1. Advanced Editing Technique

1.1 In-Cell Chart

1.1.1 Using Function

When you are creating an Excel Dashboard and are limited by space and do not want to insert a chart, you can easily create an in-cell bar chart using the REPT (repeat) function.

	A	B	C	D
1	**Labels**	**Value**	**Bar Chart 1**	**Bar Chart 2**
2	Label A	21	||||||||||||||||||||	■■■■■■■■■■■■■■■■■■■■■
3	Label B	20	||||||||||||||||||||	■■■■■■■■■■■■■■■■■■■■
4	Label C	16	||||||||||||||||	■■■■■■■■■■■■■■■■
5	Label D	19	||||||||||||||||||||	■■■■■■■■■■■■■■■■■■■
6	Label E	16	||||||||||||||||	■■■■■■■■■■■■■■■■
7	Label F	19	||||||||||||||||||||	■■■■■■■■■■■■■■■■■■■
8	Label G	13	||||||||||||	■■■■■■■■■■■■■
9	Label H	16	||||||||||||||||	■■■■■■■■■■■■■■■■
10	Label I	11	||||||||||	■■■■■■■■■■
11	Label J	13	||||||||||||	■■■■■■■■■■■■■
12	Label K	10	||||||||||	■■■■■■■■■■

The syntax for REPT function is: **REPT** (***text*****,** ***number_times***). The REPT function uses the vertical bar character | as the first argument: text and references the value cell for the second argument: number_times.

Function	Output
REPT("X", 10)	XXXXXXXXXX
REPT("Ha! ", 3)	Ha! Ha! Ha!
REPT("|", 30)	||||||||||||||||||||||||||||||

1.1.2 Using Sparklines

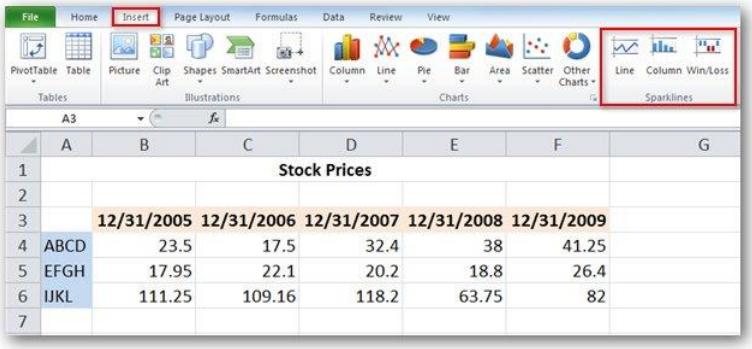
A sparkline is a tiny chart in a worksheet cell that provides a visual representation of data. Use sparklines to show trends in a series of values, such as seasonal increases or decreases, economic cycles, or to highlight maximum and minimum values. Position a sparkline near its data for greatest impact. Unlike charts on an Excel worksheet, sparklines are not objects, a sparkline is actually a tiny chart in the background of a cell.

Sum of Net Sales		Month				
Salesman	Region	Jan 07	Feb 07	Mar 07	Apr 07	May
Joseph		4655	3928	4462	4171	64
		2680	4604	4727	5668	5
		5423	5566	3503	4008	56
Lawrence		3840	3925	5928	5132	396
		4627	4219	5205	5309	770
		4896	5240	3516	6609	472

1.1.2.1 Drawing Sparkline

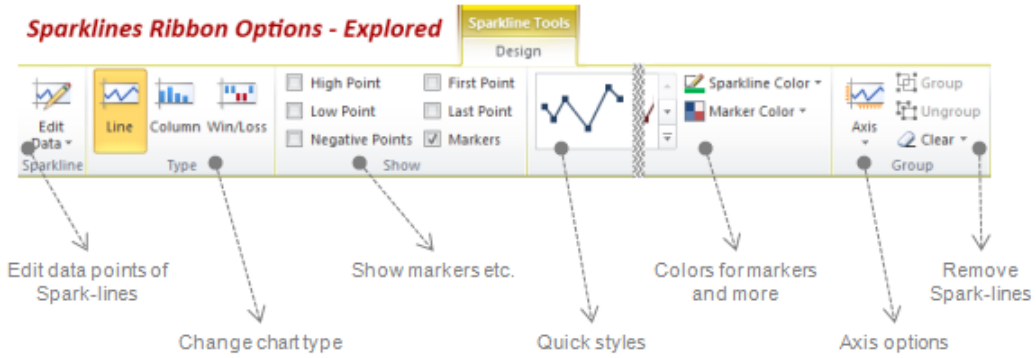
Creating sparklines in excel is very easy. You follow 3 very simple steps to get beautiful sparklines in an instant.

1. Select the data from which you want to make a sparkline.
2. Go to **Insert ➔ Sparkline** and select the type of sparkline (you have 3 options – line, column and win-loss chart)
3. Specify a target cell where you want the sparkline to be placed
4. Optional: Format the sparkline if you want.



	A	B	C	D	E	F	G
1		Stock Prices					
2							
3		12/31/2005	12/31/2006	12/31/2007	12/31/2008	12/31/2009	
4	ABCD	23.5	17.5	32.4	38	41.25	
5	EFGH	17.95	22.1	20.2	18.8	26.4	
6	IJKL	111.25	109.16	118.2	63.75	82	
7							

1.1.2.2 Customize Sparkline



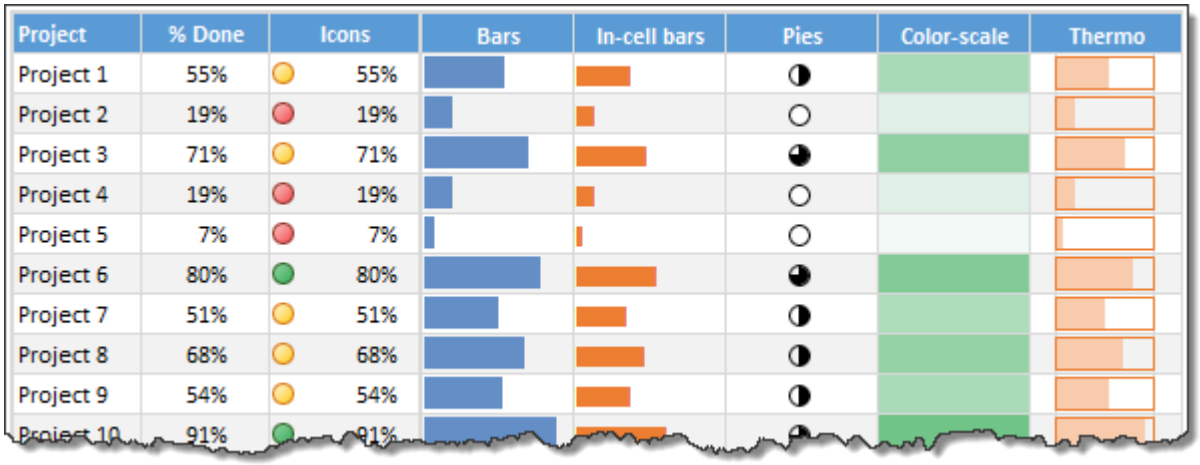
In excel, you will find a ribbon called as "Sparklines – Design" ribbon. This is where all the formatting options for sparklines are included. Some of the key formatting / customizations you can do are,

- Change the sparkline type
- Change the source data / target cells of sparkline
- Set different colors for first point, last point, highest & lowest points (applicable for column and line chart types)
- Set axis options (show / hide axis, set min and max value for vertical axis, set axis type to date axis etc.)
- Group / un-group a bunch of sparklines (you can change formatting options, axis settings en-masse when you group sparklines)
- Remove sparklines

1.1.3 Using Conditional Format

To add conditional formatting with data bars, follow these steps.

- On the Excel worksheet, select the value cells that you want to format. If the Excel table has row or column totals, don't include those cells.
- On the Ribbon, click the Home tab, and then in the Styles group, click Conditional Formatting.
- In the list of conditional formatting options, click Data Bars, and then click one of the Data Bar options. The Data Bar options are identical, except for the color.

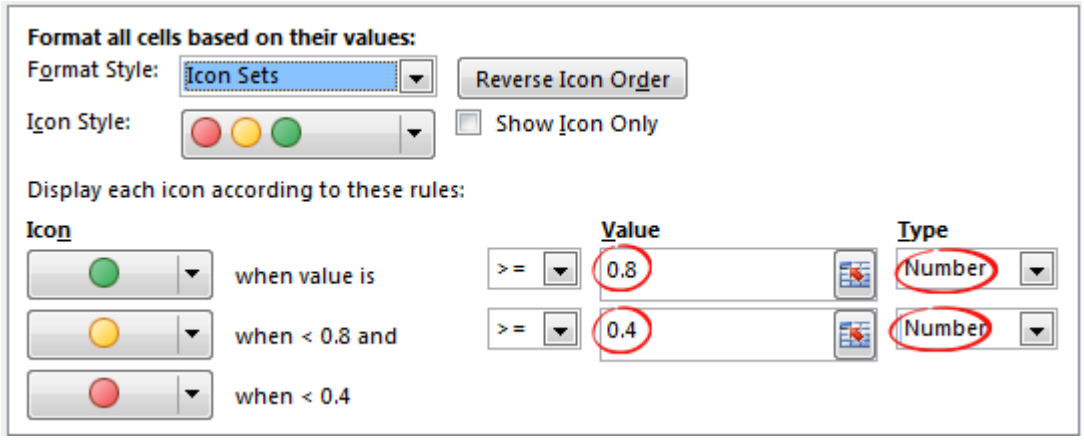


Project	% Done	Icons	Bars	In-cell bars	Pies	Color-scale	Thermo
Project 1	55%	55%					
Project 2	19%	19%					
Project 3	71%	71%					
Project 4	19%	19%					
Project 5	7%	7%					
Project 6	80%	80%					
Project 7	51%	51%					
Project 8	68%	68%					
Project 9	54%	54%					
Project 10	91%	91%					

1.1.3.1 Icon with Percentage

Project	Icons
Project 1	55%
Project 2	19%
Project 3	71%
Project 4	19%

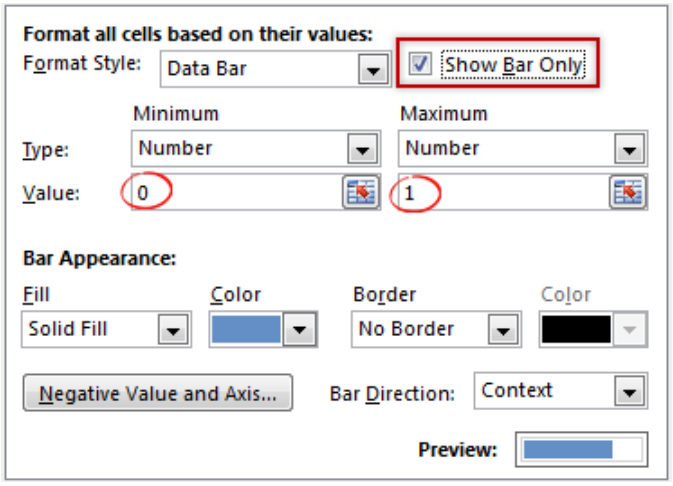
1. Select **Home ➔ Conditional Formatting ➔ Icon sets**
2. Select 3 traffic lights
3. Edit the rule as shown below:



1.1.3.2 Data Bars

Project	Bars
Project 1	
Project 2	
Project 3	
Project 4	

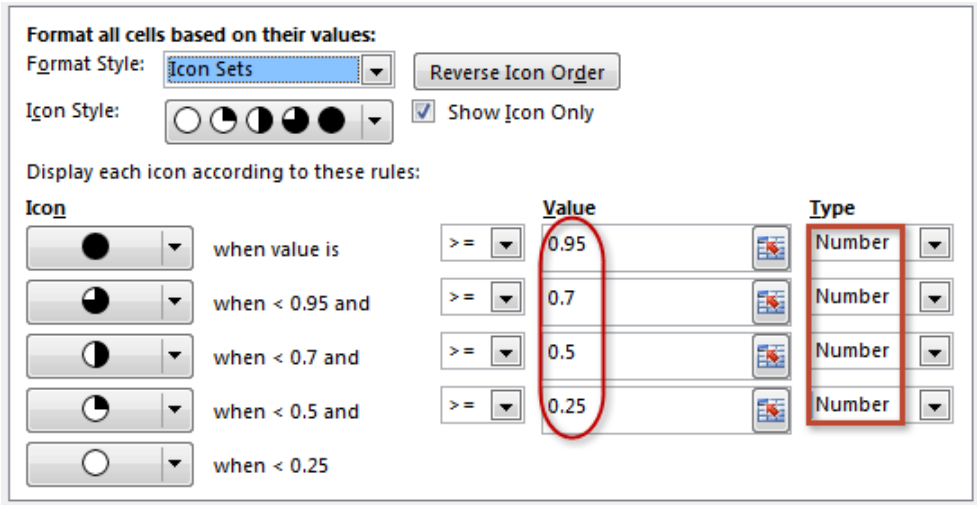
1. Select **Home ➔ Conditional Formatting ➔ Icon sets**
2. Select **Solid Fill** if available.
3. Adjust maximum bar size to 100% so that you can see relative progress better.



1.1.3.3 Pies

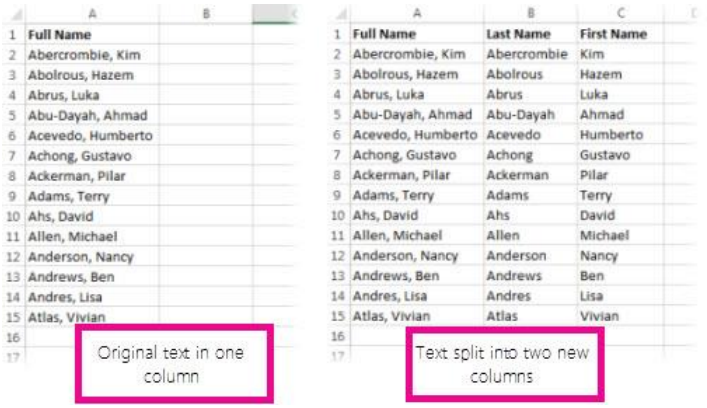
Project	Pies
Project 1	
Project 2	
Project 3	
Project 4	

1. Select **Home ➔ Conditional Formatting ➔ Icon sets**
2. Select **Pies** if available.



1.2 Text to Columns

You can take the text in one or more cells and split it into multiple cells, or vice versa using the Convert Text to Columns Wizard.

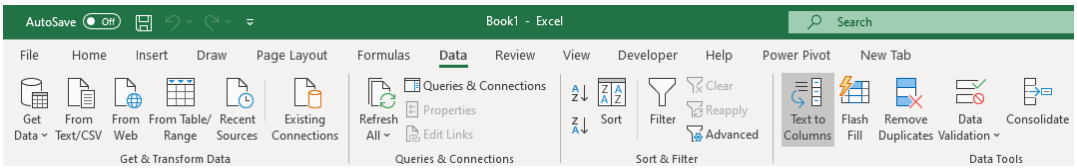


1.2.1 Split Full Names into First Name and Last Name

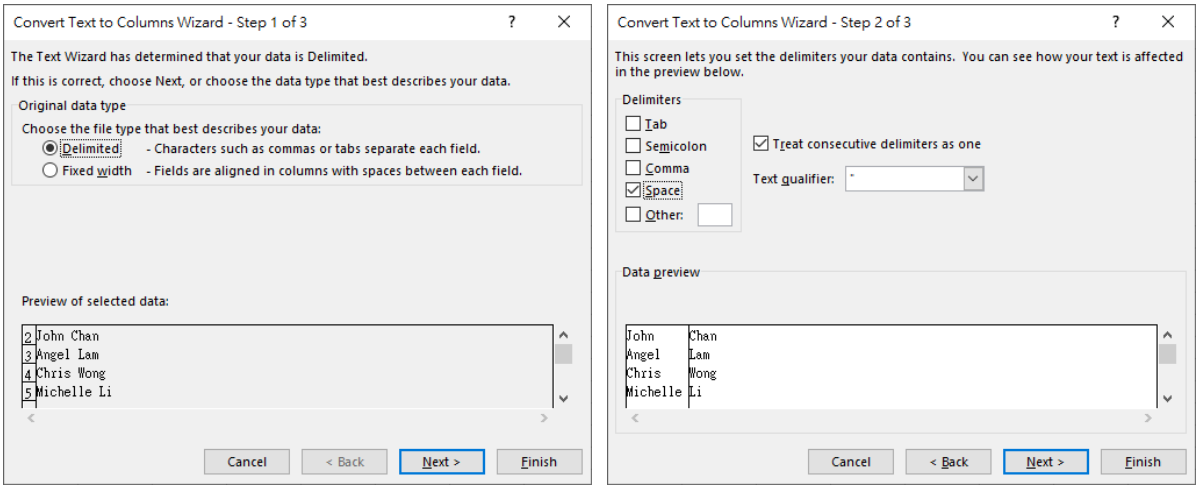
Suppose you have a dataset as shown below. To quickly split the first name and the last name and get these in separate cells, follow the below steps:

Full Name
John Chan
Angel Lam
Chris Wong
Michelle Li
Iris Mak

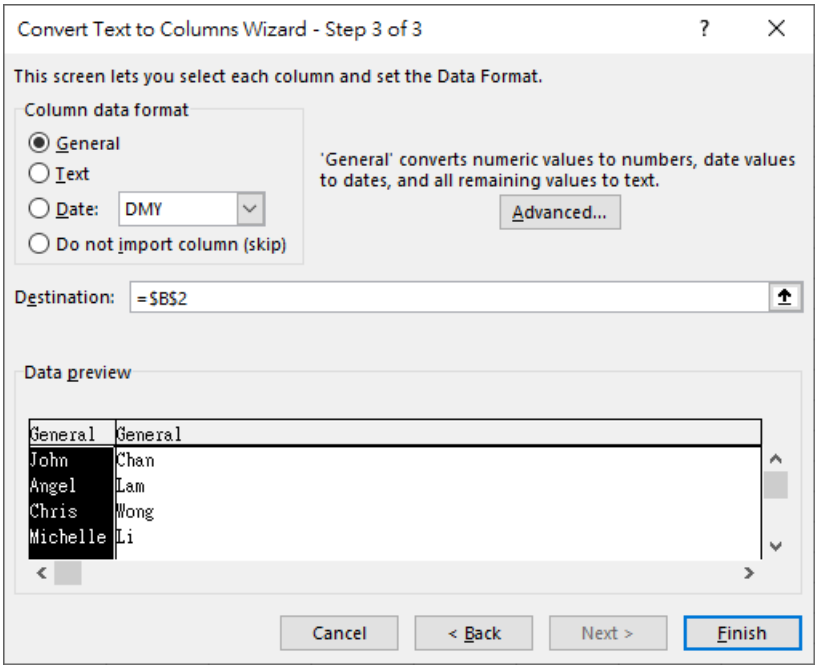
1. Select the data set. Go to **Data ➔ Data Tools ➔ Text to Columns**. This will open the Convert Text to Columns Wizard.



2. Make sure "Delimited" is selected and then press **[Next]**. Select 'Space' as the delimiter. If you suspect that there could be double/triple consecutive spaces between the names, also select 'Treat consecutive delimiters as one' option. Click **[Next]** to continue



3. Select the destination cell. If you don't select a destination cell, it would overwrite your existing data set with the first name in the first column and last name in the adjacent column. If you want to keep the original data intact, either create a copy or choose a different destination cell.



4. This would instantly give you the results with the first name in one column and last name in another column after you click **[Finish]**.

Full Name	First Name	Last Name
John Chan	John	Chan
Angel Lam	Angel	Lam
Chris Wong	Chris	Wong
Michelle Li	Michelle	Li
Iris Mak	Iris	Mak

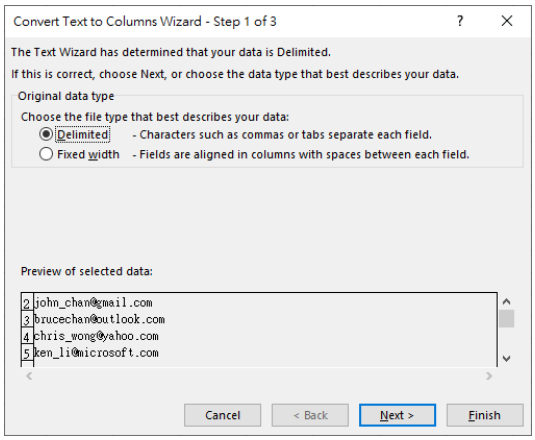
This technique works well when you the name constitutes of the first name and the last name only. The result you get from using the Text to Columns feature is static. This means that if there are any changes in the original data, you'll have to repeat the process to get updated results.

1.2.2 Split Email Address into Username and Domain Name

Text to Columns allows you to choose your own delimiter to split text. This can be used to split emails addresses into usernames and domain names as these are separated by the @ sign. Suppose you have a dataset as shown below. Here are the steps to split these usernames and domain names using the Text to Columns feature:

Email
john_chan@gmail.com
brucechan@outlook.com
chris_wong@yahoo.com
ken_li@microsoft.com
iris_mak@facebook.com

1. Select the data set, go to **Data** tab, **Data Tools** group, select **Text to Columns**. This will open the **Convert Text to Columns Wizard**. Make sure **Delimited** is selected and then press **[Next]**. Select **Other** and enter **@** in the box to the right of it. Make sure to deselect any other option. Click **[Next]** to continue.



2. Change the destination cell to the one where you want the result, and then click **[Finish].** This would split the email address and give you the first name and the last name in separate cells.

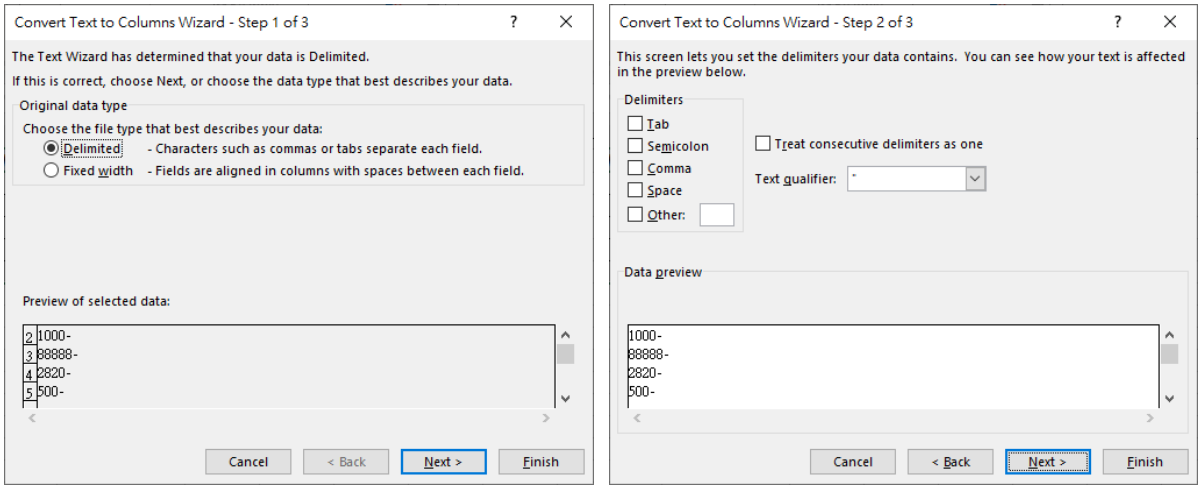
Email	Username	Domain
john_chan@gmail.com	john_chan	gmail.com
brucechan@outlook.com	brucechan	outlook.com
chris_wong@yahoo.com	chris_wong	yahoo.com
ken_li@microsoft.com	ken_li	microsoft.com
iris_mak@facebook.com	iris_mak	facebook.com

1.2.3 Convert Numbers with Trailing Minus Sign to negative numbers

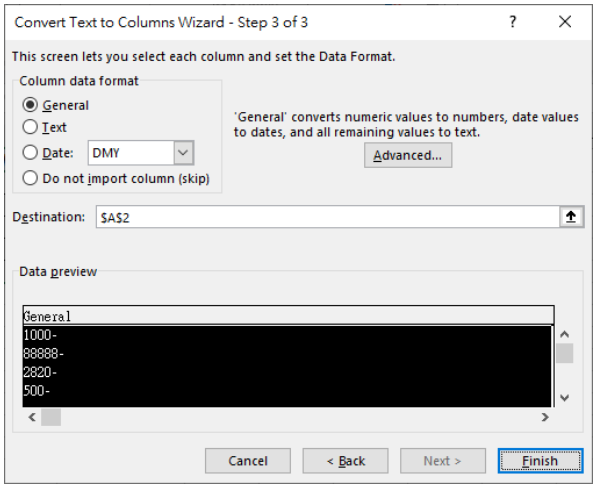
If you export numeric data from SAP, you will find that the negative numbers with trailing minus signs. Suppose you have a dataset as shown below:

Number with Trailing Minus
1000-
88888-
2820-
500-
12345

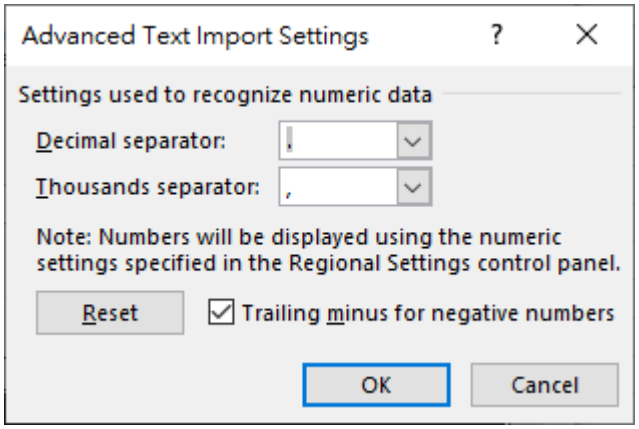
1. Select the data set. Go to **Data ➔ Data Tools ➔ Text to Columns**. This will open the Convert Text to Columns Wizard. Make sure "Delimited" is selected and then press **[Next]**. Press **[Next]** button again to continue.



2. Press **[Advanced]**.



3. In the Advanced Text Import Settings dialog box, select the 'Trailing minus for negative number' option. Click **[OK]**.



4. Change the destination cell to the one where you want the result, and press **[Finish]**. This would instantly place the minus sign from the end of the number of the beginning of it. Now you can easily use these numbers in formulas and calculations.

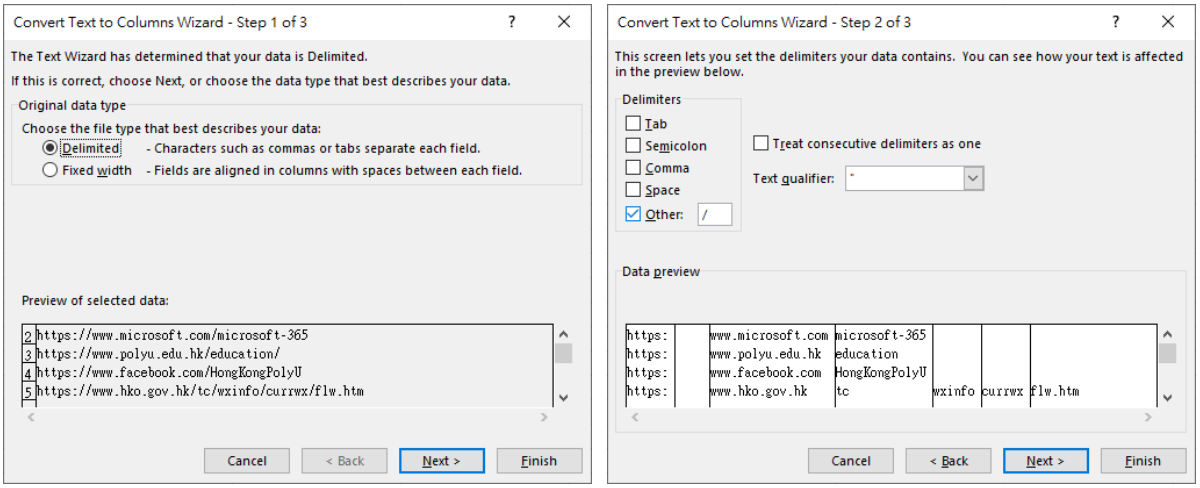
Number with Trailing Minus	Number
1000-	-1000
88888-	-88888
2820-	-2820
500-	-500
12345	12345

1.2.4 Get the Root Domain from URL

If you work with web URLs, you may sometimes need to know the total number of unique root domains. For example, in case of http://www.google.com/example1 and http://google.com/example2, the root domain is the same, which is www.google.com. Suppose you have a dataset as shown below:

URL
https://www.microsoft.com/microsoft-365
https://www.polyu.edu.hk/education/
https://www.facebook.com/HongKongPolyU
https://www.hko.gov.hk/tc/wxinfo/currwx/flw.htm
https://www.weather.gov.hk/tc/index.html

1. Select the data set. Go to **Data ➔ Data Tools ➔ Text to Columns**. This will open the Convert Text to Columns Wizard. Make sure "Delimited" is selected and then press **[Next]**. Select Other and enter / in the box to the right of it. Make sure to deselect any other option. Click **[Next]** to continue.



