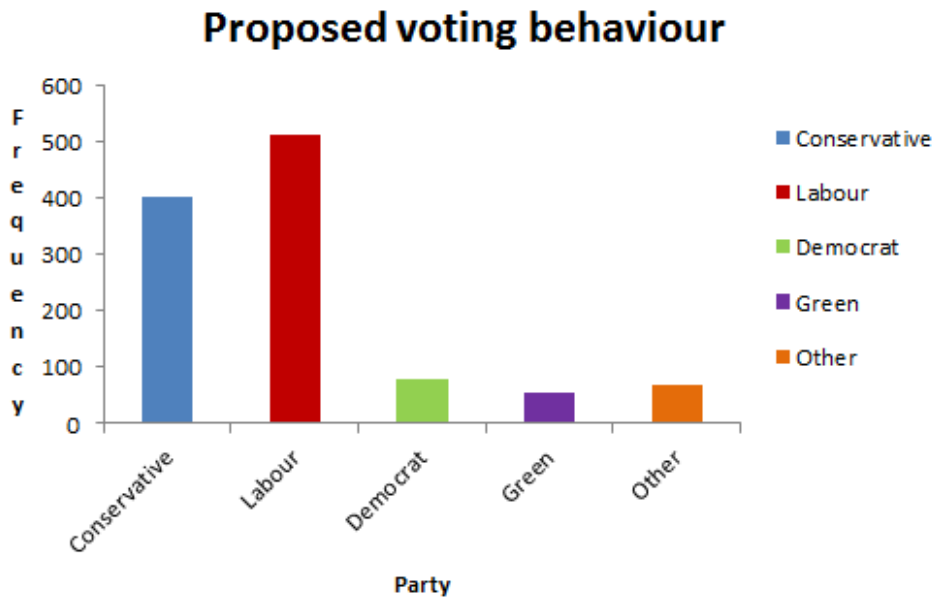
Introduction to Microsoft Excel

Online Workbook

Basic Statistics for Business and Management Students

Using Excel and IBM SPSS Statistics

This online workbook is intended to provide students with an introduction to the Microsoft Excel software package.



The document is available online to download for customers who have purchased the textbook Basic Statistics for Business and Management Students - Using Excel and IBM SPSS Statistics.

Created by Glyn Davis & Branko Pecar
Introduction to Microsoft Excel
Thursday, 01 October 2020

Introduction to Microsoft Excel

Microsoft Excel provides a series of tools that can be used to undertake the analysis of data sets as well as a presentation tool for reporting your results. It is assumed that you are familiar with **Microsoft Windows** and know how to perform tasks such as accessing commands from the menus on the menu bar, selecting items and entering information into a dialog box. This online workbook describes Microsoft Excel 2016, which is part of the **Office** suite of programmes, and focuses on the Excel skills required to enable the Excel user to undertake the statistical tests described within each chapter of the textbook.

Overview

A **spreadsheet** is a table of cells arranged in **rows** and **columns**. The data values in each cell can take many forms, such as text, dates, times, and numbers (including currency and percentages). The relationships between cells are called formulae. If you change the value in a cell, the contents of any cells that depend on that value will change automatically. This enables you to study what-if scenarios. Excel can create and manipulate spreadsheets (which are called **worksheets**). Excel can be used to enable calculations involving numbers, for example: (a) creating a family budget, (b) calculating mortgage payments, and (c) undertaking a range of statistical and non-statistical calculations. Furthermore, it is good at creating tables and graphs as illustrated in Figure WExcel1.1 below.

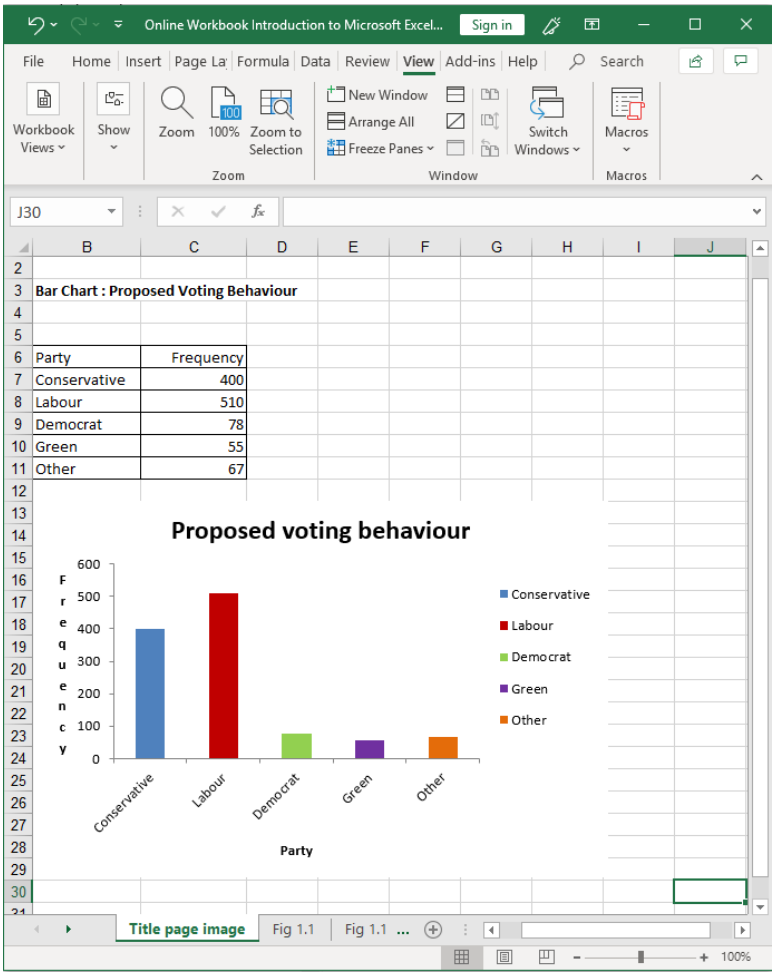


Figure WExcel1.1

The textbook is concerned with the application of the Excel spreadsheet to solve business statistics focused problems.

Learning objectives

On successful completion of this workbook you will be able to:

- Create a new Excel workbook and worksheets.
- Save and close workbooks.
- Format cells.
- Select a cell or a range of cells.
- Select a range of cells.
- Enter data into a cell or a range of cells e.g. numbers, text.
- Create and modify cell formulas.
- Create and apply names to a cell range.
- Print worksheets and workbooks and apply preview before printing worksheets.
- Understand that Excel can create a table and chart.
- Apply Excel functions to solve statistical problems.
- Load Excel Analysis ToolPak add-in to solve a range of statistical problems.
- Insert an Excel worksheet and chart into Microsoft Word.

Section 1 Introduction to Microsoft Excel

A spreadsheet is basically a document which has been divided into rows and columns. Excel is designed to ease the management of numbers and calculations. Various menu commands and buttons make it easy to arrange and format columns of numbers and to calculate totals, averages, percentages, financial, statistical and scientific formulas. The look of a spreadsheet application derives from the account ledgers that have been used to keep records for centuries. Ledger pages are lined off into rows and columns to record such things as items in inventory, income and expenses, debits and credits. The biggest advantage of a spreadsheet over these paper-based ledgers is the ability to update calculations automatically as new data is added to the worksheet.

Components of an Excel spreadsheet

- **Worksheets**
  Worksheets can be used to store, manipulate, calculate, analyse data, and create tables and charts.
- **Workbooks**
  These are a collection of sheets stored in the same file on the disk. By keeping related worksheets in the same workbook, it is easy to make simultaneous changes and edits to all workbook sheets at one time, or to consolidate related sheets or to do calculations involving multiple worksheets. The number of worksheets is constrained by the amount of available computer memory (default is 3 sheets).
- **A row**
  A Row is a line of Horizontal cells within a spreadsheet e.g. A3, B3,C3, D3, E3 etc...
  Within each worksheet there are 1,048,576 rows.
- **A column**
  A Column is a line of Vertical cells within a spreadsheet e.g. A1,A2, A3, A4, A5 etc...
  Within each worksheet there are 16,384 columns.

- **A cell**
  A cell is the intersection of a Row and a Column, which has a unique address or reference. For example, where Column C and Row 8 intersect is cell C8. You use cell references when you write formulas or refer to cells.
- **Absolute cells**
  A reference such as $A$2 tells Excel how to find a cell based on the exact location of that cell in the worksheet. An absolute reference is designated by adding a dollar sign ($) before the column letter and the row number.
- **A range**
  A selection of multiple cells is referred to as a range. A single cell in some circumstances may represent a range.
- **Charts**
  Excel can create charts quickly to visually represent a data set stored in a worksheet. A range of chart types can be created, including **pie charts**, **bar charts**, **line graphs**, and **scatter plots**.
- **Macros**
  Excel can be used to develop and store macros that can be used to undertake frequently applied tasks. A macro records your mouse clicks and keystrokes while you work and play them back later. It is used to record the sequence of actions you use to perform a certain task. When you run the macro, it plays those actions back in the exact same order.
- **Presentations**
  Excel as a range of drawing and formatting tools that can be used to create high-quality presentations. These presentations can then be printed or copied to a word processing or presentation software package.

Loading Excel

Select Start to display the Start menu > Select All Programs > Select Microsoft Office > Select Microsoft Excel 2010. Excel opens and displays an empty workbook as illustrated in Figure WExcel 1.2.

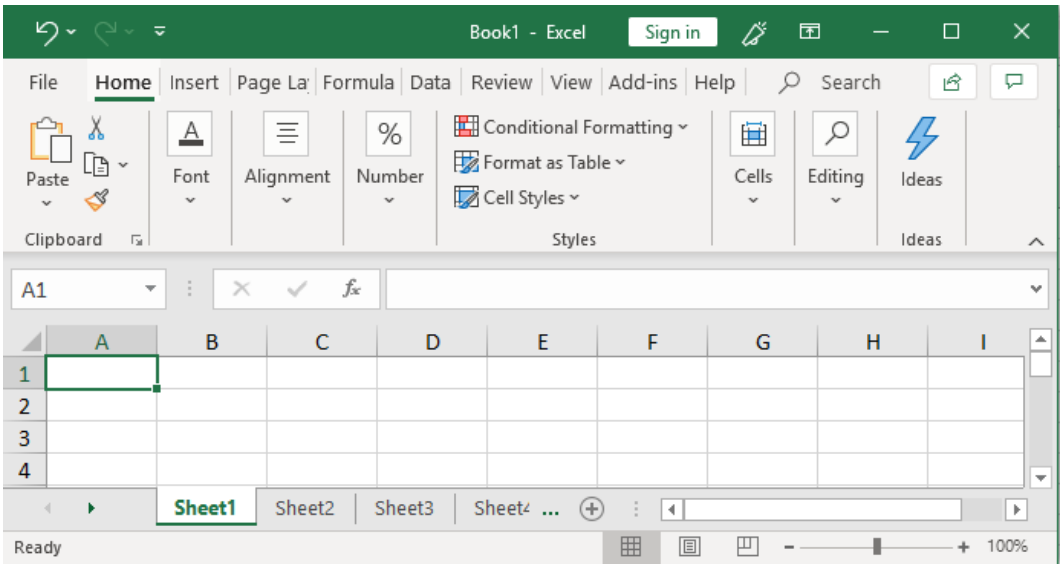


Figure WExcel 1.2

In Excel, the normal file type is referred to as a workbook. The first blank workbook displayed by Excel is called Book1 (see Figure WExcel 1.2). Each workbook contains sheets that are referred to as worksheets if they contain a spreadsheet. A new workbook usually

has three worksheets, but more can be added if required. The screen display is made up of the worksheet which is divided into rows (with headings 1, 2, 3, ……) and columns (with headings A, B, C, …..). Although you cannot see them there are 16,384 columns and 1,048,576 rows. This means that there are more than 16 million individual cells in one worksheet. At the top of the Excel workspace is the title bar displaying Microsoft Excel followed by the name of the current workbook (Book 1 in this case). Below that is the menu bar and toolbars. Then, just above the row of column headings, are the Name box containing the address of the active cell (A1 at the moment) and the Formula Bar displaying the contents of the active cell (blank at the moment).

Task panes

Task panes are user interface panels that are typically docked to one side of a window in a Microsoft Office application. Custom task panes give you a way to create your own task pane and provide users with a familiar interface to access your solution's features. For example, the interface can contain controls that run code to modify documents or display data from a data source. Excel does not have any task panes that are special it, just the ones that all Office programs have.

- Add text to clipboard - the Office clipboard keeps track of up to 24 items that you copied or cut in any Office program. The total file size that the Clipboard can store is 8 MB. How to open: Home > Clipboard tab group > dialog box launcher (default location: left side). Figure WExcel 1.3 illustrates the clipboard menu on Excel 2016.

