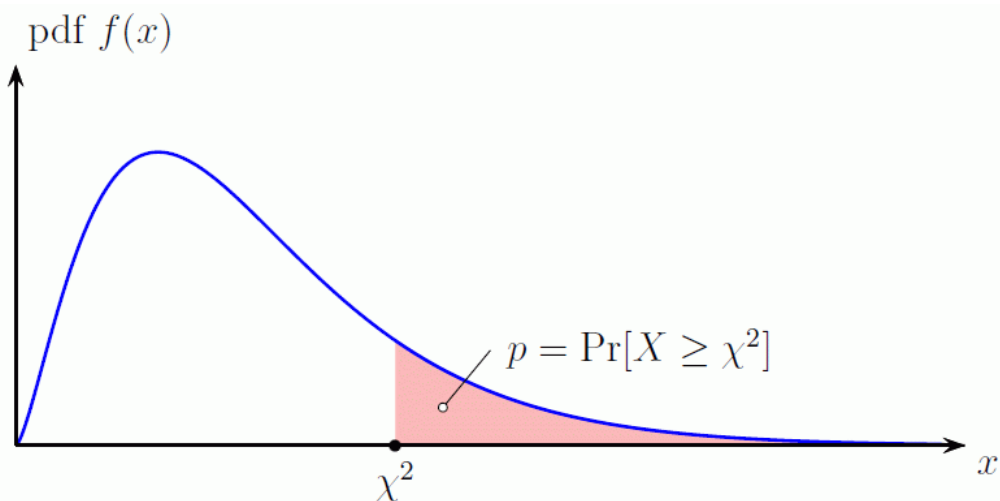
As aforementioned, the chi-squared distribution is used primarily in hypothesis testing. Unlike more widely known distributions such as the normal distribution and the exponential distribution, the chi-squared distribution is rarely used to model natural phenomena. It arises in the following hypothesis tests, among others.

The primary reason that the chi-squared distribution is used extensively in hypothesis testing is its relationship to the normal distribution. Many hypothesis tests use a test statistic, such as the  $t$  statistic in a **t-test**. For these hypothesis tests, as the sample size,  $n$ , increases, the sampling distribution of the test statistic approaches the normal distribution (**Central Limit Theorem**). Since the test statistic (such as  $t$ ) is asymptotically normally distributed, provided the sample size is sufficiently large, the distribution

used for hypothesis testing may be approximated by a normal distribution. Testing hypotheses using a normal distribution is well understood and relatively easy. The simplest chi-squared distribution is the square of a standard normal distribution. So, wherever a normal distribution could be used for a hypothesis test, a chi-squared distribution could be used.

A chi-squared distribution constructed by squaring a single standard normal distribution is said to have 1 degree of freedom, etc.

The **CHIDIST** function returns the right-tailed probability of the chi-squared distribution. The  $\chi^2$  distribution is associated with a  $\chi^2$  test. It is used to test the  $\chi^2$  test to compare observed and expected values. For example, a genetic experiment might hypothesise that the next generation of plants will exhibit a certain set of colours. By comparing the observed results with the expected ones, you can decide whether your original hypothesis is valid.



The **CHIDIST** function employs the following syntax to operate:

**CHIDIST(x, deg\_freedom)**

The **CHIDIST** function has the following arguments:

- **x**: this is required and represents the value at which you want to evaluate the distribution
- **deg\_freedom**: this is also required. This represents the number of degrees of freedom ( $k$ ).

It should be further noted that:

- if either argument is nonnumeric, **CHIDIST** returns the **#VALUE!** error value
- if  $x$  is negative, **CHIDIST** returns the **#NUM!** error value
- if **deg\_freedom** is not an integer, it is truncated
- if **deg\_freedom** < 1 or **deg\_freedom** >  $10^{10}$ , **CHIDIST** returns the **#NUM!** error value
- **CHIDIST** is calculated as **CHIDIST** =  $P(X > x)$ , where  $X$  is a  $\chi^2$  random variable

- It should be noted that this function has been replaced with one or more new functions from Excel 2010 onwards (**CHISQ.DIST.RT**) that may provide improved accuracy and whose names better reflect their usage. Although this function is still available for backward compatibility, you should consider using the new functions from now on, because this function may not be available in future versions of Excel. This may require you to amend existing models too.