2. Change the destination cell to the one where you want the result, and then click **[Finish]**. This would split the URL and give you the root domain.

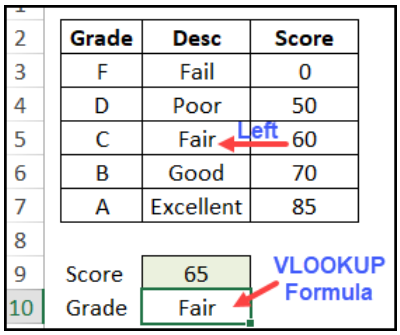
URL	Protocol	Domain
https://www.microsoft.com/microsoft-365	https:	www.microsoft.com
https://www.polyu.edu.hk/education/	https:	www.polyu.edu.hk
https://www.facebook.com/HongKongPolyU	https:	www.facebook.com
https://www.hko.gov.hk/tc/wxinfo/currwx/flw.htm	https:	www.hko.gov.hk
https://www.weather.gov.hk/tc/index.html	https:	www.weather.gov.hk

This works well when you have all the URLs that have http:// in the beginning. If it doesn't, then you will get the root domain in the first column itself. A good practice is to make these URLs consistent before using Text to Columns.

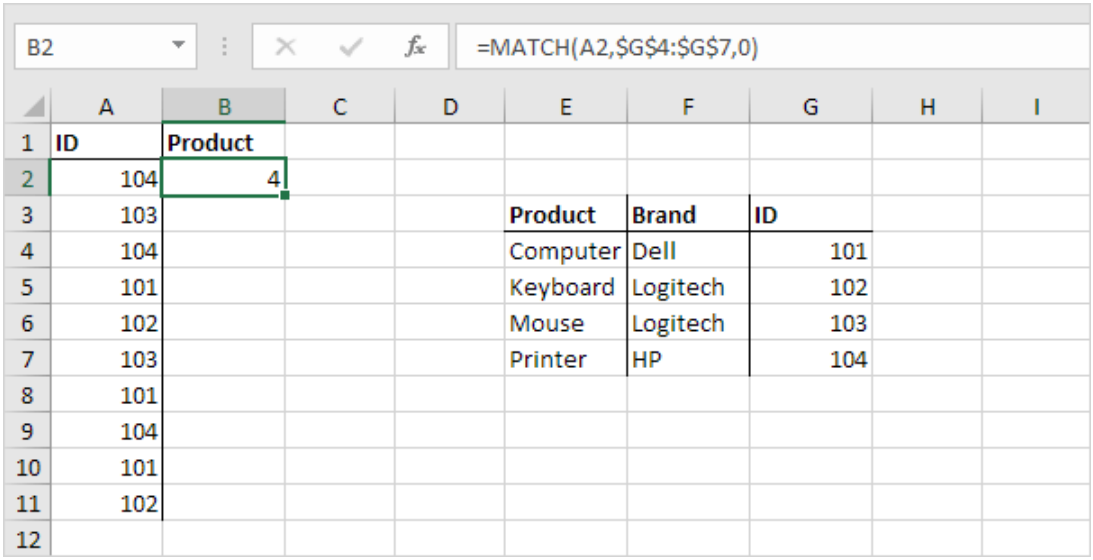
2. Advanced Formula Techniques

2.1 Left Lookup

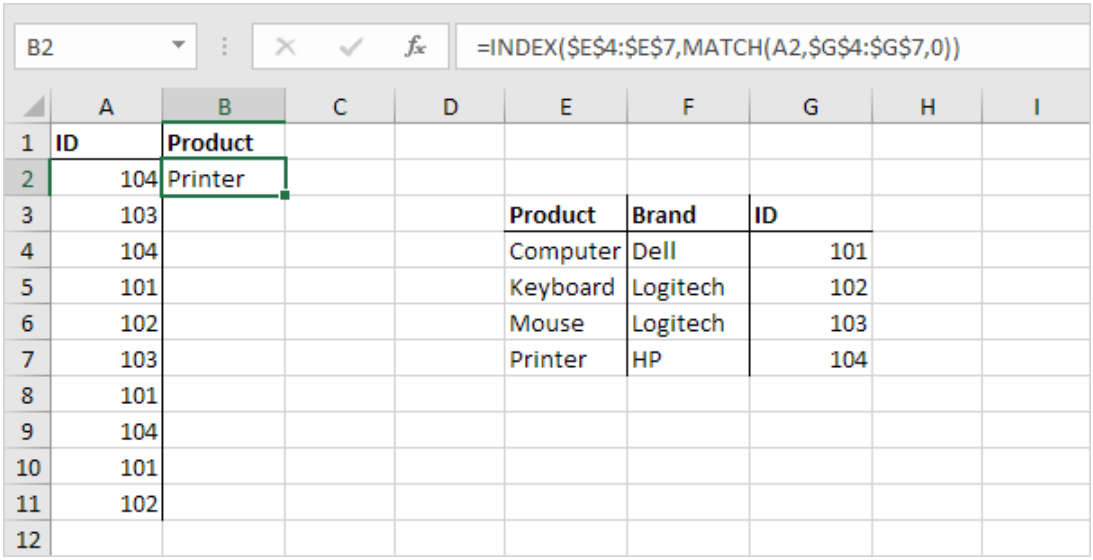
The VLOOKUP function only looks to the right. To look up a value in any column and return the corresponding value to the left, simply use INDEX and MATCH.



1. First, the MATCH function returns the position of a value in a given range.

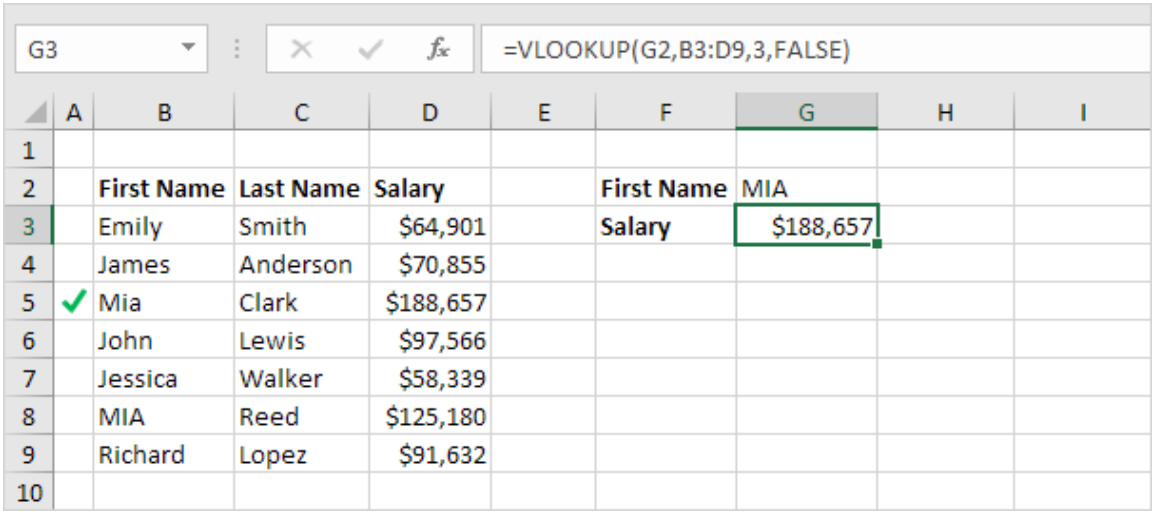


2. Use this result and the INDEX function to return the correct answer from the range.



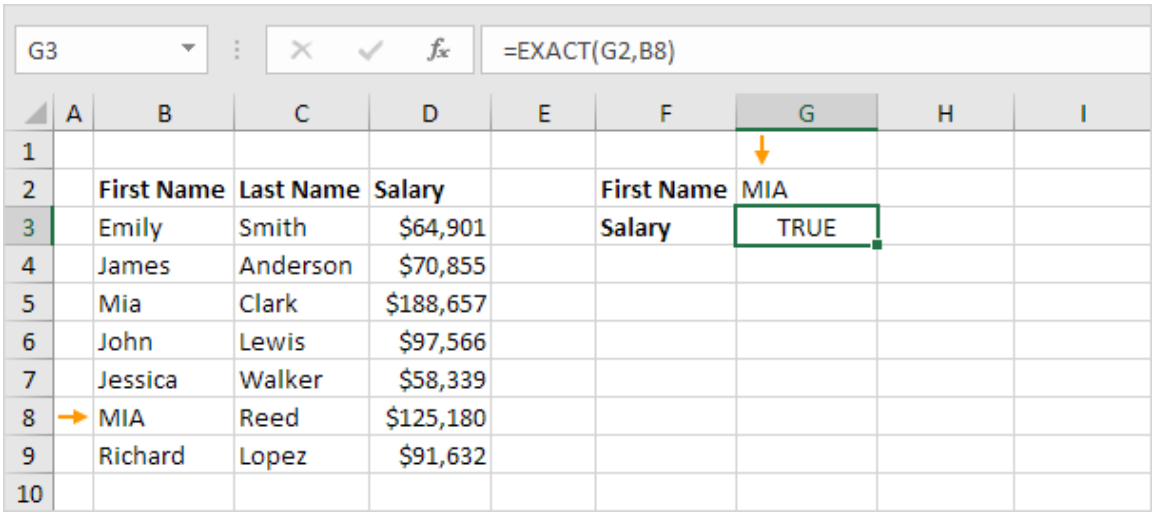
2.2 Case-sensitive Lookup

1. By default, the VLOOKUP function performs a case-insensitive lookup. For example, the simple VLOOKUP function below returns the salary of "Mia Clark". However, we want to look up the salary of "MIA Reed".



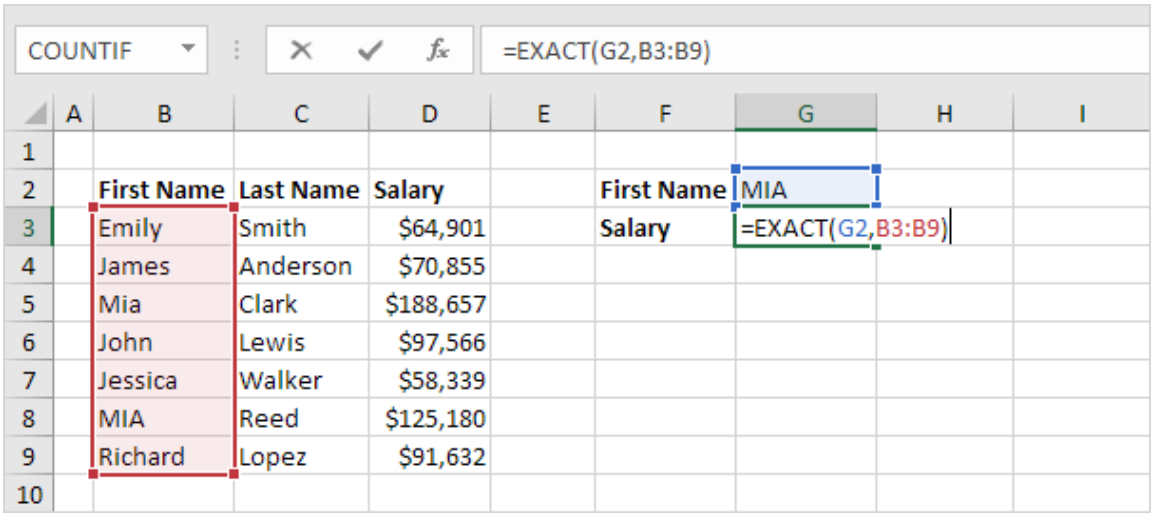
	A	B	C	D	E	F	G	H	I
1									
2		**First Name**	**Last Name**	**Salary**		**First Name**	MIA		
3		Emily	Smith	$64,901		**Salary**	$188,657		
4		James	Anderson	$70,855					
5	✓	Mia	Clark	$188,657					
6		John	Lewis	$97,566					
7		Jessica	Walker	$58,339					
8		MIA	Reed	$125,180					
9		Richard	Lopez	$91,632					
10									

2. The EXACT function returns TRUE if two strings are exactly the same.



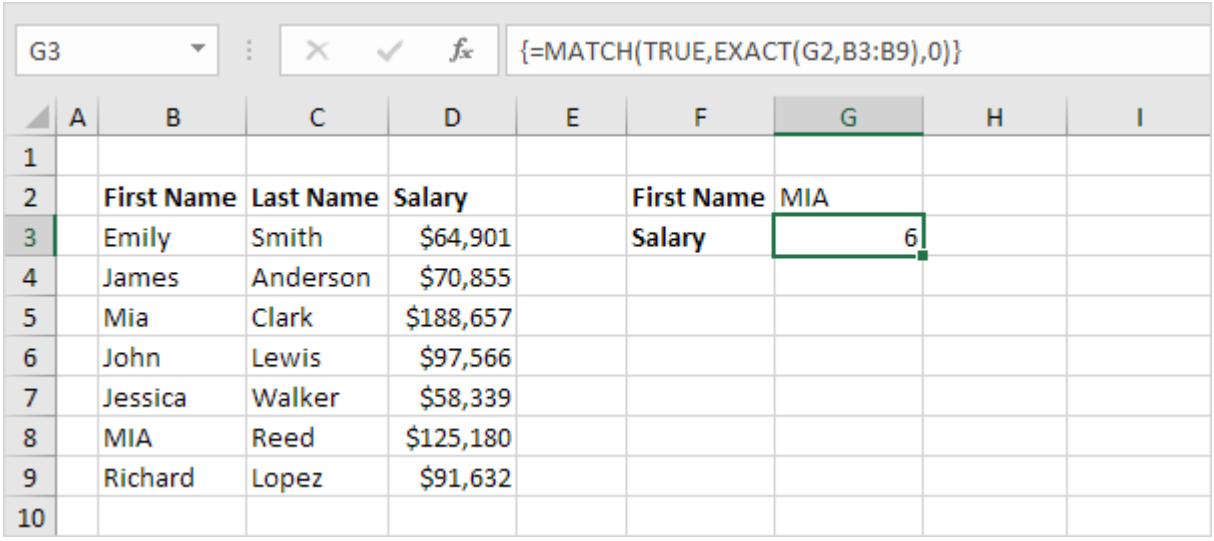
	A	B	C	D	E	F	G	H	I
1							↓		
2		**First Name**	**Last Name**	**Salary**		**First Name**	MIA		
3		Emily	Smith	$64,901		**Salary**	TRUE		
4		James	Anderson	$70,855					
5		Mia	Clark	$188,657					
6		John	Lewis	$97,566					
7		Jessica	Walker	$58,339					
8	→	MIA	Reed	$125,180					
9		Richard	Lopez	$91,632					
10									

3. When compare the lookup value with a range, the array constant created by the EXACT function is stored in Excel's memory.



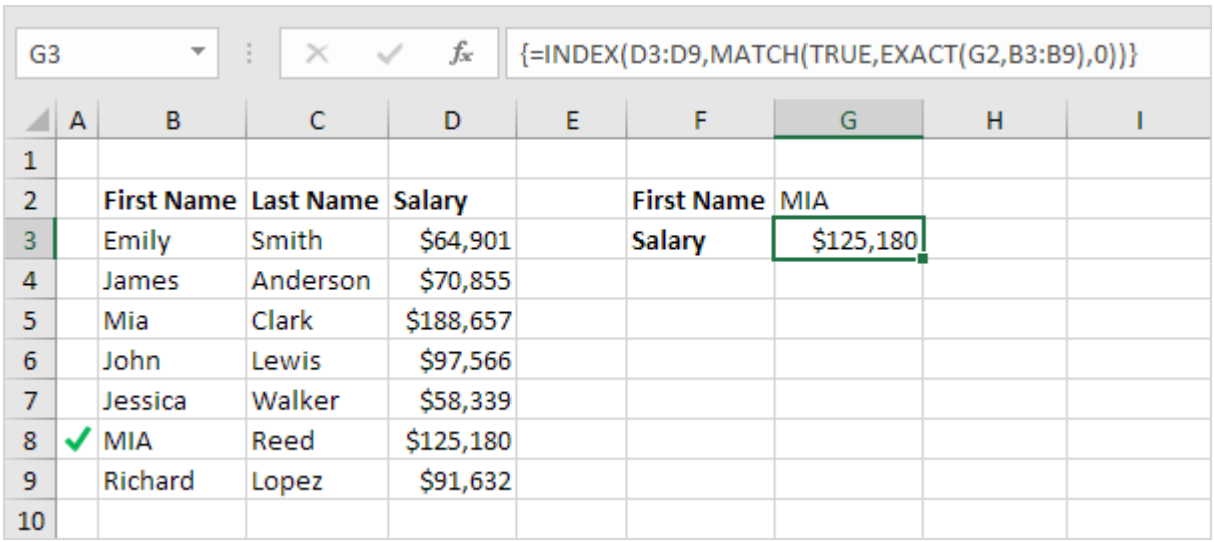
	A	B	C	D	E	F	G	H	I
1									
2		**First Name**	**Last Name**	**Salary**		**First Name**	MIA		
3		Emily	Smith	$64,901		**Salary**	=EXACT(G2,B3:B9)		
4		James	Anderson	$70,855					
5		Mia	Clark	$188,657					
6		John	Lewis	$97,566					
7		Jessica	Walker	$58,339					
8		MIA	Reed	$125,180					
9		Richard	Lopez	$91,632					
10									

4. The MATCH function can be used to finds the position of TRUE in this array constant. Remember to press **[Ctrl]** + **[Shift]** + **[Enter]**.



	A	B	C	D	E	F	G	H	I
1									
2		**First Name**	**Last Name**	**Salary**		**First Name**	MIA		
3		Emily	Smith	$64,901		**Salary**	6		
4		James	Anderson	$70,855					
5		Mia	Clark	$188,657					
6		John	Lewis	$97,566					
7		Jessica	Walker	$58,339					
8		MIA	Reed	$125,180					
9		Richard	Lopez	$91,632					
10									

5. Use the INDEX function to return a specific value in a one-dimensional range. Remember to press **[Ctrl]** + **[Shift]** + **[Enter]**.



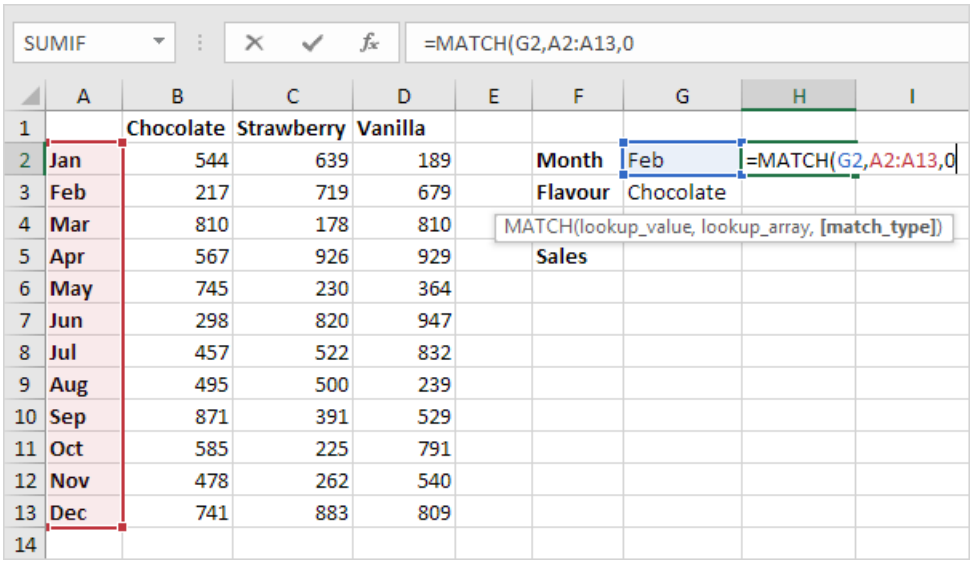
	A	B	C	D	E	F	G	H	I
1									
2		**First Name**	**Last Name**	**Salary**		**First Name**	MIA		
3		Emily	Smith	$64,901		**Salary**	$125,180		
4		James	Anderson	$70,855					
5		Mia	Clark	$188,657					
6		John	Lewis	$97,566					
7		Jessica	Walker	$58,339					
8	✓	MIA	Reed	$125,180					
9		Richard	Lopez	$91,632					
10									

2.3 Matrix Lookup

When searching for something in your Excel spreadsheets, most of the time you'd look up vertically in columns or horizontally in rows. But sometimes you need to look across both rows and columns. In other words, you aim to find a value at the intersection of a certain row and column. This is called matrix lookup (also called 2-dimensional lookup or 2-way lookup),

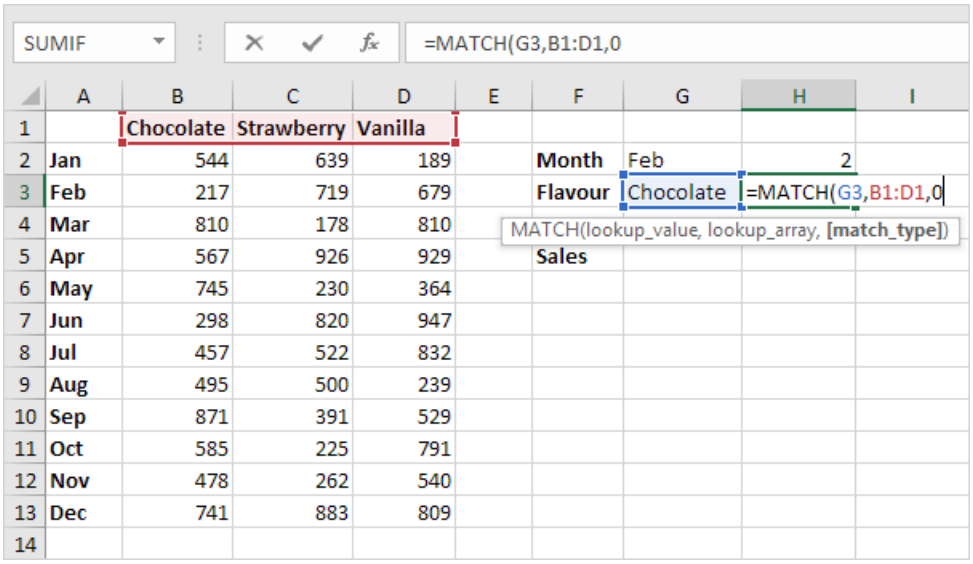
2.3.1 Using MATCH and INDEX

1. To lookup a value in a two-dimensional range, use INDEX and MATCH in Excel. For example, you want to find the sales of different ice cream flavors in each month. Use the MATCH function to find the position of Feb in the range.



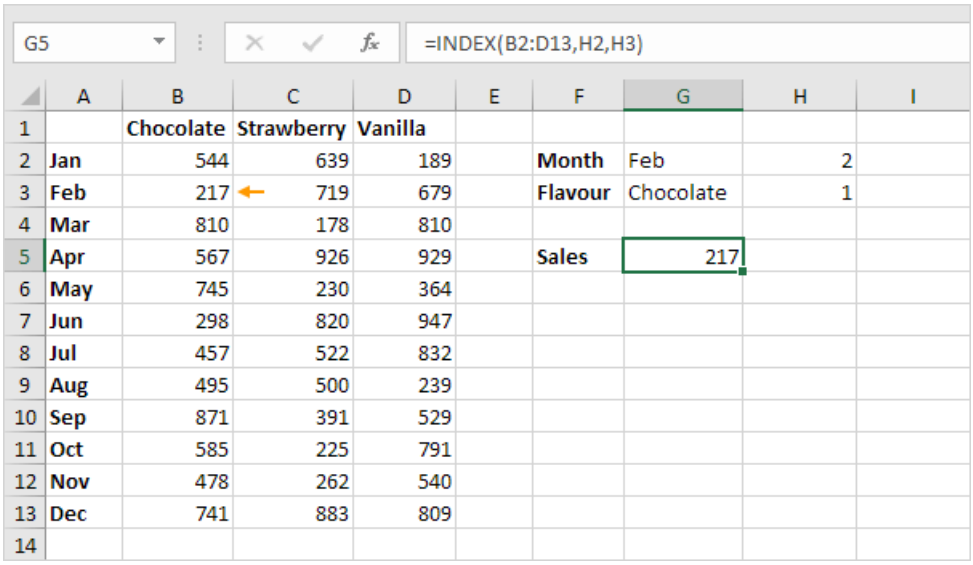
	A	B	C	D	E	F	G	H	I
1		Chocolate	Strawberry	Vanilla					
2	Jan	544	639	189		Month	Feb	=MATCH(G2,A2:A13,0	
3	Feb	217	719	679		Flavour	Chocolate		
4	Mar	810	178	810					
5	Apr	567	926	929		Sales			
6	May	745	230	364					
7	Jun	298	820	947					
8	Jul	457	522	832					
9	Aug	495	500	239					
10	Sep	871	391	529					
11	Oct	585	225	791					
12	Nov	478	262	540					
13	Dec	741	883	809					
14									

2. Use the MATCH function to find the position of Chocolate in the range.



	A	B	C	D	E	F	G	H	I
1		Chocolate	Strawberry	Vanilla					
2	Jan	544	639	189		Month	Feb	2	
3	Feb	217	719	679		Flavour	Chocolate	=MATCH(G3,B1:D1,0	
4	Mar	810	178	810					
5	Apr	567	926	929		Sales			
6	May	745	230	364					
7	Jun	298	820	947					
8	Jul	457	522	832					
9	Aug	495	500	239					
10	Sep	871	391	529					
11	Oct	585	225	791					
12	Nov	478	262	540					
13	Dec	741	883	809					
14									

3. Use these results and the INDEX function to find the sales of Chocolate in February.



	A	B	C	D	E	F	G	H	I
1		Chocolate	Strawberry	Vanilla					
2	Jan	544	639	189		Month	Feb	2	
3	Feb	217	719	679		Flavour	Chocolate	1	
4	Mar	810	178	810					
5	Apr	567	926	929		Sales	217		
6	May	745	230	364					
7	Jun	298	820	947					
8	Jul	457	522	832					
9	Aug	495	500	239					
10	Sep	871	391	529					
11	Oct	585	225	791					
12	Nov	478	262	540					
13	Dec	741	883	809					
14									

4. Put it all together.

G5 =INDEX(B2:D13,MATCH(G2,A2:A13,0),MATCH(G3,B1:D1,0))

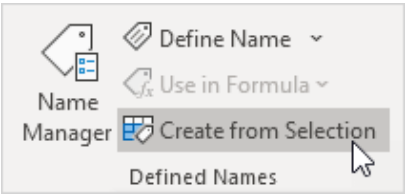
	A	B	C	D	E	F	G	H	I
1		Chocolate	Strawberry	Vanilla					
2	Jan	544	639	189		Month	Feb		
3	Feb	217	719	679		Flavour	Chocolate		
4	Mar	810	178	810					
5	Apr	567	926	929		Sales	217		
6	May	745	230	364					
7	Jun	298	820	947					
8	Jul	457	522	832					
9	Aug	495	500	239					
10	Sep	871	391	529					
11	Oct	585	225	791					
12	Nov	478	262	540					
13	Dec	741	883	809					
14									

2.3.2 Using INDIRECT

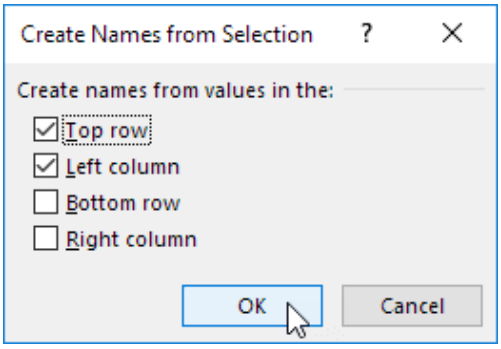
1. Select the range

	A	B	C	D	E	F	G	H	I
1		Chocolate	Strawberry	Vanilla					
2	Jan	544	639	189					
3	Feb	217	719	679					
4	Mar	810	178	810					
5	Apr	567	926	929					
6	May	745	230	364					
7	Jun	298	820	947					
8	Jul	457	522	832					
9	Aug	495	500	239					
10	Sep	871	391	529					
11	Oct	585	225	791					
12	Nov	478	262	540					
13	Dec	741	883	809					
14									

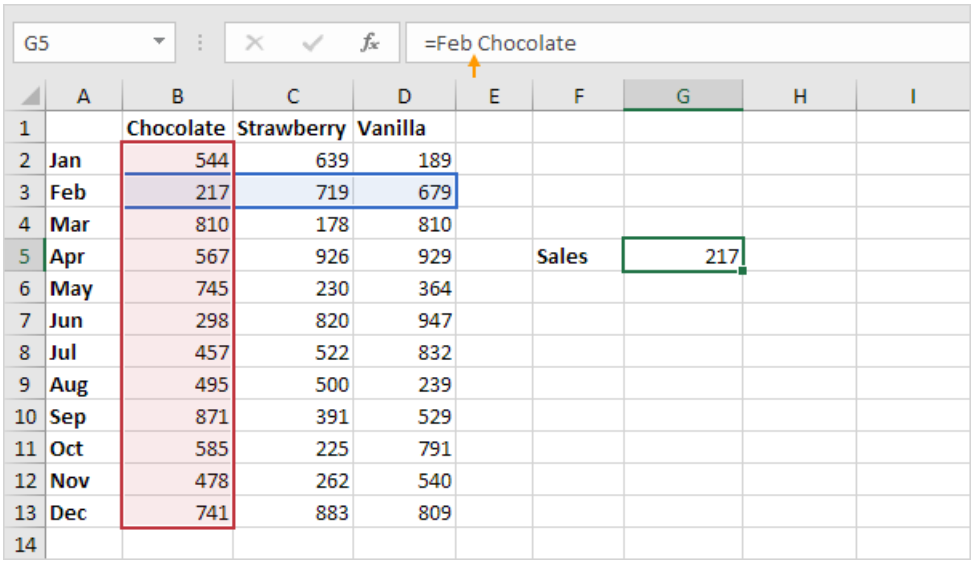
2. On the **Formulas** tab, in the **Defined Names** group, click **Create from Selection**.