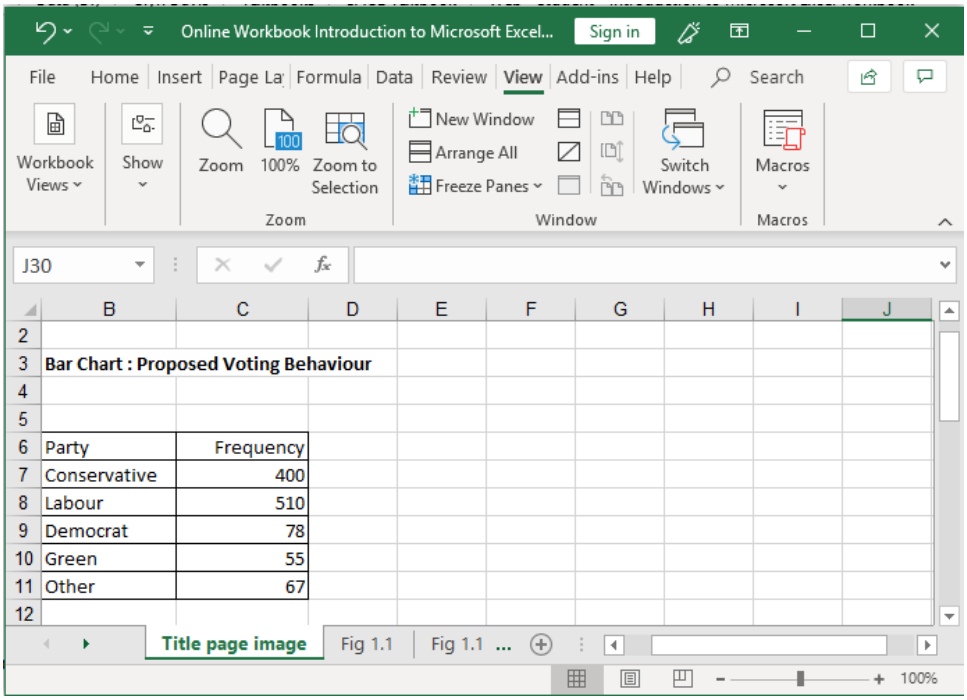


Figure WExcel 1.3

- Insert clip art - opens a search form to look for clip art images, and then shows thumbnails of the results. Not all image formats will show thumbnails. How to open: Insert > Illustrations tab group > Clip art button (default location: right side).
- Selection & Visibility - clicking the name in the list selects the object, which can be clip art, a picture, word art, or a shape, including a text box. The selection & visibility pane enables you to select objects to move or modify, to hide objects, and to change the

stacking order for objects. How to open: drawing tools: format or picture tools: format> arrange tab group > selection pane button (default location: right side).

- Research - the research pane includes a drop list of several sources to search, including a dictionary, thesaurus, and online sites. You can add other services to this list. How to open: Review > proofing tab group > Research or Thesaurus buttons and Review > Translate tab group > Translate button (default location: right side).
- Document recovery - By default, Office automatically saves your work every so often. When an Office program closes unexpectedly (perhaps from a power outage or a computer crash), the Document Recovery task pane opens the next time you start that program. It shows you a list of one to three previously saved versions of the documents that were open when the program crashed or was shut down incorrectly. Any changes you made between the AutoSave and the crash are lost. If you had recently saved your documents, you may not want any of the versions listed at all.

Help

Excel has a comprehensive, easy-to-use help system. The Office Assistant can be accessed by clicking on the question mark in Figure WExcel 1.4 can be employed to ask for help from the Help menu (Figure WExcel 1.5):

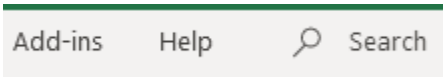


Figure WExcel 1.4

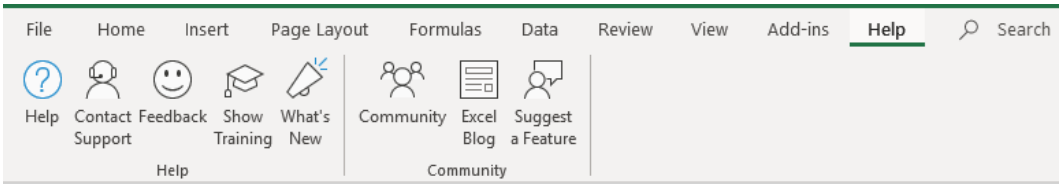


Figure WExcel 1.5 Excel Help

Saving a workbook

Your workbook can be saved to a local hard disk or stored on an external storage device e.g. USB memory stick.

1. Click on file and then save.
2. A Save As box will appear - with the file name box highlighted. Type into this box a file name and save to an appropriate location on the storage drive. It is very important to save any work created at regular time intervals.

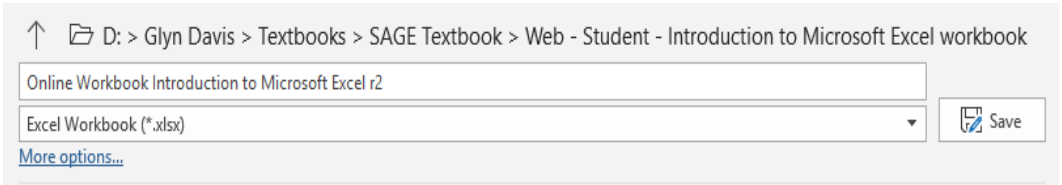


Figure WExcel 1.6 Save As menu

3. Press Delete Key on your keyboard to delete the default file name.
4. Enter the name of your workbook (e.g. TEST). Excel will automatically give it a file extension (.xls). The file extension (.XLS) denotes the file to be an Excel spreadsheet.

5. Browse to the location you would like to save the file to and select the appropriate drive, for example, GLYNDAVIS(F:).

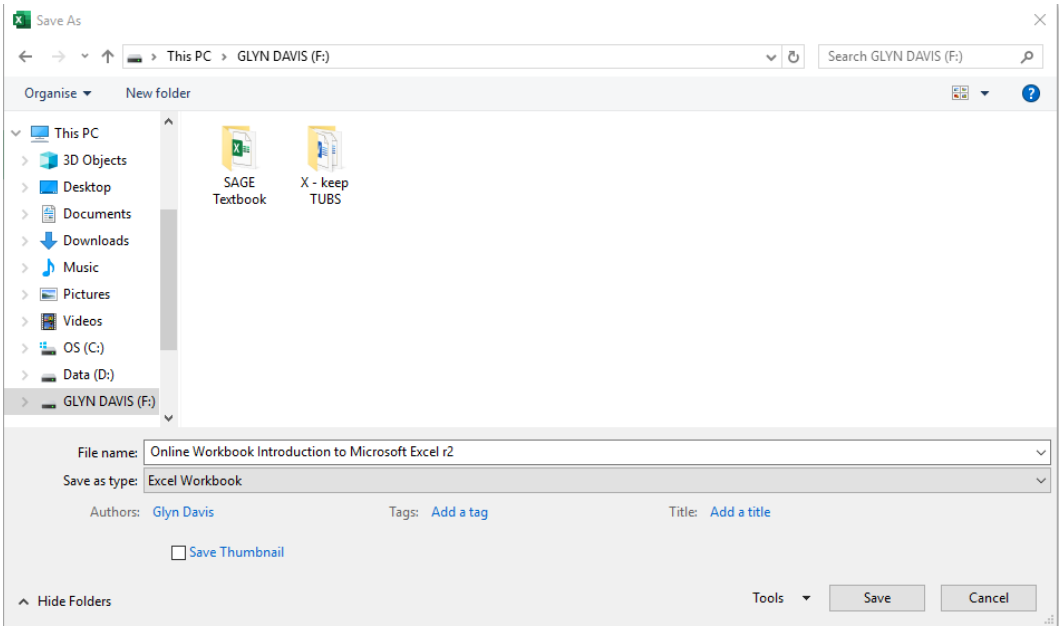


Figure WExcel 1.7 Save to the specified storage device drive

6. Click on SAVE. The name of the document is displayed at the top of the screen.

However, if you wish to make some alteration to the original document and save the altered version *as well as* keeping the original version, carry out the following procedures:

1. Click on File and then Save As.
2. The Save As box appears - with the File Name Box highlighted, containing the documents original name and the cursor flashing.
3. Press Delete Key on keyboard to delete the default file name.
4. Enter the new name of your document.
5. Click on OK. The new name of the document is displayed at the top of the screen. If you use the Save command the original document will be over written.

Opening an existing workbook

1. Click on File > Open The following screen will appear:

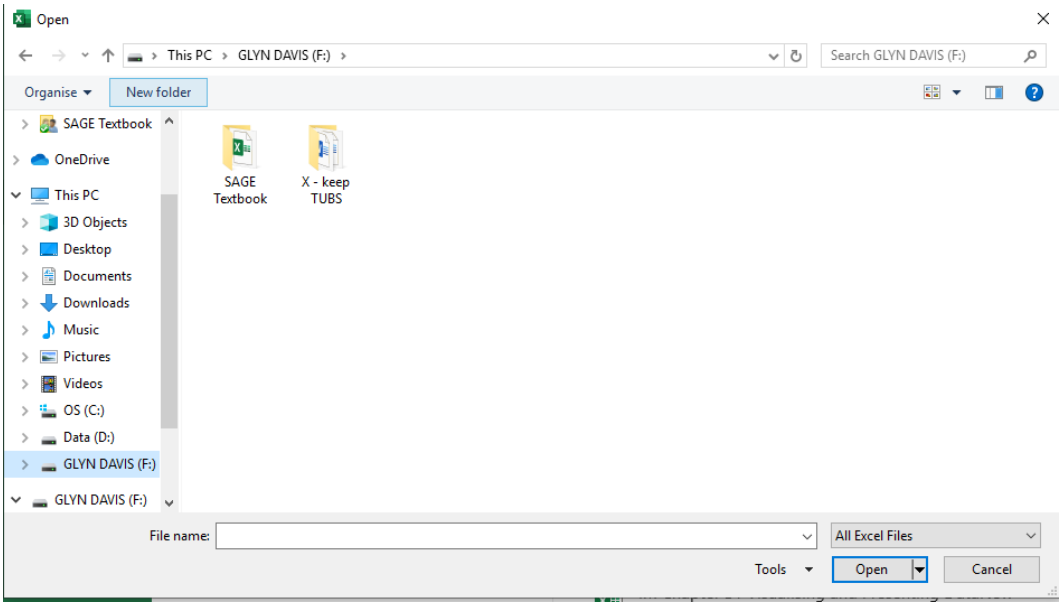


Figure WExcel 1.8 Open file dialog box

2. Select the drive you require.
3. Browse to the file/workbook you wish to open.
5. Click on Open.

Closing a workbook

You can close a workbook at any time. From the File menu, select Close. If you have made any changes to the workbook since it was last saved, you will be asked whether you wish to save those changes. Click Yes to keep the changes or No to discard them. You can rename the file if you wish to keep the changes made but save it to a different Excel file.

Switch to a new worksheet

Click on the tab at the bottom of the screen to select the next sheet.

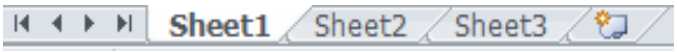


Figure WExcel 1.9 Excel worksheet tab

It is advisable to use them in sequential order to avoid confusion. Worksheets (sheet 1, sheet 2, …..) can be moved by dragging the worksheet tab to the left or right to reorder the worksheets.

Creating a new worksheet

To create a new worksheet in your workbook, click on Figure WExcel 1.10 at the bottom of the worksheet.


Figure WExcel 1.10

Opening a new workbook

Click on File > New > Select Blank workbook.

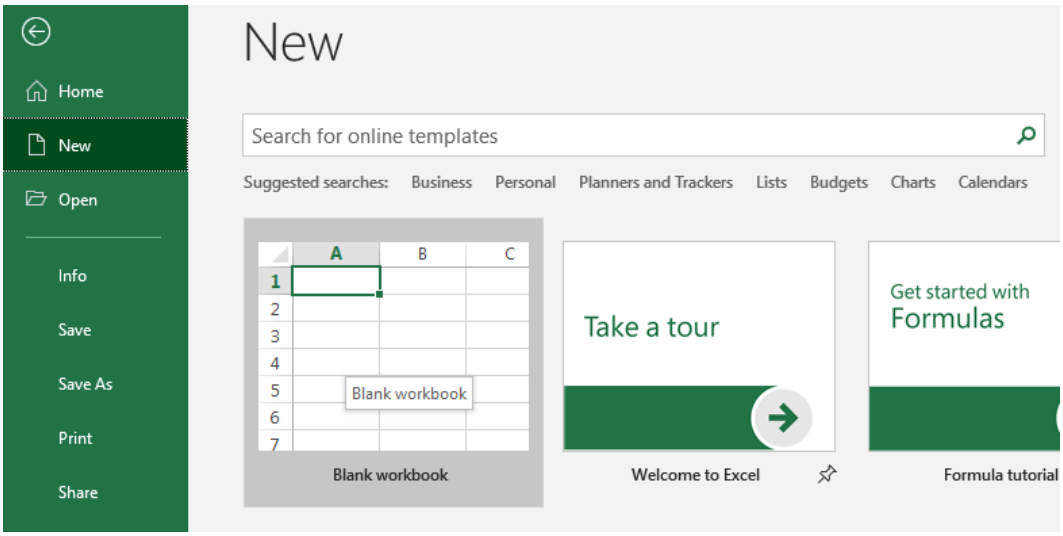


Figure WExcel 1.11

Printing and print preview

The print preview function allows you to preview your worksheet exactly as it will be printed. Click on File > Print.