Please see our example below:

	A	B	C
1	Data	Description	
2	18.307	Value at which you wish to evaluate the distribution	
3	10	Degrees of freedom	
4			
5			
6	Formula	Description	Result
7	=CHIDIST(A2,A3)	One-tailed probability of the chi-squared distribution, for the arguments specified in cells A2 and A3	0.050001
8			

## The A to Z of Excel Functions: CHIINV

The **CHIINV** function returns the inverse of the right-tailed probability of the chi-squared distribution. If **probability** = **CHIDIST(x,...)**, then **CHIINV(probability,...)** = **x**. This function may be used to compare observed results with expected ones in order to decide whether your original hypothesis is valid.

The **CHIINV** function employs the following syntax to operate:

**CHIINV(probability, deg\_freedom)**

The **CHIINV** function has the following arguments:

- probability**: this is required and represents a probability associated with the chi-squared distribution
- deg\_freedom**: this is also required. This represents the number of degrees of freedom.

It should be further noted that:

- if either argument is nonnumeric, **CHIINV** returns the #VALUE! error value
- if **probability** < 0 or **probability** > 1, **CHIINV** returns the #NUM! error value
- if **deg\_freedom** is not an integer, it is truncated
- if **deg\_freedom** < 1, **CHIINV** returns the #NUM! error value
- It should be noted that this function has been replaced with one or more new functions from Excel 2010 onwards (**CHISQ.INV.RT**) that may provide improved accuracy and whose names better reflect their usage. Although this function is still available for backward compatibility, you should consider using the new functions from now on, because this function may not be available in future versions of Excel. This may require you to amend existing models too.

Given a value for probability, **CHIINV** seeks that value **x** such that **CHIDIST(x, deg\_freedom)** = **probability**. Thus, the precision of **CHIINV** depends on the precision of **CHIDIST**. **CHIINV** uses an iterative search technique. If the search has not converged after a maximum of 100 iterations, the function returns the #N/A error value.

Please see our example below:

	A	B	C
1	Data	Description	
2	0.050001	Value at which you wish to evaluate the distribution	
3	10	Degrees of freedom	
4			
5			
6	Formula	Description	Result
7	=CHIINV(A2,A3)	Inverse of the one-tailed probability of the chi-squared distribution, for the arguments specified in cells A2 and A3	18.30697
8			

## The A to Z of Excel Functions: CHISQ.DIST

The chi-squared distribution is commonly used to study variation in the percentage of something across samples, such as the fraction of the day people spend reading these articles about obscure Excel functions. This should not be confused with the **CHIDIST** function which returns the right-tailed probability of the chi-squared distribution.

The **CHISQ.DIST** function employs the following syntax to operate:

**CHISQ.DIST(x, deg\_freedom, cumulative)**

The **CHISQ.DIST** function has the following arguments:

- **x**: this is required and represents the value at which you want to evaluate the distribution
- **deg\_freedom**: this is also required. This denotes the number of degrees of freedom
- **cumulative**: this is another mandatory argument. This is a logical value that determines the form of the function. If **cumulative** is TRUE, **CHISQ.DIST** returns the **cumulative** distribution function; if **cumulative** is FALSE, it returns the probability density function.

It should be further noted that:

- if any argument is nonnumeric, **CHISQ.DIST** returns the #VALUE! error value
- if x is negative, **CHISQ.DIST** returns the #NUM! error value
- if **deg\_freedom** is not an integer, it is truncated
- if **deg\_freedom** < 1 or **deg\_freedom** > 10<sup>10</sup>, **CHISQ.DIST** returns the #NUM! error value.

Please see more examples below:

	A	B	C
1	Formula	Description	Result
2	=CHISQ.DIST(0.5,1,TRUE)	The chi-squared distribution for 0.5, returned as the cumulative distribution function using one degree of freedom	0.520500
3	=CHISQ.DIST(2,3,FALSE)	The chi-squared distribution for 2, returned as the probability density function using three degrees of freedom	0.207554
4	=CHISQ.DIST(2,3,TRUE)	The chi-squared distribution for 2, returned as the cumulative distribution function using three degrees of freedom	0.427593
5			

## The A to Z of Excel Functions: CHISQ.DIST.RT

The **CHISQ.DIST.RT** function returns the right-tailed probability of the chi-squared distribution. The  $\chi^2$  distribution is associated with a  $\chi^2$  test. It is used to test the  $\chi^2$  test to compare observed and expected values. For example, a genetic experiment might hypothesise that the next generation of plants will exhibit a certain set of colours. By comparing the observed results with the expected ones, you can decide whether your original hypothesis is valid.

