UNDERSTANDING FUNCTIONS IN EXCEL

Functions Overview

Functions are simply pre-programmed formulas already provided for you in Excel which can perform calculations covering a wide range of categories including statistics, date and time arithmetic, financial calculations, lists, engineering, and more.

Just like normal formulas that you create, functions must start with an *equal sign*. The equal sign is then followed by the *name* of the function (usually a descriptive name which indicates the purpose of the function). Most functions also require additional information known as *arguments* which are supplied to the function in brackets after the function name. Functions are therefore written as follows:

$$=name(arguments)$$

The arguments are quite often cell or range references that contain values that can be used in the function. For example, the commonest function is the *SUM* function which, as its name suggests, is used to sum or add values together. If you wanted to add all of the values in the cells from *B10* to *D15* you would write this function as:

=SUM(B10:D15)

As you can see this is much simpler than writing your own referential formula which would look like:

=B10+B11+B12+B13+B14+B15+D10+D11+D12+D13+D14+D15

Imagine writing and proofing a formula where you had to add 200 cells!

Typing Functions

If you are familiar with the function that you need you can type it into a cell exactly the same way you type any other formula. If you are not sure if Excel has a function or you can't quite remember how it is written you can use the *Insert Function* tool ⬅ on the Formula Bar to assist you. When you click on this tool the *Insert Function* dialog box will be presented to you which lists the most recently used or common functions and also allows you to search for other functions that you might need.
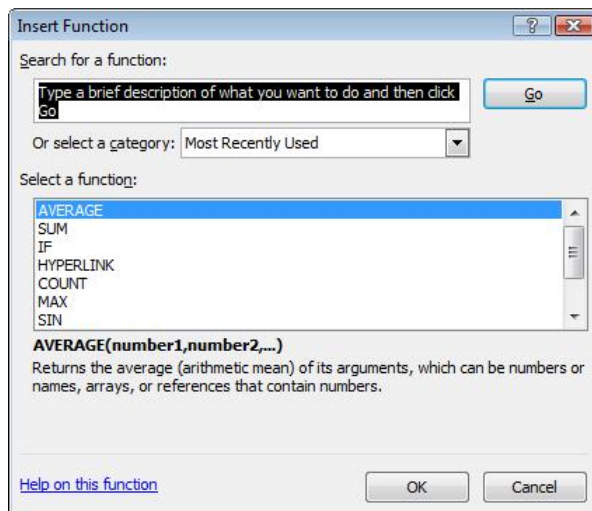
The *Insert Function* dialog box will also type the function out for you and then provide you with a further dialog box to guide you through the process of specifying the arguments that the function needs to perform its calculation.

USING THE SUM FUNCTION TO ADD

One of the most used functions is the **SUM** function. This function allows you to add the values in a range of cells. The function is writtenas: **=SUM(range or ranges to add)**.

You can type the function, and then use the pointing technique to fill in the arguments. Excel then paints marquees around the cells involved helping you to track your progress.

Try This Yourself:

1

Open File — *Before starting this exercise you MUST open the file E710 Formulas_4.xlsx...*

Click on **B9** then type **=sum(** to start the formula

Click on **B6** to point to this cellas the start, hold down →| the key and click on **B8**

Notice the relative addressing details, 3R x 1C, that appear in the tool tip…

Type **)** and press ↑ to complete the

Click on **B9**, then move the mouse pointer to the fill handleon the lower right corner of thecell and drag across to **E9** to fill the selected range with the equivalent functions

Click on the **Copy** command on the **Clipboard** group on *fx* the **Home** tab

Click on **B14**, hold down

Release Shift and press Enter to paste equivalent functionsinto the worksheet

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For Your Reference…	Handy to Know…
To **type** a **sum function** for a **contiguous range**: 1. Type **=sum(** 2. Select the range of cells 3. Type **)** 4. Press	• You can also use the **Sum** command in the**Editing** group on the **Home** tab of the **Ribbon** to have Excel automatically enter asum function based on a range of cells. • You can also type the name of a function in upper or lowercase – it is not case sensitive.

CALCULATING AN AVERAGE

The **AVERAGE** function allows you to average the values in a range of cells. It is written in much the same way as the **SUM** function, for example,
=AVERAGE(range of cells to average). The average function can be applied using the **Functions Wizard**, a part of Excel that steps you through the process of creating a function or you can type it in yourself if you are comfortable with it.

Try This Yourself:

Same File

Continue using the previous file with this exercise, or open the file E710 Formulas_6.xlsx...

Click on **B29** then click on the **Insert Function** tool 𝑓ₓ to display the **Insert Function** dialog box

Click on **AVERAGE** in **Select a function** then click on **[OK]** to display the **Function Arguments** dialog box

Click on the **Range Selector** tool 📧 for **Number1** to roll up the wizard, then hold down Ctrl and select the following ranges

B6:B8
B11:B13
B16:B18
B21:B23

Press Enter to complete the range specifications, then click on **[OK]** to complete the process

Let's use the AutoSum function…

Click on **B34**, then click on the drop arrow for the **Sum** command Σ ▾ on the **Editing** group, then select **Average**

Click on **B9**, hold down Ctrl and click on **B14**, **B19** and **B24**, then press Enter to complete the formula

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For Your Reference…

To *insert* an *average function*:

1. Click in the cell then click on the **Insert Function** 𝑓 tool
2. Click on **AVERAGE** in **Select a function**
3. Insert the required ranges then click on **[OK]**

Handy to Know…

- You can type queries like "How do I work out the monthly payment for a car loan?" into the **Search** box in the **Insert Function** dialog box. Once you have selected a function from the **Select a function** list, the **Function Arguments** dialog box will help you to enter the values into the function.

FINDING A MINIMUM VALUE

The **Minimum** or **MIN** function allows you to extract the lowest value from a range of values. It is written in much the same way as the **SUM** function. For example, **=MIN(range of cells)**.

The function can be applied using the **Function Wizard**, or by typing the function in detail directly into the cell.

Try This Yourself:

Same File

Continue using the previous file with this exercise, or open the file E710 Formulas_8.xlsx...

Click on **B31** then click on the **Insert Function** tool

to display the **Insert Function** dialog box

Click on the drop arrow for the **Or select a category** box and click on **Statistical**

Scroll down and click on **MIN** in **Select a function** then click on **[OK]** to display the **Function Arguments** tool ![icon] to roll up the

then hold down Ctrl and select the following ranges:
- B6:B8
- B16:B18
- B21:B23

Press Enter to complete range specifications, then click on **[OK]** to complete the process

Let's simply type the function this time…

Click on **B36** and type **=MIN(B9,B14,B19,B24)**

Press Enter to complete formula

(4)

MIN		=MIN(B6:B8,B11:B13,B16:B18,B21:B23)					
	A	B	C	D	E	F	G
6	January	1,050,254	1,547,000	1,488,369	1,523,124		
7	February	1,524,294	1,685,548	1,599,854	1,789,552		
8	Ma	Function Arguments					
9	1s	B6:B8,B11:B13,B16:B18,B21:B23					
10							
11	April	2,531,225	2,621,889	2,453,999	2,547,441		
12	May	550,998	850,554	818,874	837,228		
13	June	838,223	926,778	879,114	983,225		
14	2nd Quarter	3,920,446	4,399,221	4,151,987	4,367,894		
15							
16	July	1,936,882	1,641,554	1,507,774	1,386,448		
17	August	1,392,666	1,441,447	1,349,552	1,400,116		
18	September	3,332,211	223,323	322,332	673,322		
19	3rd Quarter	6,661,759	3,306,324	3,179,658	3,459,886		
20							
21	October	2,311,234	1,298,877	1,299,567	1,342,112		
22	November	1,234,455	2,341,122	1,884,566	324,555		
23	December	2,590,332	3,213,332	844,355	12,665,444		
24	4th Quarter	6,136,021	6,853,331	4,028,488	14,332,111		
25							
26	Total	22,814,261	20,776,872	17,189,577	27,994,014		
27							
28	Monthly						
29	Average	1,901,188					
30	Maximum	3,521,487					
31	Minimum	8,B21:B23)					
32							