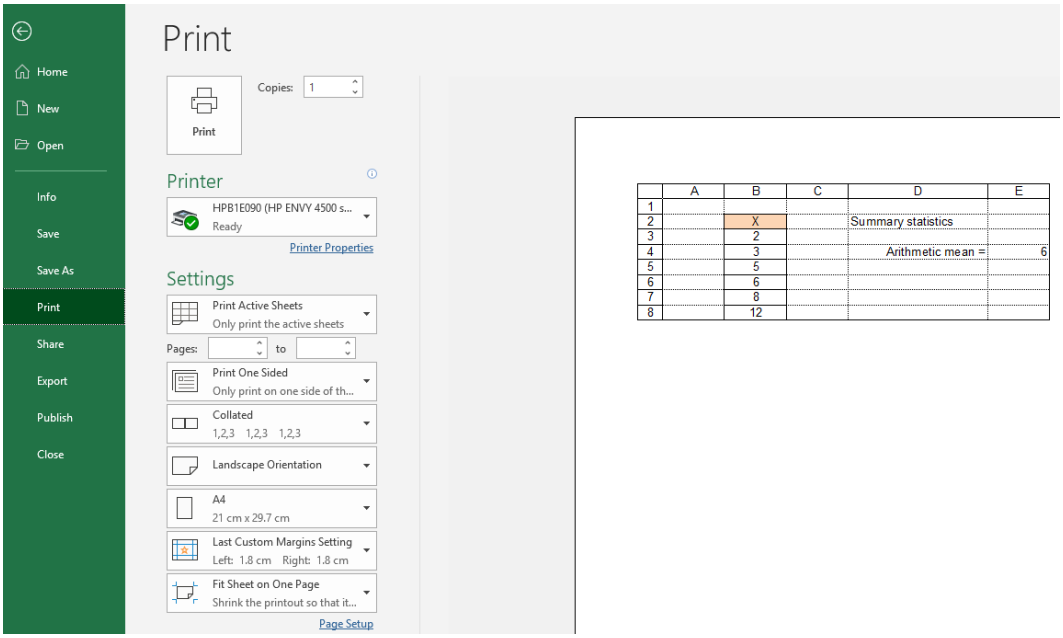


Figure WExcel 1.12 Excel print preview

What to do if you encounter a damaged Excel file?

If an Excel file is corrupted due to a computer crash (or other problem) then Excel will automatically attempt to save a file. The Document Recovery task pane shows the files that were open at the time of the computer crash. It identifies the original version of the file and the recovered version of the file.

After you open the recovered version, you can then save its changes by choosing File > Save on the Excel menu bar. The AutoRecover feature is set to automatically save changes to your workbook (provided that the file has already been saved) every ten minutes. You can modify this time by choosing Tools > Options > Save on the Excel menu bar. The Open and Repair command can be used to recover corrupt Excel files (choose File > Open and Repair).

Section 2 Entering data and formatting

Data is entered into the worksheet by moving the cursor to the appropriate position on the screen, clicking the left mouse button to select the cell, and then typing the information required. The characters you type will then appear in the active cell and on the formula bar. When you have finished typing data into a cell you should signal the end of that data by pressing the enter key. There are two basic types of information that can be entered into a worksheet: constants and formulae. The constants are of four types: numeric values, text values, date values, and time values. Two special types of constants, called logical values and error values, are also recognised by Excel but are not discussed in this online workbook. Numeric values include only the digits 0-9 and some special characters such as:

+ - E e ( ) . , £ % /

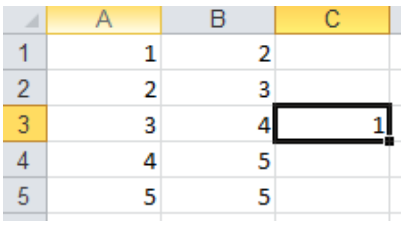
A numeric cell entry can maintain precision up to 15 digits. If you enter a number that is too long, Excel converts it to scientific notation. For example, if you type 9786798568585930 0, it will be stored as 9786798568585930 0, and displayed as 9.7868E+16. Sometimes, although the number is stored correctly in the cell, the cell is not wide enough to display it properly. In those cases, Excel will round the number off or display a string of # signs.

To solve this problem, increase the width of the column. A text entry can contain up to 32,767 characters but only 1024 characters will display in the cell, but all will be displayed in the formula bar.

If the text you enter will not fit in the width of your cell, Excel lets it overlap the adjacent cell unless that cell already contains an entry, in which case the extra text can be thought of as being tucked behind the adjacent cell. By default, text is left-justified in a cell whereas numbers are right-justified.

Entering data in a cell

1. Select a cell in which you want to enter data. See Figure WExcel 2.1.
2. Type in the entry. The entry will appear in the formula bar as it is typed.
3. To enter what you have typed press the Return key or click on the green tick to enter.



	A	B	C
1	1	2	
2	2	3	
3	3	4	1
4	4	5	
5	5	5	

Figure WExcel 2.1

Modifying data in a cell

If you are in the process of entering data in a cell and you notice that you have made a mistake, it is easy to correct it. Press the backspace computer key to delete a character to the left of the cursor or the delete key to delete a character to the right of the cursor. If you want to edit the contents of a cell, then you should double-click on the cell and make the required alterations either in the cell itself or on the formula bar.

If you want to clear the cell of its contents (formula and data), formats, comments, or all three, you can select that cell with a single click of the right mouse button and select Clear Contents as illustrated in Figure WExcel 2.2.

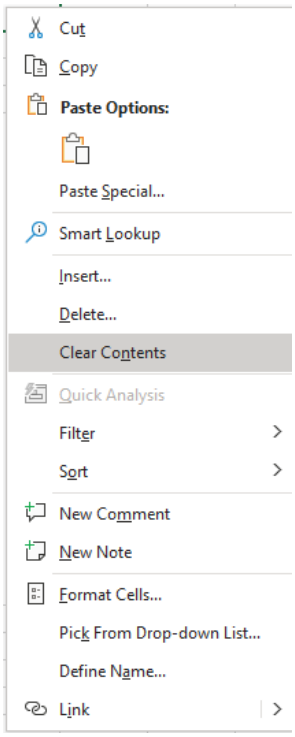


Figure WExcel 2.2

Entering data into a range

In Excel, any rectangular area of cells is known as a range. The range is defined by the top-left and bottom-right corner cell references separated by a colon (:). So, C8:G15 represents the range of cells cornered by C8 and G15. To enter the same data into a range of cells:

(a) Select the range.
(b) Enter the data.
(c) Hold down the CTRL key and press Return. All of the cells in the range should now contain the same data, or
- Select the cell containing the data.
- Move the mouse pointer to the bottom right corner of the cell until the pointer changes to a cross.

(d) Hold down the left mouse button and drag the cross in the direction you wish to fill, and then release the mouse button.

Cancelling a cell entry

To cancel a cell entry before you have pressed return. Press the Escape key (Esc), or click on the cross to cancel the entry as illustrated in Figure WExcel 2.3.

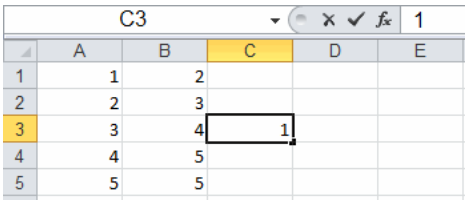


Figure WExcel 2.3

Undoing a cell entry or repeating a cell entry

To undo a cell entry after you have pressed the return key and click on the undo menu (located at the top left-hand corner of your workbook as illustrated in Figure WExcel 2.4.


Figure WExcel 2.4

You can repeat a cell entry after you have pressed the return key and click on the repeat menu as illustrated in Figure WExcel 2.5.


Figure WExcel 2.5

Entering numbers

Numbers are constant values containing only the following characters: 1 2 3 4 5 6 7 8 9 0 - + / . E e £ $ % , ( ).

Entering dates or times

If you type a date or time (e.g. 13/4/8 or 16:21) directly into a cell Excel should automatically recognise it as such and changes the cell formatting from general to the appropriate date or time format. The program will normally align it to the right of the cell and display it in the formula bar in a standard format (e.g. 13/04/2008 or 16:21:00).

If you type	Excel formatting
12/06/8	dd/mm/yy
12-June-8	dd-mmm-yy
31-Oct	dd-mmm
Oct 13 2008	Mmm d, yyyy
24/05/08 3:21	dd/mm/yy hh:mm
3:45 PM	h:mm AM/PM
3:35:30 PM	h:mm:ss AM/PM
13:50	hh:mm
13:50:35	hh:mm:ss

Table WExcel 2.1

The displayed formats in particular cells can be modified using Format > Cells > Number menu option. You can either choose a date format from the Category box or select Custom to define your own cell format. Regardless of how the date (or time) is displayed, the actual

value stored in the cell is a long numeric value e.g. the date variable 13/04/2008 would be stored under general format as 39752.

Entering text

To enter text, select a cell and type the text. A cell can hold up to 256 characters. You can format the characters within a cell individually but note that if there are more than 255 characters in the cell then the cell will show "#########". This problem can be resolved by applying text wrapping to the cell.

Formatting a worksheet

You can use many formatting options in Excel to add emphasis to your data or make the worksheet easier to read. To apply cell formats, you can either use the Toolbar or the Menu bar. You can change the format of the text by using the following parts of the toolbar:

- To apply or change font size

  1. Click on the down arrow to the right of the font size selection box as illustrated in Figure WExcel 2.6.

     Figure WExcel 2.6

  2. To select the size you require use the scroll bar arrows to move up or down the list of available sizes, then click on a number.
  3. The selected font size will appear in the font size box.

- To apply or change font type

  1. Click on the down arrow to the right of the font box as illustrated in Figure WExcel 2.7.

     Figure WExcel 2.7

  2. To select the font, you require use the scroll bar arrows to scroll through the list of available fonts, then click on a font type.
  3. The selected font type will appear in the font box.

- To bold text

  1. Click on bold button on the tool bar to enable bold type.

     Figure WExcel 2.8

  2. Enter text, highlight text, and click on bold button again to return to normal.

Figure WExcel 2.9

- To apply italic text

1. Click on italic button on the tool bar to enable *Italic* type.

Figure WExcel 2.10

2. Enter text, highlight text, and click on italic button again to return to normal.

Figure WExcel 2.11)

- To apply underlined text

1. Click on underline button on the tool bar to enable Underlined text.

Figure WExcel 2.12

2. Enter text and click on underline button again to return to normal.

Figure WExcel 2.13

- Aligning text

1. Highlight the cell.
2. Click on one of the following alignment boxes in the toolbar, to apply the desired alignment:

Left alignment	 Figure WExcel 1.26
Centred	 Figure WExcel 1.27
Right alignment	 Figure WExcel 1.28
Centre across columns	 Figure WExcel 1.29

Table WExcel 2.2

Column widths and row heights

In a new worksheet all columns and rows are set to a standard size. Rows automatically adjust to the largest font entered into the row. You may need to adjust the column width if you are entering more than 8 characters.

- Column width

  You can format one or a number of columns in the following manner:

  1. Highlight the columns you wish to alter.
  2. Right click on the computer mouse – this will pull-up the menu illustrated in Figure WExcel 2.14.

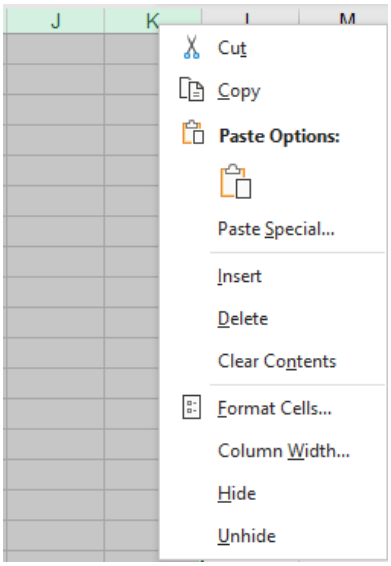


Figure WExcel 2.14

  3. Select Column Width from the drop-down menu. An additional menu box will appear as illustrated in Figure WExcel 2.15.

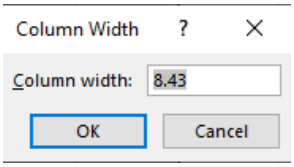


Figure WExcel 2.15 Column width

  5. Enter the column width you require.
  6. Click OK.

- Row height

  To adjust the Row Height:

  1. Select the rows.
  2. Right click on the computer mouse – this will pull-up the menu illustrated in Figure WExcel 2.16.