3. Select **Top row** and **Left column** and click **[OK]**.

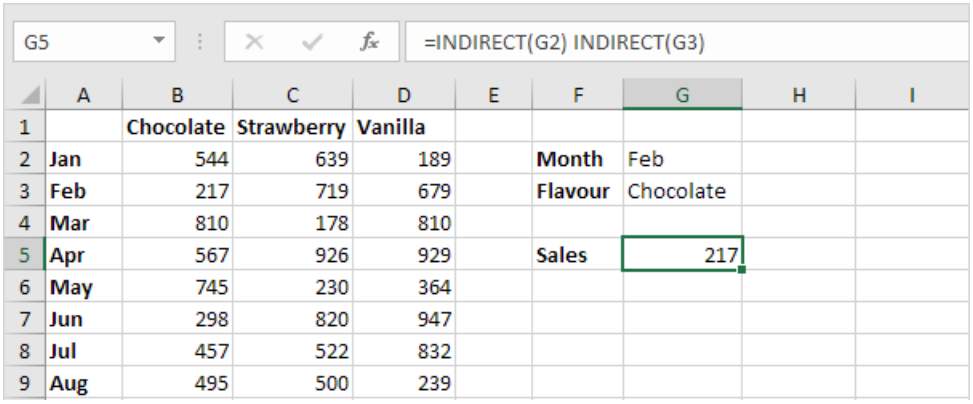


4. Excel created 15 named ranges (12 row cells and 3 column cells). Use the intersect operator (space) to return the intersection of two named ranges



	A	B	C	D	E	F	G	H	I
1		Chocolate	Strawberry	Vanilla					
2	Jan	544	639	189					
3	Feb	217	719	679					
4	Mar	810	178	810					
5	Apr	567	926	929		Sales	217		
6	May	745	230	364					
7	Jun	298	820	947					
8	Jul	457	522	832					
9	Aug	495	500	239					
10	Sep	871	391	529					
11	Oct	585	225	791					
12	Nov	478	262	540					
13	Dec	741	883	809					
14									

5. Create a dynamic two-way lookup using INDIRECT. The INDIRECT functions convert the text strings ("Feb" in cell G2 and "Chocolate" in cell G3) into valid named ranges.

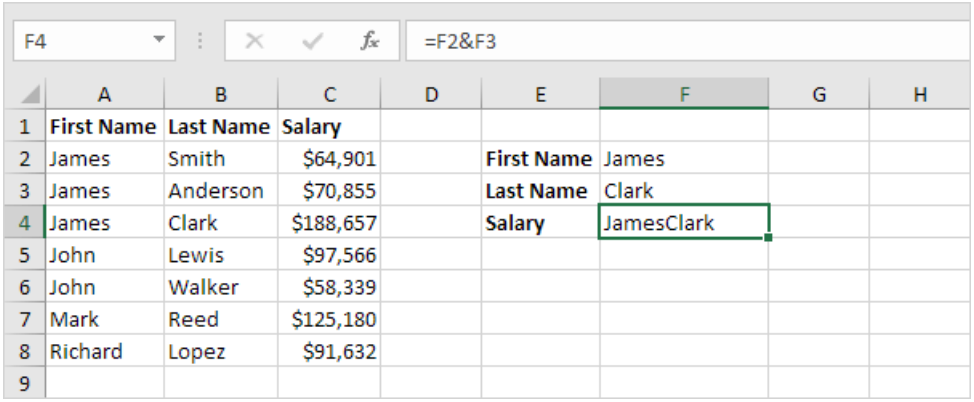


	A	B	C	D	E	F	G	H	I
1		Chocolate	Strawberry	Vanilla					
2	Jan	544	639	189		Month	Feb		
3	Feb	217	719	679		Flavour	Chocolate		
4	Mar	810	178	810					
5	Apr	567	926	929		Sales	217		
6	May	745	230	364					
7	Jun	298	820	947					
8	Jul	457	522	832					
9	Aug	495	500	239					

2.4 Multiple Conditions Lookup

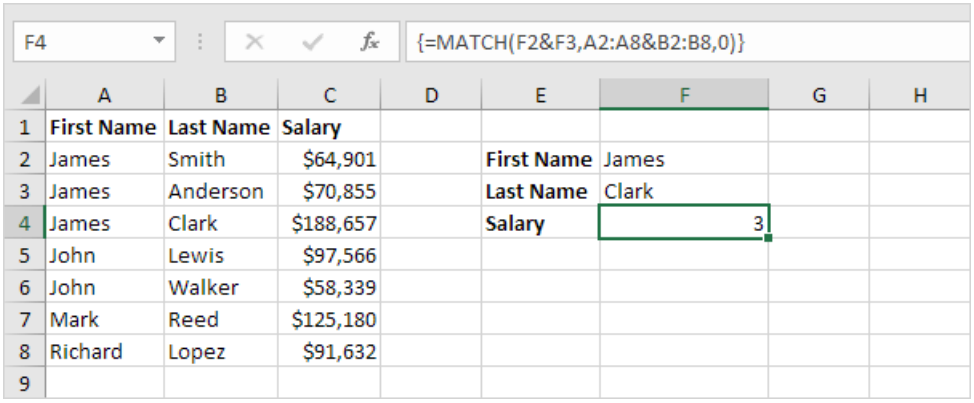
2.4.1 Using MATCH and INDEX

1. The VLOOKUP function doesn't handle multiple columns. You need to use MATCH and INDEX function to perform a two-column lookup in Excel. For example, if we want to look up the salary of James Clark, we need to use the & operator to join string.



	A	B	C	D	E	F	G	H
1	First Name	Last Name	Salary					
2	James	Smith	$64,901		First Name	James		
3	James	Anderson	$70,855		Last Name	Clark		
4	James	Clark	$188,657		Salary	JamesClark		
5	John	Lewis	$97,566					
6	John	Walker	$58,339					
7	Mark	Reed	$125,180					
8	Richard	Lopez	$91,632					
9								

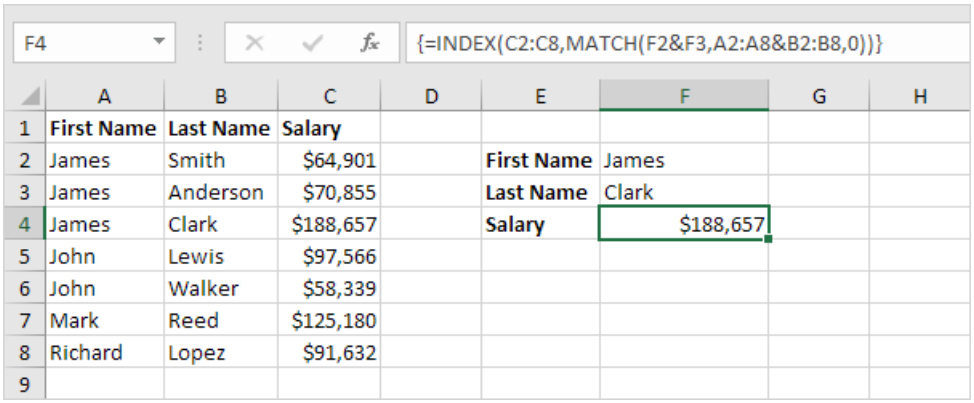
2. The MATCH function returns the position of a value in a given range. Remember to press **[Ctrl] + [Shift] + [Enter]**.



F4 {=MATCH(F2&F3,A2:A8&B2:B8,0)}

	A	B	C	D	E	F	G	H
1	**First Name**	**Last Name**	**Salary**					
2	James	Smith	$64,901		**First Name**	James		
3	James	Anderson	$70,855		**Last Name**	Clark		
4	James	Clark	$188,657		**Salary**	3		
5	John	Lewis	$97,566					
6	John	Walker	$58,339					
7	Mark	Reed	$125,180					
8	Richard	Lopez	$91,632					
9								

3. Use this result and the INDEX function to return the value.



F4 {=INDEX(C2:C8,MATCH(F2&F3,A2:A8&B2:B8,0))}

	A	B	C	D	E	F	G	H
1	**First Name**	**Last Name**	**Salary**					
2	James	Smith	$64,901		**First Name**	James		
3	James	Anderson	$70,855		**Last Name**	Clark		
4	James	Clark	$188,657		**Salary**	$188,657		
5	John	Lewis	$97,566					
6	John	Walker	$58,339					
7	Mark	Reed	$125,180					
8	Richard	Lopez	$91,632					
9								

2.4.2 Using CHOOSE and VLOOKUP

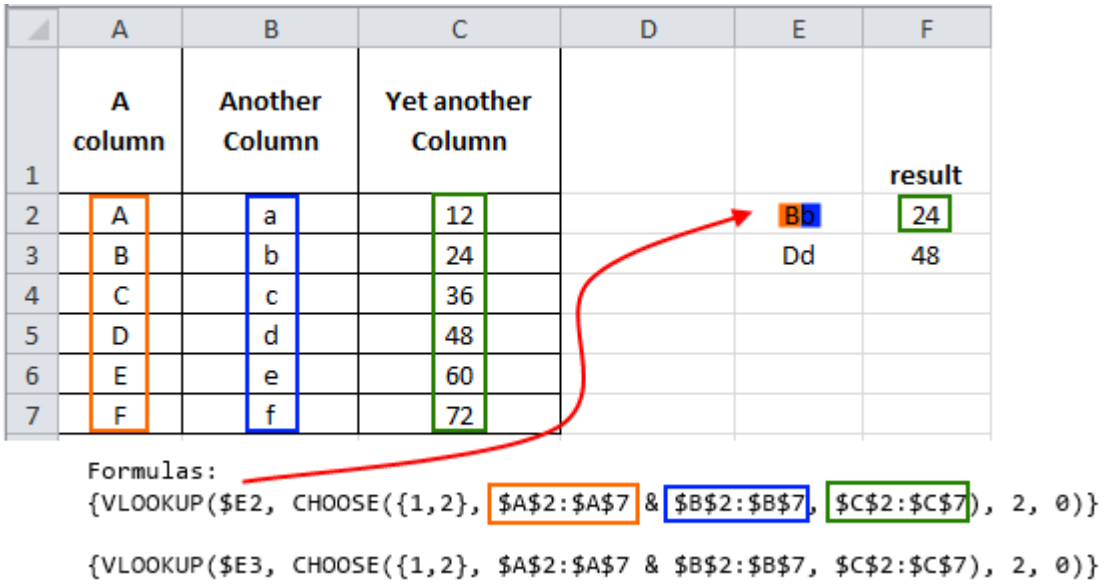
1. The other method for multiple conditions lookup is using CHOOSE and VLOOKUP function. Here's some data and we would love to know what "Bb" is:

	A	B	C	D	E	F
1	**A column**	**Another Column**	**Yet another Column**			
2	A	a	12		Bb	?
3	B	b	24		Dd	?
4	C	c	36			
5	D	d	48			
6	E	e	60			
7	F	f	72			

2. We create a helper column by concatenating the two inputs and do a basic VLOOKUP.

	A	B	C	D	F	G	H	I	J
1	**A column**	**Another Column**	**A helper Column**	**Yet another Column**		**result**	**formula**		
2	A	a	Aa	12	Bb	24	VLOOKUP($F2,$C$2:$D$7,2,0)		
3	B	b	Bb	24	Dd	48	VLOOKUP($F3,$C$2:$D$7,2,0)		
4	C	c	Cc	36					
5	D	d	Dd	48					
6	E	e	Ee	60					
7	F	f	Ff	72					

3. With a dash of CHOOSE and sprinkling of Array formulas, we're about to handle it:
   ={VLOOKUP($E2,CHOOSE({1,2}, $A$2:$A$7 & $B$2:$B$7, $C$2:$C$7), 2,0) }



	A	B	C	D	E	F
1	A column	Another Column	Yet another Column			result
2	A	a	12		Bb	24
3	B	b	24		Dd	48
4	C	c	36			
5	D	d	48			
6	E	e	60			
7	F	f	72			

Formulas:

```
{VLOOKUP($E2, CHOOSE({1,2}, $A$2:$A$7 & $B$2:$B$7, $C$2:$C$7), 2, 0)}

{VLOOKUP($E3, CHOOSE({1,2}, $A$2:$A$7 & $B$2:$B$7, $C$2:$C$7), 2, 0)}
```

Using the Array creates a makeshift virtual helper column. You can handle multi condition VLOOKUP using the following simple structure

VLOOKUP (lookup value, CHOOSE({1, 2, ...N}, Column1 & Column 2 &…& Column N, Result Column), 2, 0)

Where the lookup value is either something pre-concatenated (like Bb or Dd above) or you are using multiple criteria that you concatenate when entering the lookup value. The CHOOSE structure is easy. Always {1,2} then concatenate (with &) as many columns as you want (that the lookup values will need to look in) and the VLOOKUP's column number is always 2.

Consider the following example

	A	B	C	D	E	F	G	H
1	Start Year	Grade	Role	Savings Produced				
2	2013	A	Analyst	£174,291				
3	2014	D	Vice President	£224,534				
4	2013	C	Vice President	£204,394				
5	2013	B	Associate Vice President	£278,178				
6	2013	D	Director	£370,746				
7	2014	A	Analyst	£163,583				
8	2014	B	Associate Vice President	£270,746				
9	2013	A	Analyst	£122,575				
10	2014	D	Director	£221,802				
11								
12	Criteria							
13	2014		£221,802					
14	D		{VLOOKUP(A13&A14&A15,CHOOSE({1,2},A2:A10&B2:B10&C2:C10,D2:D10),2,0)}					
15	Director							

If we want to look up the Savings Produced for a Director of Grade D who started in 2014. That's 3 lookup criteria. Let's follow the structure = VLOOKUP(A13 & A14 & A15, CHOOSE({1,2}, A2:A10 & B2:B10 & C2:C10, D2:D10), 2, 0) and press **[Ctrl]** + **[Shift]** + **[Enter]**

The two key things to note is that our lookup value is a concatenation of the criteria, in this case we have put the criteria in A13, A14 and A15 (hence A13&A14&A15 is our lookup value). Secondly, in the CHOOSE formula, the ranges in the middle part (A2:A10&B2:B10&C2:C10) should be concatenated in the same order that the lookup value was concatenated. So, we concatenated Start Year & Grade & Role in both the lookup value and lookup columns within the CHOOSE.

2.5 Return Multiple Columns from VLOOKUP

1. By utilize an array formula using an array constant, we can use VLOOKUP to pull data from a range of multiple columns at one time. Here we have a data range with various types of fruit and the values of each in 5 different columns

	A	B	C	D	E
Apple	16	24	4	9	1
Orange	21	17	7	7	12
Grape	25	13	12	12	18
Peach	20	9	1	22	23
Pear	15	10	9	7	8
Banana	5	22	22	13	22
Prune	24	4	15	3	16
Tangerine	7	6	20	9	4
Plum	24	9	17	9	15
Nectarine	21	15	11	11	1

2. We can use the following formula to obtain the values:

	A	B	C	D	E
Plum	24	9	17	9	15

{=VLOOKUP(F21,F3:K12,{2,3,4,5,6},0)}

There are some rules for using this formula:

1. First, it's an array formula, notice the curly brackets around the entire formula. When we started the formula, we actually selected all the cells that the formula would be in. Then when we entered it, we used **[Ctrl]** + **[Shift]** + **[Enter]** rather than just Enter.
2. Second, notice that we did not have to "lock" either the lookup value or table array, since we are not copying the formula, but we could have – it would work either way.
3. Third, instead of a single value or formula like the COLUMN function, the column number is an array constant {2, 3, 4, 5, 6}. These curly brackets are entered manually. This tells the VLOOKUUP formula not to select a single column, but to select all the ones listed and insert the value in the appropriate column.

2.6 Calculation on Multiple Columns from VLOOKUP

VLOOKUP is great for extracting information from a huge data table based on what you are looking for. But what if you need to extract more than one column of information? Let's say you have salesperson's name in left most column, and monthly sales figures in next columns, one for each month.

Salesperson	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Joseph	22	22	24	25	26	28	30	32	33	33	36	36
John	10	10	11	11	12	12	13	13	14	15	15	15
Josh	26	26	27	27	27	27	29	30	30	32	32	34
Jamie	18	19	20	20	20	21	22	23	23	24	25	25
Jackie	19	20	22	24	25	25	25	27	29	30	30	31
Johnson	16	17	18	18	19	20	22	24	25	26	27	28
Jonathan	15	16	17	17	18	18	18	19	19	20	20	22
Jagjit	10	11	11	11	12	13	13	14	14	14	15	15
Jairam	21	21	21	23	24	24	25	26	27	29	30	32
Jessy	25	26	27	28	29	29	29	30	31	34	37	40
Javed	22	24	25	26	28	28	29	31	34	35	35	35
Jimmy	23	24	24	24	25	26	27	28	30	33	35	37
Juno	19	20	20	21	22	24	24	26	27	27	28	30

By applying the return multiple columns from VLOOKUP technique, together with the corresponding mathematically function, it's possible to

1. Total Sales in Months Jan, Feb & Mar for the person Joseph: 68

```
=SUM(VLOOKUP("Joseph",A3:M15,{2,3,4},FALSE))
```

2. Maximum sales per month of Josh: 34

```
=MAX(VLOOKUP("Josh",A3:M15,{2,3,4,5,6,7,8,9,10,11,12,13},FALSE))
```

3. Average monthly sale for Jonathan: 18.25

```
=AVERAGE(VLOOKUP("Jonathan",A3:M15,{2,3,4,5,6,7,8,9,10,11,12,13},FALSE))
```

Moreover, we can also calculate the commission by using matrix calculation.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rate	3%	6%	2%	3%	2%	8%	1%	3%	8%	6%	5%	2%

4. Total comission made by Jackie: 12.9025

```
=SUM(VLOOKUP("Jackie",A3:M15,{2,3,4,5,6,7,8,9,10,11,12,13},FALSE)*B20:M20)
```

3. Analysis ToolPak

3.1 Introduction

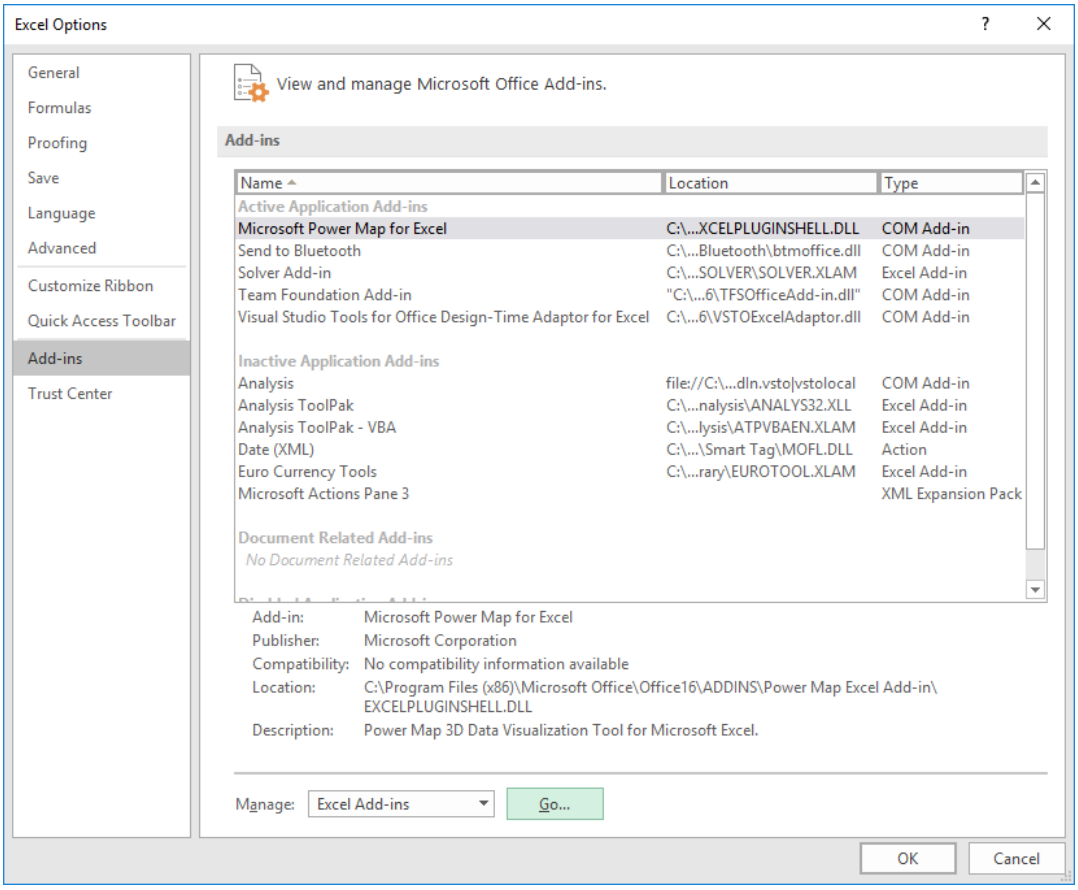
If you need to develop complex statistical or engineering analyses, you can save steps and time by using the Analysis ToolPak. You provide the data and parameters for each analysis, and the tool uses the appropriate statistical or engineering macro functions to calculate and display the results in an output table. Some tools generate charts in addition to output tables.

The data analysis functions can be used on only one worksheet at a time. When you perform data analysis on grouped worksheets, results will appear on the first worksheet and empty formatted tables will appear on the remaining worksheets. To perform data analysis on the remainder of the worksheets, recalculate the analysis tool for each worksheet.

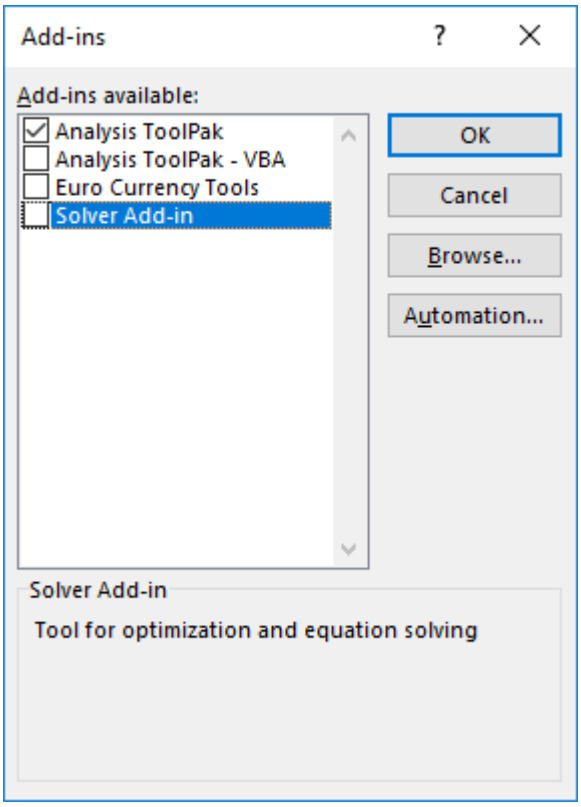
3.2 Setup the Add-in

The Analysis TookPak is an add-in utility, so you should verify that it's installed on your system before you get started.

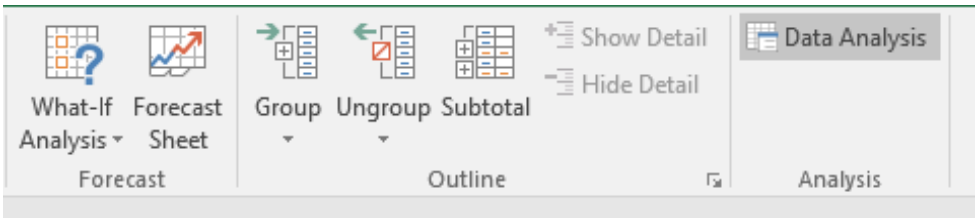
1. Click the Microsoft Office Button, and then click **Options**.
2. Click **Add-Ins**, and then in the **Manage** box, select **Excel Add-ins**. Click **[Go]**.



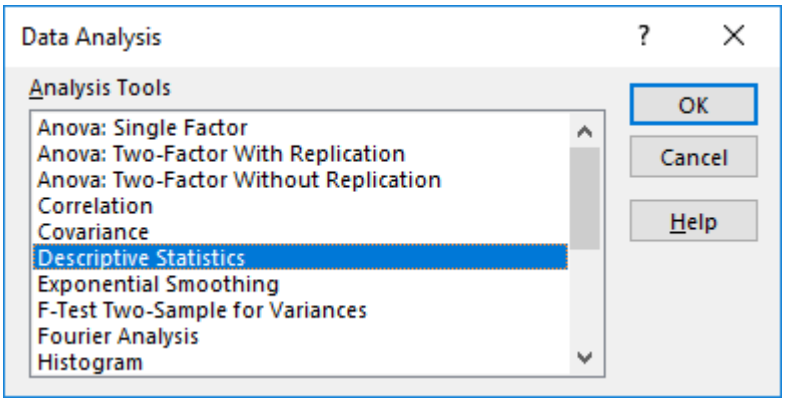
3. In the **Add-Ins** available box, select the **Analysis ToolPak** check box, and then click **[OK]**.



