



# Excel 2016

## Further Functions

### Course objectives:

- Understand and use different functions effectively
- Text Functions
- Date and Time Functions
- Math and Trig Functions
- Lookup and Reference Functions
- Logical Functions
- Statistical Functions

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### Exercise document:

Go to <https://www.library.uq.edu.au/library-services/training-resources> and click on Excel2016\_Further\_Functions.xlsx to download.

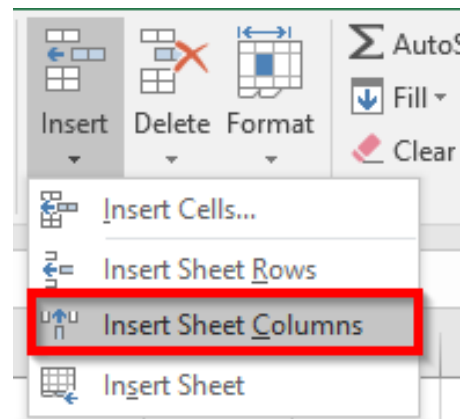
## Text Functions

Text functions are used when working with cells containing text strings. Some of the many functions available can...change text case, compare cells containing text strings and even split or concatenate (join) text strings.

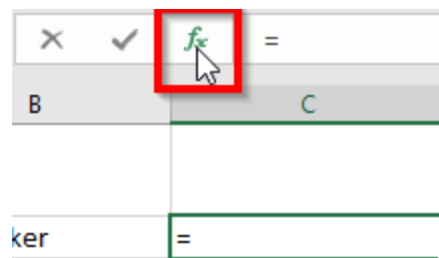
### Exercise 1. **“PROPER” Function**

This function is used to convert the case of text strings e.g. lower case to Proper Case. Other functions in this class are Lower and Upper. The proper function capitalises the first letter of each word in the selected text.

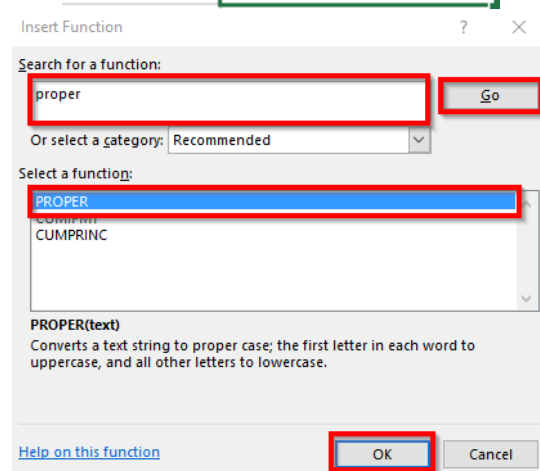
1. Open the **Excel2016\_Further\_Functions** file and open the **Exams** sheet
  2. Select cell **C1**
  3. Click on the **Home** tab > **Cells** group
  4. Click the dropdown arrow under **Insert**
  5. Select **Insert Sheet Columns**
- This inserts a new blank column - **C**
6. Select cell **C2**



7. Click on **Insert Function** icon to bring up the dialogue box



8. In the **Select a Function** area click on **PROPER**
- If the function is not in the function list, type the name or description in the **Search for a function** text area and click **Go**
9. Click on **OK** to bring up the function arguments dialogue box.



Notes

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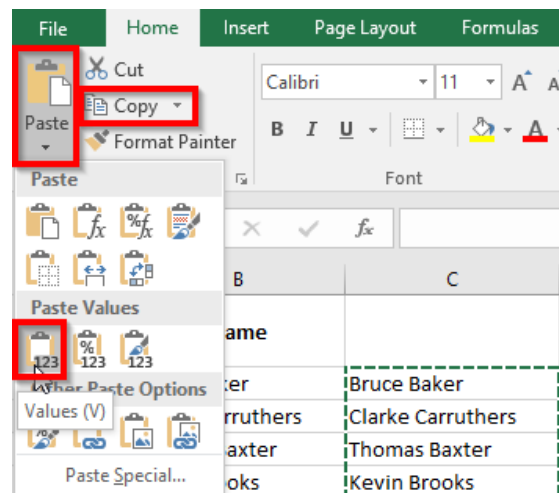
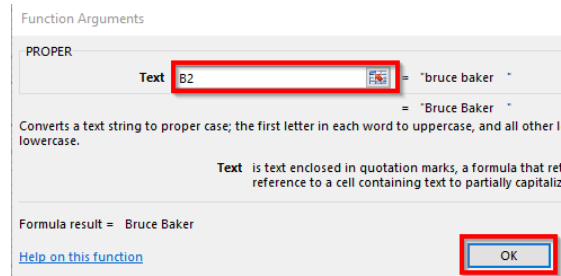
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10. Place your cursor in the **Text** textbox
  11. Click on cell **B2**
  12. Click **OK**
- “bruce jones baker” should now appear as “**Bruce Jones Baker**”
13. Autofill down to change the remaining names to **Proper** case
  14. Select cells **C2** to **C62**
  15. Select the **Home** tab > **Clipboard** group > **Copy** or **CTRL + C** on the keyboard
  16. Select cell **B2**
  17. Click on the dropdown arrow under **Paste**
  18. In the **Paste Values** section click on **Values**
  19. Delete the contents from column **C**