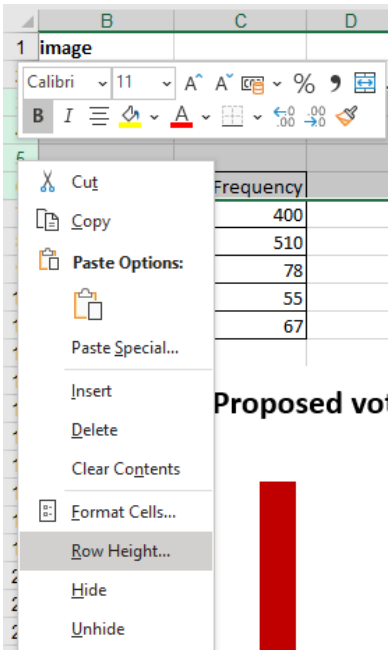


Figure WExcel 2.16

3. Select Row Height from the drop-down menu. An additional menu box will appear.

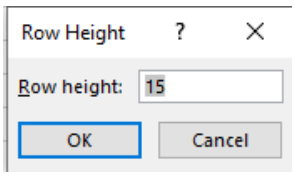


Figure WExcel 2.17 Row height

5. Enter the Row Height you require.
6. Click on OK.

Naming a worksheet

The information on sheet1 might refer to a particular project. It would make sense to name the sheet (or worksheet) accordingly.

1. Right-click on sheet1.
2. Select Rename from the menu that appears.
3. Type your project name into the text box and press Enter key.

Inserting and deleting rows and columns

Extra rows and columns can be inserted whenever you wish. As an example, insert a row between row 8 and 9.

1. Click with the right mouse click on the row name 8.
2. Select Insert.

Now, try inserting a column between column B and C

1. Click with the right mouse click on the column name B
2. Select Insert

To delete a row or column, right click on its name and select Delete from the menu which appears.

The clear command

When you use the Clear command, you will clear the contents, formats or notes but leave the cells on the worksheet. Unlike delete which removes the cell from the worksheet and the surrounding cells shift to take their place.

1. Select the range of cells you want to clear.
2. Right click on the cell range you wish to clear as illustrated in Figure WExcel 2.18. Click on Clear Contents to clear numbers and text.

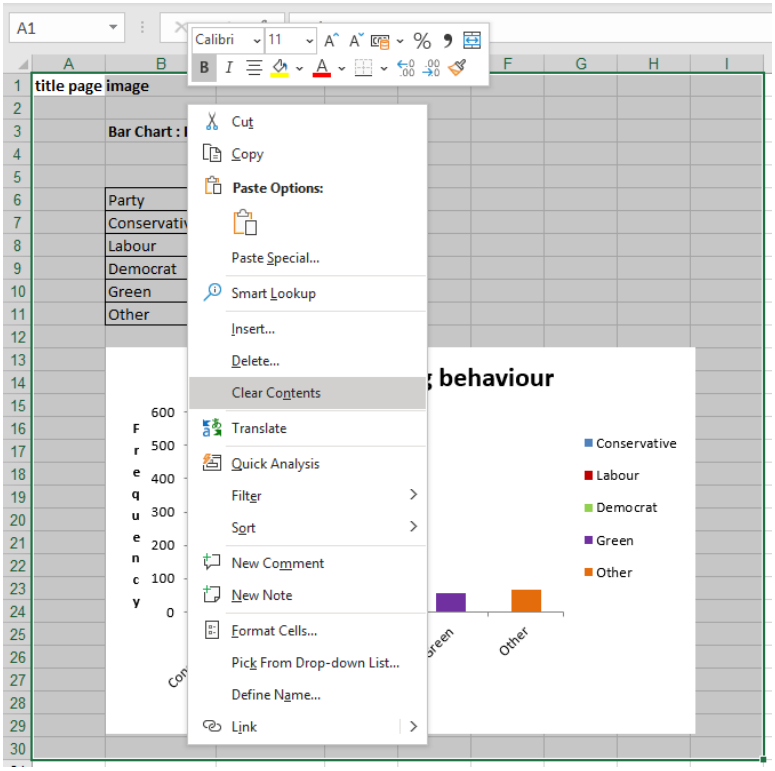


Figure WExcel 2.18

Spell checking

Excel allows you to check the spelling of your work.

Click on Review tab and select the Spelling button on the toolbar

Figure WExcel 2.19

If a spelling mistake is found Excel will prompt and provide an opportunity to correct the error.

Section 3 Performing calculations

Excel can be used to develop simple solutions to business data problems. The nature of these problems can be mathematical, statistical, and financial. This textbook will explore how you solve statistical problems using Excel.

Entering formulae

Using a formula can help you analyse data on a worksheet. With a formula you can perform operations, such as addition, multiplication and comparison on worksheet values. Excel formulas always begin with an equal sign e.g. =7/8, =3*5+4/7, =3*A3, and =A3*A3.

1. Select cell in which you want to enter formula.
2. Type an equal sign (=) to activate the formula bar. If you forget to type an equal sign, the rest of the line will be treated as text.
3. Enter the formula.
4. Press Enter or Click on the Green Tick to the left of the formula bar.

Understanding operators

Some of the mathematical operators that can be used to create formulae include:

%	Percent
^	Exponentiation
* and /	Multiplication and division
+ and -	Addition and subtraction (or negation when placed before a value i.e. -1)
&	Text joining
=	Equal
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to
<>	Not equal to

Table WExcel 3.1

It should be noted that the list is listed in order of priority starting with percent (highest priority) and ending with comparisons (lowest priority) e.g. =. >, …., <>. If you want to alter the order of priority, use parenthesis (brackets) to group expressions e.g. (i) 9 + 3/2 is equal to 10.5 and not equal to 6, (ii) (9+3)/2 is equal to 6.

Selecting cells and moving around worksheet

Selecting a cell

To select a cell:

1. Position the cursor over the cell.
2. Click the left mouse button once.

The cell will then become highlighted with a dark border, with the cell reference number appearing in the upper left portion of the screen.

Selecting a range of cells

If you wish to select more than one cell in a work sheet:

1. Click on the first cell in the range.
2. Holding the left mouse button down, drag the cursor to the last cell in the range and release the mouse button. The area of the range will be highlighted.

Select an entire row - Click the cursor in the row heading i.e. the numbers running down the left-hand side of the worksheet.

Select an entire column - Click the cursor in the column heading i.e. the alphabetic letters on the top of the worksheet.

Select all the cells within a worksheet - Click on the Select All button. The entire worksheet will then become highlighted. See Figure WExcel 3.1.

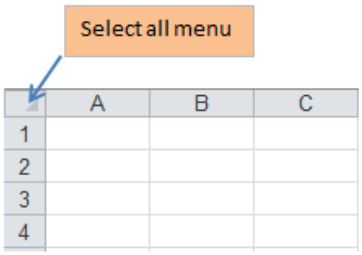


Figure WExcel 3.2

Reference operators

There are three types of reference operators: **Range**, **Union**, and **Intersection**.

Range (Colon :)

Produces one reference to all the cells between and including the two references. See Figure WExcel 3.3.

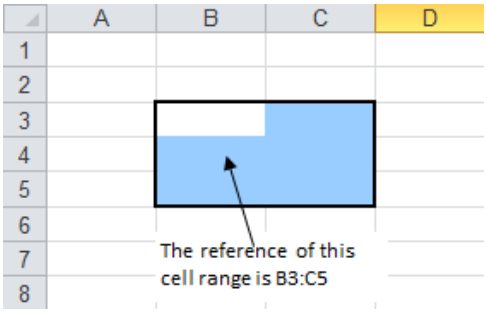


Figure WExcel 3.3

Union (Comma ,)

Produces one reference that includes the two references. See Figure WExcel 3.4.

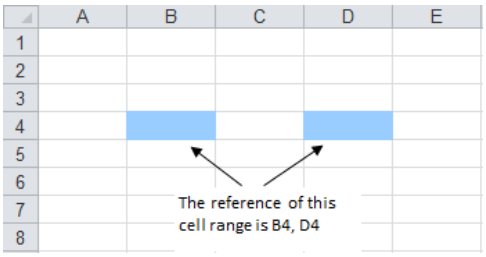


Figure WExcel 3.4

Intersection (Space)

Produces one reference to cells common to the two references. See Figure WExcel 3.5.

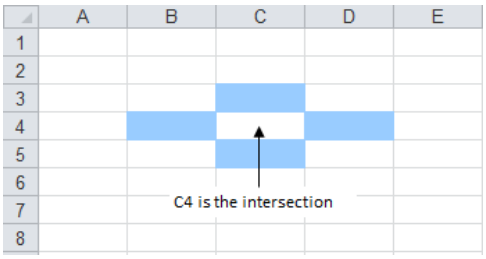


Figure WExcel 3.5

Editing a formula

To edit an existing formula:

1. Click on the cell containing the formula. The formula will then appear in the formula bar as illustrated in Figure WExcel 3.6.

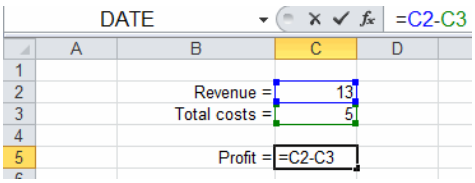


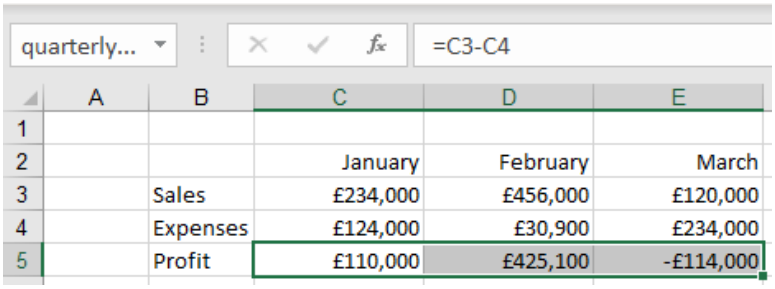
Figure WExcel 3.6

2. Edit the formula in the formula bar.
3. Press the enter key.

Creating and applying names

Names make formulas easier to read, understand, and maintain. You can change or delete names that have been defined previously and define a constant or computed value that you intend to use later. Names appear in the reference area of the formula bar when you select a named cell or an entire named range. In the example below, we will name the monthly sales data in cells C3:E3 and name this range quarterly_profit.

1. Select the range you wish to name e.g. C5:E5



	A	B	C	D	E
1					
2			January	February	March
3		Sales	£234,000	£456,000	£120,000
4		Expenses	£124,000	£30,900	£234,000
5		Profit	£110,000	£425,100	-£114,000

Figure WExcel 3.7 Range example

2. Right click on mouse and choose Define Name (see Figure WExcel 3.8).

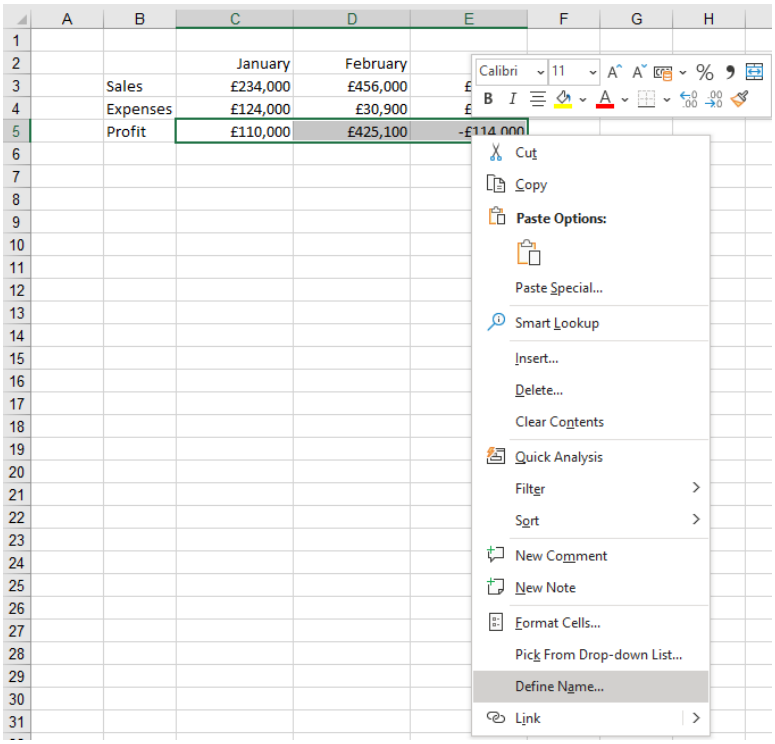


Figure WExcel 3.8

3. Enter the name to be applied to the range e.g. quarterly_profit (see Figure WExcel 3.9).

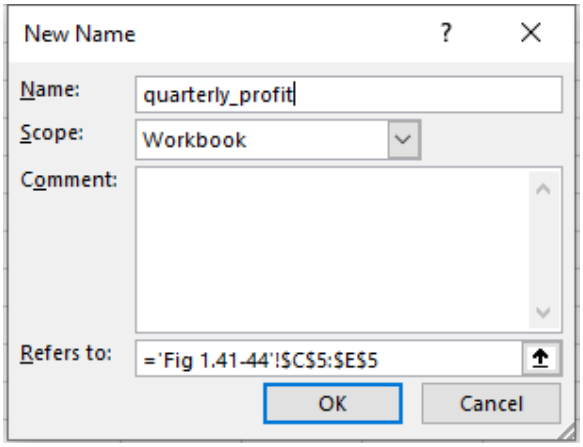


Figure WExcel 3.9

4. Click on OK.

The name may then be used in a formula, instead of using the cell locations and is easier to interpret and remember, e.g. SUM (quarterly_profit) instead of SUM (C3:E3) as illustrated in Figure WExcel 3.10.