The **CHISQ.DIST.RT** function employs the following syntax to operate:

**CHISQ.DIST.RT(x, deg\_freedom)**

The **CHISQ.DIST.RT** function has the following arguments:

- **x**: this is required and represents the value at which you want to evaluate the distribution
- **deg\_freedom**: this is also required. This denotes the number of degrees of freedom.

It should be further noted that:

- if either argument is nonnumeric, **CHISQ.DIST.RT** function returns the #VALUE! error value
- if any argument is nonnumeric, **CHISQ.DIST.RT** function returns the #VALUE! error value
- if **deg\_freedom** is not an integer, it is truncated
- if **deg\_freedom** < 1 or **deg\_freedom** > 10<sup>10</sup>, **CHISQ.DIST.RT** returns the #NUM! error value
- **CHISQ.DIST.RT** appears to be the Excel 2010 replacement for the **CHIDIST** function.

Please see another example below:

	A	B	C
1	Data	Description	
2	18.307	Value at which you wish to evaluate the distribution	
3	10	Degrees of freedom	
4			
5			
6	Formula	Description	Result
7	=CHISQ.DIST.RT(A2,A3)	One-tailed probability of the chi-squared distribution, for the arguments specified in cells A2 and A3	0.050001
8			

## The A to Z of Excel Functions: CHISQ.INV

This function returns the inverse of the left-tailed probability of the chi-squared distribution. The chi-squared distribution is commonly used to study variation in the percentage of something across samples, such as the fraction of the day people spend trying to understand what this function does.

The **CHISQ.INV** function employs the following syntax to operate:

**CHISQ.INV(probability, deg\_freedom)**

The **CHISQ.INV** function has the following arguments:

- **probability**: this is required and represents a probability associated with the chi-squared distribution
- **deg\_freedom**: this is also required. This denotes the number of degrees of freedom.

It should be further noted that:

- if either argument is nonnumeric, **CHISQ.INV** returns the #VALUE! error value
- if **probability** < 0 or **probability** > 1, **CHISQ.INV** returns the #NUM! error value
- if **deg\_freedom** is not an integer, it is truncated
- if **deg\_freedom** < 1 or **deg\_freedom** > 10^10, **CHISQ.INV** returns the #NUM! error value.

Please see yet more examples below:

	A	B	C
1	Formula	Description	Result
2	=CHISQ.INV(0.93,1)	Inverse of the left-tailed probability of the chi-squared distribution for 0.93, using one degree of freedom	3.283020
3	=CHISQ.INV(0.6,2)	Inverse of the left-tailed probability of the chi-squared distribution for 0.6, using two degrees of freedom	1.832581
4			

## The A to Z of Excel Functions: CHISQ.INV.RT

This function returns the inverse of the right-tailed probability of the chi-squared distribution. If probability = **CHISQ.DIST.RT(x,...)**, then **CHISQ.INV.RT(probability,...) = x**. Use this function to compare observed results with expected ones in order to decide whether your original hypothesis is valid.

The **CHISQ.INV.RT** function employs the following syntax to operate:

**CHISQ.INV.RT(probability, deg\_freedom)**

The **CHISQ.INV.RT** function has the following arguments:

- **probability**: this is required and represents a probability associated with the chi-squared distribution
- **deg\_freedom**: this is also required. This denotes the number of degrees of freedom.

It should be further noted that:

- if either argument is nonnumeric, **CHISQ.INV.RT** returns the #VALUE! error value
- if probability < 0 or probability > 1, **CHISQ.INV.RT** returns the #NUM! error value
- if **deg\_freedom** is not an integer, it is truncated
- if **deg\_freedom** < 1, **CHISQ.INV.RT** returns the #NUM! error value
- **CHISQ.INV.RT** appears to be the Excel 2010 replacement for the **CHIINV** function.