Other functions in this class

**Upper** - Converts all characters in a supplied text string to upper case

**Lower** - Converts all characters in a supplied text string to lower case

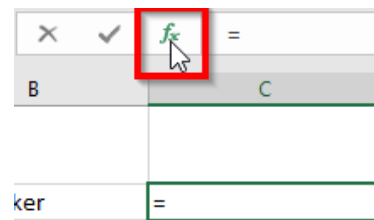


## Exercise 2.

## “EXACT” Function

This function tests if two supplied text strings are exactly the same (Cell to cell comparison). This exercise checks to determine if the list of student names in the Fees worksheet is the same as the list of student names in the Exams worksheet

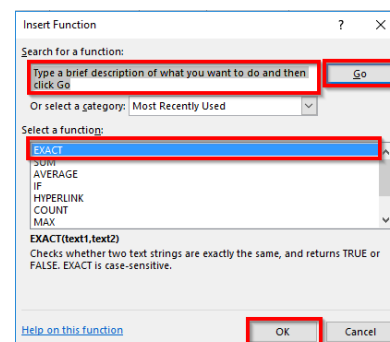
1. Open the **Exams** sheet
2. Select cell **C2**
3. Click on **Insert Function** icon to bring up the dialogue box



4. In the **Select a Function** area click on **EXACT**

If the function is not in the function list, type the name or description in the **Search for a function** text area and click **Go**

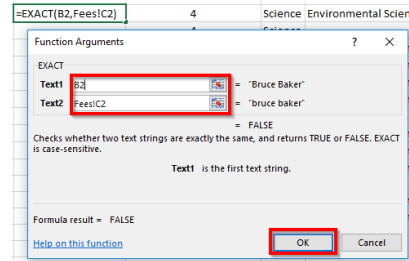
5. Click on **OK** to bring up the function arguments dialogue box.



Notes

6. Ensure your cursor is in the **Text1** textbox
7. Click on cell **B2**
8. Place your cursor is in the **Text2** textbox
9. Select the **Fees** tab
10. Click on cell **C2**
11. Click **OK**
12. Cell **C2** of the Exams sheet should now display either:
  - **TRUE** – An exact match exists between the text in the two cells
  - **FALSE** – The text in the two cells do not match exactly
13. Autofill cell **C2** down for the remaining students

**Note:** The first 3 rows returned false. This shows that although text may look the similar, they may not necessarily be exact. There may be trailing spaces and other non-printing characters that may not be visible.



Name	
Bruce Baker	FALSE
Clarke Carruthers	FALSE
Thomas Baxter	FALSE
Kevin Brooks	TRUE
Joseph Cooper	TRUE
Carol Wardlaw	TRUE
Maura Hadeley	TRUE
Lynn Walker	TRUE
Adrian Fisher	TRUE
Duncan Spencer	
Colin White	

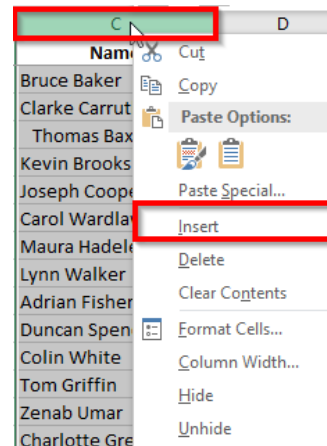
### Exercise 3.

### “TRIM” Function

This function removes additional spaces (leading, middle, trailing) from text.

1. Open the **Fees** sheet
2. Move your mouse cursor over the column **C** label
3. **Right click > Insert**

This inserts a new blank column **C**



Notes

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4. Select cell **C2**
5. Click on Insert Function icon to bring up the dialogue box
6. In the **Select a Function** area click on **Trim**

If the function is not in the function list, type the name or description in the **Search for a function** text area and click **Go**

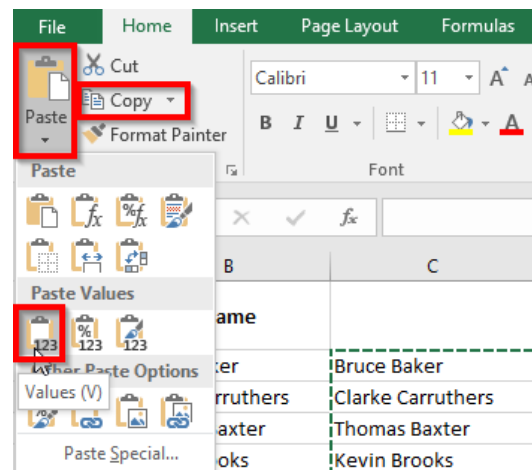
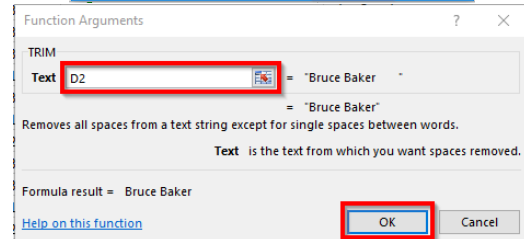
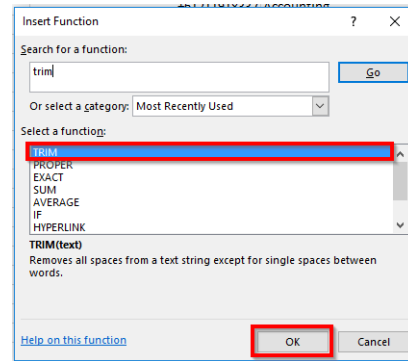
7. Click on **OK** to bring up the function arguments dialogue box.
8. Ensure your cursor is in the **Text** textbox
9. Click on cell **D2**
10. Click **OK**
11. Autofill down to trim the remaining names