(6)

MIN		=MIN(B9,B14,B19,B24)	
	A	B	C	D
27				
28	Monthly			
29	Average	1,901,188		
30	Maximum	3,521,487		
31	Minimum	550,998		
32				
33	Quarterly			
34	Average	5,703,565		
35	Maximum	6,661,759		
36	Minimum	=MIN(B9,B14,B19,B24)		
37				

(7)

B37			
	A	B	C	D
27				
28	Monthly			
29	Average	1,901,188		
30	Maximum	3,521,487		
31	Minimum	550,998		
32				
33	Quarterly			
34	Average	5,703,565		
35	Maximum	6,661,759		
36	Minimum	3,920,446		
37				

For Your Reference…

To **insert** a **minimum function**:

1. Click in the cell then click on the **Insert Function** tool
2. *Click on **MIN** in **Select a function***
3. Insert the required ranges then click on **[OK]**

Handy to Know…

- You might use a **Minimum** function in real life to find the lowest value in a large range of numbers. For example, in a large inventory it can be used to work out which product is the slowest seller.

Counting and Totalling by Criteria

Occasionally you may need to create a total that only includes certain cells, or count only certain cells in a column or row. The only way you could do this is by using functions that have conditions built into them. A condition is simply a test you can ask Excel to carry out, the result of which will determine the result of the function.

=SUMIF

You can use this function to say to Excel, "**only** total the numbers in the *Total* column where theentry in the *Course* column is "Word Intro".

The syntax of the SUMIF() function is detailed below:

=SUMIF(range,criteria,sum_range)

Range is the range of cells you want to test.

Criteria are the criteria in the form of a number, expression, or text that defines which cells will be added. For example, criteria can be expressed as 32, "32", ">32","apples".

Sum_range are the actual cells to sum. The cells in sum_range are summed only if their corresponding cells in *Range* match the criteria. If sum_range is omitted, the cells in *Range* aresummed.

Using the example above the SUMIF() function would be as follows:

=SUMIF(B4:B30,"Word Intro",C4:C30)

=SUMIFS()

This function allows you to be more specific about which cells summed, by having more than one criteria range. For example, you may want to find out total attendees for the Word Intro courses justfor the beginning of January (dates before 15/1/2013). The syntax is:
SUMIFS(**sum_range**, **criteria_range1**, **criteria1,** [criteria_range2, criteria2], ...)

Using the example above the SUMIFS() function would be as follows:

=SUMIFS(C4:C3,B4:B30,"Word Intro",A4:A30,"<15/1/2013")

=COUNTIF

The COUNTIF function allows you to count those cells that meet a certain condition. The functionsyntax is as follows:

=COUNTIF(range,criteria)

Range is the range of cells from which you want to count cells.

Criteria are the criteria in the form of a number, expression, or text that defines which cells will be counted. For example, criteria can be expressed as 32, "32", ">32", "apples".

With our example (shown above), the COUNTIF function you could use to determine the number ofWord Intro courses run would be:

 =COUNTIF(B4:B30, "Word Intro")   or   =COUNTIF(B4:B30, D4) *(if D4 contains 'Word Intro')*

=COUNTIFS()

The COUNTIFS function allows you to count cells that meet more than one condition. The syntax is:

COUNTIFS(criteria_range1, criteria1, [criteria_range2, criteria2]…)

For example, if you had a 3 month schedule of courses, you may want to count the number of WordIntro courses which run in February only:

=COUNTIFS(B4:B30,"WORD INTRO",A4:A30,">31/1/13",A4:A30,"<28/2/13")

Calculations with Dates

Excel also allows you to perform calculations with dates. All dates are stored in Excel as sequential numbers. By default, January 1 1900 is serial number 1, and January 1, 2004 is serial number 40933 because it is 40,933 days after January 1, 1900. Excel stores times as decimal fractions because time is considered a portion of a day.

Because dates and times are values, they can be added, subtracted, and included in other calculations. You can view a date as a serial value and a time as a decimal fraction by changing theformat of the cell that contains the date or time to *General* format.

Viewing Dates as Numbers

To view dates as numbers:

1. Select the cell and click **Cells** on the **Format** menu.

2. Click the **Number** tab, and then click **Number** in the *Group* box.

Calculating the Difference Between two Dates

In the following example the date in cell **B1** has been subtracted from the date in cell **B2**. The resultin cell **B3** has been formatted to display a number (the number of days between two dates) with no decimal places.
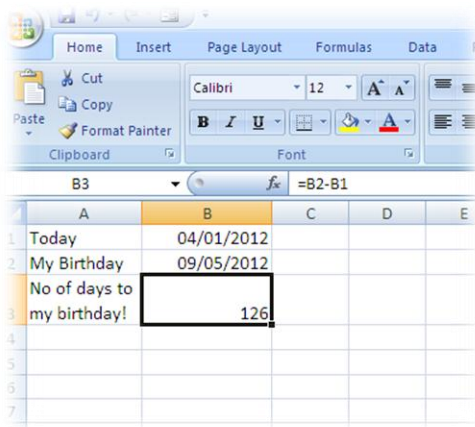
NB: You will need to format the result of the formula to a number format, as it may display as a date.

If you want to know what the date is 3 weeks' time, and you have the current date in cell A1, thenyour formula could be:

=A1+21

Date Functions

Excel won't recognise a date just typed in directly into a formula: Eg =12/1/2012+21. You would have to use a date function to convert the date into one that Excel can understand as below:

=DATE

=Date(2012,1,12)+21 The arguments being: (year,month,day)

=TODAY

=TODAY() Current date – this is a dynamic date (will change every day). You could use this in a formula to see what the date will be in 3 weeks' time from today's date: =Today()+21

=NOW

=NOW() Returns the current time. Recalculates as the sheet recalculates. To force a recalculation, press F9.

=MONTH

=MONTH(date) Returns the month as a number from 1 (January) to 12 (December)

=DAY

=DAY(date)

Returns the day of the month as a number from 1 to 31

=YEAR

=YEAR(date)

Returns the year as an integer. From the year 1900 to 9999

Adding Months and Years to a date

Adding months using the above method won't be accurate, given than the number of days in a month varies. The below function will add a precise number of months to any given date. Using cellB1 in the above example, the function will calculate what the date will be in 3 months' time from 4/1/2012:

=DATE(YEAR(B1),MONTH(B1)+3,DAY(B2))

Adding Years to a date

You can use the above function and add the number of years to the 'YEAR' part of the function. For example to add 5 years to the date in cell B1:

=DATE(YEAR(B1)+5,MONTH(B1),DAY(B2))

Text Functions

=CONCATENATE

You can join the contents of cells together using & (ampersand) symbol.
 Eg. =A1&B2 will result in **haroldgreen**. To include a space in between, you will need to add the space in as another argument:
=A1&" "&B2

As this can be laborious if you have several cells to join together, there is a function called **CONCATENATE** to help. You can join up to 255 separate arguments.
This function takes a series of text arguments separated by commas and joins them together to create a string. Arguments can be cell references, numbers or text. In the example below, we want column D to say "Harold Green is aged 75", "Violet Brown is aged 77" etc

We can use CONCATENATE to achieve this as follows:
=CONCATENATE(A2," ",B2,"is ",C2)