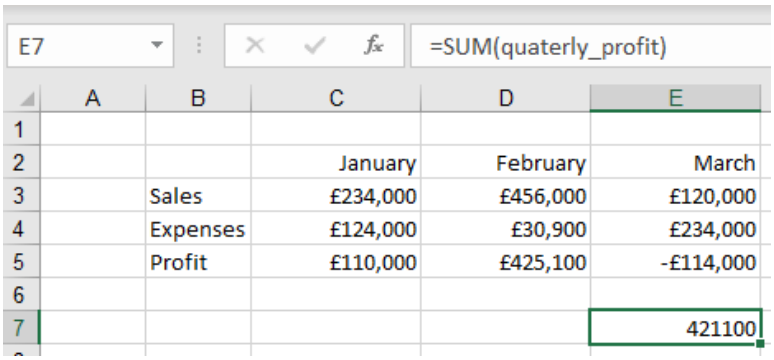


Figure WExcel 3.10

Copying formulas to adjacent cells

Rather than retyping a formula in each of the adjacent cells it is much more convenient to copy the formulas across.

1. Click inside the cell that contains the formula you wish to copy

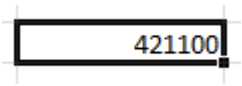


Figure WExcel 3.11

2. Position the mouse cursor at the bottom left hand corner of the cell. The mouse cursor will then change to a cross.
3. Hold the left-hand button on the mouse down and drag to where you want the formula to be copied to. For example, the formula in Figure WExcel 3.12 has been dragged two cells to the right.

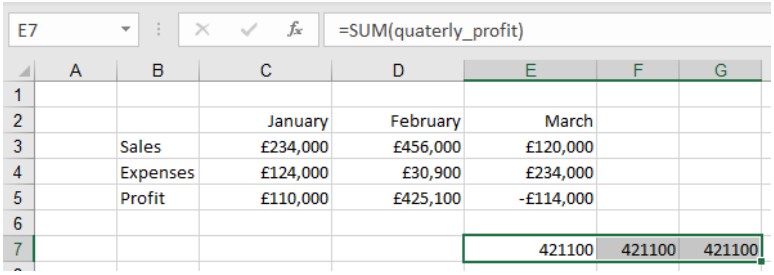


Figure WExcel 3.12

Using absolute and relative references

The $ sign in a cell will tell Excel how to treat your references when copying the content of a cell. To illustrate this concept, consider what happens to the following formulas in Cell C14 that are copied to D15:

- =C14 becomes =D15
- =$C14 becomes =$C15
- =C$14 becomes =D$14
- =$C$14 becomes =$C$14

This simple example illustrates the $ sign acts as an 'anchor' to fix the row number or column letter. You will find when creating a spreadsheet solution (or model) that a term in the equation can be constant. To illustrate this concept consider a example where you would like to calculate price (p) based upon demand for a product (d) where the relationship between price and demand is given by the equation p = 2d. We can see that no matter what the value of p, or d, the number 2 does not change. The number 2 is fixed (or constant) and in a spreadsheet this value would be fixed using the $ sign.

Example WExcel 3.1

Consider solving this problem for price when the demand undergoes a unit change from 1 – 4. We can see from the equation in cell B2 that price=2*A2. When we copy the formula down then the price is calculated for a demand change from 1, 2, 3, and 4.

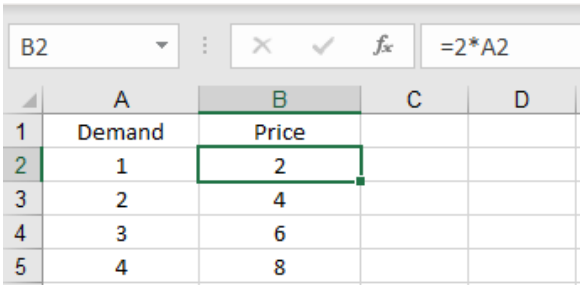


Figure WExcel 3.13

Example WExcel 3.2

This same problem can be solved by fixing the value of the number 2 in the spreadsheet (cell C3). In this case the price in cell C7 is given by the formula price = C3*B7. When we copy the formula down from C7 to C10 the price value is calculated for the demand change. We note from the spreadsheet solution that the price in cell C8 is zero and not the correct value of 4.

Inspecting the equation in cell C8 we note that the formula is price = C4*B8. The B8 reference is correct but C4 is incorrect and should read C3, which represents the position of the number 2.

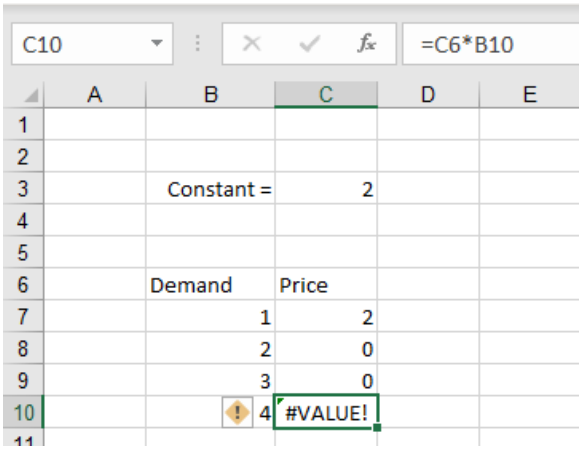


Figure WExcel 3.14.

Example WExcel 3.3

To solve this problem, we fix the cell position of the number 2 and we achieve this using the Excel $ sign. Therefore, in cell C7 we insert the correct price equation = $C$3*B7. The use of $C$3 is to fix the value of the number 2. If we now copy the formula down from C7 to C10 we can now see that we have the correct values for price based upon changing demand

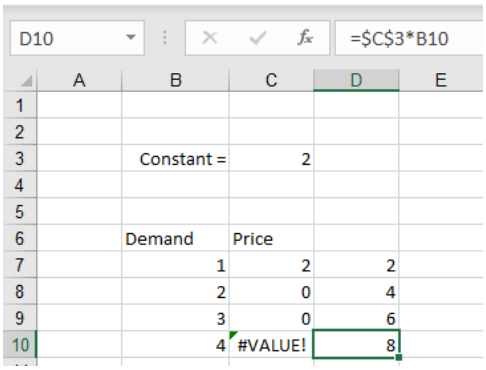


Figure WExcel 3.15

IF function

The **IF** function is very useful in solving numerical problems and enables the user to ask questions of the type 'Is this true or false' and then undertake a particular action. The technique can be illustrated by exploring the marks for two examination tests in which the tutor would like to find out which students obtained a higher mark for test 1 compared to test 2 (Table WExcel 3.1).

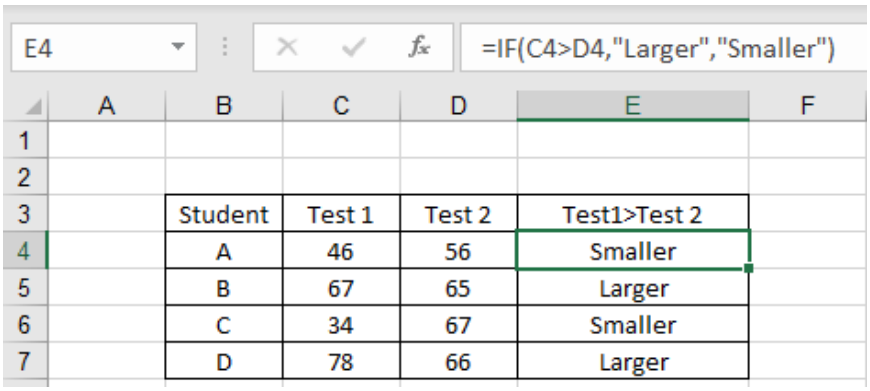
Student	Test 1	Test 2
A	46	56
B	67	65
C	34	67
D	78	66

Table WExcel 3.1

This problem can be solved by using the IF function.

Excel solution
=IF(condition, value_if_true, value_if_false)

To solve this problem, we insert the data into Excel (Figure WExcel 1.50). Test 1 (C4:C7) and Test 2 (D4:D7). In cell E4, insert =IF(C4 > D4, “Larger”, “Smaller”). This will place the text ‘Smaller’ in cell E4 (46 < 56).



	A	B	C	D	E	F
1						
2						
3		Student	Test 1	Test 2	Test1>Test 2	
4		A	46	56	Smaller	
5		B	67	65	Larger	
6		C	34	67	Smaller	
7		D	78	66	Larger	

Figure WExcel 3.16

Now complete for the other three students by copying the formula down from cell E4 to E7.

Interpretation
Two students (B and D) obtained higher marks for test 1 compared to test 2.

Adding a column of numbers using AutoSum

To add the demand values together from the previous example we can make use of the Excel AutoSum function.

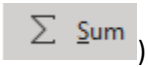
1. Click in D9.

	A	B	C	D	E
1					
2					
3		Student	Test 1	Test 2	Test1>Test 2
4		A	46	56	Smaller
5		B	67	65	Larger
6		C	34	67	Smaller
7		D	78	66	Larger
8					
9					

Figure WExcel 3.17

2. Click on the AutoSum button on the toolbar as illustrtaed in Figure WExcel 3.18 (Formulas > Autosum).

Figure WExcel 3.18

3. Say we choose the Sum option - the AutoSum (

) suggests a range that is to be summed, in this case D4:D8.

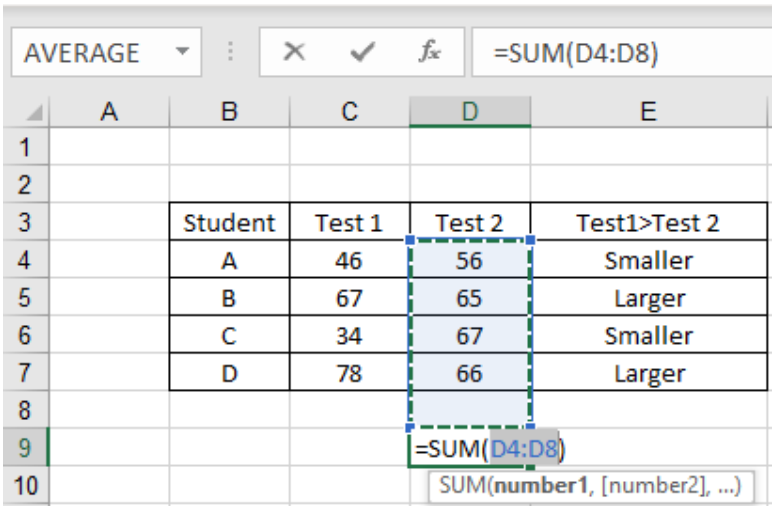


Figure WExcel 3.19

4. Modify the range from D4:D8 to D4:D7
5. Press the Enter key.

Figure WExcel 3.20 illustrates the final solution in cell D9.

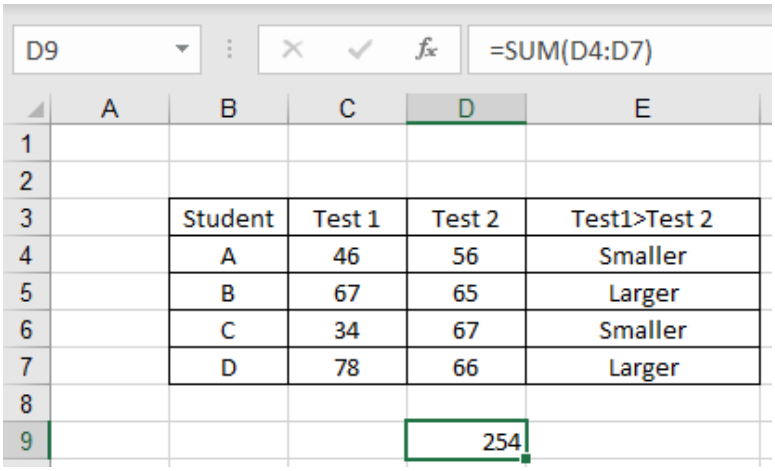


Figure WExcel 3.20

You can achieve this by using the Excel function SUM () e.g. total demand = SUM (B7:B10). The use of Excel functions will be explored briefly in the next section and in detail throughout the textbook and online workbooks.

What if analysis

What-if analysis in Microsoft Excel can be used to check what happens if you modify a value in a formula. For example, what-if analysis can be used to modify a student module mark given a recent change to the mark after external examiner comments, or, what would happen to the profit/loss account if we modified a variable cost.