4. After you load the **Add-in**, the [**Data Analysis]** command is available in the **Analysis** group on the **Data** tab.



5. When you click on the **[Data Analysis]** button, list of Analysis Tools will be shown:



3.3 Analysis Tools

3.3.1 Anova

The Anova analysis tools provide different types of variance analysis. The tool that you should use depends on the number of factors and the number of samples that you have from the populations that you want to test.

3.3.1.1 Anova: Single Factor

This tool performs a simple analysis of variance on data for two or more samples. The analysis provides a test of the hypothesis that each sample is drawn from the same underlying probability distribution against the alternative hypothesis that underlying probability distributions are not the same for all samples. If there are only two samples, you can use the worksheet function T.TEST. With more than two samples, there is no convenient generalization of T.TEST, and the Single Factor Anova model can be called upon instead.

3.3.1.2 Anova: Two-Factor with Replication

This analysis tool is useful when data can be classified along two different dimensions. For example, in an experiment to measure the height of plants, the plants may be given different brands of fertilizer (for example, A, B, C) and might also be kept at different temperatures (for example, low, high). For each of the six possible pairs of {fertilizer, temperature}, we have an equal number of observations of plant height. Using this Anova tool, we can test:

Whether the heights of plants for the different fertilizer brands are drawn from the same underlying population. Temperatures are ignored for this analysis.

Whether the heights of plants for the different temperature levels are drawn from the same underlying population. Fertilizer brands are ignored for this analysis.

Whether having accounted for the effects of differences between fertilizer brands found in the first bulleted point and differences in temperatures found in the second bulleted point, the six samples representing all pairs of {fertilizer, temperature} values are drawn from the same population. The alternative hypothesis is that there are effects due to specific {fertilizer, temperature} pairs over and above the differences that are based on fertilizer alone or on temperature alone.

Input range

	Group 1	Group 2
Trial 1	75	58
	68	56
	71	61
	75	60
Trial 2	66	62
	70	60
	68	59
	68	68

3.3.1.3 Anova: Two-Factor Without Replication

This analysis tool is useful when data is classified on two different dimensions as in the Two-Factor case With Replication. However, for this tool it is assumed that there is only a single observation for each pair (for example, each {fertilizer, temperature} pair in the preceding example).

3.3.2 Correlation

The CORREL and PEARSON worksheet functions both calculate the correlation coefficient between two measurement variables when measurements on each variable are observed for each of N subjects. (Any missing observation for any subject causes that subject to be ignored in the analysis.) The Correlation analysis tool is particularly useful when there are more than two measurement variables for each of N subjects. It provides an output table, a correlation matrix, that shows the value of CORREL (or PEARSON) applied to each possible pair of measurement variables.

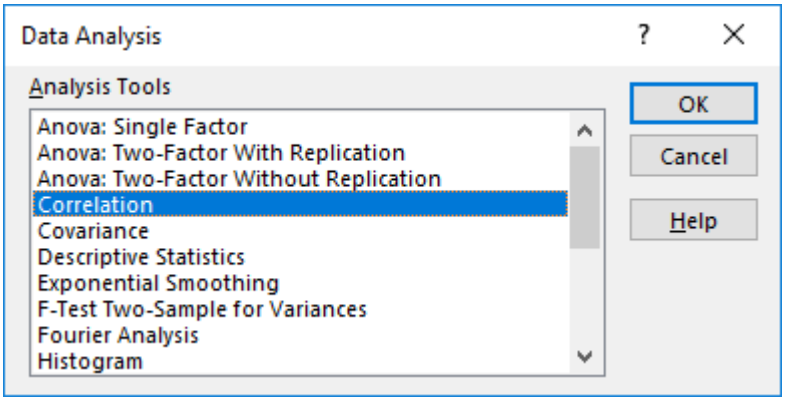
The correlation coefficient, like the covariance, is a measure of the extent to which two measurement variables "vary together." Unlike the covariance, the correlation coefficient is scaled so that its value is independent of the units in which the two measurement variables are expressed. (For example, if the two measurement variables are weight and height, the value of the correlation coefficient is unchanged if weight is converted from pounds to kilograms.) The value of any correlation coefficient must be between -1 and +1 inclusive.

You can use the correlation analysis tool to examine each pair of measurement variables to determine whether the two measurement variables tend to move together — that is, whether large values of one variable tend to be associated with large values of the other (positive correlation), whether small values of one variable tend to be associated with large values of the other (negative correlation), or whether values of both variables tend to be unrelated (correlation near 0 (zero)).

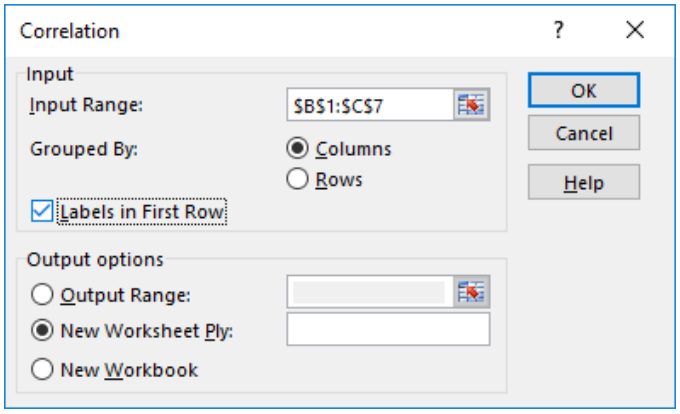
3.3.2.1 Example:

We are going to check to see if there is a correlation between the number of leaflets we give out and the number of people who visit our shop.

1. On the **Data** tab in the **Analysis** group, click **Data Analysis**. Select **Correlation** and press **[OK]**.



2. Input the following information and press **[OK]**:
   - Specify the input range to be B1:C7
   - Select the **Labels in First Row** checkbox



3. Excel produces the following Summary Output.

	Number of Leaflet	*Number of Visitor*
Number of Leaflet	1	
Number of Visitor	0.543835807	1

- Positive Correlation: A coefficient of 1 denotes a perfect positive correlation. (Very Strong = 1)
- Negative Correlation: A coefficient of -1 denotes a perfect negative correlation. (Very Strong = -1)
- No Correlation: A coefficient of 0 means that there is no correlation.

3.3.3 Covariance

The Correlation and Covariance tools can both be used in the same setting, when you have N different measurement variables observed on a set of individuals. The Correlation and Covariance tools each give an output table, a matrix, that shows the correlation coefficient or covariance, respectively, between each pair of measurement variables. The difference is that correlation coefficients are scaled to lie between -1 and +1 inclusive. Corresponding covariances are not scaled. Both the correlation coefficient and the covariance are measures of the extent to which two variables "vary together."

The Covariance tool computes the value of the worksheet function COVARIANCE.P for each pair of measurement variables. (Direct use of COVARIANCE.P rather than the Covariance tool is a reasonable alternative when there are only two measurement variables, that is, N=2.) The entry on the diagonal of the Covariance tool's output table in row i, column i is the covariance of the i-th measurement variable with itself. This is just the population variance for that variable, as calculated by the worksheet function VAR.P.

You can use the Covariance tool to examine each pair of measurement variables to determine whether the two measurement variables tend to move together — that is, whether large values of one variable tend to be associated with large values of the other (positive covariance), whether small values of one variable tend to be associated with large values of the other (negative covariance), or whether values of both variables tend to be unrelated (covariance near 0 (zero)).

3.3.4 Descriptive Statistics

The Descriptive Statistics analysis tool generates a report of univariate statistics for data in the input range, providing information about the central tendency and variability of your data.

3.3.5 Exponential Smoothing

The Exponential Smoothing analysis tool predicts a value that is based on the forecast for the prior period, adjusted for the error in that prior forecast. The tool uses the smoothing constant a, the magnitude of which determines how strongly the forecasts respond to errors in the prior forecast. Note: Values of 0.2 to 0.3 are reasonable smoothing constants. These values indicate that the current forecast should be adjusted 20 percent to 30 percent for error in the prior forecast. Larger constants yield a faster response but can produce erratic projections. Smaller constants can result in long lags for forecast values.

3.3.6 F-Test Two-Sample for Variances

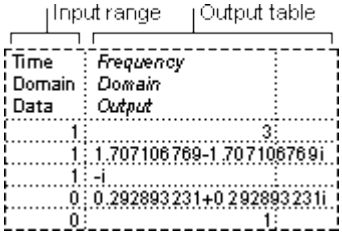
The F-Test Two-Sample for Variances analysis tool performs a two-sample F-test to compare two population variances.

For example, you can use the F-Test tool on samples of times in a swim meet for each of two teams. The tool provides the result of a test of the null hypothesis that these two samples come from distributions with equal variances, against the alternative that the variances are not equal in the underlying distributions.

The tool calculates the value f of an F-statistic (or F-ratio). A value of f close to 1 provides evidence that the underlying population variances are equal. In the output table, if f < 1 "P(F <= f) one-tail" gives the probability of observing a value of the F-statistic less than f when population variances are equal, and "F Critical one-tail" gives the critical value less than 1 for the chosen significance level, Alpha. If f > 1, "P(F <= f) one-tail" gives the probability of observing a value of the F-statistic greater than f when population variances are equal, and "F Critical one-tail" gives the critical value greater than 1 for Alpha.

3.3.7 Fourier Analysis

The Fourier Analysis tool solves problems in linear systems and analyzes periodic data by using the Fast Fourier Transform (FFT) method to transform data. This tool also supports inverse transformations, in which the inverse of transformed data returns the original data.



3.3.8 Histogram

The Histogram analysis tool calculates individual and cumulative frequencies for a cell range of data and data bins. This tool generates data for the number of occurrences of a value in a data set. For example, in a class of 20 students, you can determine the distribution of scores in letter-grade

categories. A histogram table presents the letter-grade boundaries and the number of scores between the lowest bound and the current bound. The single most-frequent score is the mode of the data.

3.3.9 Moving Average

The Moving Average analysis tool projects values in the forecast period, based on the average value of the variable over a specific number of preceding periods. A moving average provides trend information that a simple average of all historical data would mask. Use this tool to forecast sales, inventory, or other trends. Each forecast value is based on the following formula.

Formula to calculate moving averages:

$$F_{(t+1)} = \frac{1}{N}\sum_{j=1}^{N} A_{t-j+1}$$

- N is the number of prior periods to include in the moving average
- A_j is the actual value at time j
- F_j is the forecasted value at time j

3.3.10 Random Number Generation

The Random Number Generation analysis tool fills a range with independent random numbers that are drawn from one of several distributions. You can characterize the subjects in a population with a probability distribution. For example, you can use a normal distribution to characterize the population of individuals' heights, or you can use a Bernoulli distribution of two possible outcomes to characterize the population of coin-flip results.

3.3.11 Rank and Percentile

The Rank and Percentile analysis tool produces a table that contains the ordinal and percentage rank of each value in a data set. You can analyze the relative standing of values in a data set. This tool uses the worksheet functions RANK.EQ andPERCENTRANK.INC. If you want to account for tied values, use the RANK.EQ function, which treats tied values as having the same rank, or use the RANK.AVG function, which returns the average rank for the tied values.

3.3.12 Regression

The Regression analysis tool performs linear regression analysis by using the "least squares" method to fit a line through a set of observations. You can analyze how a single dependent variable is affected by the values of one or more independent variables. For example, you can analyze how an athlete's performance is affected by such factors as age, height, and weight. You can apportion shares in the performance measure to each of these three factors, based on a set of performance data, and then use the results to predict the performance of a new, untested athlete.

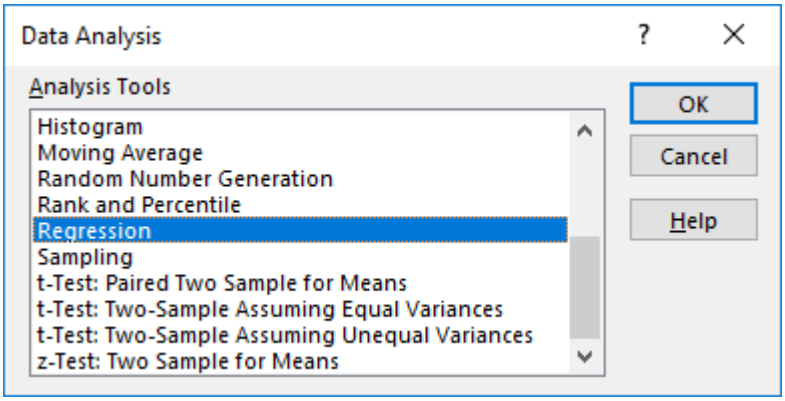
The Regression tool uses the worksheet function LINEST.

3.3.12.1 Example

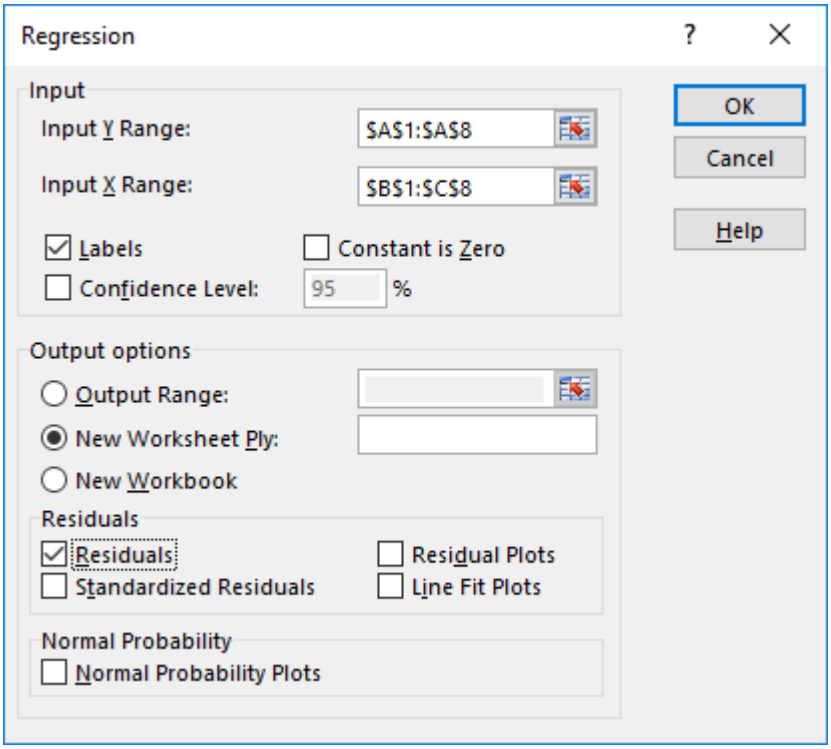
We should like to know is there a relation between Quantity Sold (Output) and Price and Advertising (Input).

Quantity Sold	Selling Price	Advertising Cost
8,500	$2.00	$2,800.00
4,700	$5.00	$200.00
5,800	$3.00	$400.00
7,400	$2.00	$500.00
6,200	$5.00	$3,200.00
7,300	$3.00	$1,800.00
5,600	$4.00	$900.00

1. On the **Data** tab in the **Analysis** group, click **Data Analysis**. Select **Regression** and click **OK**.



2. Input the following information and press **[OK]**:
   - Select the output (A1:A8) as Y Range. This is the predictor variable (also called dependent variable).
   - Select the input (B1:C8) as X Range. These are the explanatory variables (also called independent variables). These columns must be adjacent to each other.
   - Select the **Labels** and **Residuals** checkbox.



3. Excel produces the following Summary Output.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.980681431
R Square	0.961736068
Adjusted R Square	0.942604102
Standard Error	310.5239249
Observations	7

ANOVA

	df	SS	MS	F	Significance F
Regression	2	9694299.568	4847149.784	50.26854403	0.001464128
Residual	4	385700.4318	96425.10794		
Total	6	10080000			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	8536.213882	386.9117478	22.06243137	2.49812E-05	7461.974654	9610.453111	7461.974654	9610.453111
Selling Price	-835.7223514	99.65304469	-8.386320297	0.001106064	-1112.40356	-559.0411432	-1112.40356	-559.0411432
Advertising Cost	0.592228496	0.104346803	5.675578729	0.004755309	0.302515325	0.881941666	0.302515325	0.881941666

RESIDUAL OUTPUT

Observation	Predicted Quantity Sold	Residuals
1	8523.008967	-23.00896712
2	4476.047825	223.9521754
3	6265.938227	-465.9382265
4	7160.883427	239.1165726
5	6252.733311	-52.73331119
6	7095.05812	204.9418798
7	5726.330123	-126.3301229

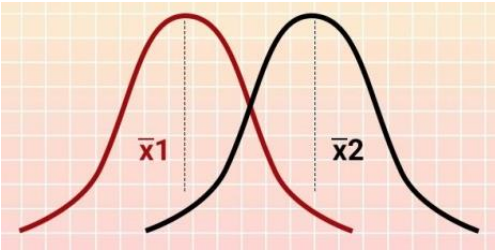
- R Square equals 0.96, which is a very good fit. 96% of the variation in Quantity Sold is explained by the independent variables Price and Advertising. The closer to 1, the better the regression line (read on) fits the data.
- To check if your results are reliable (statistically significant), look at Significance F (0.001). If this value is less than 0.05, you're OK. If Significance F is greater than 0.05, it's probably better to stop using this set of independent variables. Delete a variable with a high P-value (greater than 0.05) and rerun the regression until Significance F drops below 0.05.
- The regression line is: y = Quantity Sold = 8536 - 836 * Price + 0.59 * Advertising. In other words, for each unit increase in price, Quantity Sold decreases with 836 units. For each unit increase in Advertising, Quantity Sold increases with 0.592 units. This is valuable information. You can also use these coefficients to do a forecast. For example, if price equals $4 and Advertising equals $3000, you might be able to achieve a Quantity Sold of 8536 - 836 * 4 + 0.592 * 3000 = 6970.
- The residuals show you how far away the actual data points are fom the predicted data points (using the equation). For example, the first data point equals 8500. Using the equation, the predicted data point equals 8536 - 836 * 2 + 0.592 * 2800 = 8523, giving a residual of 8500 - 8523 = -23.

3.3.13 Sampling

The Sampling analysis tool creates a sample from a population by treating the input range as a population. When the population is too large to process or chart, you can use a representative sample. You can also create a sample that contains only the values from a particular part of a cycle if you believe that the input data is periodic. For example, if the input range contains quarterly sales figures, sampling with a periodic rate of four places the values from the same quarter in the output range.

3.3.14 t-Test

The t test tells you how significant the differences between groups are; In other words it lets you know if those differences (measured in means/averages) could have happened by chance.



The Two-Sample t-Test analysis tools test for equality of the population means that underlie each sample. The three tools employ different assumptions: that the population variances are equal, that the population variances are not equal, and that the two samples represent before-treatment and after-treatment observations on the same subjects.

For all three tools below, a t-Statistic value, t, is computed and shown as "t Stat" in the output tables. Depending on the data, this value, t, can be negative or nonnegative. Under the assumption of equal underlying population means, if t < 0, "P(T <= t) one-tail" gives the probability that a value of the t-Statistic would be observed that is more negative than t. If t >=0, "P(T <= t) one-tail" gives the probability that a value of the t-Statistic would be observed that is more positive than t. "t Critical one-tail" gives the cutoff value, so that the probability of observing a value of the t-Statistic greater than or equal to "t Critical one-tail" is Alpha.

"P(T <= t) two-tail" gives the probability that a value of the t-Statistic would be observed that is larger in absolute value than t. "P Critical two-tail" gives the cutoff value, so that the probability of an observed t-Statistic larger in absolute value than "P Critical two-tail" is Alpha.

3.3.14.1 t-Test: Paired Two Sample for Means

You can use a paired test when there is a natural pairing of observations in the samples, such as when a sample group is tested twice — before and after an experiment. This analysis tool and its formula perform a paired two-sample Student's t-Test to determine whether observations that are taken before a treatment and observations taken after a treatment are likely to have come from distributions with equal population means. This t-Test form does not assume that the variances of both populations are equal.

Note: Among the results that are generated by this tool is pooled variance, an accumulated measure of the spread of data about the mean, which is derived from the following formula.

$$S^2 = \frac{n_1 S_1^2 + n_2 S_2^2}{n_1 + n_2 - 2}$$

3.3.14.2 t-Test: Two-Sample Assuming Equal Variances

This analysis tool performs a two-sample student's t-Test. This t-Test form assumes that the two data sets came from distributions with the same variances. It is referred to as a homoscedastic t-Test. You can use this t-Test to determine whether the two samples are likely to have come from distributions with equal population means.

3.3.14.3 t-Test: Two-Sample Assuming Unequal Variances

This analysis tool performs a two-sample student's t-Test. This t-Test form assumes that the two data sets came from distributions with unequal variances. It is referred to as a heteroscedastic t-Test. As with the preceding Equal Variances case, you can use this t-Test to determine whether the two samples are likely to have come from distributions with equal population means. Use this test when there are distinct subjects in the two samples. Use the Paired test, described in the follow example, when there is a single set of subjects and the two samples represent measurements for each subject before and after a treatment. The following formula is used to determine the statistic value t.

$$t' = \frac{\bar{x} - \bar{y} - \Delta_0}{\sqrt{\frac{S_1^2}{m} + \frac{S_2^2}{n}}}$$

The following formula is used to calculate the degrees of freedom, df. Because the result of the calculation is usually not an integer, the value of df is rounded to the nearest integer to obtain a critical value from the t table. The Excel worksheet function T.TEST uses the calculated df value without rounding, because it is possible to compute a value for T.TEST with a non-integer df. Because of these different approaches to determining the degrees of freedom, the results of T.TEST and this t-Test tool will differ in the Unequal Variances case.

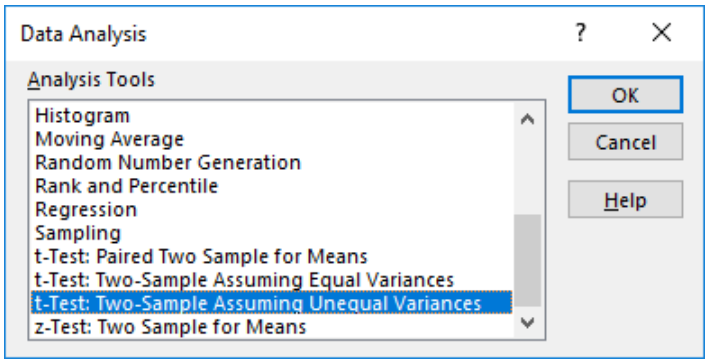
$$df = \frac{\left(\frac{S_1^2}{m} + \frac{S_2^2}{n}\right)^2}{\frac{\left(S_1^2/m\right)^2}{m-1} + \frac{\left(S_2^2/n\right)^2}{n-1}}$$

3.3.14.4 Example

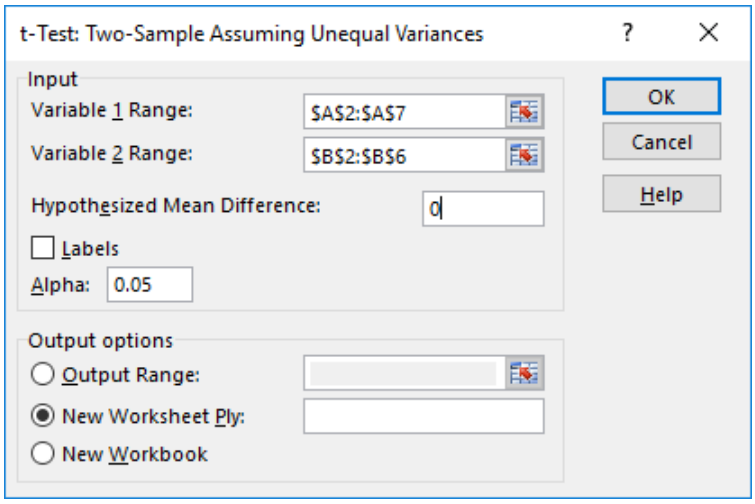
Below you can find the study hours of 6 female students and 5 male students.

Female	Male
26	23
25	30
43	18
34	25
18	28
52	

1. On the **Data** tab in the **Analysis** group, click **Data Analysis**.
2. Since the variances of the two populations are unequal, select **t-Test: Two-Sample Assuming Unequal Variances** and click **OK**.



3. Input the following information and press **[OK]**:
   - Click in the Variable 1 Range box and select the female's study hour (A2:A7).
   - Click in the Variable 2 Range box and select the male's study hour (B2:B6).
   - Click in the Hypothesized Mean Difference box and type 0 (H0: μ1 - μ2 = 0).



4. We do a two-tail test (inequality). lf t Stat < -t Critical two-tail or t Stat > t Critical two-tail, we reject the null hypothesis. This is not the case, -2.365 < 1.473 < 2.365. Therefore, we do not reject the null hypothesis. The observed difference between the sample means (33 - 24.8) is not convincing enough to say that the average number of study hours between female and male students differ significantly.

	Variable 1	*Variable 2*
Mean	33	24.8
Variance	160	21.7
Observations	6	5
Hypothesized Mean Difference	0	
df	7	
t Stat	1.47260514	
P(T<=t) one-tail	0.0921702	
t Critical one-tail	1.89457861	
P(T<=t) two-tail	0.1843404	
t Critical two-tail	2.36462425	

3.3.15 z-Test

The z-Test: Two Sample for Means analysis tool performs a two sample z-Test for means with known variances. This tool is used to test the null hypothesis that there is no difference between two population means against either one-sided or two-sided alternative hypotheses. If variances are not known, the worksheet function Z.TEST should be used instead.

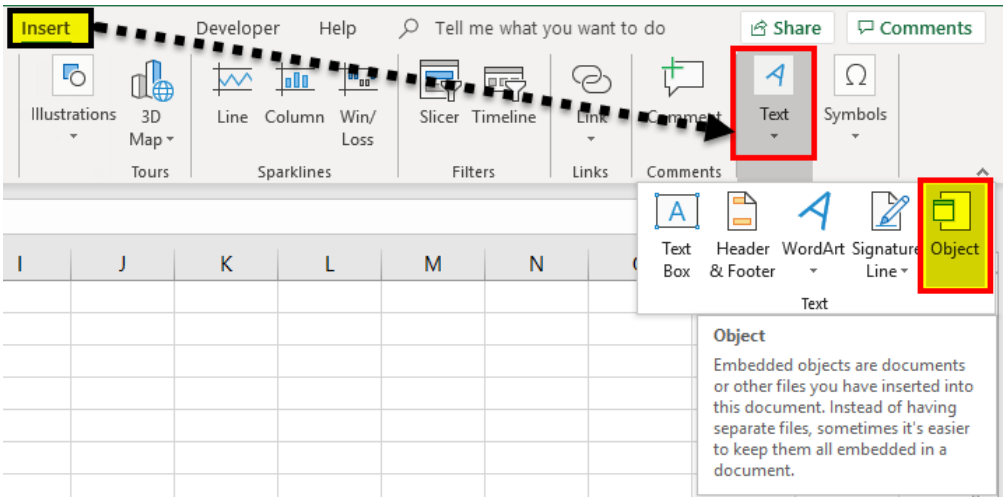
When you use the z-Test tool, be careful to understand the output. "P(Z <= z) one-tail" is really P(Z >= ABS(z)), the probability of a z-value further from 0 in the same direction as the observed z value when there is no difference between the population means. "P(Z <= z) two-tail" is really P(Z >= ABS(z) or Z <= -ABS(z)), the probability of a z-value further from 0 in either direction than the observed z-value when there is no difference between the population means. The two-tailed result is just the one-tailed result multiplied by 2. The z-Test tool can also be used for the case where the null hypothesis is that there is a specific nonzero value for the difference between the two population means. For example, you can use this test to determine differences between the performances of two car models.