12. Select cells **C2** to **C62**
13. Select the **Home** tab > **Clipboard** group > **Copy**
14. Select cell **D2**
15. Click on the dropdown arrow under **Paste**
16. In the **Paste Values** section click on **Values**
17. Right Click column C heading and Delete column **C** from the Fees sheet

**NB:** The exact function on the Exams sheet should now be true for all names.

Other functions in this class:

**Clean** - Removes all non-printable characters from a supplied text string. Spaces are not removed.

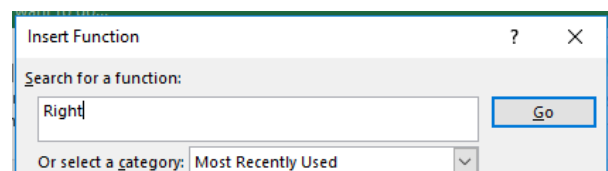


## Exercise 4. **“CONCATENATE” and “RIGHT” Functions**

**Concatenate** is a function used to join two or more text strings together. The **Right** function returns a specified number of characters from the end of a supplied text string. This exercise will remove the country code from students' mobile number and replace it with a zero.

### **Remove +61 from phone numbers**

1. Open the **Fees** sheet
2. Insert a blank column before column **I** and label it **Mobile Number**
3. Select cell **I2**
4. Click on Insert Function icon to bring up the dialogue box
5. Search for the function **Right**
6. Click **Go**



Notes

7. In the **Select a Function** area click on **Right**
8. Click on **OK** to bring up the function arguments dialogue box.
9. Ensure your cursor is in the **Text** textbox
10. Click on cell **J2**
11. In the **Num\_chars** text box type **9**
12. Click **OK**

You are now left with the phone number which is missing a **Zero (0)**

**Add a leading Zero to all numbers**

13. Select cell **I2** and modify your formula as follows:  
**=CONCATENATE(0, RIGHT(J2,9))**

Autofill down for the remaining numbers

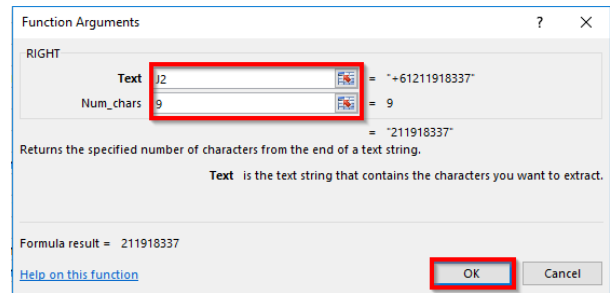
14. Select cells **I2** to **I62**
15. Select the **Home** tab > **Clipboard** group > **Copy**
16. Select cell **I2**
17. Click on the dropdown arrow under **Paste**
18. In the **Paste Values** section click on **Values**
19. Delete column **J** (Phone Number)

Other functions in this class:

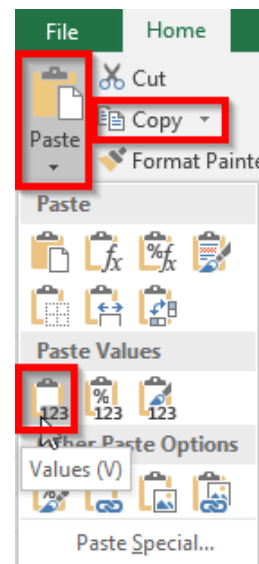
**Left** - returns a specified number of characters from the beginning of a supplied text string

**Mid** - returns a specified number of characters from the middle of a supplied text string

**Rept** - returns a string consisting of a supplied text string, repeated a specified number of times



Mobile Number	Phone Number
=CONCATENATE(0, RIGHT(J2,9))	+61211918337
	+61221918941
	+61221010545



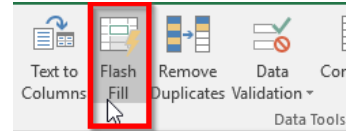
Notes

## Exercise 5.

## Flash Fill

This function gives the ability to create new data sets from existing data based on patterns. It can be used to extract, insert, format, concatenate, reverse, etc., different types of data. This exercise will separate student names into **first** and **last** names.