The Function Arguments dialogue box will look like this:
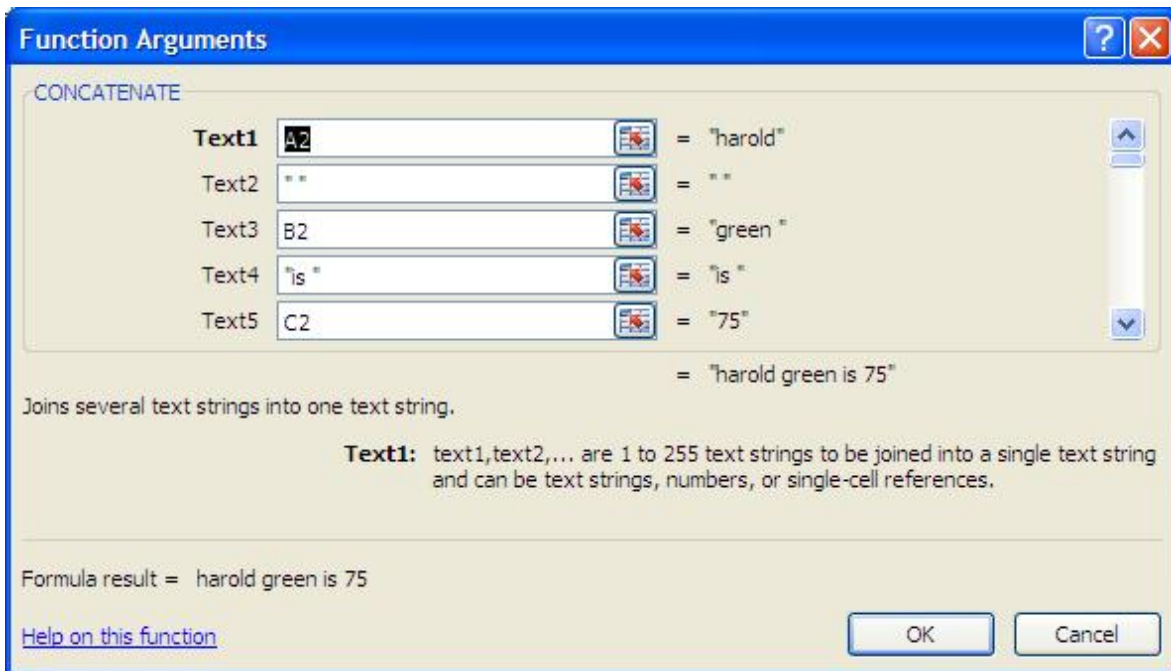
=TRIM

Removes all spaces from text except for singe spaces between words. Use TRIM on text that youhave received from another application that may have irregular spacing.

=TRIM(*text*)

Text is the text from which you want spaces removed. This is usually a cell ref.

=PROPER

Converts a text string to proper case. The first letter of each word is a capital, the rest is in lower case:

=PROPER(*text*)

Text is the text from which you want to convert to proper case. This is usually a cell ref.

=UPPER

Converts a text string to all upper case (capital) letters:

=UPPER(*text*)

Text is the text from which you want to convert to upper case. This is usually a cell ref.

=LOWER

Converts a text string to lower case.

=LOWER(*text*)

Text is the text from which you want to convert to lower case. This is usually a cell ref.

You can combine the above case conversion functions with the concatenate function to always havea text string in the case you want:

= **PROPER(CONCATENATE**(A2," ",B2,"is ",C2))

The above function will result in:

Harold Green is 75

=LEFT, =RIGHT

Returns the specified number of characters from a text string, starting from the left:

=**LEFT**(A3,5) will return *57003*. These are the first five characters in Cell A3, starting from theleft.

=**RIGHT**(A3,5) will return *697/1*. These are the last five characters in Cell A3, starting from theright.

.

=MID

=**MID** returns the middle characters from a text string, given a starting point and how many to returnfrom that point:

=**MID(A3,7,2)** will return *69*. These are the two characters to the right of the 7th character.

=LEN

=LEN will return the number of characters in a string.

=LEN(A3) will return 11. There are 11 characters in Cell A3
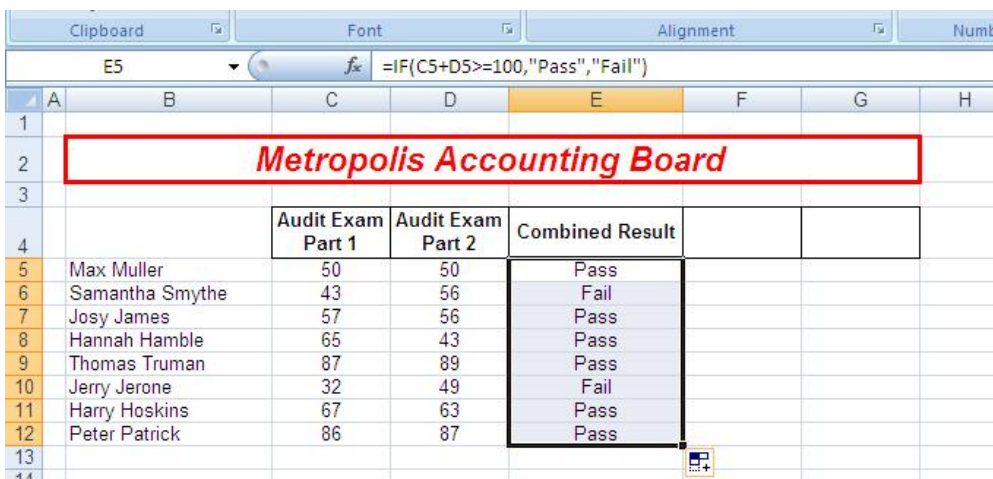
Logical Functions

=IF

=IF checks if a **condition** is met and returns one value if **TRUE**, and another value if **FALSE**
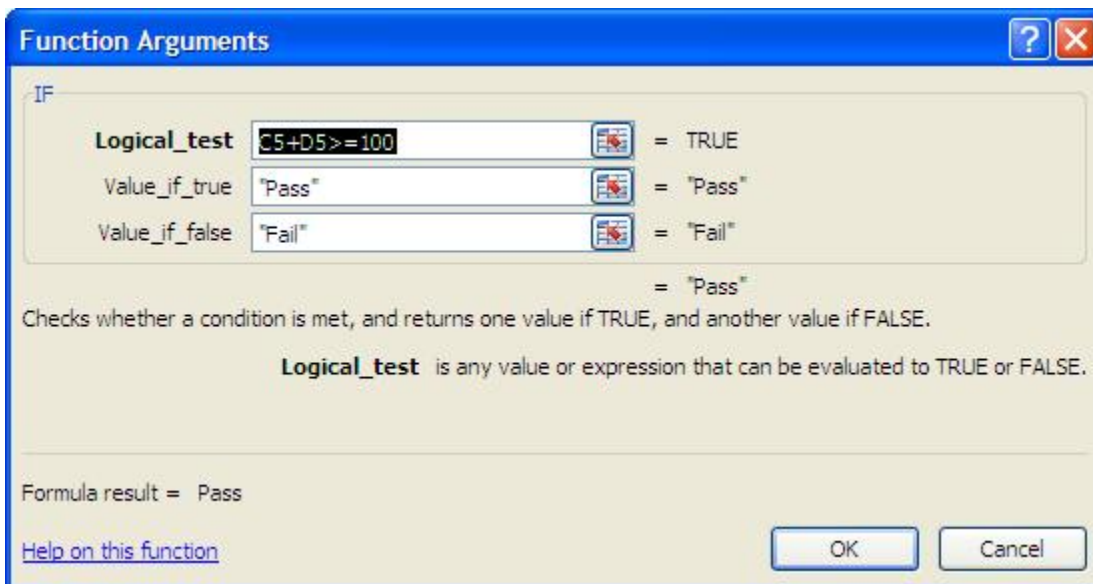
Eg

1. **=IF**(A1>10,"Over 10","10 or less") returns "**Over 10**" if A1 is greater than 10, and "**10 or less**"if A1 is less than or equal to 10.