4. Integrating Excel with Other Applications

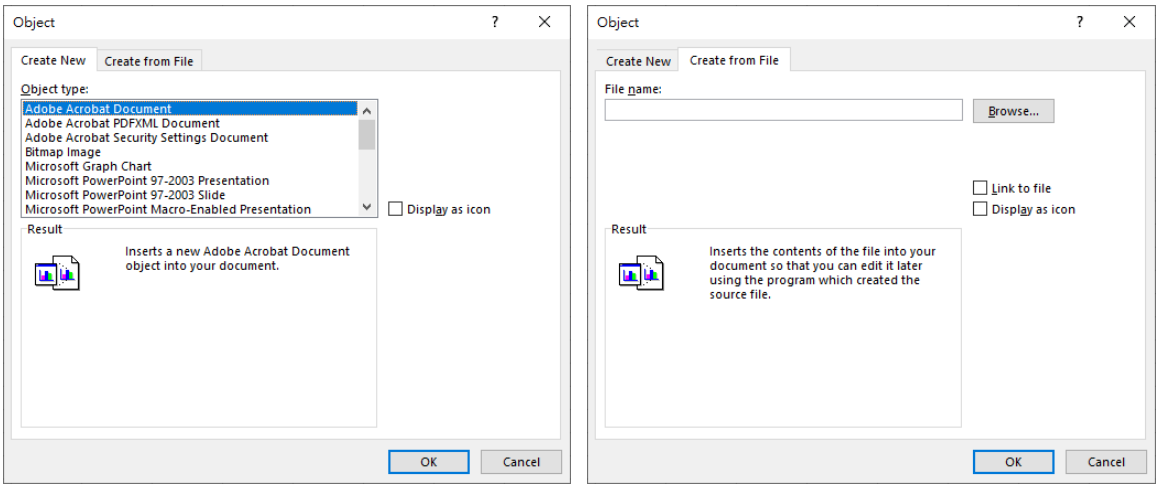
4.1 Linking and Embedding

You can display a linked object or embedded object in a workbook exactly as it appears in the source program or as an icon. If the workbook will be viewed online, and you don't intend to print the workbook, you can display the object as an icon. This minimizes the amount of display space it occupies. Viewers who want to display the information can double-click the icon.

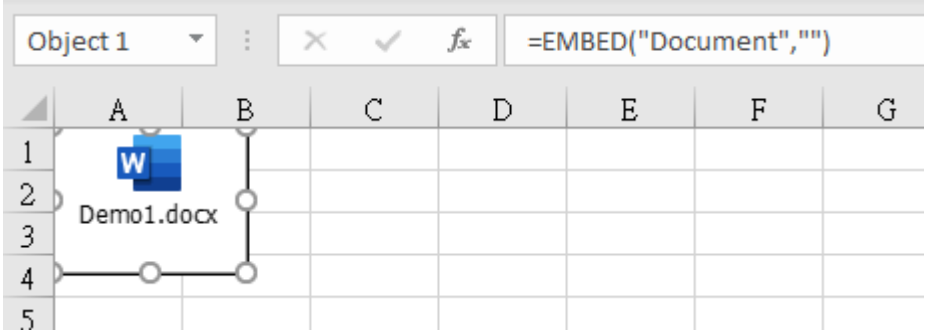
1. Select **Insert** tab, **Text** group, and choose **Object**.



2. You can either create a new object, or directly create it from a file. If you want to link the data to the source file, select the **Link to file** checkbox. Press **[OK]** to continue.



3. The new object will be embedded to your worksheet.



4.2 Using Hyperlinks

A hyperlink is a link from a document that opens another page or file when you click it. The destination is frequently another Web page, but it can also be a picture, or an e-mail address, or a program. The hyperlink itself can be text or a picture.

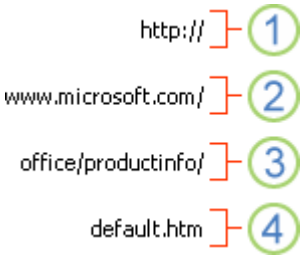
When a site user clicks the hyperlink, the destination is shown in a Web browser, opened, or run, depending on the type of destination. For example, a hyperlink to a page shows the page in the Web browser, and a hyperlink to an AVI file opens the file in a media player

You can use hyperlinks to do the following:

- Navigate to a file or Web page on a network, intranet, or Internet
- Navigate to a file or Web page that you plan to create in the future
- Send an e-mail message
- Start a file transfer, such as downloading or an FTP process

When you point to text or a picture that contains a hyperlink, the pointer becomes a hand, indicating that the text or picture is something that you can click.

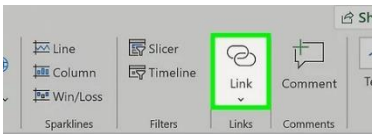
A URL (Uniform Resource Locator) contains a protocol, FTP, or FILE, a Web server or network location, and a path and file name. The following illustration defines the parts of the URL:



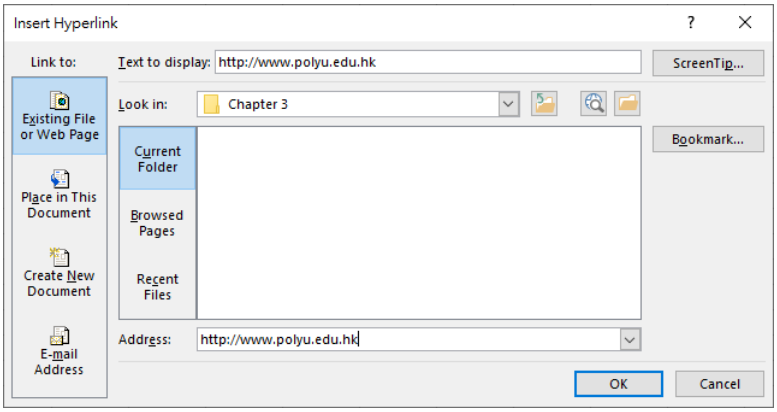
① Protocol used (http, ftp, file)
② Web server or network location
③ Path
④ File name

To create a hyperlink, follow these steps:

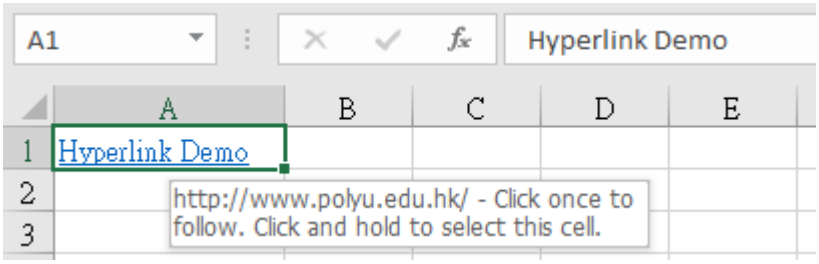
1. Click the cell where you want to create a hyperlink. You can also select an object (such as a picture or an element in a chart) that you want to use to represent the hyperlink.
2. Select **Insert** tab, **Link** group, and choose **Link**.



3. Enter the URL in the **Address** box of the **Insert Hyperlink** dialog, and press **[OK]** to confirm.



4. The hyperlink is created for the specified cell. A tooltip will be displayed once you move your mouse on that cell

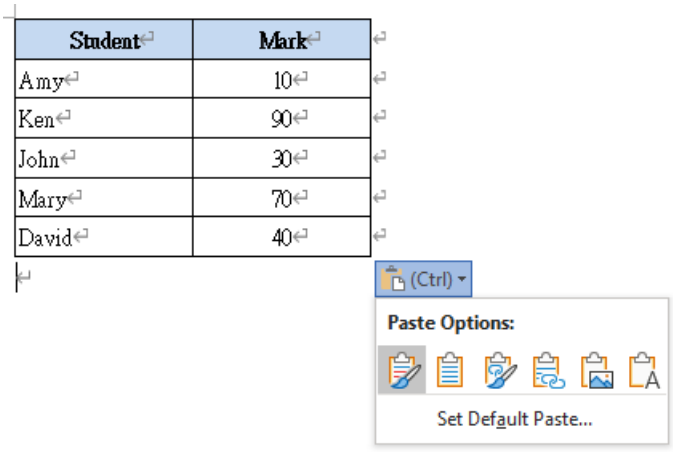


4.3 Using Excel Data in Word and PowerPoint Documents

Its many presentation features notwithstanding, Microsoft Excel is at heart an analytical tool. When it comes time to organize information and present it to others, you're likely to turn to Word and PowerPoint. Naturally, these programs are designed to work hand-in-glove with Excel, so you can easily do your number crunching in Excel and transfer the results to Word or PowerPoint when you need to make a verbal or visual presentation.

4.3.1 Pasting an Excel Table from the Clipboard

If you copy an Excel worksheet range to the Clipboard and then paste into Word, the smart-tag menu that appears below the lower-right corner of the pasted data, provides quick access to the formatting options that Microsoft thinks you're most likely to want.



These options are as follows:

- **Keep Source Formatting.** Word receives the data as a block of HTML and creates a table, preserving the fonts, alignment properties, numeric formatting, text color, and shading of your original. In most, but not all, cases, this option (the default) is an adequate way to create a table in Word that matches the appearance of your Excel data. After you have performed the paste, you can use commands on Word's Table menu to modify such characteristics as column widths and the position of the table within surrounding text.
- **Match Destination Table Style.** The data becomes a table in Word, but Word formats it as if you had created the table directly in Word. Numeric formatting and character styles that you used in Excel are preserved, but in most other respects your data will look as though you typed it in Word rather than pasting it from Excel. If your default font in Word is Times New Roman,

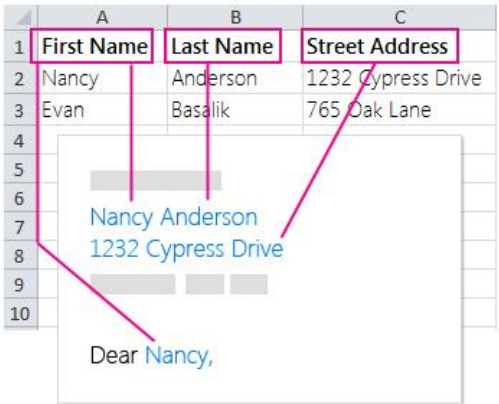
for example, your table will appear in Times New Roman, regardless of what font you used in Excel. Use this option if you want to make the table's appearance blend in maximally with the rest of your document. Note, however, that if your data in Excel uses non-default alignments, you'll probably need to do some formatting after it arrives in Word. As with the default choice (Keep Source Formatting), Word's Table menu is available to help you with column widths, text-flow options, and so on.

- **Keep Text Only.** If you choose this option, Word does not create a table. Instead, it simply pastes each cell's contents in the current default font, separating cells with single tab characters. You might find this option useful if you're simply copying a single column from Excel. Where multiple columns are involved, the Keep Text Only choice usually produces a misaligned hash in Word.
- **Apply Style or Formatting.** This option behaves like the Keep Source Formatting option, but causes Word to display the Styles and Formatting task pane, allowing you to apply styles or character formatting immediately.

4.4 Mail Merge

4.4.1 Overview

Mail merge is useful for creating a set of documents that are essentially the same but where each document contains unique elements. For example, in a letter that announces a new product, company logo and the text about the product will appear in each letter, and the address and greeting line will be different in each letter.



4.4.2 Document Type

Word provides tools for incorporating your data into the following kinds of documents.

- **Letters** that include a personalized greeting. Each letter prints on a separate sheet of paper.
- **Email** where each recipient's address is the only address on the To line. You'll be sending the email directly from Word.
- **Envelopes** or **Labels** where names and addresses come from your data source.
- **Directory** that lists a batch of information for each item in your data source. Use it to print out your contact list, or to list groups of information, like all of the students in each class. This type of document is also called a catalog merge.

4.4.3 Data Sources

Recipients of a mail merge usually come from a list of names and data in an existing list, like an Excel spreadsheet, or your Outlook contacts list. The existing list could also be any database that you can connect to. If you don't already have a list, you can type one up as part of the mail merge process. The list or database is known as the data source for your mail merge.

- **New list:** If you don't have a data source yet, use the form that opens to create your list. The list is saved as a database (.mdb) file that you can reuse.
- **Existing list:** An existing list might be an Excel spreadsheet, Access database, or some other type of database.
  - An Excel spreadsheet works well as a data source for mail merge if all data is well-formatted and on one sheet so that it can be read by Word.
  - With Access, you can select data from any table or query defined in the database.
  - To access other kinds of data sources, you'll run the Data Connection Wizard:
- **Outlook Contact List:** You can retrieve contact information directly from your Outlook contact list in Word.

4.4.4 Creating Mail Merge

4.4.4.1 Prepare data in Excel for mail merge

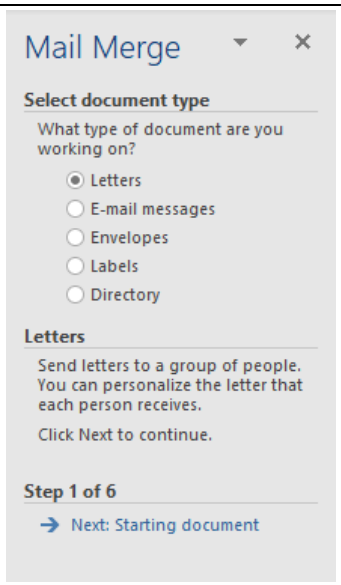
The most important step in the mail merge process is to set up and prepare your data. You'll use your Excel spreadsheet as the data source for the recipient list.

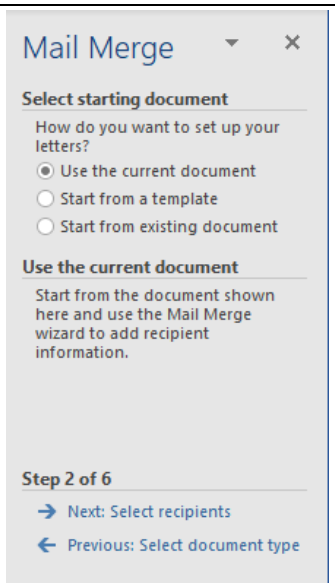
Here are some tips to prepare your data for a mail merge. Make sure:

- Column names in your spreadsheet match the field names you want to insert in your mail merge. For example, to address readers by their first name in your document, you'll need separate columns for first and last names.
- All data to be merged is present in the first sheet of your spreadsheet.
- Data entries with percentages, currencies, and postal codes are correctly formatted in the spreadsheet so that Word can properly read their values.
- The Excel spreadsheet to be used in the mail merge is stored on your local machine.
- Changes or additions to your spreadsheet are completed before it's connected to your mail merge document in Word.

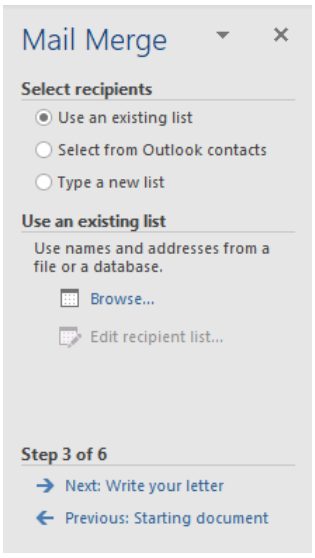
4.4.4.2 Start the Mail Merge

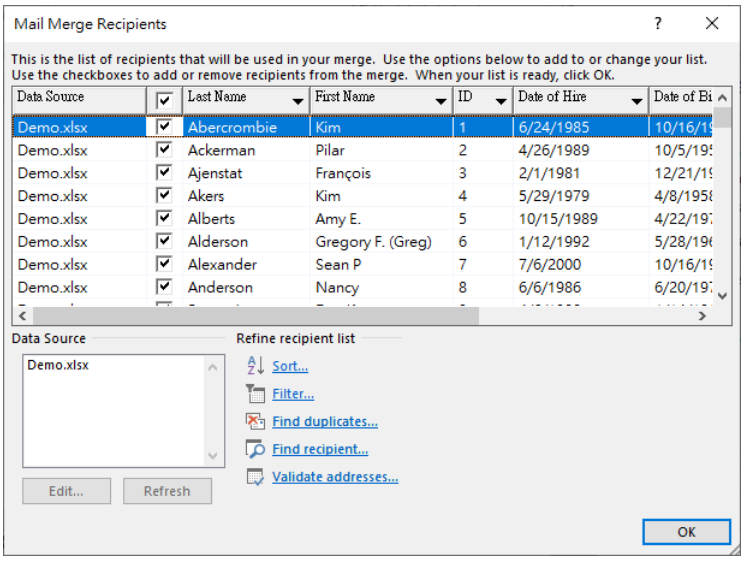
1. This step in the mail-merge process involves two choices. First, choose the type of document that you want to merge information into. Then, choose the main document that want to use. The main document is the model for all of the merged documents that eventually create.
   - The Mail Merge task pane opens with a question about what type of merged document you are creating. After you choose, click **Next** at the bottom of the task pane.
   - If your main document is already open, or you are starting with a blank document, you can click **Use the current document**. Otherwise, click **Start from a template** or **Start from existing document**, and then locate the template or document that you want to use.





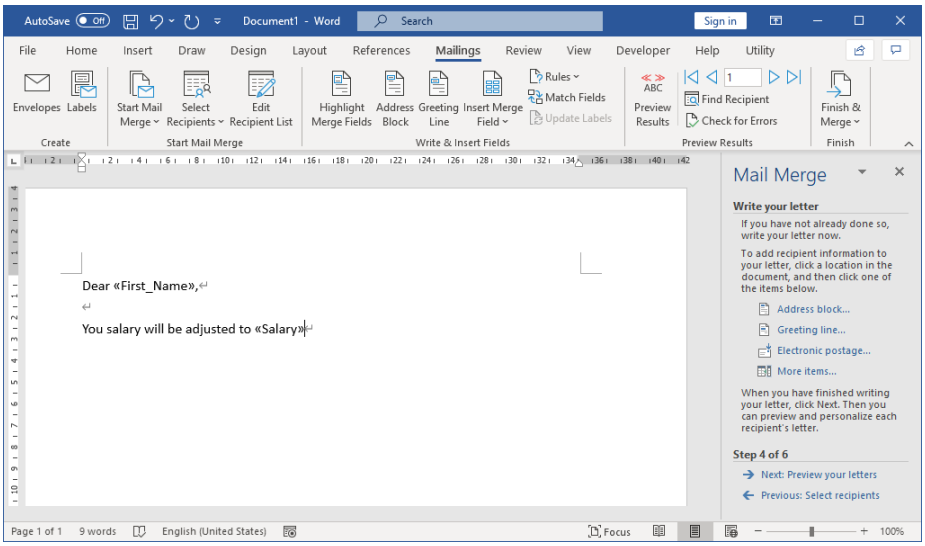
2. To merge unique information into your main document, you must connect to the data file where the unique information is stored. If you don't want to use all the data in the file in your merge, you can choose the records that you want to use.
   - In this step in the mail-merge process, you connect to the data file where the unique information that you want to merge into your documents is stored. If you have a Excel worksheet that contains your customer information, click **Use an existing list**, and then click **Browse** to locate the file.
   - Just because you connect to a certain data file doesn't mean that you have to merge information from all the records in that data file into your main document. After you connect to the data file that you want to use or create a new date file, the Mail Merge Recipients dialog box opens. You can select a subset of records for your mail merge by sorting or filtering the list.



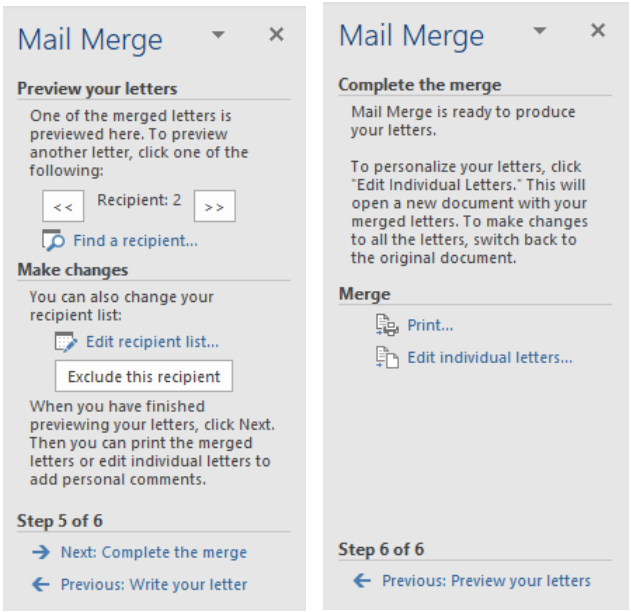


3. After you connect your main document to a data file, you're ready to add fields that indicate where the unique information will appear in each copy of the document that you generate when you merge. To make sure that Word can find a column in your data file that corresponds to every address or greeting element, you may need to match fields.

- If your main document is still blank, type the information that will appear in each copy. Then, add fields by clicking the hyperlinks in the task pane. Fields are placeholders that you insert into the main document at locations where you want unique information to appear. For example, you can click the Address block or Greeting line links in the task pane to add fields near the top of a new product letter, so that each recipient's letter contains a personalized address and greeting. Fields appear in your document within chevrons, for example, «AddressBlock». If you click More items in the task pane, you can add fields that match any of the columns in your data file.



4. After you add fields to your main document, you are ready to preview the merge results. When you're satisfied with the preview, you can complete the merge.
   - You can preview your merged documents and make changes before complete the merge
   - What you do now depends on what type of document you're creating. If you are merging letters, you can print the letters or modify them individually. If you choose to modify the letters, Word saves them all to a single file, with one letter per page.



5. Working with External Data

5.1 Introduction

You can compile your data into Excel by retyping or by copying and pasting. But importing is most effective when you're working with large amounts of data that would be time-consuming to enter manually or too large to copy and paste. In addition, if you import your data, Excel can automatically update your reports and summaries whenever the original source database is updated.

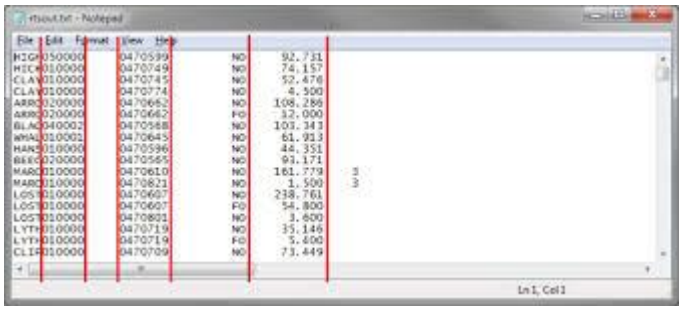
The main benefit of connecting to external data is that you can periodically analyse this data in Excel without repeatedly copying the data, which is an operation that can be time-consuming and error prone. After connecting to external data, you can also automatically refresh your Excel workbooks from the original data source whenever the data source is updated with new information.

5.2 Text Import Wizard

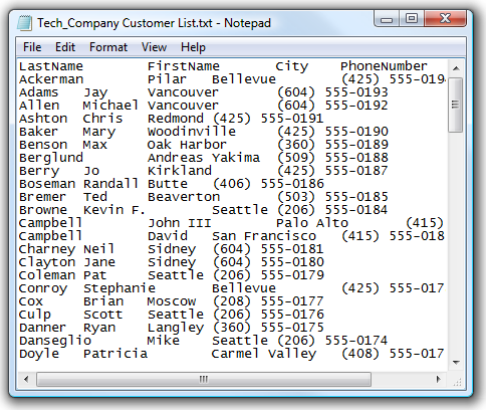
5.2.1 Different File Types

Text files, CSV files, and Excel spreadsheets are great ways to store data, depending on your need:

- Text File (TXT) – Text files contain plain text and are commonly created with Notepad
  - Fixed Width Text File: Data in a fixed-width text file is arranged in rows and columns, with one entry per row. Each column has a fixed width, specified in characters, which determines the maximum amount of data it can contain. No delimiters are used to separate the fields in the file.
  - Tab-Delimited Text File: A tab-delimited text file is a file containing tabs that separate information with one record per line. A tab delimited file is often used to upload data to a system
- Comma Separated Value File (CSV) – A CSV file also contains plain text and is versatile because it can be opened on any operating system, in any text editor, and also in spreadsheet applications, like Excel. If you paste spreadsheet data into a CSV file, it's separated by commas.



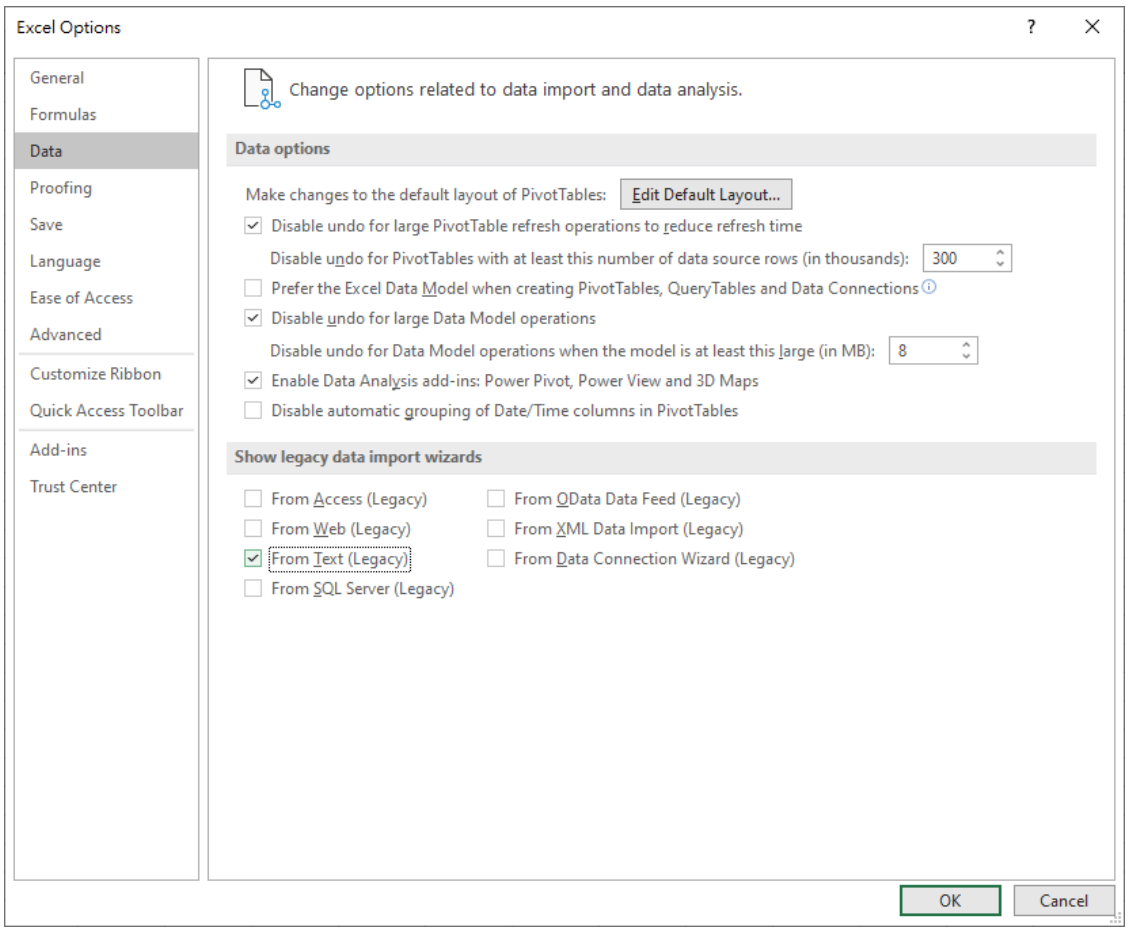
Fixed-width Text File



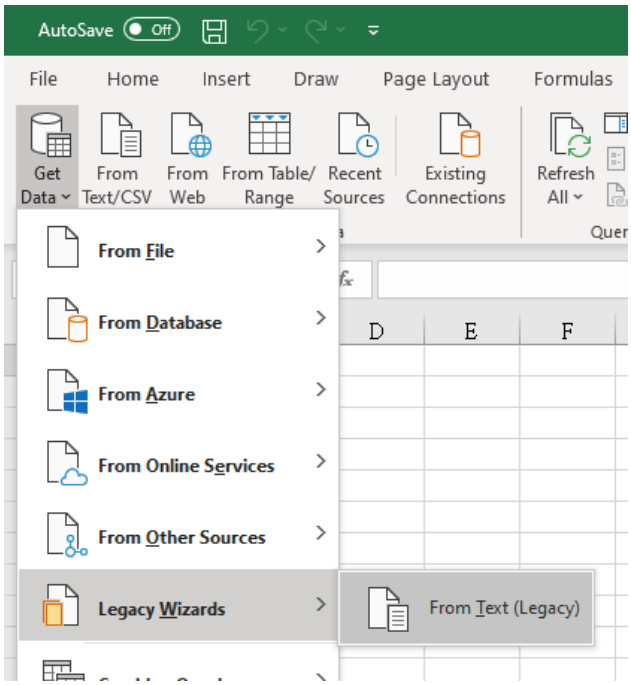
Tab-delimited Text File

5.2.2 Using Text Import Wizard

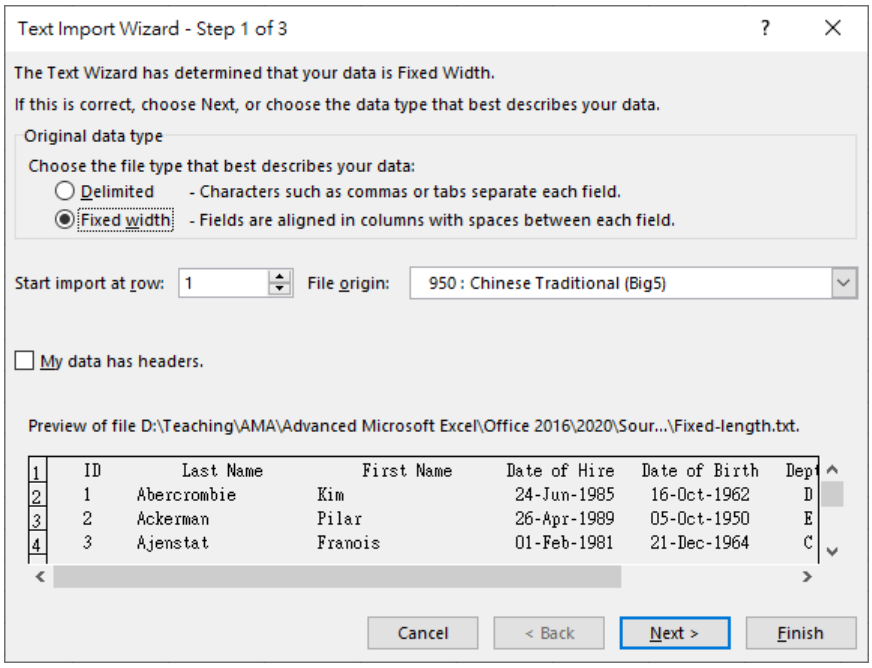
1. In order to activate the **Text Import Wizard**, select the **Data** button on the left of the **Excel Options** and tick the checkbox **From Text (Legacy)**.