1. Open the **Exams** sheet
2. Delete Column **C**
3. Insert two blank columns before column **B** and label them it **Firstname** and **Lastname**
4. Select cell **B2**, type **Bruce** and press **Enter**
5. Select the **Data** tab > **Data Tools** group > **Flash Fill**



Alternatively, you can use the keyboard shortcut **Control + E**

The first names of all students will be automatically populated

1. Select cell **C2** and type **Jones Baker**
2. Select cell **C3** and type in **Carruthers**
3. Select the **Data** tab > **Data Tools** group > **Flash Fill**
4. Delete column **D** (Name)

NB: The last name had to be entered twice to provide an example of each type of surname. This enabled excel to know that some students had two surnames while others had one.

App No	Firstname	Lastname	Name
1	Bruce		bruce jones baker
2	Clarke		clarke carruthers
3	Thomas		thomas baxter
4	Kevin		kevin brooks
5	Joseph		joseph cooper
6	Carol		carol james wardlaw
7	Maura		maura hadeley
8	Lynn		lynn walker
9	Adrian		adrian fisher
10	Duncan		duncan spencer
11	Colin		colin white

Firstname	Lastname
Bruce	Jones Baker
Clarke	Carruthers
Thomas	Baxter
Kevin	Brooks
Joseph	Cooper
Carol	James Wardlaw
Maura	Hadeley
Lynn	Walker
Adrian	Fisher
Duncan	Spencer
Colin	White

## Date and Time Functions

### Exercise 6.

### Exact Date calculations

The DATEDIF function calculates the number of days, months, or years between two dates. The formula has the syntax **DATEDIF(start\_date,end\_date,unit)**.

**Unit** refers to the type of information to be returned. The following units are used in this function.

- Y - The number of complete years in the period.
- M - The number of complete months in the period.
- D - The number of days in the period
- MD - The difference between the days in start\_date and end\_date. The months and the years of the dates are ignored
- YM - The difference between the months in start\_date and end\_date. The days and the years of the dates are ignored
- YD - The difference between the days of start\_date and end\_date. The years of the dates are ignored

In the following exercise the **Today()** function (gives the current date) is being used as the end date criteria. The **&** symbol is used to join/concatenate the result(s) and text.

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### Calculate the exact age of the students

1. Select the **Fees** worksheet
2. Select cell **F2**
3. Start the formula by typing  
**=DATEDIF(D2,TODAY(),"Y")&" Years, "**
4. Press **Enter**

=DATEDIF(D2,TODAY(),"Y")&" years, "

This calculates the number of complete years and adds the word years.

5. Click on cell **F2**. The formula will appear in the formula bar
6. Add the following to your formula **&DATEDIF(D2,TODAY(),"YM")&" Months, "**
7. Press **Enter**
8. This calculates the number of complete years and months.

=DATEDIF(D2,TODAY(),"Y")&" years, "&DATEDIF(D2,TODAY(),"YM")&" Months "

9. Click on cell **F2**. The formula will appear in the formula bar
10. Add the following to your formula **&DATEDIF(D2,TODAY(),"MD")&" Days "**
11. Press **Enter**
12. This calculates the number of complete years, months and days.
13. Fill down the calculation for the other students

=DATEDIF(D2,TODAY(),"Y")&" years, "&DATEDIF(D2,TODAY(),"YM")&" Months, "&DATEDIF(D2,TODAY(),"md")&" Days "

## Math and Trig Functions

### Exercise 7.

### "SUMIF" Function

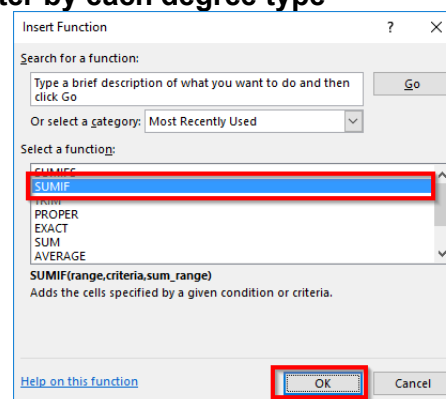
The SUMIF function adds data in the cells in a supplied range that satisfy a single criterion

### Calculate the amount of fees paid per semester by each degree type

1. Open the **Fees** sheet and select cell **L66**
2. Click on Insert Function icon to bring up the dialogue box
3. In the **Select a Function** area click on **SUMIF**

If the function is not in the function list, type the name or description in the **Search for a function** text area and click **Go**

4. Click on **OK** to bring up the function arguments dialogue box.



Notes

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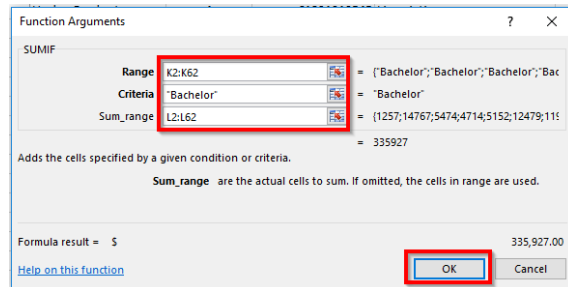
5. Type in the following arguments:

- **Range:** \$K\$2:\$K\$62
- **Criteria:** Bachelor
- **Sum\_range:** L2:L62

6. Click on **OK**

7. Autofill to the right to get the values for the other semesters

NB: Use absolute referencing to lock the criteria range before applying Autofill



Other functions in this class:

**Averageif** – Gives the average of cells in a supplied range that satisfy a given criterion

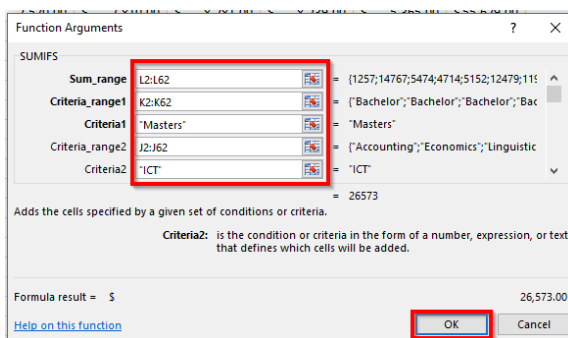
## Exercise 8. **“SUMIFS” Function**

The SUMIFS function adds data in the cells in a supplied range, that satisfy multiple criteria.

**Calculate the amount of fees paid per semester by Masters students in ICT**

1. Open the **Fees** sheet and select cell **L67**
2. Click on the **Insert Function** icon to bring up the dialogue box
3. In the **Select a Function** area click on **SUMIFS** > **OK**
4. Type in the following arguments:
  - **Sum\_range:** L2:L62
  - **Criteria\_range1:** \$K\$2:\$K\$62
  - **Criteria1:** Masters
  - **Criteria\_range2:** \$J\$2:\$J\$62
  - **Criteria2:** ICT
5. Click on **OK**
6. Autofill to the right to get the values for the other semesters

NB: Use absolute referencing to lock the criteria ranges before applying Autofill



Total Fees - Bachelor	\$ 335,927.00	\$ 314,658.00	\$ 276,081.00
Total Fees - Masters in ICT	\$ 26,573.00	\$ 27,812.00	\$ 16,978.00

Other functions in this class:

**Averageifs** – Gives the average of cells in a supplied range that satisfy multiple criteria

Notes

## Exercise 9.

## “SUMPRODUCT” Function

The SUMIFS function has the limitation of being unable to sum multiple ranges for the selected criteria. The Sumproduct function can be used to overcome this. Sumproduct returns the sum of the products of corresponding values in two or more supplied arrays

**Calculate the amount of fees paid for sem 1 and sem 4 by Masters students in ICT**

1. Open the **Fees** sheet and select cell **L71**
2. Enter the following formula...

`=SUMPRODUCT((L2:L62+O2:O62)*(K2:K62="Masters")*(J2:J62="ICT"))`

3. Press **Enter**

The function computes the total amount of fees paid by ICT Masters students for Semesters 1 and 4. This saves having to do multiple calculations to achieve the same result.

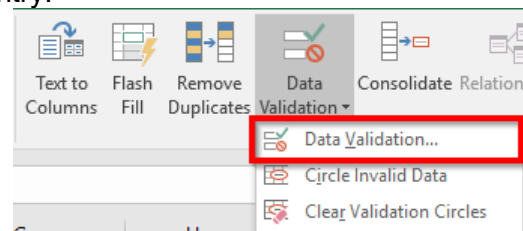
## Lookup and Reference Functions

## Exercise 10.

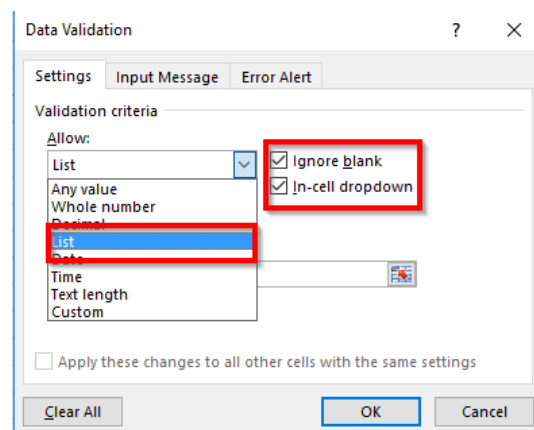
## Dropdown Lists

Typing existing data into formulas can result in errors. For example, having trailing spaces after a value can cause an error in the evaluation of a formula. Predefined dropdown lists in excel can be used to avoid unnecessary data entry.