Given a value for probability, **CHISQ.INV.RT** seeks that value x such that **CHISQ.DIST.RT(x, deg\_freedom) = probability**. Thus, precision of **CHISQ.INV.RT** depends on precision of **CHISQ.DIST.RT**. **CHISQ.INV.RT** uses an iterative search technique. If the search has not converged after 64 iterations, the function returns the #N/A error value. There aren't many functions that stop at 64 iterations: we would be interested to know why this is the case here.

Another example:

	A	B	C
1	Data	Description	
2	0.050001	Value at which you wish to evaluate the distribution	
3	10	Degrees of freedom	
4			
5			
6	Formula	Description	Result
7	=CHISQ.INV.RT(A2,A3)	Inverse of the one-tailed probability of the chi-squared distribution, for the arguments specified in cells A2 and A3	18.30697
8			

## The A to Z of Excel Functions: CHISQ.TEST

This function returns the test for independence. **CHISQ.TEST** returns the value from the chi-squared ( $\chi^2$ ) distribution for the statistic and the appropriate degrees of freedom. You can use  $\chi^2$  tests to determine whether hypothesised results are verified by an experiment.

The **CHISQ.TEST** function employs the following syntax to operate:

**CHISQ.TEST(actual\_range, expected\_range)**

The **CHISQ.TEST** function has the following arguments:

- **actual\_range**: this is required and represents the range of data that contains observations to test against expected values
- **expected\_range**: this is also required. This denotes the range of data that contains the ratio of the product of row totals and column totals to the grand total.

It should be further noted that:

- if **actual\_range** and **expected\_range** have a different number of data points, **CHISQ.TEST** returns the #N/A error value
- the  $\chi^2$  test first calculates a  $\chi^2$  statistic using the formula:

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(A_{ij} - E_{ij})^2}{E_{ij}}$$

where:

- o **A<sub>ij</sub>** = actual frequency in the i-th row, j-th column
- o **E<sub>ij</sub>** = expected frequency in the i-th row, j-th column
- o **r** = number of rows
- o **c** = number of columns
- a low value of  $\chi^2$  is an indicator of independence. As can be seen from the formula above,  $\chi^2$  is always positive or 0, and is 0 only if **A<sub>ij</sub> = E<sub>ij</sub>** for every i and j
- **CHISQ.TEST** returns the probability that a value of the  $\chi^2$  statistic at least as high as the value calculated by the above formula could have happened by chance under the assumption of independence. In computing this probability, **CHISQ.TEST** uses the  $\chi^2$  distribution with an appropriate number of degrees of freedom, **df**.  
If **r** > 1 and **c** > 1, then **df** = (**r** - 1)(**c** - 1). If **r** = 1 and **c** > 1, then **df** = **c** - 1 or if **r** > 1 and **c** = 1, then **df** = **r** - 1. **r** = **c** = 1 is not allowed and #N/A is returned
- the use of **CHISQ.TEST** is most appropriate when **E<sub>ij</sub>**'s are not too small. Some statisticians suggest that each **E<sub>ij</sub>** should be greater than or equal to 5
- **CHISQ.TEST** appears to be the Excel 2010 replacement for the **CHITEST** function.

Please see the examples below:

	A	B	C
1	Men (Actual)	Women (Actual)	Description
2	58	35	Agree
3	11	25	Neutral
4	10	23	Disagree
5			
6	Men (Expected)	Women (Expected)	Description
7	45.35	47.65	Agree
8	17.56	18.44	Neutral
9	16.09	16.91	Disagree
10			
11	Formula	Description	Result
12	=CHISQ.TEST(A2:B4,A7:B9)	The $\chi^2$ statistic for the above data is 16.16957 with two degrees of freedom	0.000308192
13	=CHISQ.INV.RT(C12,2)	Proof of the $\chi^2$ statistic	16.16957507
14			



# The A to Z of Excel Functions: CHITEST

## The CHITEST function

This function returns the test for independence. **CHITEST** returns the value from the chi-squared ( $\chi^2$ ) distribution for the statistic and the appropriate degrees of freedom. You can use  $\chi^2$  tests to determine whether hypothesised results are verified by an experiment.