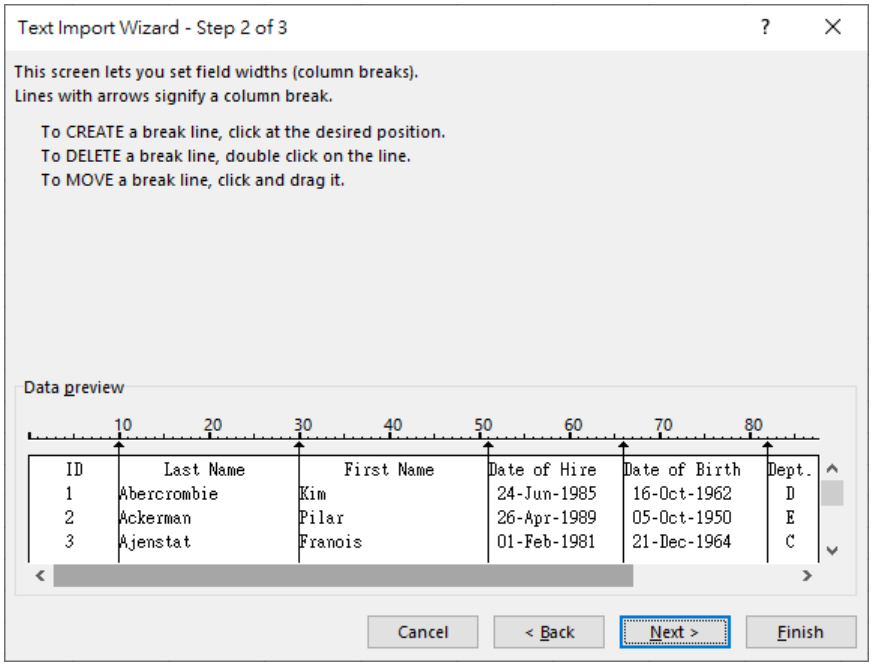
2. In the Data tab, select Get **Data ➔ Legacy Wizards ➔ From Text (Legacy)**.



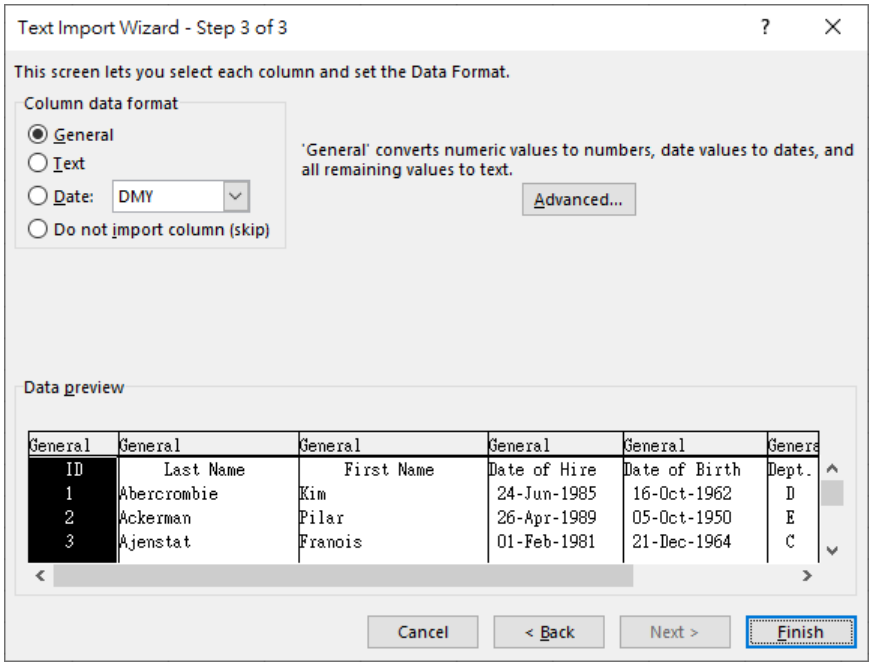
3. The Text Import Wizard will be popup after select the file. Select "**Fixed width**" and press **[Next>]**.
   - **Original data type:** If items in the text file are separated by tabs, colons, semicolons, spaces, or other characters, select Delimited. If all of the items in each column are the same length, select Fixed width.
   - **Start import at row:** Select a row number to specify the first row of the data that you want to import.
   - **File origin:** Select the character set that is used in the text file. In most cases, you can leave this setting at its default. If you know that the text file was created by using a different character set than the character set that you are using on your computer, you should change this setting to match that character set.



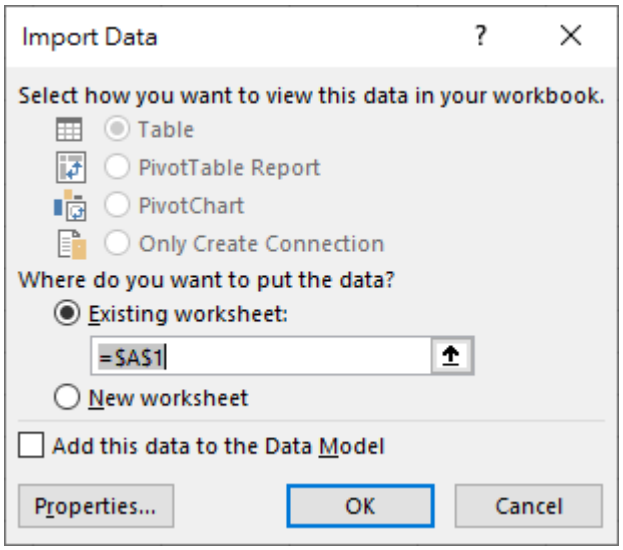
4. To specify how you want to divide the text into columns.



5. Define the **Column data format** and click **[Finish]**



6. Define where do you want to put the data.



7. The data will be imported.

	A	B	C	D	E	F	G
1	ID	Last Name	First Name	Date of Hire	Date of Birth	Dept.	Salary
2	1	Abercrombie	Kim	24-Jun-85	16-Oct-62	D	US$91,000
3	2	Ackerman	Pilar	26-Apr-89	5-Oct-50	E	US$31,000
4	3	Ajenstat	Franois	1-Feb-81	21-Dec-64	C	US$48,000
5	4	Akers	Kim	29-May-79	8-Apr-58	C	US$47,000
6	5	Alberts	Amy E.	15-Oct-89	22-Apr-70	D	US$60,000
7	6	Alderson	Gregory F.	12-Jan-92	28-May-64	D	US$100,000
8	7	Alexander	Sean P	6-Jul-00	16-Oct-62	E	US$29,000
9	8	Anderson	Nancy	6-Jun-86	20-Jun-76	C	US$68,000
10	9	Bacon Jr.	Dan K.	6-Apr-88	14-Jan-61	B	US$85,000
11	10	Bankert	Julie	21-Apr-83	24-Nov-77	C	US$100,000
12	11	Barbariol	Angela	16-Feb-96	18-Apr-64	A	US$92,000

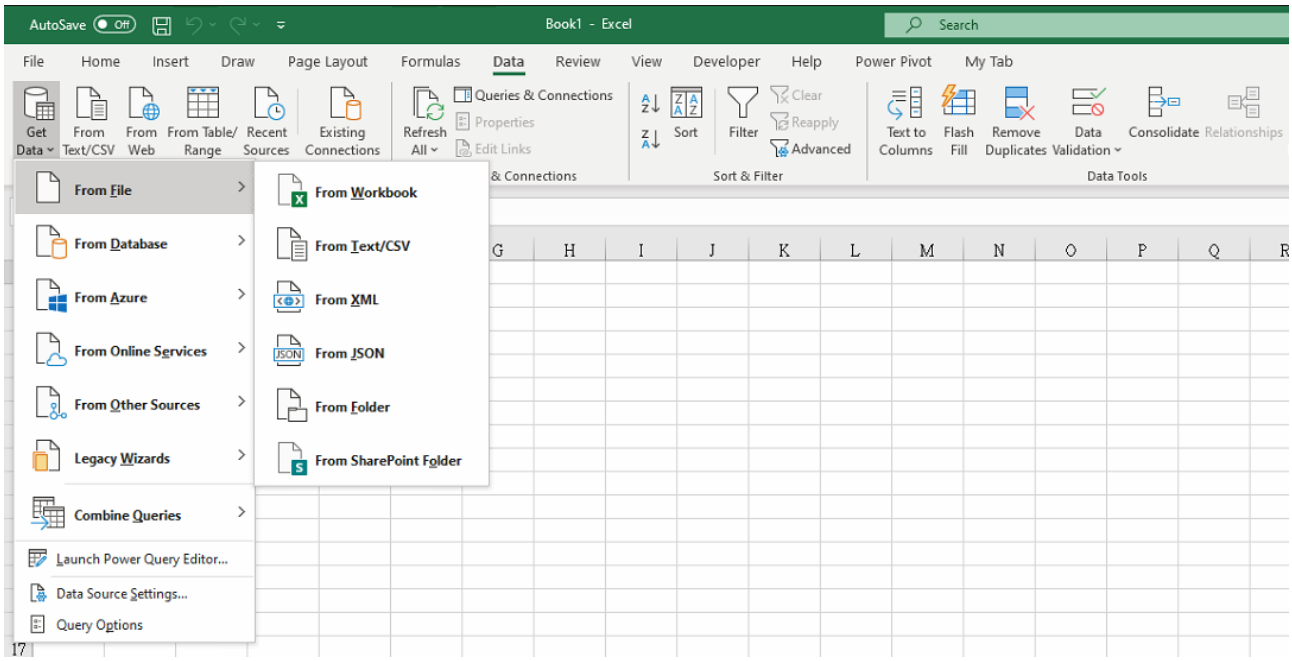
5.3 Power Query

5.3.1 What is Power Query?

Power Query is a business intelligence tool available in Excel that allows you to import data from many different sources and then clean, transform and reshape your data as needed. It allows you to set up a query once and then reuse it with a simple refresh. Power Query can import and clean millions of rows into the data model for analysis after. The user interface is intuitive and well laid out so it's really easy to pick up. It's an incredibly short learning curve when compared to other Excel tools like formulas or VBA.

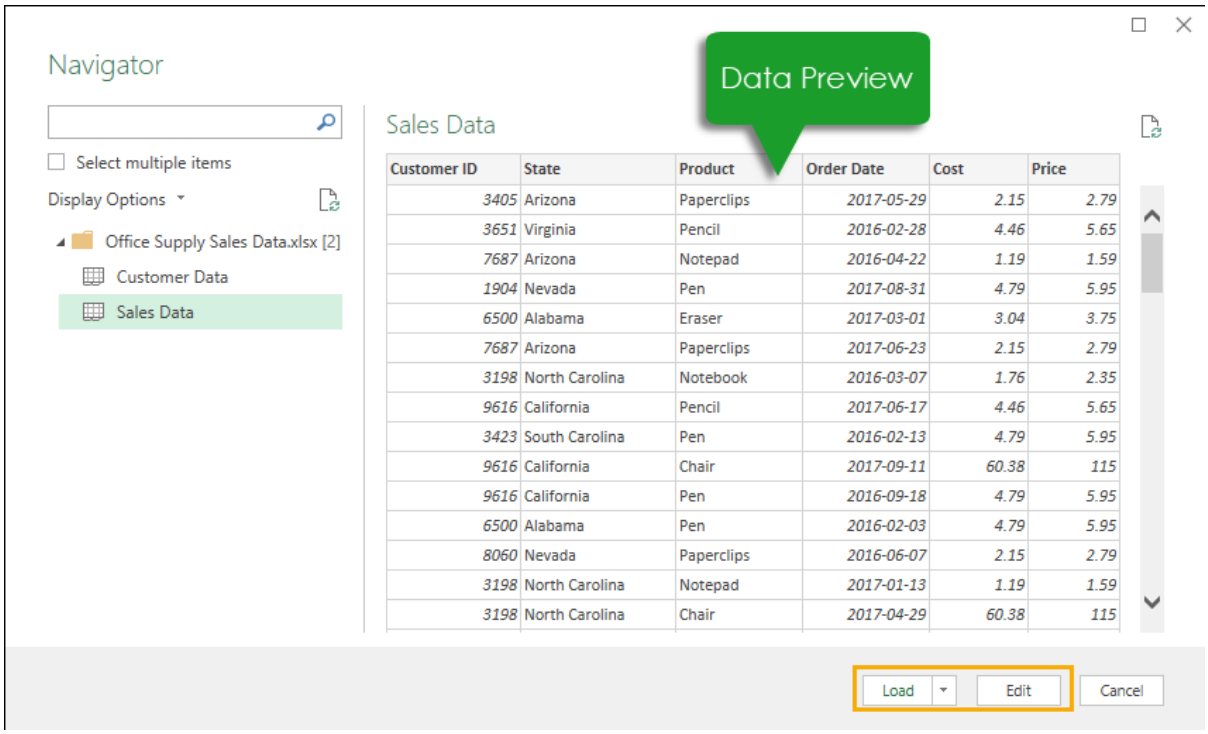
5.3.2 What can Power Query Import?

Importing your data with Power Query is simple. Excel provides many common data connections that are accessible from the Data tab and can be found from the **Get Data** command. There are a couple of the more common query types available in the top level of the ribbon commands found in the **Get & Transform** section of the **Data** Tab.



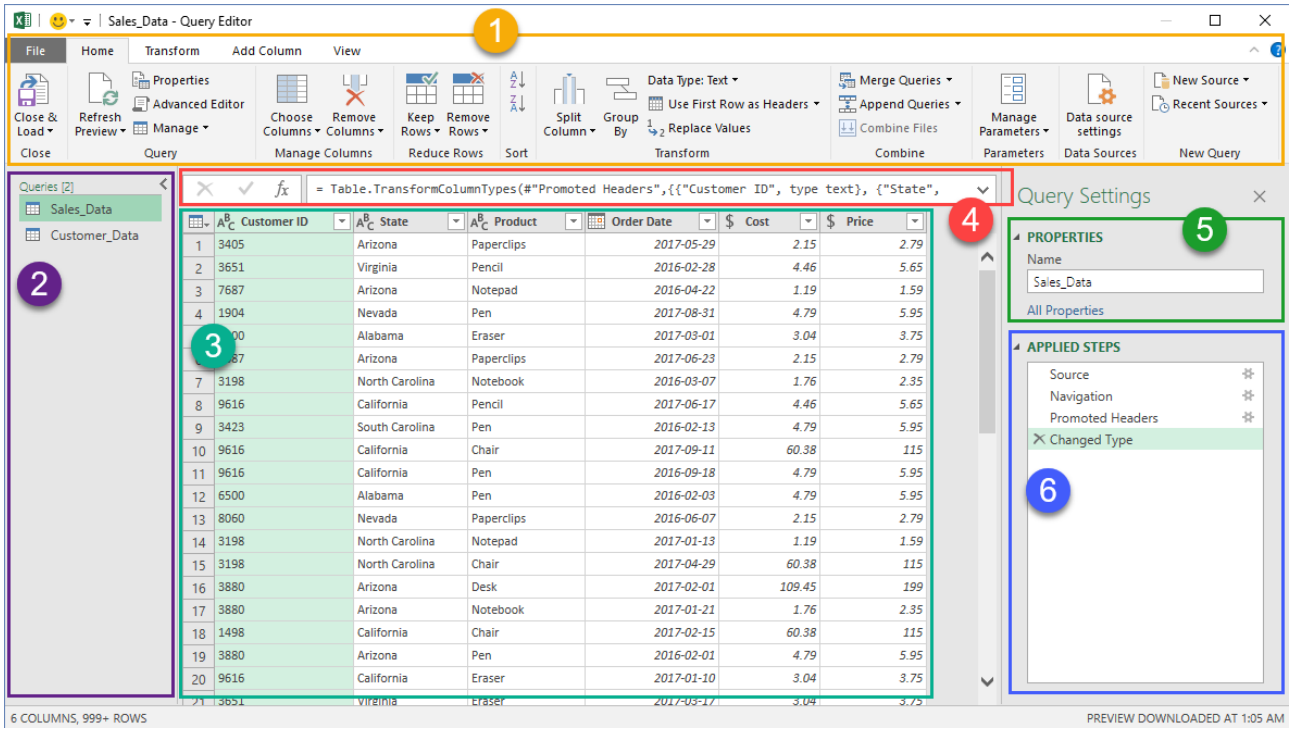
- **From File** – Get data from a single file such as an Excel workbook, Text or CSV file, XML and JSON files. You can also import multiple files from within a given folder.
- **From Database** – Get data from various databases such as SQL Server, Microsoft Access, Analysis Services, SQL Server Analysis Server, Oracle, IBM DB2, MySQL, PostgreSQL, Sybase, Teradata and SAP HANA databases.
- **From Azure** – Get data from Microsoft Azure
- **From Online Services** – Get data from online services like Sharepoint, Microsoft Exchange, Dynamics 365, Facebook and Salesforce.
- **From Other Sources** – Get data from other sources like a table or range inside the current workbook, from the web, a Microsoft Query, Hadoop, OData feed, ODBC and OLEDB.

Depending on which type of data connection you choose, Excel will guide you through the connection set up and there might be several options to select during the process. At the end of the setup process, you can preview the data in the data preview window to make sure it's what you're expecting. You can then load the data as is by pressing the **[Load]** button, or you can proceed to the query editor to apply any data transformation steps by pressing the **[Edit]** button.



5.3.3 Query Editor

After connecting your data with edit option, you will be presented with the query editor. This is where any data transformation steps will be created or edited. There are 6 main areas in the editor.



(1) **The Ribbon** – The user interface for the editor is quite similar to Excel and uses a visual ribbon style command center. It organizes data transformation commands and other power query options into 5 main tabs.

(2) **Query List** – This area lists all the queries in the current workbook. You can navigate to any query from this area to begin editing it.

(3) **Data Preview** – This area is where you will see a preview of the data with all the transformation steps currently applied. You can also access a lot of the transformation commands here either from the filter icons in the column headings or with a right click on the column heading.

(4) **Formula Bar** – This is where you can see and edit of the current transformation. Each transformation you make on your data is recorded and appears as a step in the applied steps area.

(5) **Properties** – This is where you can name your query. When you close and load the query to an Excel table, power query will create a table with the same name as its source query if the table name isn't already taken.

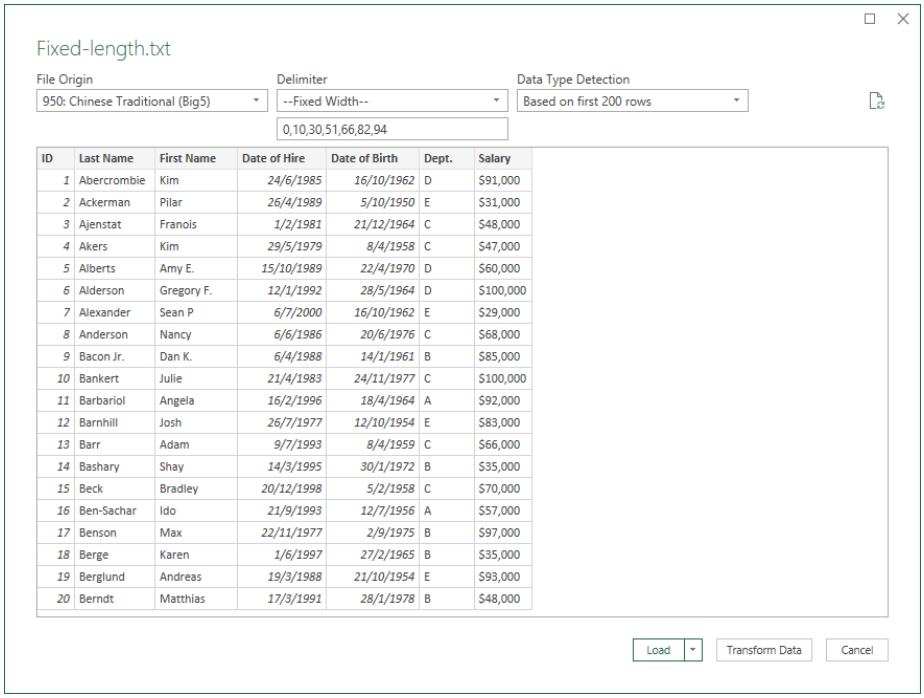
(6) **Applied Steps** – This area is a chronological list of all the transformation steps that have been applied to the data. You can move through the steps here and view the changes in the data preview area. You can also delete, modify or reorder any steps in the query here.

5.3.4 Import Data to Excel

5.3.4.1 Import from Fixed-width Text File

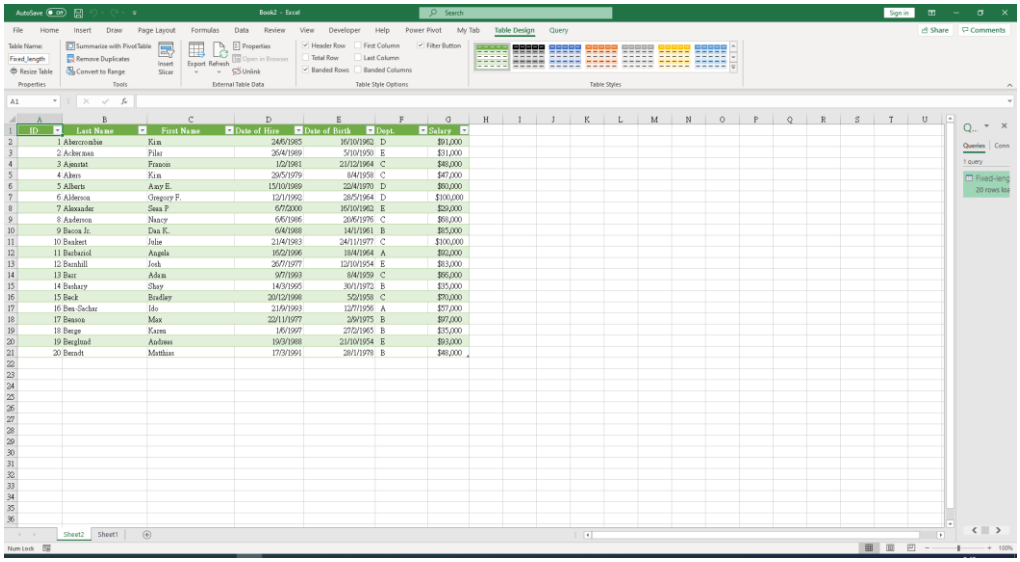
In order to import a text file in fixed-length or tab-delimiter format, follow these steps:

1. Click the cell you want to put the data and then **Data ➔ Get & Transform Data ➔ From Text/CSV**.
2. Locate the file you want to import. To specify how you want to divide the text into columns and then click **[Load]**.