1. Open the **Fees** sheet and select cell **L73**
2. Select the **Data** tab > **Data tools** group > **Data Validation**



3. On the **Data Validation** dialogue box select the **Settings** tab
4. From the dropdown list under **Allow**, select **List**
5. Tick **Ignore blank** and **In-cell dropdown**

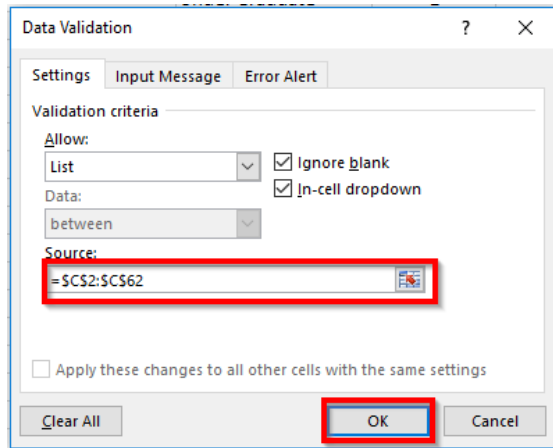


Notes

6. Click in the **Source** data field and select cells C2 to C62
- Alternatively, you can enter: `=C$2:C$62` into the source field
7. Click **OK**

A dropdown list of student names is now created in cell L73.  
Updating the list of students automatically updates the list dropdown list.

8. Select cell L74
9. **Repeat** this **exercise** using cells `=L$1:$T$1` as the **Source** data.

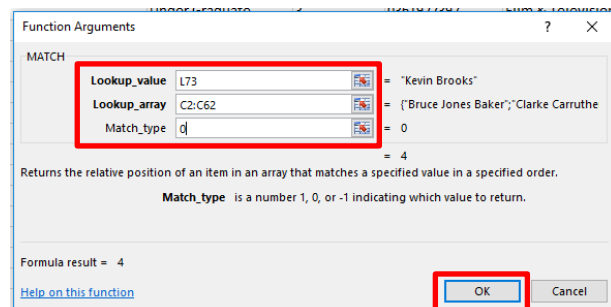


## Exercise 11. **“MATCH” Function**

The MATCH function finds the relative position of a value in a supplied list or array. The value of the MATCH function is not very obvious when used on its own. It is however a very useful function when combined with other functions.

### Determine the position of Kevin Brooks

1. Open the **Fees** sheet and select cell L73
2. Choose **Kevin Brooks** from the dropdown list
3. Select cell L77
4. Click on Insert Function icon to bring up the dialogue box
5. In the **Select a Function** area click on **MATCH**
6. Click on **OK** to bring up the function arguments dialogue box.
7. Type in the following arguments:
  - **Lookup\_value:** L73
  - **Lookup\_array:** C2:C62
  - **Match\_type:** 0
8. Click on **OK**



### Match Types:

- 1 : Greater than
- 0 : Exact
- 1 : Less than

### Notes

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## Exercise 12.

## “INDEX” Function

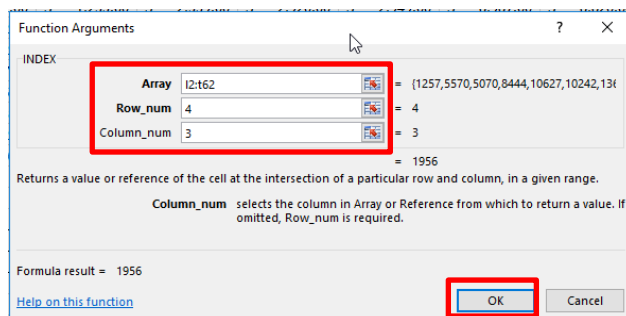
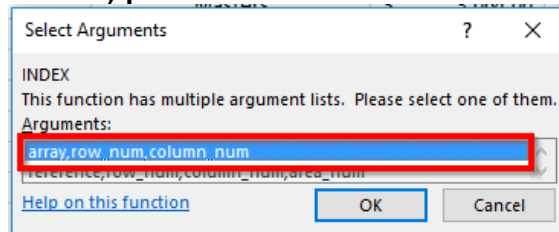
The INDEX function returns the data in a cell (or range of cells) for given rows and columns.

**Determine how much a student (e.g Kevin Brooks) paid in Sem 3**

1. Open the **Fees** sheet and select cell **L78**
2. Click on Insert Function icon to bring up the dialogue box
3. In the **Select a Function** area click on **INDEX**

If the function is not in the function list, type the name or description in the **Search for a function** text area and click **Go**

4. Click on **OK** to bring up the select arguments dialogue box.
5. Select **array,row\_num,column\_num**
6. Click **OK**
7. Type in the following arguments:
  - **Array:** L2:t62
  - **Row\_num:** 4
  - **Column\_num:** 3
8. Click on **OK**



The use of the INDEX function requires the user to know the row and column location of the data to be returned. This can be difficult, especially on large spreadsheets.

The solution to this problem is to use the function together with other functions such as the MATCH function, which automatically identifies the relative row and column of a value.

## Exercise 13.

## Combining the INDEX and MATCH Functions

1. Open the **Fees** sheet and select cell **L75**
2. Enter the following formula

```
=index(l2:t62,match(l73,c2:c62,0),Match(l74,l1:t1,0))
```

3. Press **Enter**

The MATCH functions will determine the relative positions of the values entered in cells **L73** and **L74**. The INDEX function will then use those positions to output the required data. In this example the result will be how much a particular student owes in a particular semester.