The CHITEST function employs the following syntax to operate:

**CHITEST(actual\_range, expected\_range)**

The **CHITEST** function has the following arguments:

- **actual\_range**: this is required and represents the range of data that contains observations to test against expected values
- **expected\_range**: this is also required. This denotes the range of data that contains the ratio of the product of row totals and column totals to the grand total.

It should be further noted that:

- if **actual\_range** and **expected\_range** have a different number of data points, **CHITEST** returns the #N/A error value
- the  $\chi^2$  test first calculates a  $\chi^2$  statistic using the formula:

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(A_{ij} - E_{ij})^2}{E_{ij}}$$

where:

- o **Aij** = actual frequency in the i-th row, j-th column
- o **Eij** = expected frequency in the i-th row, j-th column
- o **r** = number of rows
- o **c** = number of columns
- a low value of  $\chi^2$  is an indicator of independence. As can be seen from the formula above,  $\chi^2$  is always positive or 0, and is 0 only if **Aij** = **Eij** for every i and j
- **CHITEST** returns the probability that a value of the  $\chi^2$  statistic at least as high as the value calculated by the above formula could have happened by chance under the assumption of independence. In computing this probability, **CHITEST** uses the  $\chi^2$  distribution with an appropriate number of degrees of freedom, **df**.  
If **r** > 1 and **c** > 1, then **df** = (**r** - 1)(**c** - 1). If **r** = 1 and **c** > 1, then **df** = **c** - 1 or if **r** > 1 and **c** = 1, then **df** = **r** - 1. **r** = **c** = 1 is not allowed and #N/A is returned
- the use of **CHITEST** is most appropriate when **Eij**'s are not too small. Some statisticians suggest that each **Eij** should be greater than or equal to 5
- It should be noted that this function has been replaced with one or more new functions from Excel 2010 onwards (**CHISQ.TEST**) that may provide improved accuracy and whose names better reflect their usage. Although this function is still available for backward compatibility, you should consider using the new functions from now on, because this function may not be available in future versions of Excel. This may require you to amend existing models too.

Please see our final examples for this month below:

	A	B	C
1	Men (Actual)	Women (Actual)	Description
2	58	35	Agree
3	11	25	Neutral
4	10	23	Disagree
5			
6	Men (Expected)	Women (Expected)	Description
7	45.35	47.65	Agree
8	17.56	18.44	Neutral
9	16.09	16.91	Disagree
10			
11	Formula	Description	Result
12	=CHISQ.TEST(A2:B4,A7:B9)	The $\chi^2$ statistic for the above data is 16.16957 with two degrees of freedom	0.000308192
13	=CHISQ.INV.RT(C12,2)	Proof of the $\chi^2$ statistic	16.16957507
14			

More next month.

## Upcoming SumProduct Training Courses

Location	Course	Date	Duration
Melbourne	Power Pivot, Power Query and Power BI	4th - 6th Dec 2017	3 days
Melbourne	Excel Tips & Tricks	11th Dec 2017	1 day
Melbourne	Financial Modelling	12th - 13th Dec 2017	2 days
Sydney	Excel Tips & Tricks	15th Jan 2018	1 day
Sydney	Financial Modelling	16th - 17th Jan 2018	2 days
Sydney	Power Pivot, Power Query and Power BI	22nd - 24th Jan 2018	3 days
Melbourne	Power Pivot, Power Query and Power BI	29th - 31st Jan 2018	3 days
Hobart	Financial Modelling	5th - 6th Feb 2018	2 days
Melbourne	Power Pivot, Power Query and Power BI	4th - 6th Dec 2017	3 days
Brisbane	Excel Tips & Tricks	12th Feb 2018	1 days
Brisbane	Financial Modelling	13th - 14th Feb 2018	2 days
Melbourne	Excel Tips & Tricks	19th Feb 2018	1 day
Melbourne	Financial Modelling	20th - 21st Feb 2018	2 days
Perth	Financial Modelling	26th - 27th Feb 2018	2 days
Sydney	Visual Basic for Applications	12th Mar 2018	1 day
Sydney	Power Pivot, Power Query and Power BI	19th - 21st Mar 2018	3 days
Adelaide	Financial Modelling	5th - 6th Apr 2018	2 days
Sydney	Excel Tips & Tricks	23rd Apr 2018	1 day
Sydney	Financial Modelling	26th - 27th Apr 2018	2 days
Melbourne	Excel Tips & Tricks	30th Apr 2018	1 day
Melbourne	Financial Modelling	1st - 2nd May 2018	2 day
Melbourne	Power Pivot, Power Query and Power BI	14th - 16th May 2018	2 day
Auckland	Financial Modelling	21st - 22nd May 2018	2 days
Wellington	Financial Modelling	24th - 25th May 2018	2 days
Darwin	Financial Modelling	4th - 5th Jun 2018	2 days
Sydney	Power Pivot, Power Query and Power BI	18th - 20th Jun 2018	1 day
Sydney	Financial Modelling	25th - 26th Jun 2018	2 days