2. **=IF**(C5+D5>=100,"Pass","Fail") returns "**Pass**" if the sum of C5 and D5 is 100 or more, and "**Fail**" if the result is less than 100.

The Function Arguments would be:

Value-if-true and Value-if-false can be Text, Values or Calculations/Formulae.

Nested IF

You may want to evaluate more than one condition, and therefore, result in more than one outcome.You can have up 64 nested IF functions in Excel 2007.

Eg **=IF**(C5+D5>150,"**A**",IF(C5+D5>=100,"**B**","**Fail**"))

IF C5+D5 is greater than 150, then the result will be "A", if C5+D5 is greater or equal to 100, then theresult will be "B", if C5+D5 is less than 100 (this is only other number it could be!) then the result is "Fail"

In Excel 2007 onwards you can have up to 64 nests!

=AND

You may have more than one condition to meet for your logical test to be true. You can Nest the AND function inside the IF and have up to 30 conditions to be evaluated.

EG The students ONLY get a Merit if they gain more than 80 marks for both Part 1 **AND** Part 2 of theAudit Exam:

=IF(AND(C5>80,D5>80),"Merit","")

Only the students who have achieved over 80 marks in both exams will gain a Merit

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=OR

If you have more than one condition, but *any* can be met for the result to true, then use OR.

=IF(OR(C5>80,D5>80),"Merit","")

The students who have achieved over 80 marks in Audit Exam Part 1 *OR* Part 2 will gain a Merit

	B	C	D	G
		D7		f_x 86
1				
2				
3				
4		Audit Exam Part 1	Audit Exam Part 2	Merit
5	Max Muller	50	50	=IF(OR(C5>80,D5>80),"Merit","")
6	Samantha Smythe	43	56	=IF(OR(C6>80,D6>80),"Merit","")
7	Josy James	57	86	=IF(OR(C7>80,D7>80),"Merit","")
8	Hannah Hamble	65	43	=IF(OR(C8>80,D8>80),"Merit","")
9	Thomas Truman	87	89	=IF(OR(C9>80,D9>80),"Merit","")
10	Jerry Jerone	32	49	=IF(OR(C10>80,D10>80),"Merit","")
11	Harry Hoskins	67	63	=IF(OR(C11>80,D11>80),"Merit","")
12	Peter Patrick	86	87	=IF(OR(C12>80,D12>80),"Merit","")
13				

=NOT

Reverses the true value. Eg:

=IF(NOT(C5=50,"OK","") will return "OK" as C5 does = 50, but none of the other cells in the ColumnC have the value 50, therefore the result will be "blank" for the rest of the column.

=VLOOKUP

The **VLOOKUP** function will look up a value in the first column of table, and returns the value in thesame row from a column that you specify.

	F5		fx	=VLOOKUP(E5,SALARY,2)				
	A	B	C	D	E	F	G	H
1	**Personnel Database**							
2								
3								
4	Surname	First name	Job title	Grade	Spinal Po	Salary	Years in Post	
5	Abbey	Rachel	Maintenance Engineer	M1	34	£23,451.00	2	
6	Laing	Peter	Maintenance Engineer	M1	36	£24,750.00	6	
7	Baron	Michelle	Admin Assistant	Sc1	6	£9,912.00	1	

	SALARY		fx	1			
	A	B	C	D	E	F	G
						Salary Scales as at 1 July 1999	
						1	6,359
						2	7,214
						3	7,963
						4	9,267
						5	9,588
						6	9,912
						7	10,233
						8	10,554
						9	10,875
						10	11,100
						11	11,817
						12	12,066
						13	12,390
						14	12,618
						15	12,879

Range called SALARY

In the above example =VLOOKUP(E5,SALARY,2) looks at value in cell E5 (34), looks for this value in the first column in the range "SALARY" and returns the value in column 2 of that range.

lookup_value: the value to be looked up

table_array: where to look the information up

col_index: the number of the column from the start of the table_array that you want to retrieve

index_num: 'True' will find the closest match, 'False' will find the exact match

=HLOOKUP

=HLOOKUP is as the VLOOKUP function, but looks up the value in first *row* of a range, instead ofthe first column.

Maths Functions

Maths functions are in the *Math & Trig* category in the Formulas tab:

=ROUND

=ROUND if useful to force the result of a calculation to be a specific number of decimal places. Unlike number formatting, which just changes what the number looks like, but retains the accuracy ofthe original calculation, and if this value is then used in other formulae, it may result in rounding errors.
Eg =ROUND(2.3165,2) Result will be 2.32

This can be nested into another function: For example:

=ROUND(C5*12.5%,2)

Will round to 2 decimal places the result of the calculation C5 multiplied by 12.5%

=INT

=INT rounds the number to the nearest integer

=INT(2.3165)

Will return the integer part of the value – the result will be 2.

Understanding error messages

Excel may display error messages if your formulae or functions contain mistakes (note that it will notdetect all errors in calculations). It is always worth checking the result of your formulae by hand if theformula is at all complex. Excel's error messages contain a **#** symbol followed by a diagnostic word (see the table below). In some cases, the cell with an error in it has a small green arrow in the corner. In such cases, if you click in the cell a yellow symbol with an exclamation mark appears. Click the exclamation mark for options to help you to trace the source of the error.

Green triangle   #NAME?   Cell containing error

Invalid Name Error
Help on this error
Show Calculation Steps…
Ignore Error
Edit in Formula Bar
Error Checking Options…
Show Formula Auditing Toolbar

messageYellow symbol with exclamation mark

Options for dealing with error
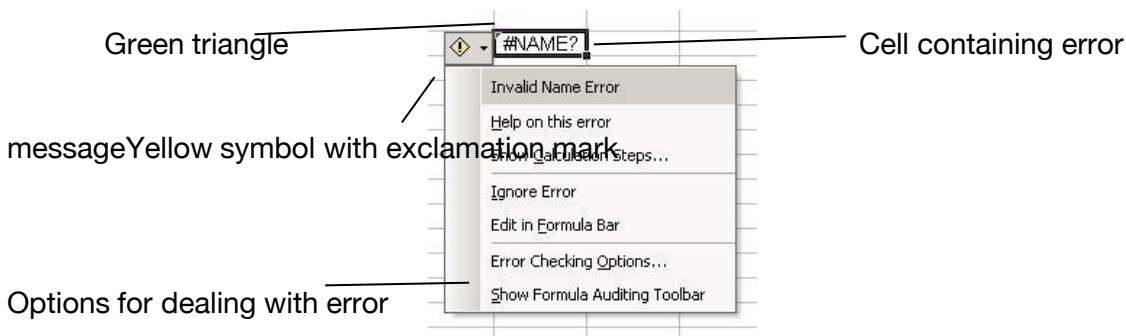
Conditional Formatting