Notes

## Logical Functions

### Exercise 14.

### “AND” Function

The **AND** function compares a number of user-defined logical conditions and returns TRUE if **ALL** of the conditions evaluate to true, or FALSE if not. It is useful if you want to check if all values satisfy certain specified criteria. A total of 255 logical conditions can be tested.

#### Determine which students qualify for RHD candidature

1. Open the **Exams** sheet and select cell **K2**
2. Click on Insert Function icon to bring up the dialogue box
3. In the **Select a Function** area click on **AND**

If the function is not in the function list, type the name or description in the **Search for a function** text area and click **Go**

4. Click on **OK** to bring up the function arguments dialogue box.

5. Type in the following arguments:

- **Logical1:** H2="Research"
- **Logical2:** J2>=6

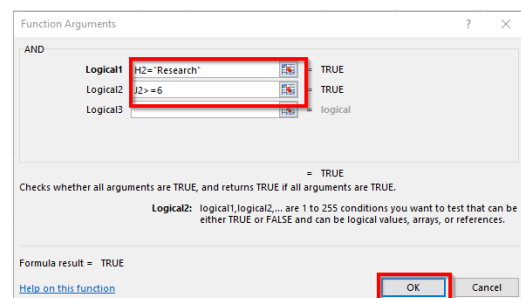
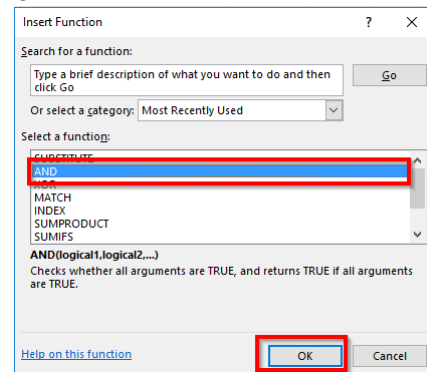
6. Click on **OK**

7. Fill down to complete the data

The function will test whether the student is a research student and scored a GPA of 6 or more. If both conditions are satisfied the function will evaluate to TRUE, otherwise it will evaluate to FALSE.

Other functions in this class:

**OR** - Compares a number of user-defined logical conditions and returns TRUE if ANY of the conditions evaluate to true, or FALSE if not.



### Exercise 15.

### Combining “IF” and “AND” Functions

The result of an **AND** or **OR** function can be combined with other functions to provide more meaningful results. For example, instead of displaying TRUE/FALSE, explanatory feedback can be provided if you combine the **And** and **IF** functions.

1. Open the **Exams** sheet and select cell **K2**
2. Modify the existing formula to the following:

```
=IF(AND(H2="Research",J2>=6),"Qualified","Not Qualified")
```

3. Press **Enter**

The formula uses the result of the AND function as the logical test for the IF statement and returns a value of Qualified if TRUE and a value of Not Qualified if FALSE.

4. Fill down to complete the data

Notes

## Statistical Functions

### Exercise 16.

### “COUNTBLANK” Function

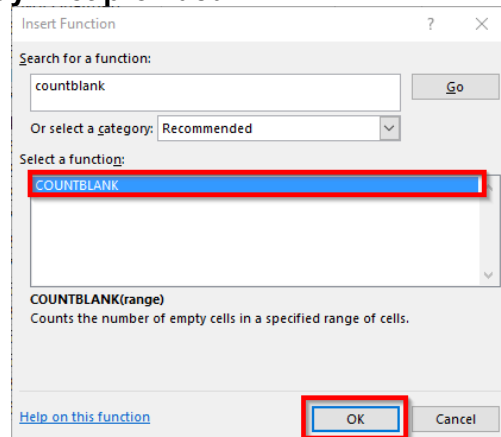
The COUNTBLANK function returns the number of blank cells in a supplied range of cells. It is useful in large spreadsheets with missing values.

#### Count the number of students with “Field of Study” not provided

1. Open the **Exams** sheet and select cell **O66**
2. Click on Insert Function icon to bring up the dialogue box
3. In the **Select a Function** area click on **COUNTBLANK**

If the function is not in the function list, type the name or description in the **Search for a function** text area and click **Go**

4. Click on **OK** to bring up the function arguments dialogue box.

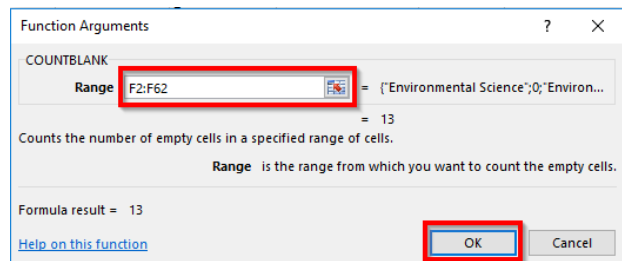


5. Type in the following argument:  
**Range:** F2:F62
6. Click on **OK**
7. The number of blank cells will be displayed

Other functions in this class:

**COUNTA** – Gives the number of non-blank cells in a supplied range of cells.

**COUNT** – Gives the number of numerical values in a supplied range of cells



### Exercise 17.

### “COUNTIF” Function

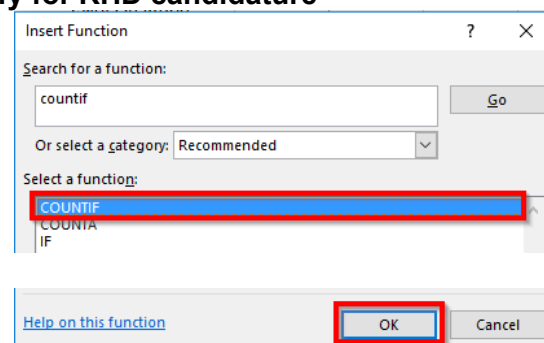
The COUNTIF function returns the number of cells in a range, that satisfy a given criterion.