Example WExcel 3.4

To illustrate this concept, consider the situation where a student would like to achieve an A grade in an economics module. The student requires a minimum overall mark of 70% with the module assessments consisting of three parts with individual weights: in course assignment 1 (weight 25%), in course assignment 2 (weight 25%), and end examination (weight 50%). The student has received the assignment marks and was awarded 66% and 72% respectively. What mark will the student need to obtain from the examination to achieve an A grade? To solve this problem the student set up a simple Excel worksheet with the two assignment marks included and the overall mark calculated from the stated formula (value in cell E6 and formula in cell F6).

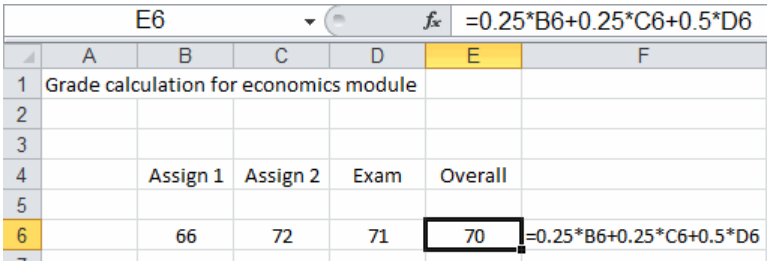


Figure WExcel 3.21 Grade calculation

Click in cell D6 and enter a series of examination mark values, one at a time:

- Examination mark 90%. The effect of this change will be to ripple through the worksheet formulae. In this case, the overall mark is now 79.5%. In this case the student would achieve an A grade (>70%) but the student would have to obtain more marks in the examination (90%) than is required to achieve an A grade (70% +).
- Examination mark 70%. This would achieve an overall mark of 69.5%, or 70%, if the examination board rules allow for rounding up to 70%. If we are in doubt, we could modify the examination mark to 71%.
- Examination mark 71%. This would achieve the required overall mark of 70% and the student would achieve an A grade.

Insert function

Excel provides the user with a range of built in functions which will allow a range of statistical techniques to be applied to a data set. A range of functions will be employed in later chapters but for the time being we will be content with being able to call the function, Select Formula > Select Function.

Figure WExcel 3.22

To access the Insert Function menu as illustrated in Figure WExcel 3.23.

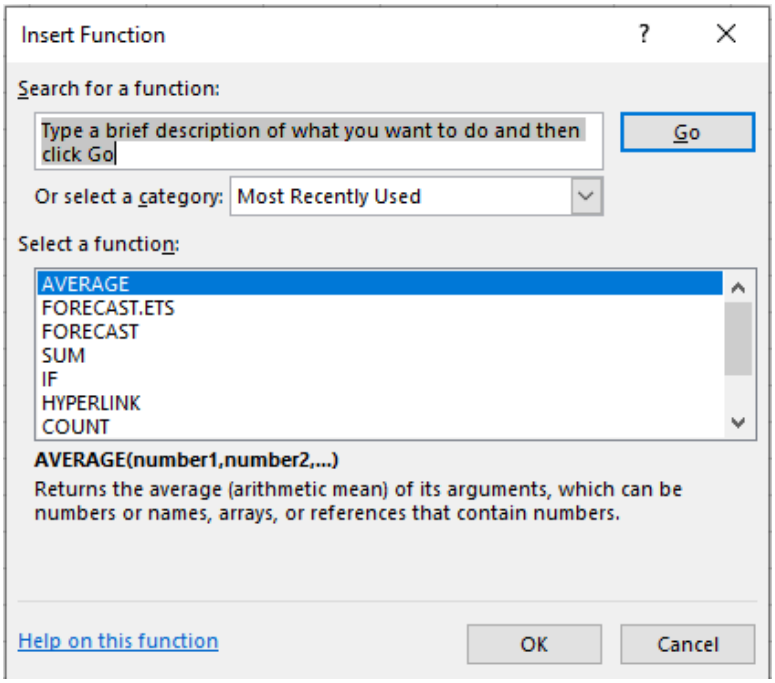


Figure WExcel 3.23

A list of the Microsoft Excel functions can be found at the end of this document or go to the Microsoft Excel support web site at

Section 4 Statistics with Excel

Excel has many built-in functions, from simple mathematical calculations like average and sum, statistics functions like average and standard deviation, to complex financial and engineering functions. It is advisable to check the formulae used internally by the functions to ensure that they will give correct answers for the data used.

Descriptive statistics

Descriptive statistics are those that describe the characteristics of the data. We will be looking at mean, trimmed mean, standard deviation, median, maximum, minimum, skew and kurtosis.

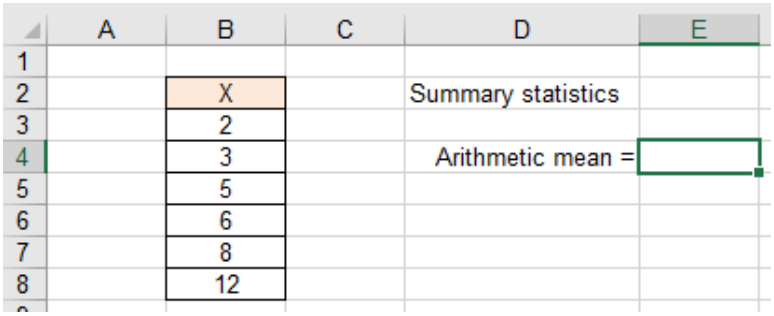
1. Mean - the mean calculates the average of the data.
2. Trimmed mean - the mean may be distorted by values that are untypical or wrong. A trimmed mean calculates the average by excluding the most extreme data in pairs. For example, we can calculate the average with the highest and lowest values removed, or with the two highest and two lowest values removed. The trimmed mean always removes the data values in pairs.
3. Standard deviation - the standard deviation is a measure of how much the data is dispersed from the mean. For a normal distribution, 68% of the values should lie within 1 standard deviation from the mean, 95% of the values will lie within 2 standard deviations from the mean, and 99.7% of the values would lie within 3 standard deviations from the mean.
4. Median - the median is the middle value in an ordered set of data points, or the average of the two middle values if there is an even number of data points.
5. Maximum and minimum - the largest and smallest values in a data set.
6. Skew - a measure of how asymmetric the distribution is. If the chart extends further to the left of the mean than it does to the right, then the distribution of the data has negative skewness. If the

chart extends further to the right of the mean than it does to the left, then the distribution has positive skewness.

7. Kurtosis - is a measure of how 'peaked' a distribution is. The normal distribution has a kurtosis value of zero and is sometimes referred to as being mesokurtic. A negative number indicates the data is less peaked than the normal distribution, which is sometimes called a platykurtic. A positive number indicates the data is more peaked than the normal distribution. The term leptokurtic is sometimes used in this circumstance. There are different ways of calculating the kurtosis statistic. If you are comparing your calculations to published values, try to ensure that the same statistical formula is being used for both data sets.

Using a function

We will introduce specific functions in the other guides but the following example of applying the AVERAGE function to calculate the mean age in the sample dataset in Figure WExcel 4.1 illustrates their use:



	A	B	C	D	E
1					
2		X		Summary statistics	
3		2			
4		3		Arithmetic mean =	
5		5			
6		6			
7		8			
8		12			

Figure WExcel 4.1

- Data set in Cells B2:B8 (includes label X in Cell B2)
- Select the cell in which you wish the calculation to be placed (Cell E4)
- Select Formulas > Insert Function > Statistical to open the Function Argument dialogue box (Figures WExcel 4.2).

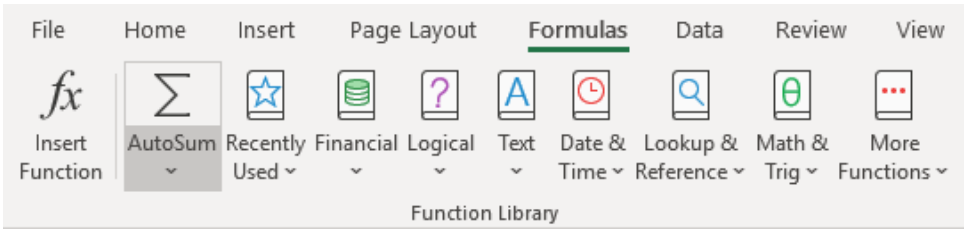


Figure WExcel 4.2

Choose Average

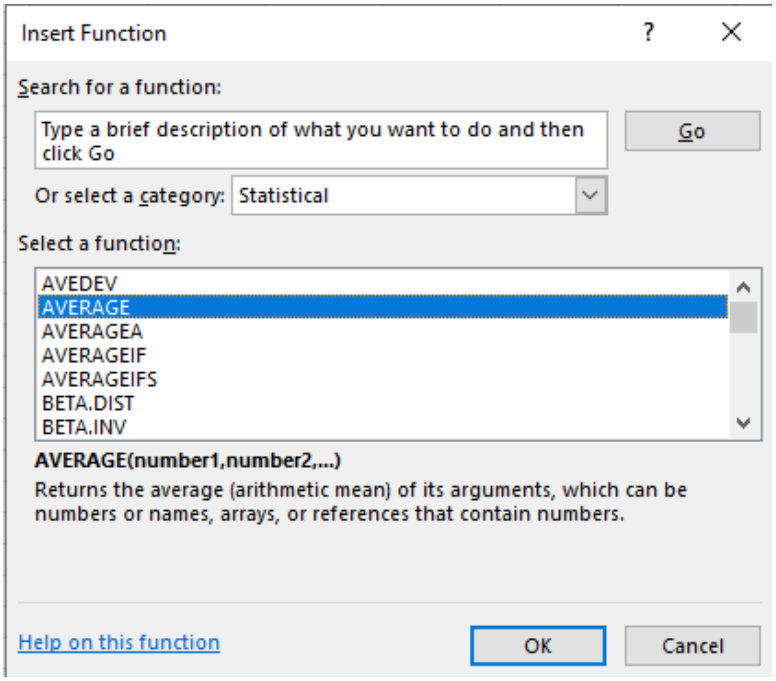


Figure WExcel 4.3
Click OK

Now select the cells to be included within the calculation (B3:B8)

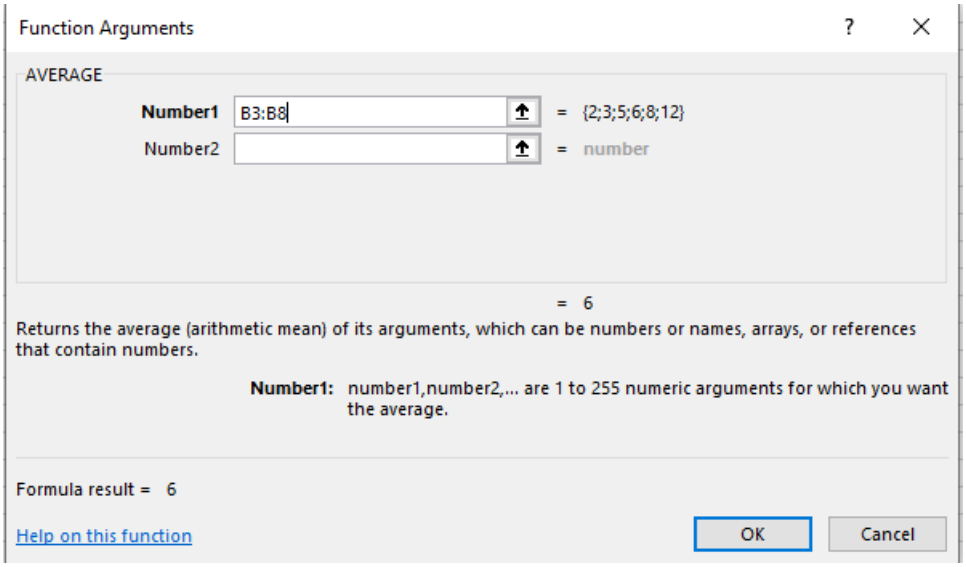


Figure WExcel 4.4

Click OK

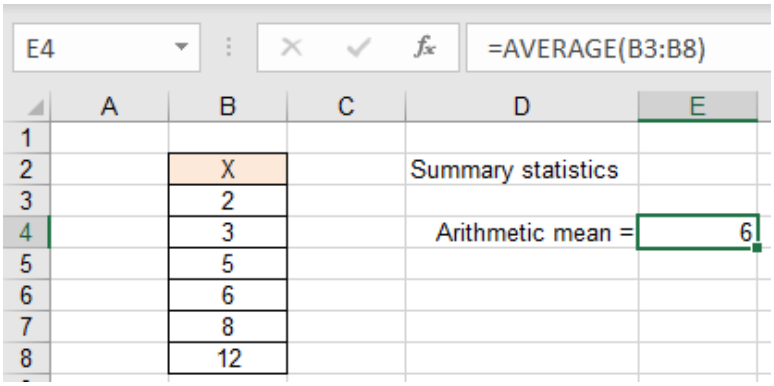


Figure WExcel 4.5

From Excel, the arithmetic mean (or average, or mean) = 6.

Microsoft Excel functions

Table WExcel 1.5 provides a list of all Excel functions that you may find helpful in solving business statistics type problems. The Excel function includes a link to the Microsoft support web site for that Excel function.