Conditional formatting will format cells to your specifications or to preset formats, which match the criteria that you specify. For example, you may want to highlight all the cells that have a value higher than 80 in a red font with a yellow background.
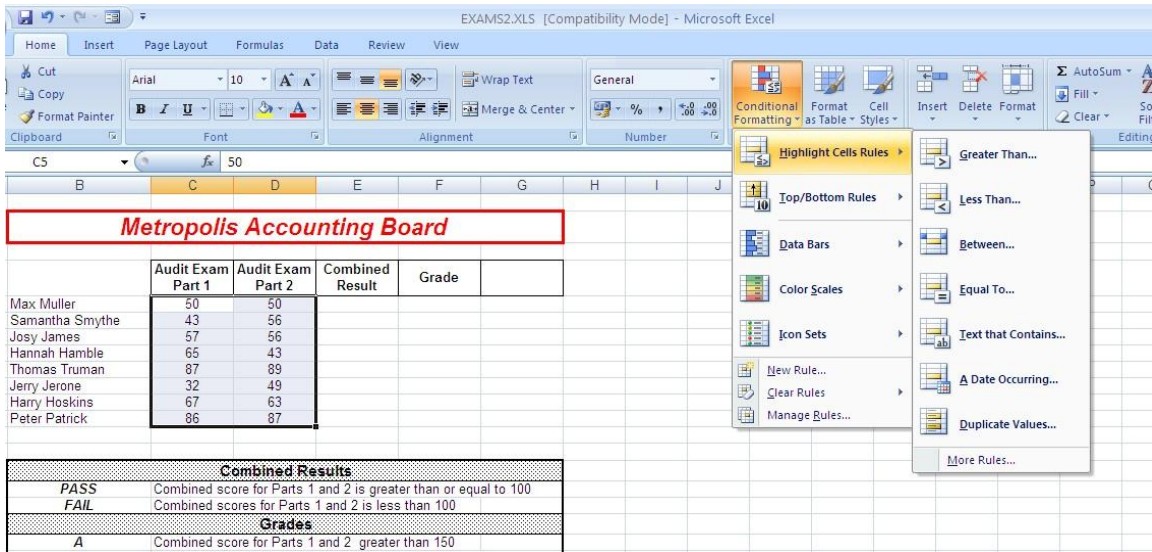
1. This is a cell formatting feature, so you need to select the cell range which you want to affect first. Then click on the **Conditional Formatting** button in the **Styles** group on the **Home** tab.

2. On the Highlight Cell Rules option, choose the criteria required. Eg Greater Than, and specify80 as the value and then choose from the list of formats offered, or create your own with Custom Format...
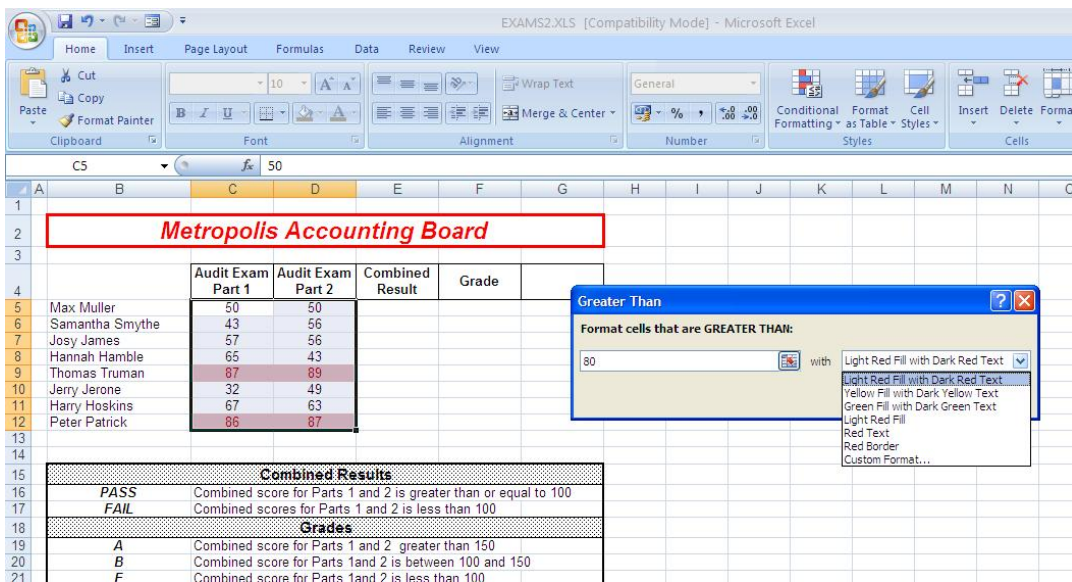
You can also use text criteria – cells which contain certain text strings (Text that Contains...)

Dates occurring in differing date/time frames :
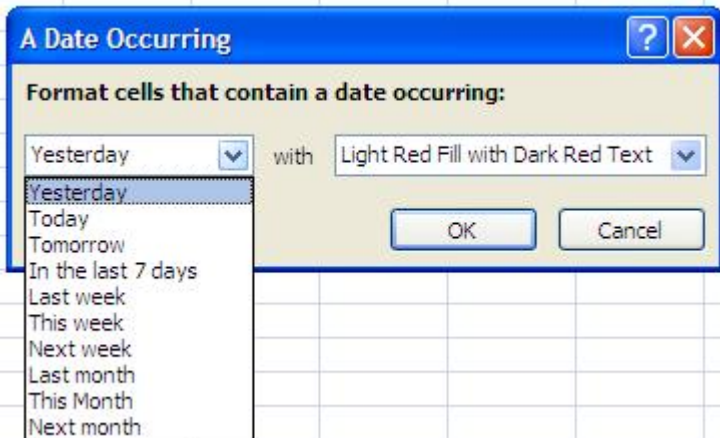
Conditional Formatting using a Formula

You may want to make your Conditional Formatting more dynamic by using cell references in your criteria. So when the content of the cell(s) change, the formatting will also change.

In the example below, the cells which contain values greater than or equal to the value in cell G5, the colour fill will change.
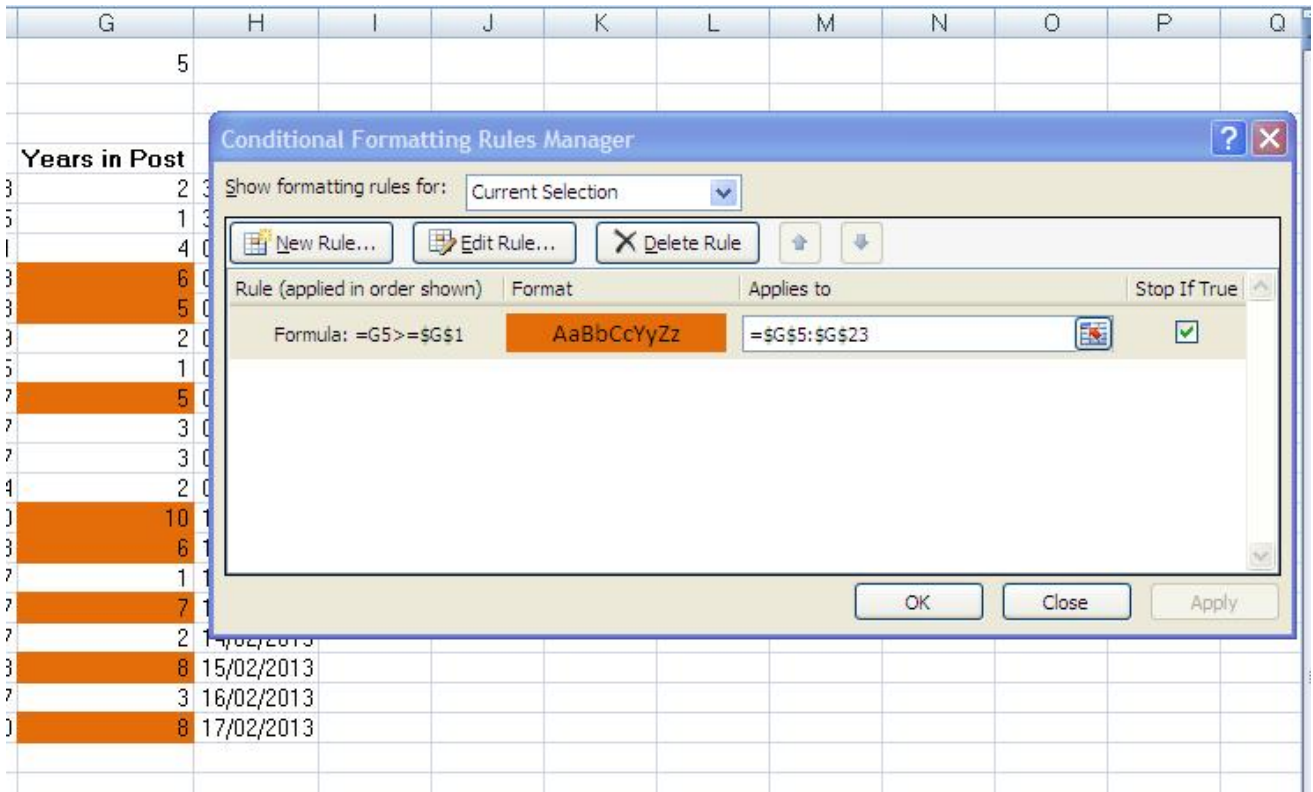
To use a formula:

1. Select the cell range you wish to apply the rule to
2. Click on Conditional Formatting, New Rule and select
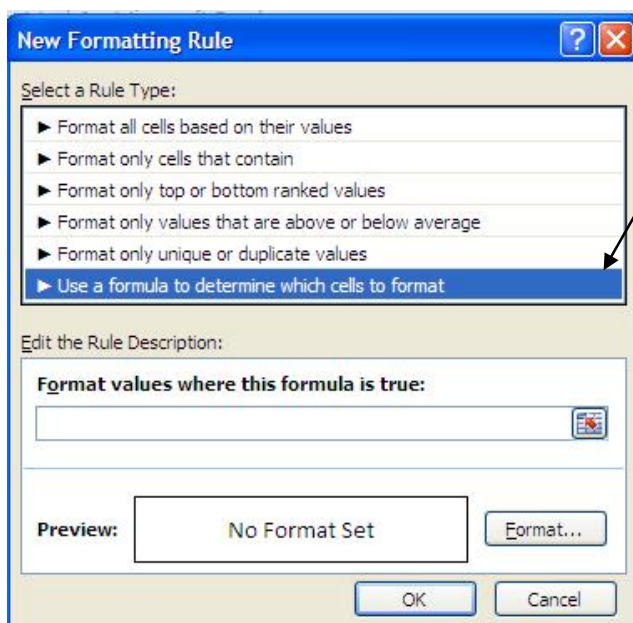
3. Select the cell (or type in the cell reference) at the beginning of your range – in this example cell G5. Make sure that it is NOT absolute

4. Complete the formula using the cell which will contain your variable value – G1 (this cell *must* be absolute)

5. Set the Format as required
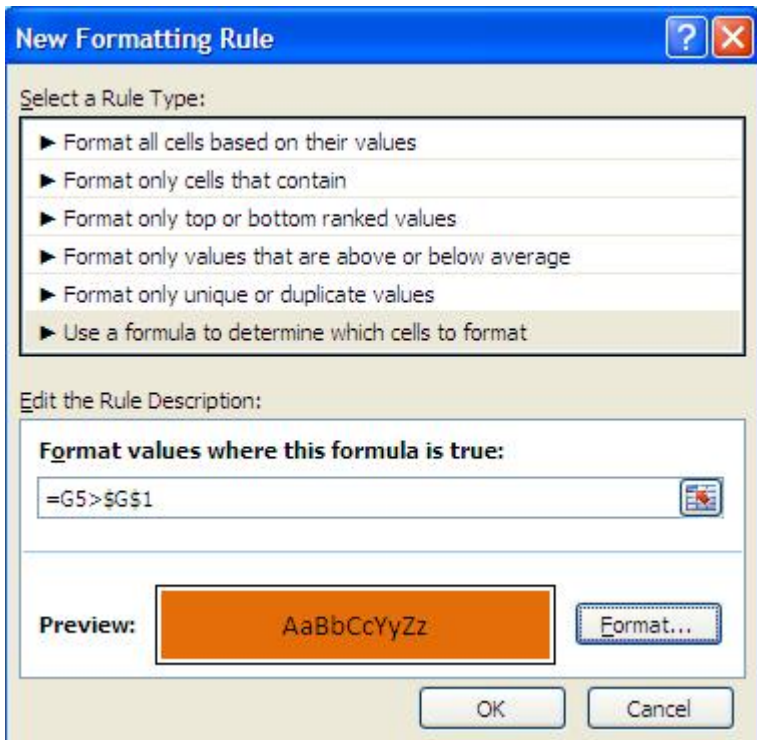
Clearing Conditional Formats

You can clear all Rules by selecting Clear Rules on the Conditional Formatting button or be selective in the Rules you wish to delete or edit with the Manage Rules Option

Statistical Functions

S/N	FUNCTION	CATEGORY	DESCRIPTION	USAGE
01	SUM	Math & Trig	Adds all the values in a range of cells	=SUM(E4:E8)
02	MIN	Statistical	Finds the minimum value in a range of cells	=MIN(E4:E8)
03	MAX	Statistical	Finds the maximum value in a range of cells	=MAX(E4:E8)
04	AVERAGE	Statistical	Calculates the average value in a range of cells	=AVERAGE(E4:E8)
05	COUNT	Statistical	Counts the number of cells in a range of cells	=COUNT(E4:E8)
06	LEN	Text	Returns the number of characters in a string text	=LEN(B7)
07	SUMIF	Math & Trig	Adds all the values in a range of cells that meet a specified criteria. =SUMIF(range,criteria,[sum_range])	=SUMIF(D4:D8,">=1000",C4:C8)
08	AVERAGEIF	Statistical	Calculates the average value in a range of cells that meet the specified criteria. =AVERAGEIF(range,criteria,[average_range])	=AVERAGEIF(F4:F8,"Yes",E4:E8)
09	DAYS	Date & Time	Returns the number of days between two dates	=DAYS(D4,C4)
10	NOW	Date & Time	Returns the current system date and time	=NOW()

Numeric Functions

As the name suggests, these functions operate on numeric data. The following table shows some of the common numeric functions.

S/N	FUNCTION	CATEGORY	DESCRIPTION	USAGE
1	ISNUMBER	Information	Returns True if the supplied value is numeric and False if it is not numeric	=ISNUMBER(A3)
2	RAND	Math & Trig	Generates a random number between 0 and 1	=RAND()
3	ROUND	Math & Trig	Rounds off a decimal value to the specified number of decimal points	=ROUND(3.14455,2)
4	MEDIAN	Statistical	Returns the number in the middle of the set of given numbers	=MEDIAN(3,4,5,2,5)
5	PI	Math & Trig	Returns the value of Math Function PI(π)	=PI()
6	POWER	Math & Trig	Returns the result of a number raised to a power. **POWER(number, power)**	=POWER(2,4)
7	MOD	Math & Trig	Returns the Remainder when you divide two numbers	=MOD(10,3)
8	ROMAN	Math & Trig	Converts a number to roman numerals	=ROMAN(1984)

String Functions

These basic excel functions are used to manipulate text data. The following table shows some of the common string functions.