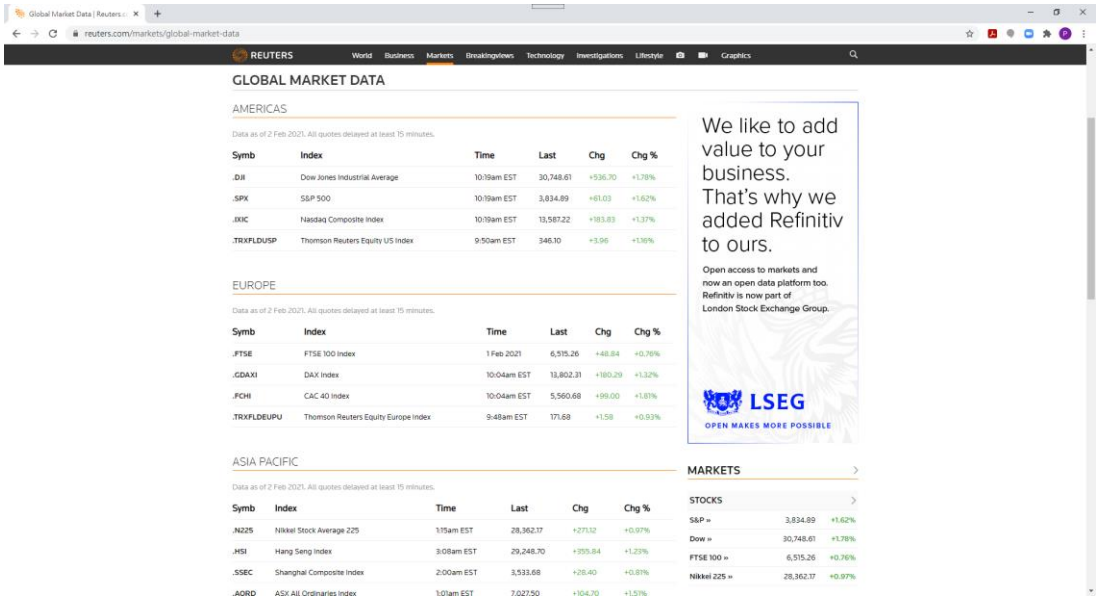
ID	Last Name	First Name	Date of Hire	Date of Birth	Dept.	Salary
1	Abercrombie	Kim	24/6/1985	16/10/1962	D	$91,000
2	Ackerman	Pilar	26/4/1989	5/10/1950	E	$31,000
3	Ajenstat	Franois	1/2/1981	21/12/1964	C	$48,000
4	Akers	Kim	29/5/1979	8/4/1958	C	$47,000
5	Alberts	Amy E.	15/10/1989	22/4/1970	D	$60,000
6	Alderson	Gregory F.	12/1/1992	28/5/1964	D	$100,000
7	Alexander	Sean P	6/7/2000	16/10/1962	E	$29,000
8	Anderson	Nancy	6/6/1986	20/6/1976	C	$68,000
9	Bacon Jr.	Dan K.	6/4/1988	14/1/1961	B	$85,000
10	Bankert	Julie	21/4/1983	24/11/1977	C	$100,000
11	Barbariol	Angela	16/2/1996	18/4/1964	A	$92,000
12	Barnhill	Josh	26/7/1977	12/10/1954	E	$83,000
13	Barr	Adam	9/7/1993	8/4/1959	C	$66,000
14	Bashary	Shay	14/3/1995	30/1/1972	B	$35,000
15	Beck	Bradley	20/12/1998	5/2/1958	C	$70,000
16	Ben-Sachar	Ido	21/9/1993	12/7/1956	A	$57,000
17	Benson	Max	22/11/1977	2/9/1975	B	$97,000
18	Berge	Karen	1/6/1997	27/2/1965	B	$35,000
19	Berglund	Andreas	19/3/1988	21/10/1954	E	$93,000
20	Berndt	Matthias	17/3/1991	28/1/1978	B	$48,000

3. The file will be loaded into the Excel table.

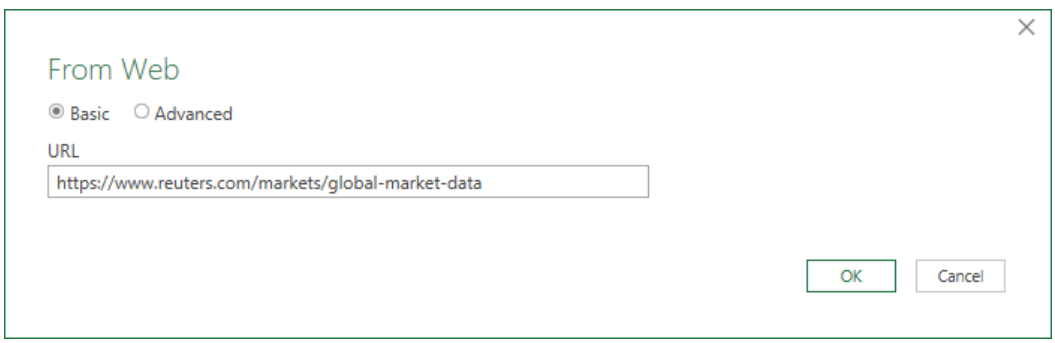


5.3.4.2 Import from Web

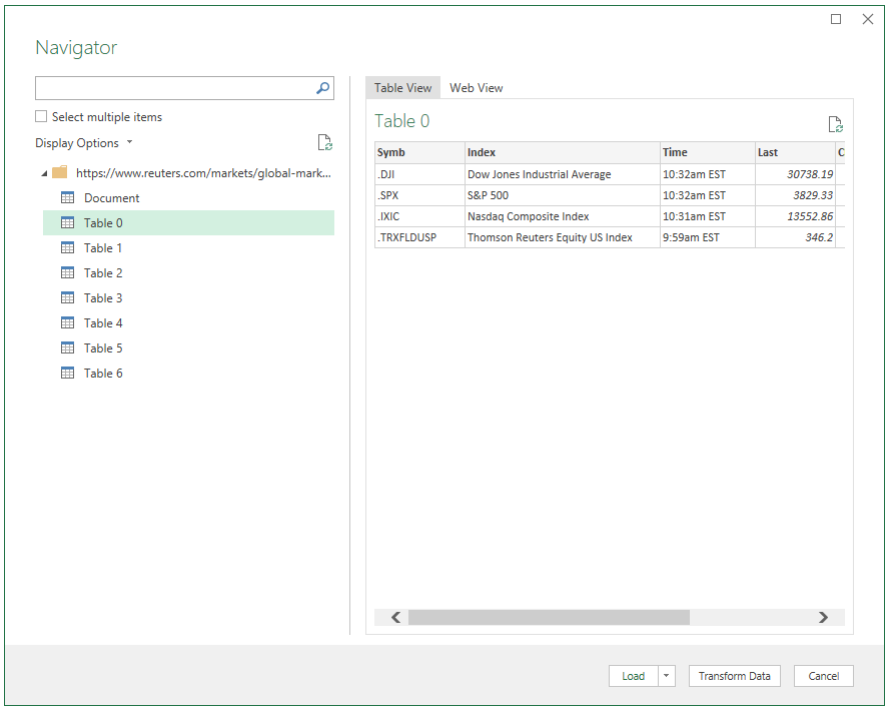
1. The first step is to connect to the data source. For example, we will get the global market data from Reuters (https://www.reuters.com/markets/global-market-data). The information we need is in a table that is part of the overall webpage.



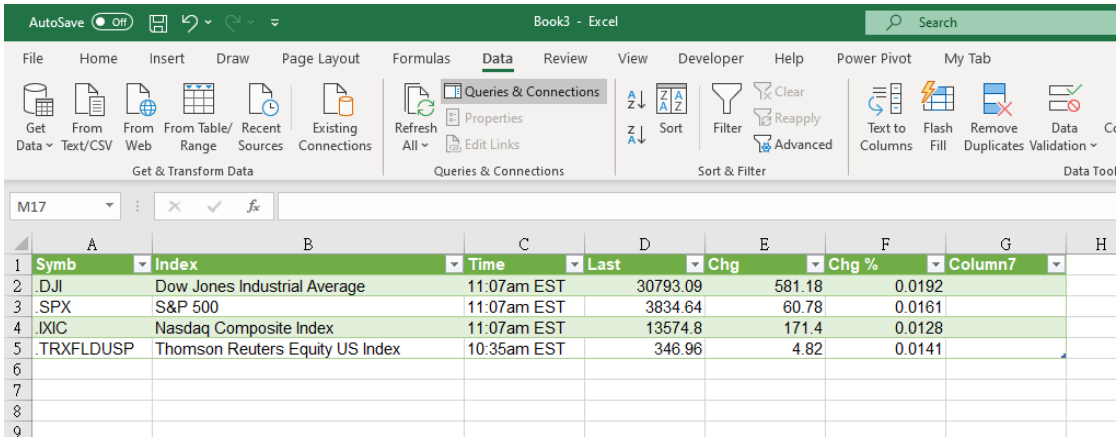
2. Select **Data ➔ Get & Transform Data ➔ From Web**. Input URL in the "**From Web**" dialog box and press **[OK]** to continue.



3. Select the table you wish to import. Then press **[Load]**.



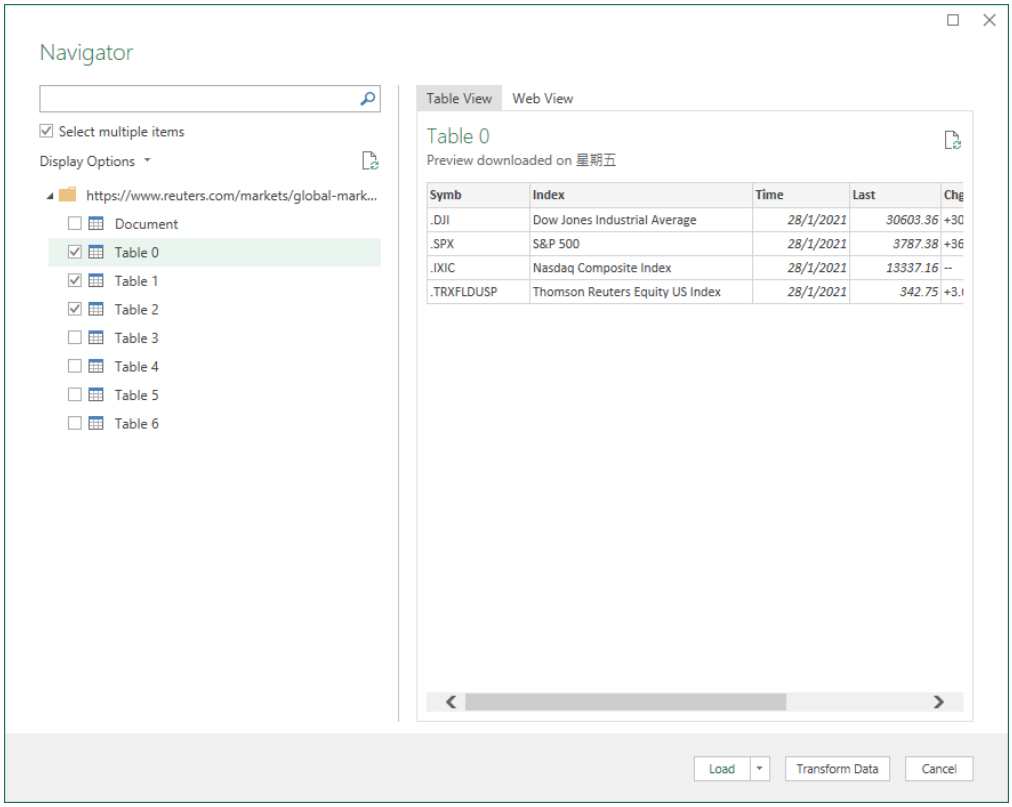
4. The data are imported to Excel.



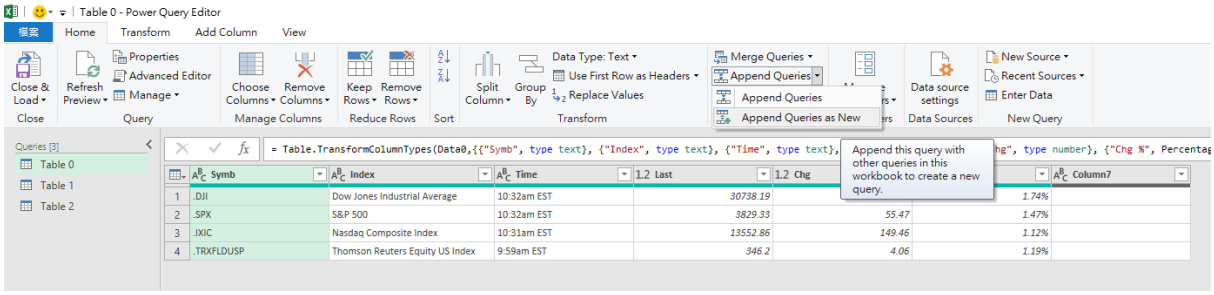
5.3.4.3 Import by Transformation

1. Refer to previous example, there are multiple tables in the website. We would like to combine them into one single table for output. Select **Data ➔ Get & Transform Data ➔ From Web**. Input URL in the "**From Web**" dialog box and press **[OK]** to continue.

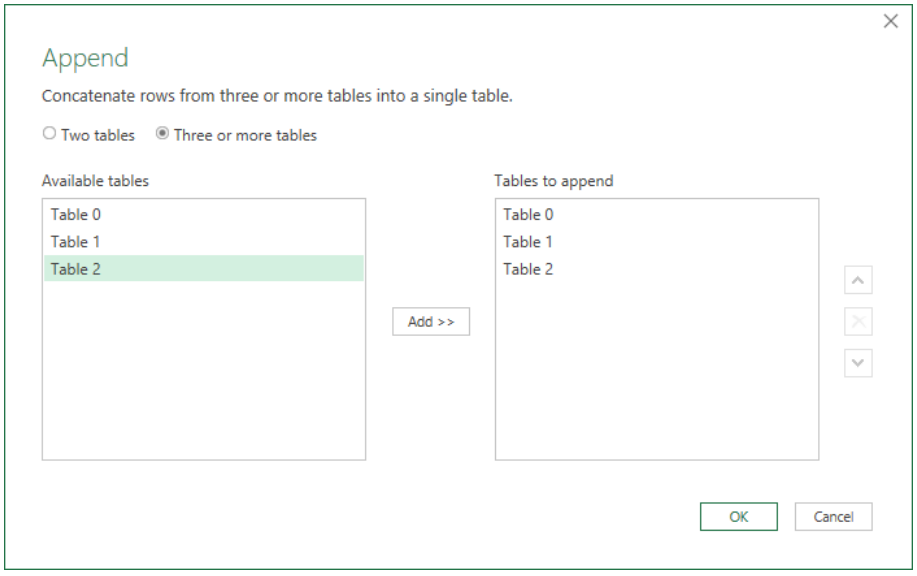
2. In order to select multiple tables, tick the "**Select multiple items**" checkbox. Then select the table you wish to import. Then press **[Transform Data]**.



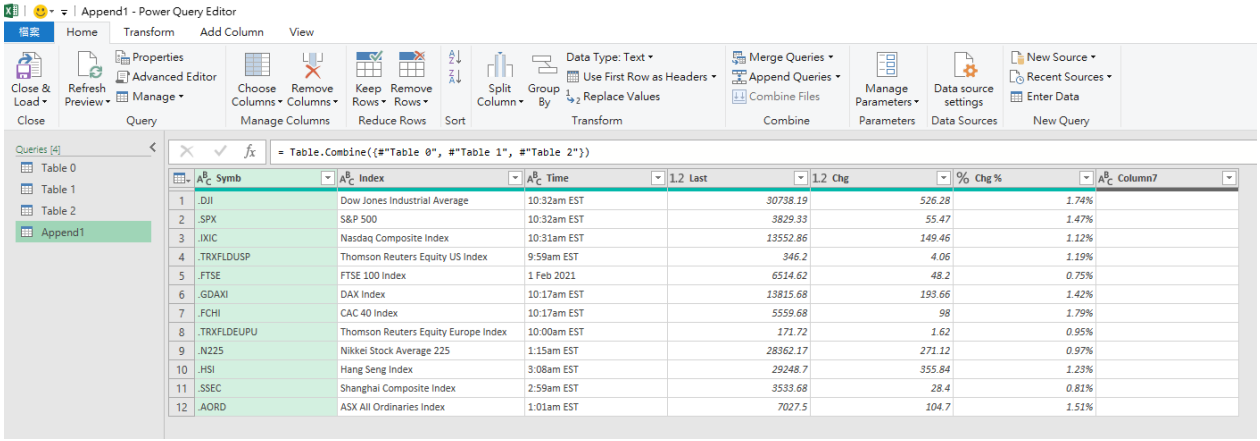
3. In **Home** tab, **Combine** group, select **Append Queries ➔ Append Queries as New**.



4. Select "**Three or more tables**" and add all tables to "**Tables to append**" section. Press **[OK]** to continue.

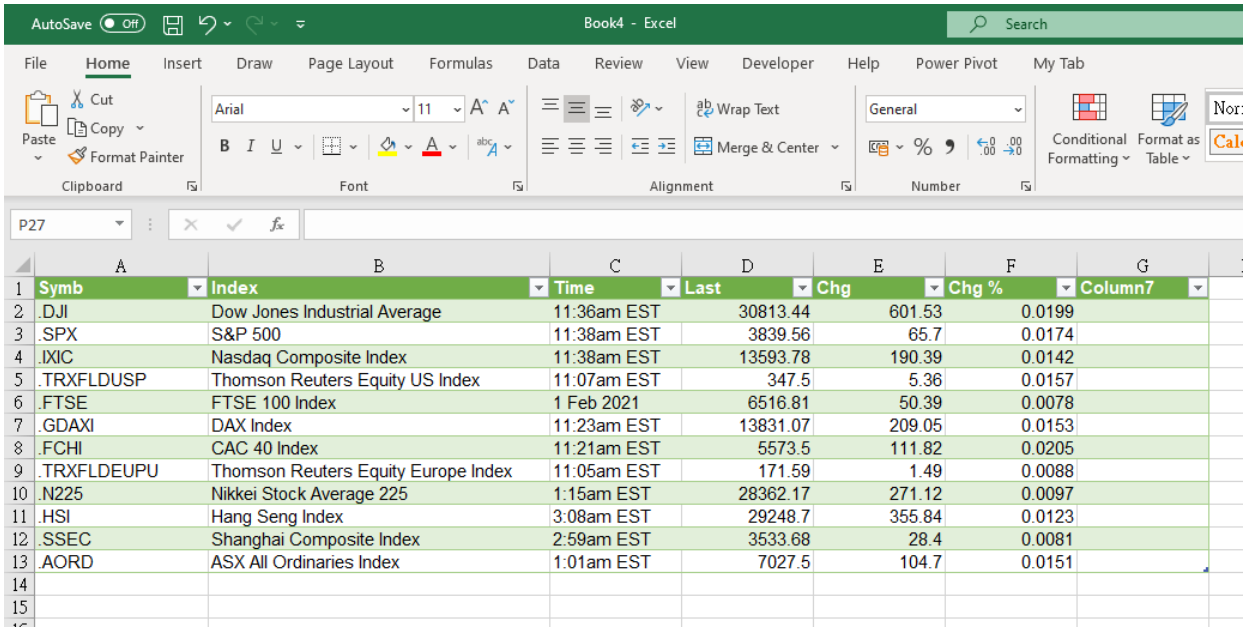


5. Three tables combined into a new query “Append1”. Press **[Load & Load]** to back to Excel.



	Symb	Index	Time	Last	Chg	Chg %	Column7
1	.DJI	Dow Jones Industrial Average	10:32am EST	30738.19	526.28	1.74%	
2	.SPX	S&P 500	10:32am EST	3829.33	55.47	1.47%	
3	.IXIC	Nasdaq Composite Index	10:31am EST	13552.86	149.46	1.12%	
4	.TRXFLDUSP	Thomson Reuters Equity US Index	9:59am EST	346.2	4.06	1.19%	
5	.FTSE	FTSE 100 Index	1 Feb 2021	6514.62	48.2	0.75%	
6	.GDAXI	DAX Index	10:17am EST	13815.68	193.66	1.42%	
7	.FCHI	CAC 40 Index	10:17am EST	5559.68	98	1.79%	
8	.TRXFLDEUPU	Thomson Reuters Equity Europe Index	10:00am EST	171.72	1.62	0.95%	
9	.N225	Nikkei Stock Average 225	1:15am EST	28362.17	271.12	0.97%	
10	.HSI	Hang Seng Index	3:08am EST	29248.7	355.84	1.23%	
11	.SSEC	Shanghai Composite Index	2:59am EST	3533.68	28.4	0.81%	
12	.AORD	ASX All Ordinaries Index	1:01am EST	7027.5	104.7	1.51%	

6. The data will be imported as a single table in worksheet.



	A	B	C	D	E	F	G
1	Symb	Index	Time	Last	Chg	Chg %	Column7
2	.DJI	Dow Jones Industrial Average	11:36am EST	30813.44	601.53	0.0199	
3	.SPX	S&P 500	11:38am EST	3839.56	65.7	0.0174	
4	.IXIC	Nasdaq Composite Index	11:38am EST	13593.78	190.39	0.0142	
5	.TRXFLDUSP	Thomson Reuters Equity US Index	11:07am EST	347.5	5.36	0.0157	
6	.FTSE	FTSE 100 Index	1 Feb 2021	6516.81	50.39	0.0078	
7	.GDAXI	DAX Index	11:23am EST	13831.07	209.05	0.0153	
8	.FCHI	CAC 40 Index	11:21am EST	5573.5	111.82	0.0205	
9	.TRXFLDEUPU	Thomson Reuters Equity Europe Index	11:05am EST	171.59	1.49	0.0088	
10	.N225	Nikkei Stock Average 225	1:15am EST	28362.17	271.12	0.0097	
11	.HSI	Hang Seng Index	3:08am EST	29248.7	355.84	0.0123	
12	.SSEC	Shanghai Composite Index	2:59am EST	3533.68	28.4	0.0081	
13	.AORD	ASX All Ordinaries Index	1:01am EST	7027.5	104.7	0.0151	
14							
15							

5.3.5 Refresh Imported Data

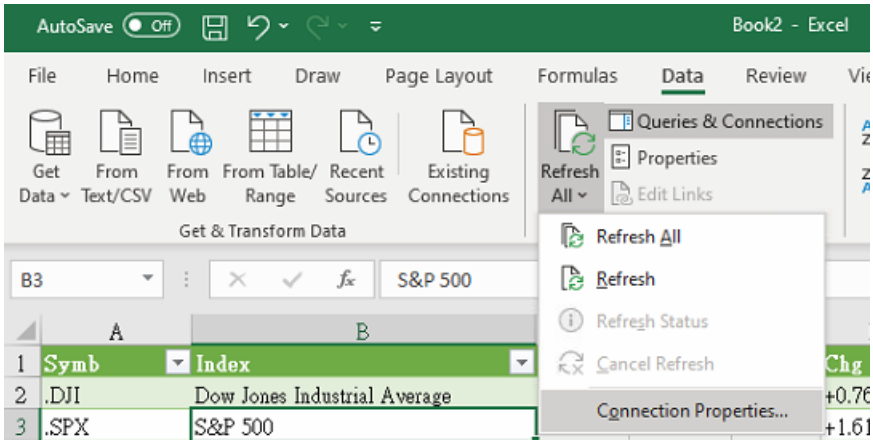
Excel provides many options for refreshing imported data, including refreshing the data whenever you open the workbook and automatically refreshing data at timed intervals. You can continue to work in Excel while data is being refreshed, and you can also check the status of the refresh while it's being refreshed.

If your external data source requires a password to gain access to the data, you can require that the password be entered each time the external data range is refreshed.

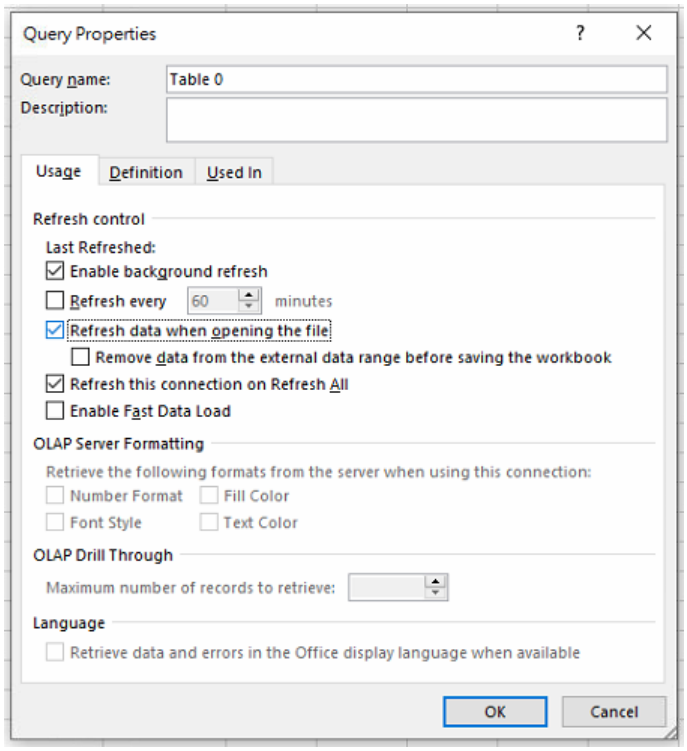
When an external data range expands and additional records are returned, Excel can fill formulas in adjacent columns or within the data range so that they remain next to the appropriate data.

5.3.5.1 Configure Connection Properties

You can define many connection properties such as automatically refresh, background refresh by choosing **Data** tab, **Queries & Connections** group, select **Refresh All ➔ Connection Properties…**.



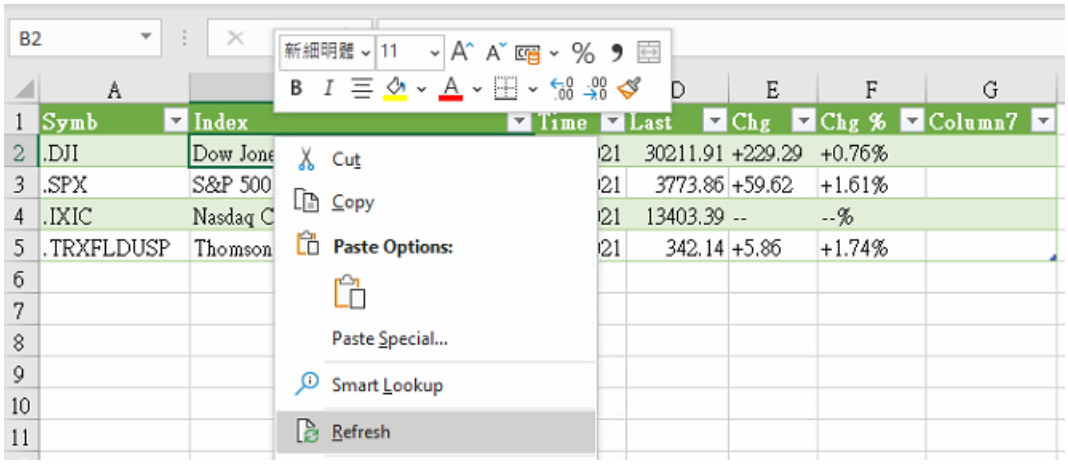
Then you can setup your configuration in the Query Properties dialog box,



- Tick the "**Enable background refresh"** check box to run the query in the background or clear it to run the query while you wait.
- If your enable the "**Refresh every minute**", then the workbook will refresh automatically in the given period.
- You can refresh an external data range automatically when you open the workbook if the checkbox "**Refresh data when opening the file**" is ticked. Moreover, if the "**Remove data from the external data range before saving the workbook**" checkbox is ticked, the workbook is saved without external data in order to reduce file size

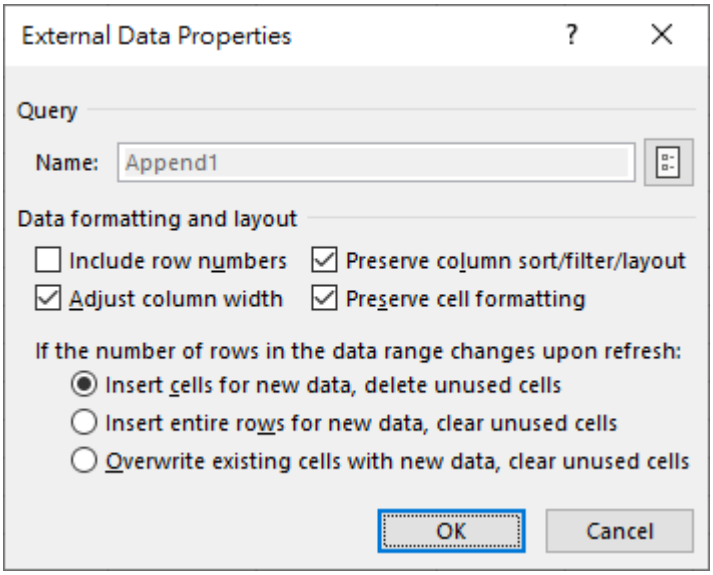
5.3.5.2 Refresh Data in an Imported File

If your worksheet contains more than one external data range that you want to refresh, right click the imported data and click **Refresh**.



5.3.5.3 Preserve Cell Formatting when you Refresh an External Data Range

1. Select the data, then choose **Data** tab, **Queries & Connections** group, select **Properties**.



2. Do one or both of the following under Data formatting and layout section:
   - If you want to preserve cell formatting that you apply, select the **Preserve cell formatting** check box.
   - If you want to preserve column widths that you set, clear the **Adjust column width** check box.
3. Click **[OK]**.
4. To refresh the external data range, right click the imported data and click Refresh.