	Excel Function & link to Microsoft Help	Description
1	AVEDEV	Returns the average of the absolute deviations of data points from their mean
2	AVERAGE	Returns the average of its arguments
3	AVERAGEA	Returns the average of its arguments, including numbers, text, and logical values
4	AVERAGEIF	Returns the average (arithmetic mean) of all the cells in a range that meet a given criteria
5	AVERAGEIFS	Returns the average (arithmetic mean) of all cells that meet multiple criteria.
6	BASE	Converts a number into a text representation with the given radix (base)
7	BINOM.DIST	Returns the individual term binomial distribution probability
8	BINOM.DIST.RANGE	Returns the probability of a trial result using a binomial distribution
9	BINOM.INV	Returns the smallest value for which the cumulative binomial distribution is less than or equal to a criterion value
10	BINOMDIST	Returns the individual term binomial distribution probability
11	CHIDIST	Returns the one-tailed probability of the chi-squared distribution
12	CHIINV	Returns the inverse of the one-tailed probability of the chi-squared distribution

13	CHISQ.DIST	Returns the cumulative beta probability density function
14	CHISQ.DIST.RT	Returns the one-tailed probability of the chi-squared distribution
15	CHISQ.INV	Returns the inverse of the left-tailed probability of the chi-squared distribution.
16	CHISQ.INV.RT	Returns the inverse of the one-tailed probability of the chi-squared distribution
17	CHISQ.TEST	Returns the test for independence
18	CHITEST	Returns the test for independence
19	COMBIN	Returns the number of combinations for a given number of objects
20	COMBINA	Returns the number of combinations with repetitions for a given number of items
21	CONFIDENCE	Returns the confidence interval for a population mean
22	CONFIDENCE.NORM	Returns the confidence interval for a population mean
23	CONFIDENCE.T	Returns the confidence interval for a population mean, using a Student's t distribution
24	CORREL	Returns the correlation coefficient between two data sets
25	COUNT	Counts how many numbers are in the list of arguments
26	COUNTA	Counts how many values are in the list of arguments
27	COUNTBLANK	Counts the number of blank cells within a range
28	COUNTIF	Counts the number of cells within a range that meet the given criteria
29	COUNTIFS	Counts the number of cells within a range that meet multiple criteria
30	COVAR	Returns covariance, the average of the products of paired deviations
31	COVARIANCE.P	Returns covariance, the average of the products of paired deviations
32	COVARIANCE.S	Returns the sample covariance, the average of the products deviations for each data point pair in two data sets
33	CRITBINOM	Returns the smallest value for which the cumulative binomial distribution is less than or equal to a criterion value

34	DEVSQ	Returns the sum of squares of deviations
35	EXP	Returns ‘e’ raised to the power of a given number
36	EXPON.DIST	Returns the exponential distribution
37	EXPONDIST	Returns the exponential distribution
38	F.DIST	Returns the F probability distribution
39	F.DIST.RT	Returns the (right-tailed) F probability distribution for two data sets.
40	F.INV	Returns the inverse of the F probability distribution
41	F.INV.RT	Returns the inverse of the (right-tailed) F probability distribution.
42	F.TEST	Returns the result of an F-test
43	FACT	Returns the factorial of a number
44	FACTDOUBLE	Returns the double factorial of a number
45	FDIST	Returns the F probability distribution
46	FINV	Returns the inverse of the F probability distribution
47	FORECAST	Returns a value along a linear trend
48	FORECAST.ETS	Uses an exponential smoothing algorithm to predict a future value on a timeline, based on a series of existing values
49	FORECAST.ETS. CONFINT	Returns a confidence interval for a forecast value at a specified target date.
50	FORECAST.ETS. SEASONALITY	Returns the length of the repetitive pattern Excel detects for a specified time series.
51	FORECAST.ETS.STAT	Returns a statistical value relating to a time series forecasting.
52	FORECAST.LINEAR	Predicts a future point on a linear trend line fitted to a supplied set of x- and y- values.
53	FREQUENCY	Returns a frequency distribution as a vertical array
54	FTEST	Returns the result of an F-test
55	GEOMEAN	Returns the geometric mean

56	HARMEAN	Returns the harmonic mean
57	HYPGEOM.DIST	Returns the hypergeometric distribution
58	HYPGEOMDIST	Returns the hypergeometric distribution
59	IF	Specifies a logical test to perform
60	IFS	Tests a number of supplied conditions and returns a result corresponding to the first condition that evaluates to TRUE.
61	INT	Rounds a number down to the nearest integer
62	INTERCEPT	Returns the intercept of the linear regression line
63	KURT	Returns the kurtosis of a data set
64	LARGE	Returns the k-th largest value in a data set
65	LINEST	Returns the parameters of a linear trend
66	MAX	Returns the largest value from a list of supplied numbers
67	MAXIFS	Returns the largest value from a subset of values in a list that are specified according to one or more criteria.
68	MIN	Returns the smallest value from a list of supplied numbers
69	MINIFS	Returns the smallest value from a subset of values in a list that are specified according to one or more criteria.
70	MEDIAN	Returns the median of the given numbers
71	MODE	Returns the most common value in a data set
72	NEGBINOM.DIST	Returns the negative binomial distribution
73	NEGBINOMDIST	Returns the negative binomial distribution
74	NORM.DIST	Returns the normal cumulative distribution
75	NORM.INV	Returns the inverse of the normal cumulative distribution
76	NORM.S.DIST	Returns the standard normal cumulative distribution
77	NORM.S.INV	Returns the inverse of the standard normal cumulative distribution.

78	NORMDIST	Returns the normal cumulative distribution
79	NORMINV	Returns the inverse of the normal cumulative distribution
80	NORMSDIST	Returns the standard normal cumulative distribution
81	NORMSINV	Returns the inverse of the standard normal cumulative distribution
82	PEARSON	Returns the Pearson product moment correlation coefficient
83	PERCENTILE	Returns the k-th percentile of values in a range
84	PERCENTILE.EXC	Returns the k-th percentile of values in a range, where k is in the range 0 to 1, exclusive
85	PERCENTILE.INC	Returns the k-th percentile of values in a range, where k is in the range 0 to 1, inclusive.
86	PERCENTRANK	Returns the percentage rank of a value in a data set
87	PERCENTRANK.EXC	Returns the rank of a value in a data set as a percentage (0..1, exclusive) of the data set
88	PERCENTRANK.INC	Returns the percentage rank of a value in a data set
89	PERMUT	Returns the number of permutations for a given number of objects
90	PERMUTATIONA	Returns the number of permutations for a given number of objects (with repetitions) that can be selected from the total objects
91	PI	Returns the value of pi
92	POISSON	Returns the Poisson distribution
93	POISSON.DIST	Returns the Poisson distribution
94	POWER	Returns the result of a number raised to a power
95	QUARTILE	Returns the quartile of a data set
96	QUARTILE.EXC	Returns the quartile of the data set, based on percentile values from 0..1, exclusive
97	QUARTILE.INC	Returns the quartile of a data set
98	RAND	Returns a random number between 0 and 1
99	RANDBETWEEN	Returns a random number between the numbers you specify

100	RANK	Returns the rank of a number in a list of numbers
101	RANK.AVG	Returns the rank of a number in a list of numbers
102	RANK.EQ	Returns the rank of a number in a list of numbers
103	ROUND	Rounds a number to a specified number of digits
104	ROUNDDOWN	Rounds a number down, toward zero
105	ROUNDUP	Rounds a number up, away from zero
106	RSQ	Returns the square of the Pearson product moment correlation coefficient
107	SKEW	Returns the skewness of a distribution
108	SKEW.P	Returns the skewness of a distribution based on a population: a characterization of the degree of asymmetry of a distribution around its mean
109	SLOPE	Returns the slope of the linear regression line
110	SMALL	Returns the k-th smallest value in a data set
111	SQRT	Returns a positive square root
112	STANDARDIZE	Returns a normalized value
113	STDEV	Estimates standard deviation based on a sample
114	STDEV.P	Calculates standard deviation based on the entire population
115	STDEV.S	Estimates standard deviation based on a sample
116	STDEVA	Estimates standard deviation based on a sample, including numbers, text, and logical values
117	STDEVP	Calculates standard deviation based on the entire population
118	STDEVPA	Calculates standard deviation based on the entire population, including numbers, text, and logical values
119	STEYX	Returns the standard error of the predicted y-value for each x in the regression
120	SUM	Adds its arguments
121	SUMIF	Adds the cells specified by a given criteria

122	SUMIFS	Adds the cells in a range that meet multiple criteria
123	SUMPRODUCT	Returns the sum of the products of corresponding array components
124	SUMSQ	Returns the sum of the squares of the arguments
125	SUMX2MY2	Returns the sum of the difference of squares of corresponding values in two arrays
126	SUMX2PY2	Returns the sum of the sum of squares of corresponding values in two arrays
127	SUMXMY2	Returns the sum of squares of differences of corresponding values in two arrays
128	T	Converts its arguments to text
129	T.DIST	Returns the Student's left-tailed t-distribution.
130	T.DIST.2T	Returns the cumulative, two-tailed Student's t-distribution.
131	T.DIST.RT	Returns the cumulative, right-tailed Student's t-distribution.
132	T.INV	Returns the t-value of the Student's t-distribution as a function of the probability and the degrees of freedom
133	T.INV.2T	Returns the two-tailed inverse of the Student's t-distribution.
134	T.TEST	Returns the probability associated with a Student's t-test
135	TDIST	Returns the Student's t-distribution
136	TINV	Returns the inverse of the Student's t-distribution
137	TREND	Returns values along a linear trend
138	TRUNC	Truncates a number to an integer
139	TTEST	Returns the probability associated with a Student's t-test
140	VAR	Estimates variance based on a sample
141	VAR.P	Calculates variance based on the entire population
142	VAR.S	Estimates variance based on a sample
143	VARA	Estimates variance based on a sample, including numbers, text, and logical values

144	VARP	Calculates variance based on the entire population
145	Z.TEST	Returns the one-tailed probability-value of a z-test
146	ZTEST	Returns the one-tailed probability-value of a z-test

Table WExcel 4.1

Excel Data Analysis add-in

The standard capabilities of Excel can be extended by using add-ins. Some of the add-ins are produced by Microsoft, but there are also many other add-ins produced by other companies.

To activate or deactivate add-ins:

Run Excel and have an Excel file open.

Select File > Options

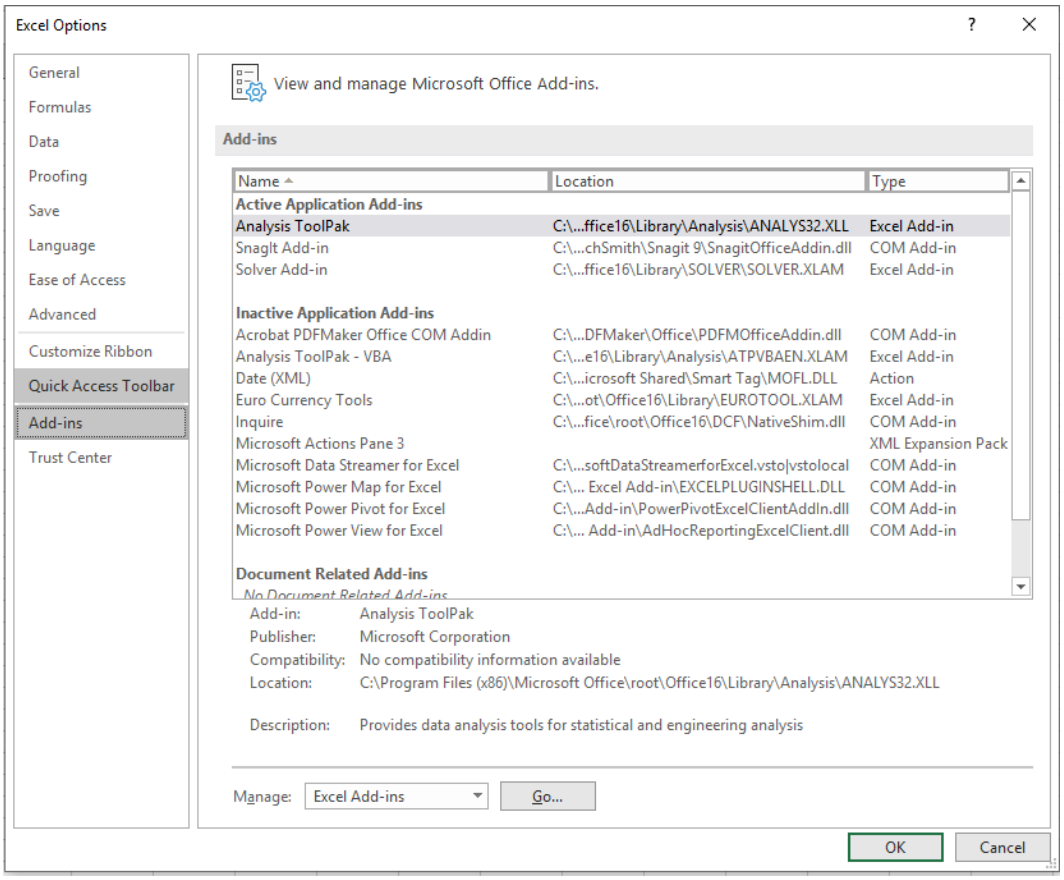


Figure WExcel 4.1

Select Excel Add-ins from the Manage box and click Go. This will access the Add-ins menu for Analysis ToolPak as illustrated in Figure WExcel 4.2.