S/N	FUNCTION	CATEGORY	DESCRIPTION	USAGE	COMMENT
1	LEFT	Text	Returns a number of specified characters from the start (left-hand side) of a string	=LEFT("GURU99", 4)	Left 4 Characters of "GURU99"
2	RIGHT	Text	Returns a number of specified characters from the end (right-hand side) of a string	=RIGHT("GURU99",2)	Right 2 Characters of "GURU99"
3	MID	Text	Retrieves a number of characters from the middle of a string from a specified start position and length. **=MID (text, start_num, num_chars)**	=MID("GURU99",2,3)	Retrieving Characters 2 to 5
4	ISTEXT	Information	Returns True if the supplied parameter is Text	=ISTEXT(value)	value - The value to check.
5	FIND	Text	Returns the starting position of a text string within another text string. This function is case-sensitive. **=FIND(find_text, within_text, [start_num])**	=FIND("oo","Roofing",1)	Find oo in "Roofing", Result is 2
6	REPLACE	Text	Replaces part of a string with another specified string. **=REPLACE (old_text, start_num, num_chars, new_text)**	=REPLACE("Roofing",2,2,"xx")	Replace "oo" with "xx"

VLOOKUP function

The VLOOKUP function is used to perform a vertical look up in the left most column and return a value in the same row from a column that you specify. Let's explain this in a layman's language. The home supplies budget has a serial number column that uniquely identifies each item in the budget. Suppose you have the item serial number, and you would like to know the item description, you can use the VLOOKUP function. Here is how the VLOOKUP function would work.

=VLOOKUP (C12, A4:B8, 2, FALSE)

HERE,

- **"=VLOOKUP"** calls the vertical lookup function
- **"C12"** specifies the value to be looked up in the left most column
- **"A4:B8"** specifies the table array with the data
- **"2"** specifies the column number with the row value to be returned by the VLOOKUP function
- **"FALSE,"** tells the VLOOKUP function that we are looking for an exact match of the supplied look up value

The animated image below shows this in action

IF, AND, OR, Nested IF & NOT Logical Functions in Excel

What is a Logical Function?

It is a feature that allows us to introduce decision-making when executing formulas and functions. Functions are used to;

- Check if a condition is true or false
- Combine multiple conditions together

What is a condition and why does it matter?

A condition is an expression that either evaluates to true or false. The expression could be a function that determines if the value entered in a cell is of numeric or text data type, if a value is greater than, equal to or less than a specified value, etc

IF Function example

We will work with the home supplies budget from this topic. We will use the IF function to determine if an item is expensive or not. We will assume that items with a value greater than 6,000 are expensive. Those that are less than 6,000 are less expensive. The following image shows us the dataset that we will work with.

- Put the cursor focus in cell F4
- Enter the following formula that uses the IF function
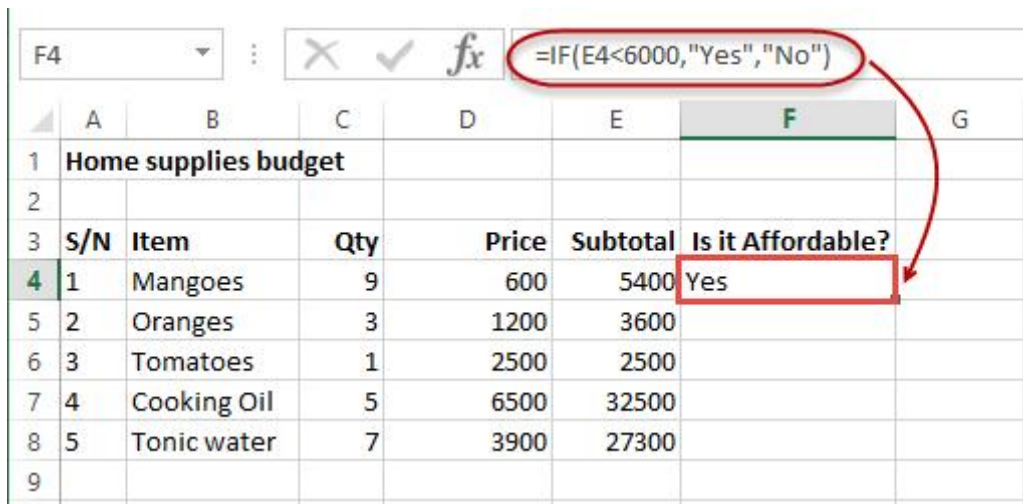
=IF(E4<6000,"Yes","No")

HERE,

- **"=IF(…)"** calls the IF functions
- **"E4<6000"** is the condition that the IF function evaluates. It checks the value of cell address E4 (subtotal) is less than 6,000
- **"Yes"** this is the value that the function will display if the value of E4 is less than 6,000
- **"No"** this is the value that the function will display if the value of E4 is greater than 6,000

When you are done press the enter key

You will get the following results

F4					=IF(E4<6000,"Yes","No")	
	A	B	C	D	E	F	G

	A	B	C	D	E	F	G
1	Home supplies budget						
2							
3	S/N	Item	Qty	Price	Subtotal	Is it Affordable?	
4	1	Mangoes	9	600	5400	Yes	
5	2	Oranges	3	1200	3600		
6	3	Tomatoes	1	2500	2500		
7	4	Cooking Oil	5	6500	32500		
8	5	Tonic water	7	3900	27300		
9							

Excel Logic functions explained

The following table shows all of the logical functions in Excel

S/N	FUNCTION	CATEGORY	DESCRIPTION	USAGE
01	AND	Logical	Checks multiple conditions and returns true if they all the conditions evaluate to true.	=AND(1 > 0,ISNUMBER(1)) The above function returns TRUE because both Condition is True.
02	FALSE	Logical	Returns the logical value FALSE. It is used to compare the results of a condition or function that either returns true or false	FALSE()
03	IF	Logical	Verifies whether a condition is met or not. If the condition is met, it returns true. If the condition is not met, it returns false. **=IF(logical_test,[value_if_true],[value_if_false])**	=IF(ISNUMBER(22),"Yes", "No") 22 is Number so that it return Yes.

04	IFERROR	Logical	Returns the expression value if no error occurs. If an error occurs, it returns the error value	=IFERROR(5/0,"Divide by zero error")
05	IFNA	Logical	Returns value if #N/A error does not occur. If #N/A error occurs, it returns NA value. #N/A error means a value if not available to a formula or function.	=IFNA(D6*E6,0) N.B the above formula returns zero if both or either D6 or E6 is/are empty
06	NOT	Logical	Returns true if the condition is false and returns false if condition is true	=NOT(ISTEXT(0)) N.B. the above function returns true. This is because ISTEXT(0) returns false and NOT function converts false to TRUE
07	OR	Logical	Used when evaluating multiple conditions. Returns true if any or all of the conditions are true. Returns false if all of the conditions are false	=OR(D8="admin",E8="cashier") N.B. the above function returns true if either or both D8 and E8 admin or cashier
08	TRUE	Logical	Returns the logical value TRUE. It is used to compare the results of a condition or function that either returns true or false	TRUE()

Nested IF functions

A nested IF function is an IF function within another IF function. Nested if statements come in handy when we have to work with more than two conditions. Let's say we want to develop a simple program that checks the day of the week. If the day is Saturday we want to display "party well", if it's Sunday we want to display "time to rest", and if it's any day from Monday to Friday we want to display, remember to complete your to do list.