6. Collaboration and Security

6.1 Introduction

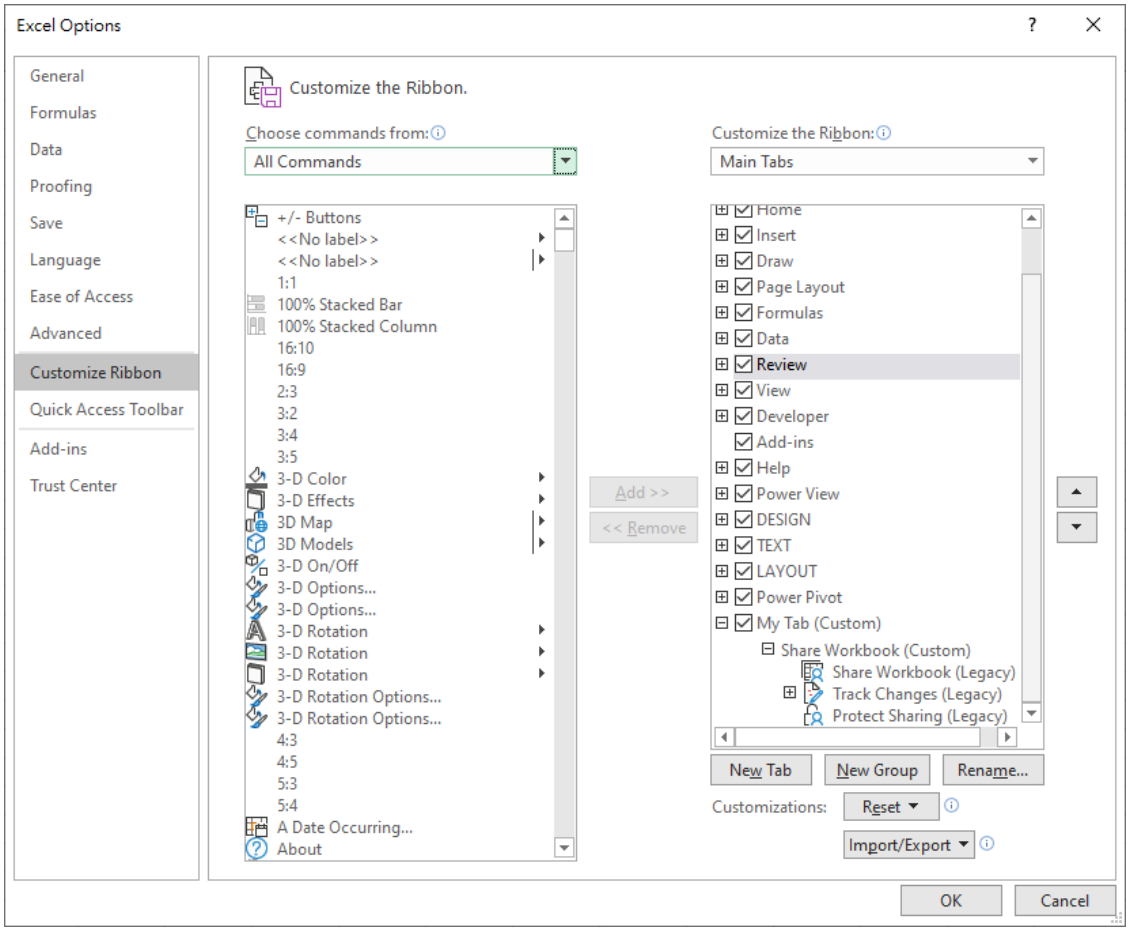
It has always been possible to share Excel files on a network. You just had to make sure that you coordinated your efforts to avoid having more than one person open a file at the same time.

6.2 Shared Workbook

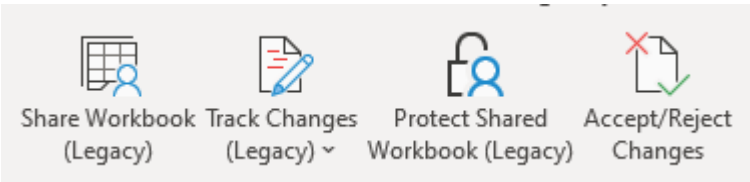
6.2.1 Enabling the Shared Workbook Feature

In the **Excel Options,** click the **Customize Ribbon** button on the left. To add the **Data Form** option, change the drop-down list to **All Commands** and add the following commands.

- Share Workbook (Legacy)
- Trace Changes (Legacy)
- Protect and Share Workbook (Legacy)
- Accept/Reject Change

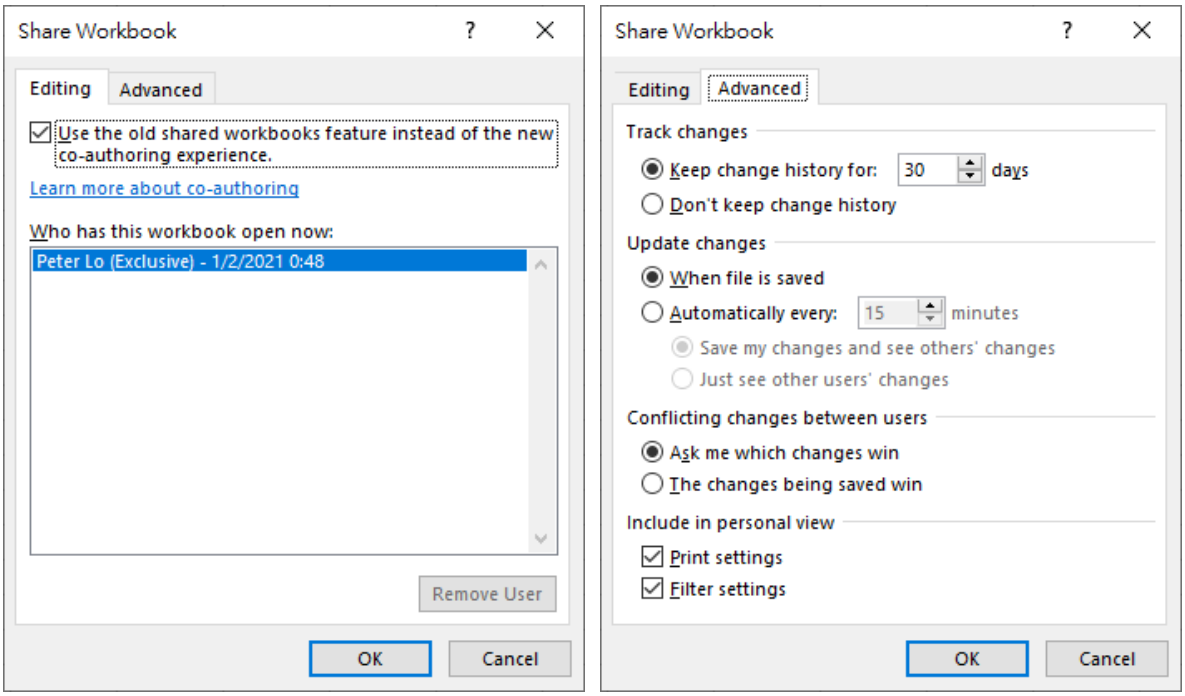


Once you click **[OK]** button, the command will be added to the tab.

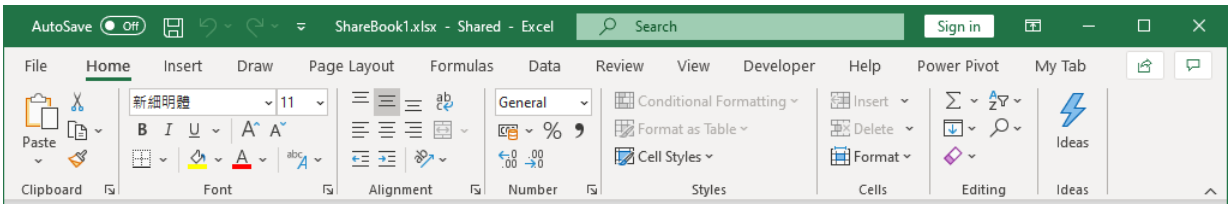


6.2.2 Share Workbook

1. Create a new workbook or open an existing workbook. Then place it on a network location. For example, put it on a location like \\server_name\folder_name. Then choose **Share Workbook (Legacy)**.
2. Select "**Use the old-shared workbooks features instead of the new co-authoring experience**" and click **[OK]**. Only one user is allowed to change the workbook by default. You can change some aspects of the default behavior of shared workbooks. Each shared workbook user can set these options individually. Use the first section on the **Advanced** tab to specify the length of time you want to keep track of changes, or whether you want to track them at all



3. If this is a new workbook, type a name in the File name box. If this is an existing workbook, click **[OK]** to save the workbook. When you're done, "**- Shared**" will appear at the top of the Excel window, next to the filename.



6.2.3 Tracking

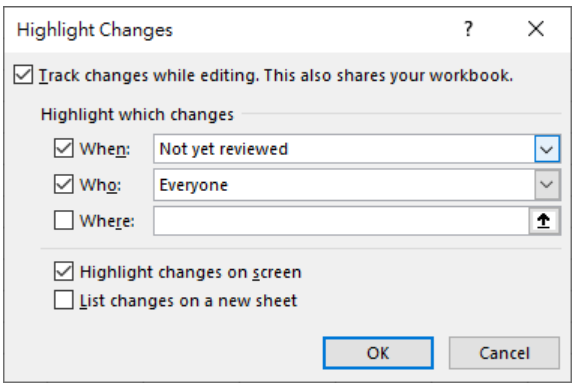
Excel can maintain and display information about how a worksheet was changed. Change tracking logs details about workbook changes each time you save a workbook. You can use this history to understand what changes were made, and to accept or reject revisions.

This capability is particularly useful when several users edit a workbook. It's also useful when you submit a workbook to reviewers for comments, and then want to merge input into one copy, selecting which changes and comments to keep

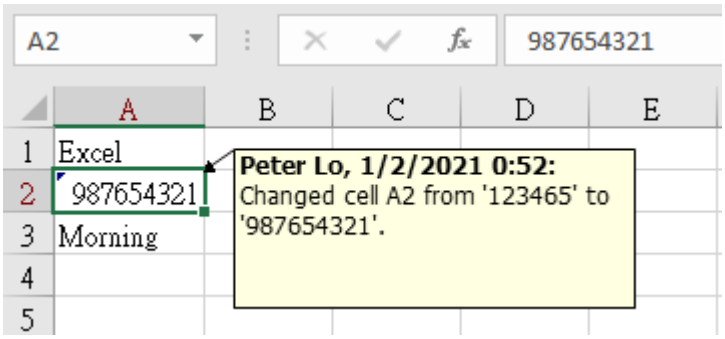
6.2.3.1 Highlight Changes

You can decide at any time to go through each change that has been made to the shared workbook, provided the "**Track changes while editing. This also shares your workbook**" check box was selected in the Highlight Changes dialog box when the worksheet was first saved for sharing.

1. Select **Track Change (Legacy)** ➔ **Highlight Changes…,** define **When**, **Who** and **Where** do you wish to review in the **Highlight Change** dialog box.



2. The list for the change will be displayed in color for indication.

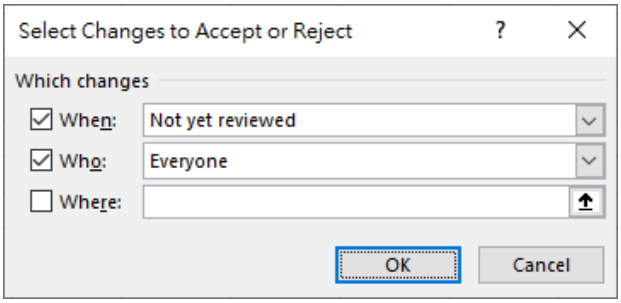


3. If the **List changes on a new sheet** checkbox is select, the selected changes will be displayed in a report in a new worksheet.

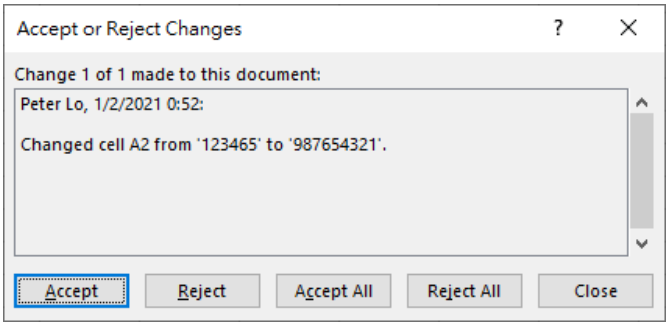
	A	B	C	D	E	F	G	H	I	J	K
1	Action Number	Date	Time	Who	Change	Sheet	Range	New Value	Old Value	Action Type	Losing Action
2	1	1/2/2021	0:52	Peter Lo	Cell Change	Sheet1	A2	987654321	123465		
3	2	1/2/2021	22:38	Peter Lo	Cell Change	Sheet1	A3	Evening	Morning		
4											
5	The history ends with the changes saved on 1/2/2021 at 22:38.										

6.2.3.2 Accept or Reject Changes

1. Select **Track Change (Legacy)** ➔ **Accept/Reject Changes**, define **when**, **who** and **where** do you wish to review in the **Select Changes to Accept or Reject** dialog box.



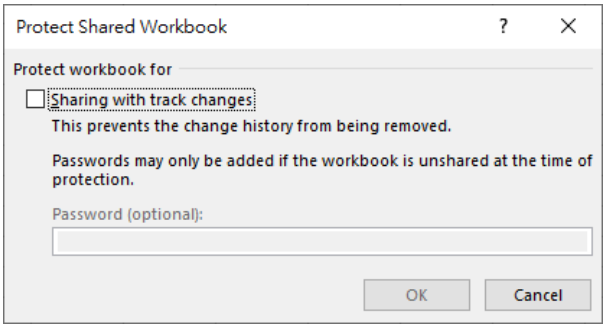
2. Then you can accept or reject each change one by one.



6.2.4 Protect Tracking Changes

Change tracking in Excel is closely linked with shared workbooks.

1. Select **Protect Shared Workbook (Legacy)**.



2. If you click **Sharing with track changes** and then click **[OK]**, change tracking for the shared workbook is protected so no one in your workgroup can turn it off directly. However, anyone can turn off the protection. To eliminate this possibility, you can enter a password in the **Protect Shared Workbook** dialog box. But you must do this when the workbook is not in shared mode. Then anyone who tries to turn off protection must enter the identical, case-sensitive password.

6.2.5 Unsupported Features

Please be aware that Shared Workbooks is an older method of sharing. Therefore, many items and actions are not supported when this method is used.

Unsupported Items	Unsupported Actions
Creating or inserting tables	Inserting or deleting blocks of cells
Adding or changing conditional formats	Deleting worksheets
Adding or changing data validation	Merging cells or splitting merged cells
Creating or changing charts or PivotChart reports	Sorting or filtering by format
Inserting or changing pictures or other objects	Using drawing tools
Inserting or changing hyperlinks	Assigning, changing, or removing passwords
Creating, changing, or viewing scenarios	Protecting or unprotecting worksheets or the workbook
Inserting automatic subtotals	Grouping or outlining data

Creating data tables	Writing, recording, changing, viewing, or assigning macros
Creating or changing PivotTable reports	Changing or deleting array formulas
Creating or applying slicers	Adding, renaming, or deleting XML maps
Creating or modifying sparklines	Mapping cells to XML elements
Adding or changing Microsoft Excel 4 dialog sheets	Using the XML Source task pane, XML toolbar, or XML commands on the Data menu
	Using a data form to add new data
Adding threaded comments	Editing, or deleting threaded comments

6.3 Protecting Files

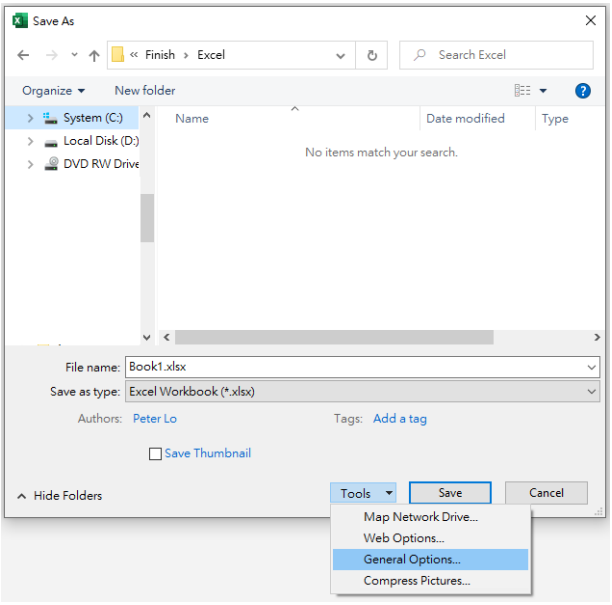
Excel features related to hiding data or locking data with passwords are not intended to secure or protect confidential information in Excel. These features are merely meant to obscure data or formulas that might confuse some users or to prevent others from viewing or making changes to that data. Excel does not encrypt data that is hidden or locked in a workbook. To help prevent modification of confidential data and to help protect it from being viewed, you may want to limit access to any workbook files that contain such information by storing them in locations that are available only to authorized users. Excel provides several layers of security and protection to control who can access and change your data:

- For optimal security, you should protect your entire workbook file with a password, allowing only authorized users to view or modify your data.
- For additional protection of specific data, you can protect certain worksheet or workbook elements, with or without a password. Use element protection to help prevent anyone from accidentally or deliberately changing, moving, or deleting important data.

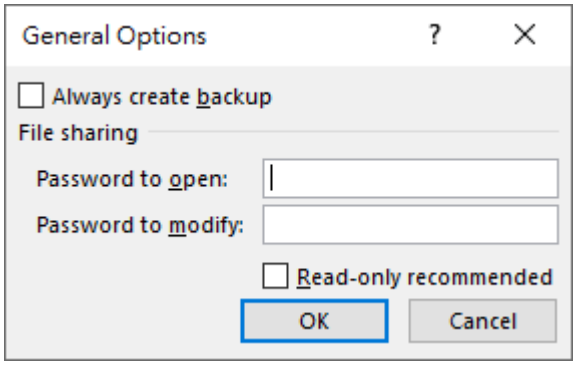
6.3.1 Securing a Workbook file

Password security at the workbook file level uses advanced encryption to help protect your workbook from unauthorized access.

1. Select **File** ➔ **Save As**, and then select **Tools** ➔ **General Options** in the **Save As** dialog.



2. You can specify two separate passwords that users must type to and then save the workbook.
   - **Password to open** – This password is encrypted to help protect your data from unauthorized access.
   - **Password to modify** – This password is not encrypted and is only meant to give specific users permission to edit workbook data and save changes to the file.



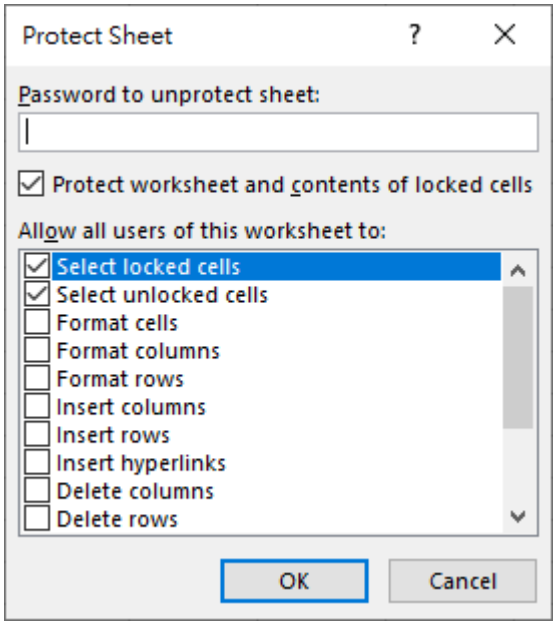
6.3.2 Protecting Specific Worksheet or Workbook Elements

When you share an Excel file so that others can collaborate on the data, you can prevent any user from making changes to specific worksheet or workbook elements by protecting (or locking down) certain parts of the file. You can also specify a password to allow individual users to modify specific elements.

When you protect a worksheet, all cells on the worksheet are locked by default, and users cannot make any changes to a locked cell. For example, they cannot insert, modify, delete, or format data in a locked cell. You can, however, specify which elements users will be allowed to change when you protect the worksheet.

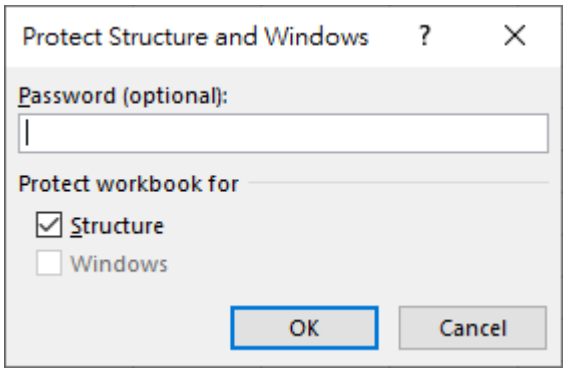
6.3.2.1 Protect Worksheet

To protect a worksheet, select **Review** group, **Change** Tab, **Protect Sheet**. You can control access to individual worksheet or chart sheet elements by selecting or clearing the following check boxes



6.3.2.2 Protect Workbook

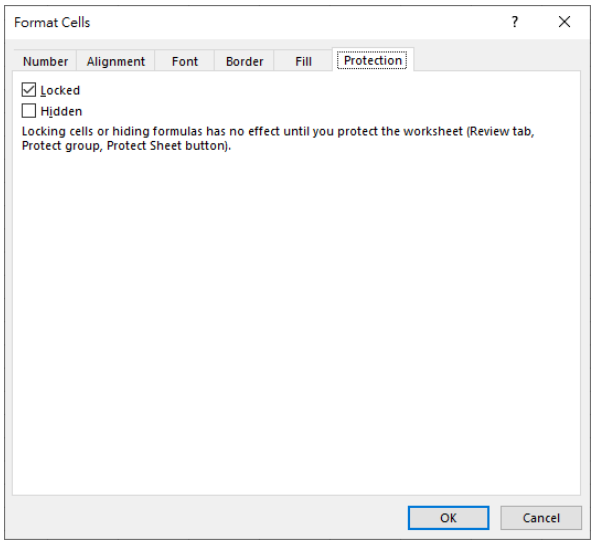
To protect a workbook, select **Review** group, **Change** Tab, **Protect Workbook**. You can control access to entity workbook by selecting or clearing the following check boxes.



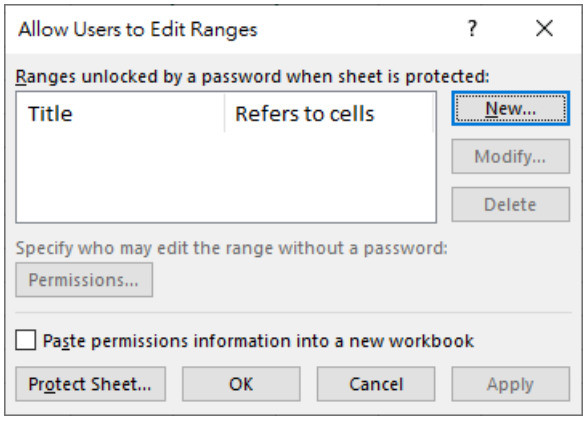
6.3.3 Permission to Access Specific Areas of a Protected Worksheet

Before you protect a worksheet, you can unlock the ranges that you want users to be able to change or enter data in. You can:

- Unlock cells for all users on the Protection tab of the Format Cells dialog box by choosing **Format ➔ Cells**.



- Unlock cells for specific users in the **Allow Users to Edit Ranges** dialog box by choosing select **Review** group, **Change** Tab, **Allow Users to Edit Ranges**.

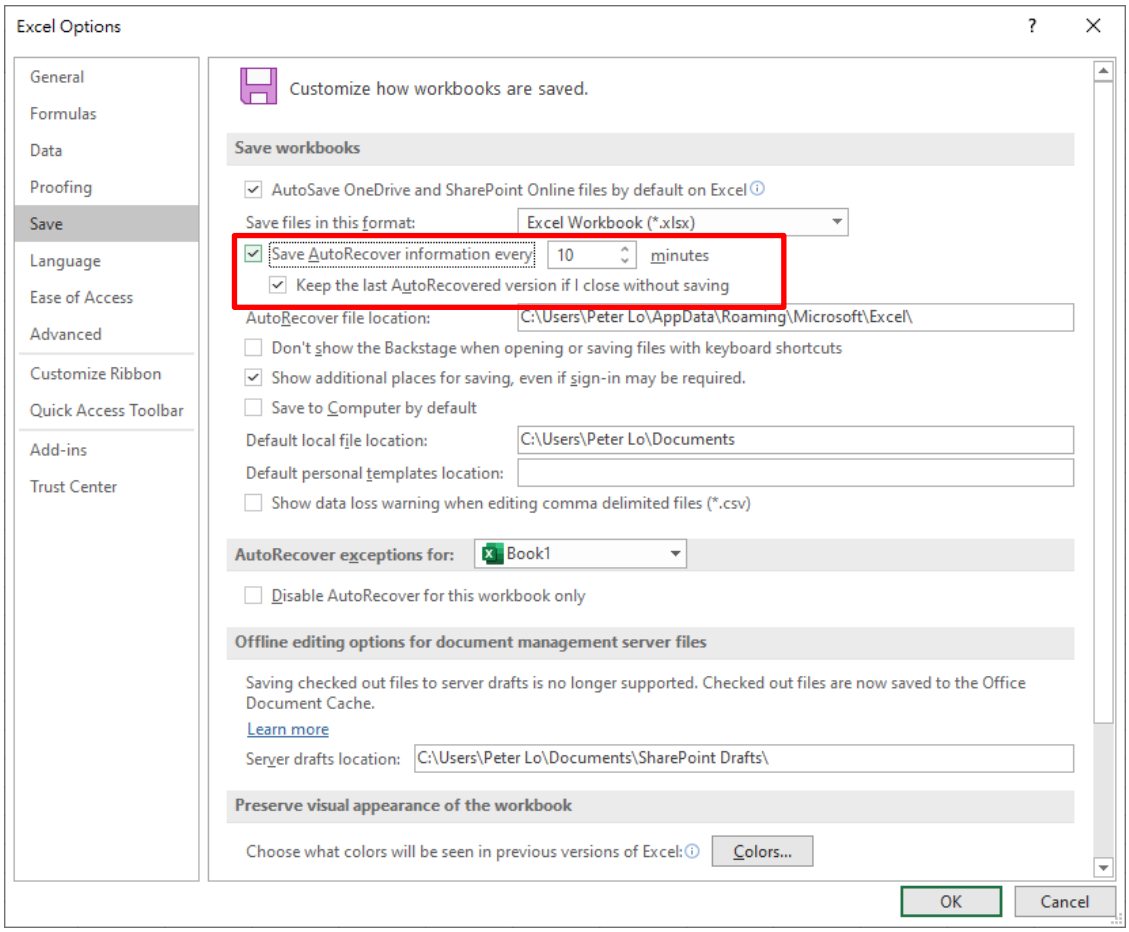


Users whom you specify in the Permissions for range dialog box (Permissions button) can automatically edit the range without entering the password. All other users are prompted for the password when they want to edit the range.

6.4 Recover Unsaved Excel Sheet

To save your effort and to save you from mess, there is a wonderful feature which will automatically keep saving your Excel sheet at certain interval of time and will maintain revisions of the same.

1. To ensure that Auto Save option is turned on in your Excel, just click on the **File ➔ Options**. On the Excel **Options** Window, Click the **Save** tab at the left hand pane. In the "**Save Workbooks**" option, ensure that the option "**Save AutoRecover information**" is enabled. Default time for saving is 10 minutes, you can increase or decrease it as per your needs. When this option is enabled and you have been working on an Excel Sheet for 10 minutes or more and you close it by mistake, you can recover up to last 5 AutoSave revisions of the same.



2. To recover an AutoSave version of an excel sheet, click **File ➔ Info** and check out the **Version** and **Manage Version** option. Some important points related to AutoSave Feature are:
   - Access up to the last five AutoSave versions of your previously saved active workbook. If you save and close your workbook, all AutoSave versions will automatically be deleted. If you close a previously saved workbook without saving, your last AutoSave version is kept until your next editing session.

- Recover workbooks that were never previously saved. Unsaved workbooks are saved for four days before they are automatically deleted.