## Referral Programme



Have you heard about the SumProduct Referral programme? If you successfully introduce us to a client we will pay you 10% of the net profits of the engagement won upon receipt of client payment. Sounds like a pretty good deal to us!

Terms and conditions apply. Referrer must be over 18 years of age, able to issue an invoice and not be an employee, director, agent or other related party of the client engaged. For further information, drop us a line at [contact@sumproduct.com](mailto:contact@sumproduct.com). We hope to hear from you!

## Key Strokes

Each newsletter, we'd like to introduce you to useful keystrokes you may or may not be aware of. Given its our five-year anniversary, here's the most requested keyboards shortcut table – get **CTRL** of the shortcut alphabet:

Keystroke	What it does
CTRL + A	Select current region / all
CTRL + B	Bold (toggle)
CTRL + C	Copy
CTRL + D	Fill down
CTRL + F	Find dialog box
CTRL + G	Go To dialog box
CTRL + H	Replace dialog box
CTRL + I	Italics (toggle)
CTRL + K	Insert hyperlink
CTRL + L	Excel 2007 / later: Create Table; Excel 2003 / earlier: Create List
CTRL + N	New workbook
CTRL + O	Open workbook
CTRL + P	Print
CTRL + R	Fill right
CTRL + S	Save
CTRL + T	Excel 2007 / later: Insert Table
CTRL + U	Underline (toggle)
CTRL + V	Paste
CTRL + W	Close Window
CTRL + X	Cut
CTRL + Y	Redo
CTRL + Z	Undo

There are over 540 keyboard shortcuts in Excel. For a comprehensive list, please download our Excel file a [www.sumproduct.com/thought/keyboard-shortcuts](http://www.sumproduct.com/thought/keyboard-shortcuts). Also, check out our new daily **Excel Tip of the Day** feature on the [www.sumproduct.com](http://www.sumproduct.com) homepage.

## Our Services

We have undertaken a vast array of assignments over the years, including:

- **Business planning**
- **Building three-way integrated financial statement projections**
- **Independent expert reviews**
- **Key driver analysis**
- **Model reviews / audits for internal and external purposes**
- **M&A work**
- **Model scoping**
- **Power BI, Power Query & Power Pivot**
- **Project finance**
- **Real options analysis**
- **Refinancing / restructuring**
- **Strategic modelling**
- **Valuations**
- **Working capital management**

If you require modelling assistance of any kind, please do not hesitate to contact us at [contact@sumproduct.com](mailto:contact@sumproduct.com).

## Link to Others

These newsletters are not intended to be closely guarded secrets. Please feel free to forward this newsletter to anyone you think might be interested in converting to "the SumProduct way".

If you have received a forwarded newsletter and would like to receive future editions automatically, please subscribe by completing our newsletter registration process found at the foot of any [www.sumproduct.com](http://www.sumproduct.com) web page.

## Any Questions?

If you have any tips, comments or queries for future newsletters, we'd be delighted to hear from you. Please drop us a line at [newsletter@sumproduct.com](mailto:newsletter@sumproduct.com).

## Training

SumProduct offers a wide range of training courses, aimed at finance professionals and budding Excel experts. Courses include Excel Tricks & Tips, Financial Modelling 101, Introduction to Forecasting and M&A Modelling.

Check out our more popular courses in our training brochure:



Drop us a line at [training@sumproduct.com](mailto:training@sumproduct.com) for a copy of the brochure or download it directly from <http://www.sumproduct.com/training>.

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