A nested if function can help us to implement the above example. The following flowchart shows how the nested IF function will be implemented.
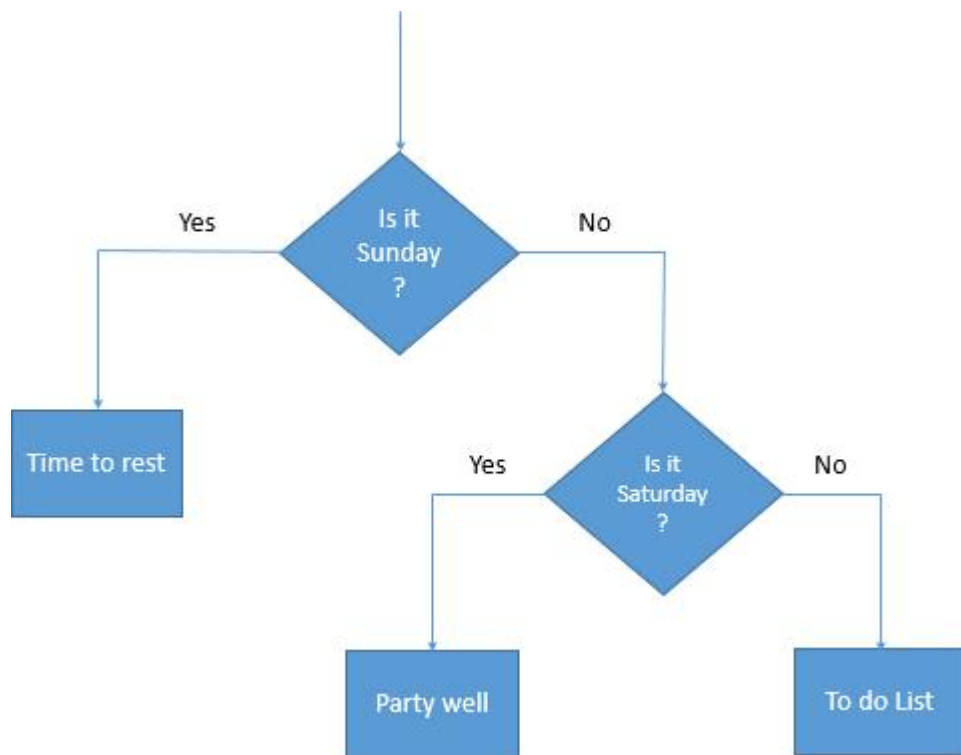
The formula for the above flowchart is as follows

=IF(B1="Sunday","time to rest",IF(B1="Saturday","party well","to do list"))

HERE,

- **"=IF(….)"** is the main if function
- **"=IF(…,IF(….))"** the second IF function is the nested one. It provides further evaluation if the main IF function returned false.

Precision formatting

Care must be taken when working with formatted numbers. It is important to remember that formatted numbers, i.e. the numbers which appear on the screen, may not be the same as the value stored in the cell or the numbers used in calculations. The discrepancy can cause the results displayed to be different from the manually calculated answers.

In the example opposite, there are two columns of numbers that appear to be the same. The first column adds up to 95 but the second column adds up to 100. Take a close look at the value stored in cell A1, as displayed in the *Formula* bar. The value stored in all the cells in the first column is actually 9.5. This has been formatted to appear as a whole number (integer). The calculation is actually correct (10*9.5=95), although it appears to be incorrect. The problem can be avoided by using number formats cautiously, or it can be resolved by setting the precision for the entire worksheet as explained below.

Setting the precision of number formats

To set the precision of number formats for an entire worksheet:

1. Click the Office button , then select Excel Options button

2. Click on the *Advanced* category

3. Scroll down to *When calculating this workbook*

4. Choose the **Precision as displayed** box and click **OK**

When you choose **OK** you are warned that constant numbers throughout the workbook will be rounded permanently to match cell-formatting.

This will affect all cells in the worksheet. If you only want to round certain cells, then you can use the =ROUND function to round to a specific number of decimal places or the =INT function to convert to an integer only.

Example:

The =ROUND function will round the contents of cell C6 to 2 decimal places, using mathematical rounding, and will return 7.57

Statistical & mathematical functions

Some of the most commonly used statistical and mathematical functions are shown below.

Function	Example	Description
MAX	MAX(C1:C10)	Finds the largest cell value in the specified range of cells.
MIN	MIN(C1:C10)	Finds the smallest cell value in the specified range of cells.
AVERAGE	AVERAGE(C1:10)	Finds the average cell value in the specified range of cells.
MEDIAN	MEDIAN(C1:C10)	Finds the median or middle value in the specified range ofcells.
STDEV	STDEV(C1:C10)	Finds the standard deviation of the values in a range of cells.
COUNT	COUNT(C1:C10)	Counts the number of cells containing numbers.
COUNTA	COUNTA(C1:C10)	Counts the number of cells containing numbers or letters (i.e.the number of non-blank cells).
COUNTBLANK	COUNTBLANK(C1:C10)	Counts the number of blank cells.
COUNTIF	COUNTIF(	
INT	INT(C6)	Returns the integer value (5.35 becomes 5, 7.34 becomes 7)
ROUND	ROUND(C1, 2)	Rounds the cell value to the specified number of decimalplaces (2 in this example; use 0 to get a whole number).
SQRT	SQRT(C1)	Calculates the square root of a cell value.
RADIANS	RADIANS(C1)	Converts angles from degrees to radians.
SIN	SIN(C1)	Calculates the Sine of an angle (in radians – use the RADIANS function to convert degrees into radians). Other trigonometric functions include COS and TAN.

Cell references

In functions, you often need to refer to a range of cells. The way Excel displays cell references in functions depends on whether the cells you want the function to act upon aretogether in a block, or in several non-adjacent cells or blocks.

The table below explains how to use different operators to refer to cells:

Operator	Example	Description
Reference operator : (colon)	B5:B15	Range operator that produces one reference to all thecells between two references, including the two references.
, (comma)	SUM(B5:B15,D5:D15)	Union operator that combines multiple references into onereference.
(single space)	=B5:B15 A7:D7	Intersection operator that produces one reference to cellscommon to two references. In this example, cell B7 is common to both ranges; therefore the result would be thecontents of cell B7.

Absolute cell referencing

The ability to copy formulae from one location to another in a spreadsheet can save you a significant amount of work. Normally, if you copy a formula involving a cell reference to another location, the cell reference is adjusted relative to its starting point. So, for example, if you copy a formula which multiplies two cells to the left of it, the formula will adjust to the new location by multipling the two cells to the left at the new position. Ie if you start a formula is in C1 and multiply A1 by B1, and you then copy the formula to C2, the formula willbecome A2 multiplied by B2, as these are the two cells to the left of C2. The formula has updated automatically to refer to adjacent cells. This is an example of a **relative referencing** system.

Sometimes we may need to refer to a **specific** cell location in a worksheet, and so we wantthat cell reference to remain unchanged, regardless of where the formula is placed. We need a method to fix our cell reference so that it does not update when we copy the formulato another location – we need an **absolute cell reference**.

Making a reference absolute

If you type a **$** sign before both the column letter and the row number of the cell referencethen the relative reference A1 becomes the absolute reference A1. This absolute reference won't change if you copy the formula.

A beter method is the keyboard shortcut, **F4**. This is quicker and more accurate.

- When constructing a formula and the cell which you want to make absolute is selected,press the **F4 key.**

$ signs are automatically placed in front of the column and row references.

Absolute references explained

The data on the left show the basic earnings for a group of staff. Their manager has decided to award them a bonus payment, and wishes to storethe total pay in column C.

The formula for cell C6 is **=B6+B3**. Here the $ is used to make the reference to cell B3 absolute. When this formula is copied into cells C7:C12, theformula updates as shown.

Cell B6 in the initial formula is relative, therefore this reference will change when copied, but B3 is absolute and will not change to another referencewhen copied.

Mixed references

If only the column reference or the row reference is to be absolute, prefix one or other ofthese with a $ sign. For example, if the column is to be *absolute* and the row *relative* A1becomes $A1, if the row is to be *absolute* and the column *relative* A1 becomes A$1.

1. Double-click in the cell as if to edit it.

2. Highlight the cell reference to be made absolute and press **F4**. Note that by pressing **F4** a number of times you cycle through different options for creating a **mixed reference**.

A1	Relative
A1	Absolute
$A1	Mixed (Column Absolute, Row Relative)
A$1	Mixed (Column Relative, Row