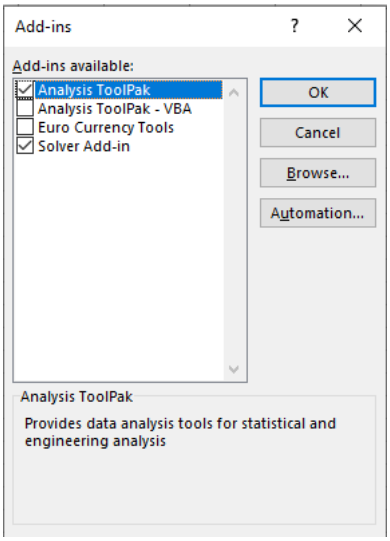


Figure WExcel 4.2

Select:

- Analysis ToolPak
- Solver Add-in

Click OK.

An extra command will now be available in Excel called Data Analysis that is accessible via Data > Data Analysis.

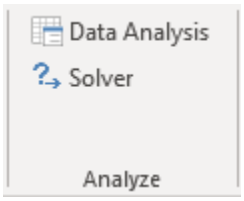


Figure WExcel 4.3

This will allow a series of analyses to be performed on data sets.

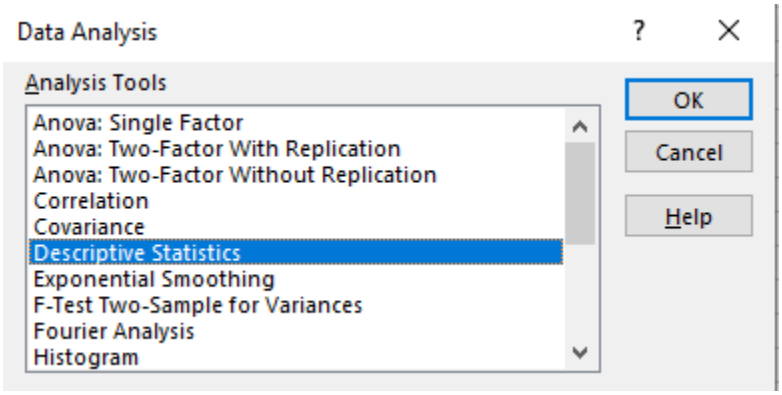


Figure WExcel 4.4

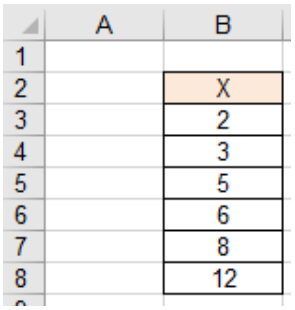
Table WExcel 4.1 shows some of the functions available in the Data Analysis ToolPak

Function name	Description
Anova: Single Factor	Performs a one-way analysis of variance (ANOVA)
Correlation	Creates a correlation matrix showing the Pearson correlation coefficient (r) for each pair of variables of N cases selected
Descriptive statistics	Calculates a range of univariate descriptive statistics, including measures of central tendency, dispersion, skewness and kurtosis for a variable
Histogram	Generates a histogram for a range of data (this function also generates a table of the data on which the histogram is based and can be used for Pareto analysis)
t-Test: Paired Two-Sample for Means	Performs a t-test to compare the means of a paired sample
t-Test: Two-Sample Assuming Equal Variances	Performs a t-test to compare the means of two independent samples, assuming equal variances
t-Test: Paired Two-Sample Assuming Unequal Variances	Performs a t-test to compare the means of two independent samples, assuming unequal variances

Table WExcel 4.2

Example: Descriptive Statistics

For example, let us calculate the descriptive statistics for the last example.



	A	B
1		
2		X
3		2
4		3
5		5
6		6
7		8
8		12

Figure WExcel 4.5

- Data set in Cells B2:B8 (includes label X in Cell B2)
- Select the cell in which you wish the calculations to be placed (say Cell D2)
- Select Data > Data Analysis

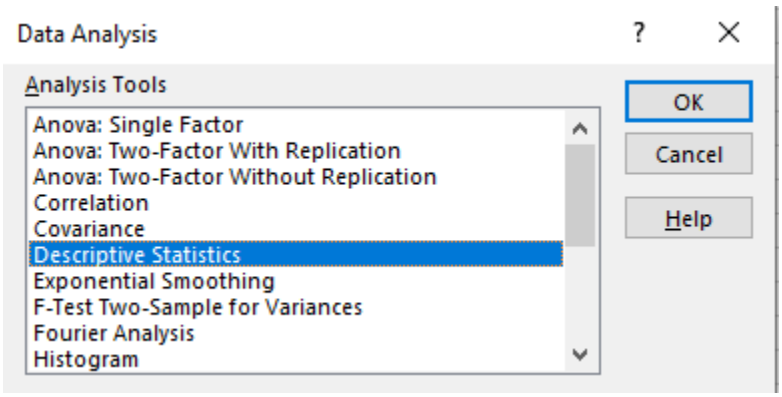


Figure WExcel 4.6

Select Descriptive Statistics
Click OK

Click on  in Input Range and select cell range B3:B8.
Grouped by Columns
In Output Range select cell D2.

Click on Summary statistics check box

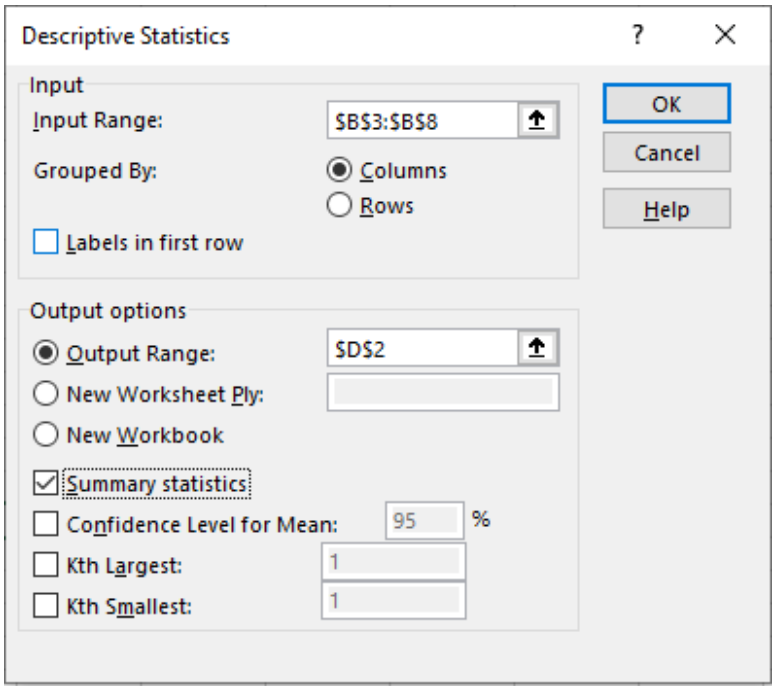


Figure WExcel 4.7

Click OK

	A	B	C	D	E
1					
2		X		*Column1*	
3		2			
4		3		Mean	6
5		5		Standard Error	1.483239697
6		6		Median	5.5
7		8		Mode	#N/A
8		12		Standard Deviation	3.633180425
9				Sample Variance	13.2
10				Kurtosis	0.378787879
11				Skewness	0.825722824
12				Range	10
13				Minimum	2
14				Maximum	12
15				Sum	36
16				Count	6

Figure WExcel 4.8

From the Excel solution illustrated in Figure WExcel 4.8, a range of summary statistics are provided, including the mean value of 6. This agrees with the previous method.

Example Two Sample Independent t test (equal variances)

A marketing research firm requires to test how effective a new version of a popular bottled water is using a sample of 20 people, half of whom taste the old water and half who taste the new water. The people in the study are then given a questionnaire which evaluates how enjoyable the water was. Determine whether there is a significant difference between the perception of the new and old water.

	A	B	C
1			
2		New water version	Old water version
3		16	11
4		15	9
5		18	8
6		12	16
7		21	17
8		14	12
9		17	11
10		11	16
11		12	7
12		16	10

Figure WExcel 4.8

Based upon further information, the analysts decide to conduct a two independent sample t-test assuming unequal variances.

H_0: no difference in population rating

$\mu_1 = \mu_2$

H1: difference in population rating

$\mu_1 \neq \mu_2$

Two tail test

Undertake test

Select Data > Data Analysis

Choose:

t-test: Two-Sample Assuming Unequal Variances

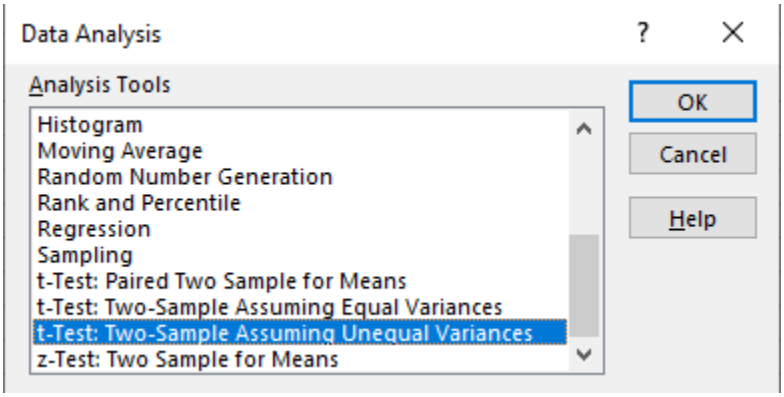


Figure WExcel 4.9

Click OK

Input:

Variable 1 Range: B3:B12
Variable 2 Range: C3:C12
Hypothesized Mean Difference: 0
Output Range: E2

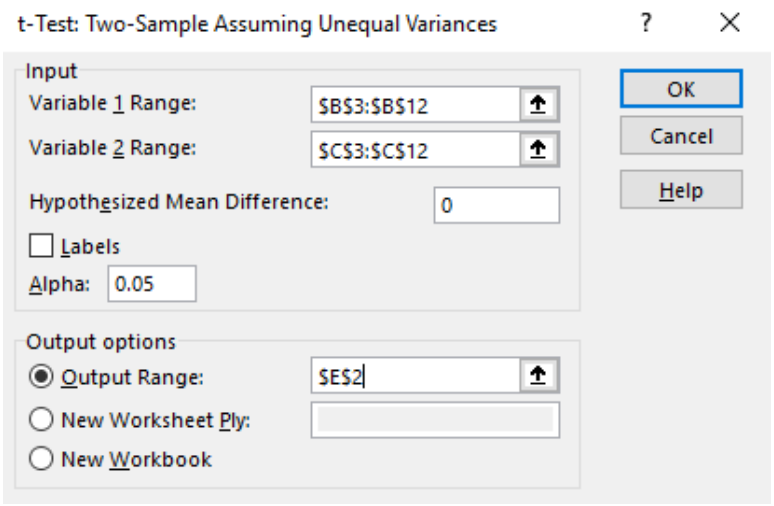


Figure WExcel 4.10

Click OK

	A	B	C	D	E	F	G
1							
2		New water version	Old water version		t-Test: Two-Sample Assuming Unequal Variances		
3		16	11				
4		15	9			*Variable 1*	*Variable 2*
5		18	8		Mean	15.2	11.7
6		12	16		Variance	9.511111111	12.45555556
7		21	17		Observations	10	10
8		14	12		Hypothesized Mean Difference	0	
9		17	11		df	18	
10		11	16		t Stat	2.361489204	
11		12	7		P(T<=t) one-tail	0.014838335	
12		16	10		t Critical one-tail	1.734063607	
13					P(T<=t) two-tail	0.029676669	
14					t Critical two-tail	2.10092204	

Figure WExcel 4.11

From Figure WExcel 4.12

Mean 1 = 15.2
Variance 1 = 9.51
Mean 2 = 11.7
Variance 2 = 12.46

Observe Mean 1 > Mean 2 but is this statistically significant.

To answer this question, look at the t-test results.

Number of observations n = 10
Degrees of freedom df = 9

t-test statistic = 2.36

Given we have a 2-tail test then

P(T <= t) two-tail = 0.02967 …

T Critical two-tail = 2.1009 …

Decision

Observe

- Test statistic t = 2.36 > critical t value = 2.1
- Test p-value = 0.02967 < 0.05

Both cases will give you the same conclusion.

Accept the alternative hypothesis, H1.

The sample data collected suggests that the new bottled water is more highly rated compared to the old bottled water. Remember this will be based upon the model assumptions (random sampling, independent variables, population normally distributed, etc).

Summary

This workbook provided the reader with an introduction to the Microsoft Excel spreadsheet that will be required to tackle the Excel topics described in the textbook.

Excel - recommended online support

1. Microsoft Excel help center https://support.office.com/en-gb/excel
2. Excel Functions http://www.excelfunctions.net/
3. ExcelUser http://www.exceluser.com/