#### Count the number of students who qualify for RHD candidature

1. Open the **Exams** sheet and select cell **O67**
2. Click on Insert Function icon to bring up the dialogue box
3. In the **Select a Function** area click on **COUNTIF**

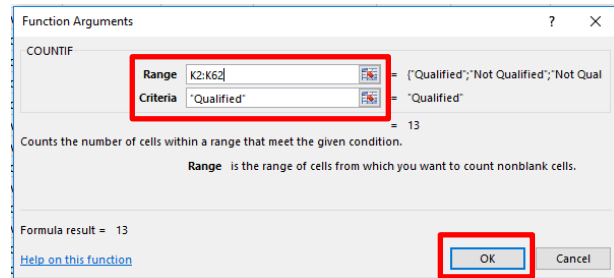
If the function is not in the function list, type the name or description in the **Search for a function** text area and click **Go**

4. Click on **OK** to bring up the function arguments dialogue box.



Notes

5. Type in the following arguments:
  - **Range:** K2:K62
  - **Criteria:** Qualified
6. Click on **OK**
7. The number of qualified students will be displayed



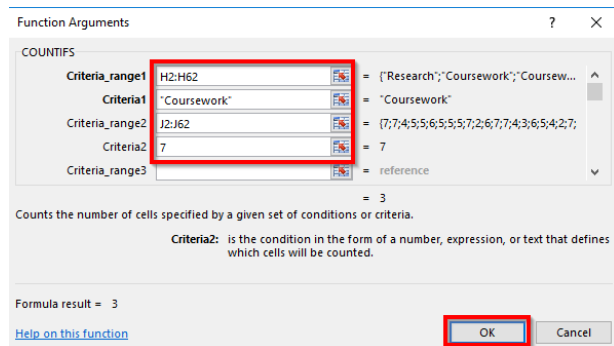
## Exercise 18.

## “COUNTIFS” Function

The COUNTIFS function returns the number of cells in a range, that satisfy a set of given criteria.

### Count the number of coursework students who scored a GPA of 7

1. Open the **Exams** sheet and select cell **O68**
2. Click on the **Insert Function** icon to bring up the dialogue box
3. In the **Select a Function** area click on **COUNTIFS** then **OK**
4. Type in the following arguments:
  - **Criteria\_range1:** H2:H62
  - **Criteria1:** Coursework
  - **Criteria\_range2:** J2:J62
  - **Criteria2:** 7
5. Click on **OK**
6. The number of students who satisfy the criteria will be displayed



Notes

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## Extension Exercises

The information and exercises in the following pages are included for those who want to learn some extra functionality in Excel.

## Importing External Data

Data located in compatible external files can be imported into excel without the need to retype all the information again. Depending on the format of the data you would like to import, different methods can be used, including Opening and saving in Excel, Linking to data, Importing data and Copying data into excel.

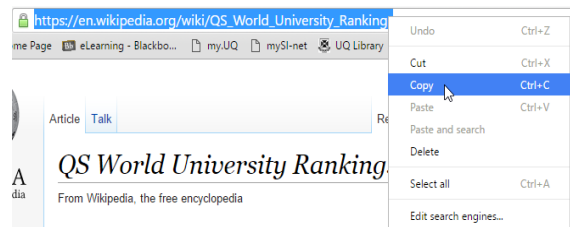
### Exercise 19. *Import/Link to Data on a Website*

#### Importing Data

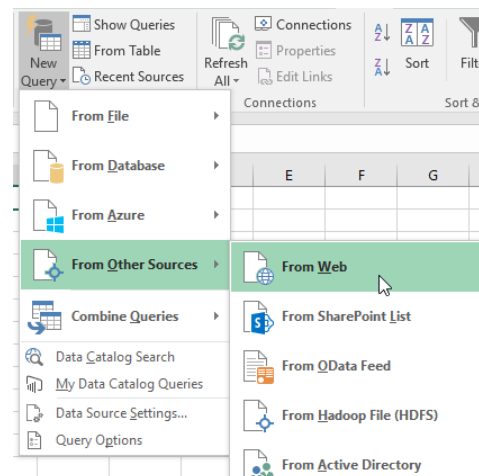
Data from websites and other sources can be imported into Excel if it is in an appropriate format.

1. Copy the URL of the webpage with the data you want to import.

e.g. World University Rankings on Wikipedia  
([https://en.wikipedia.org/wiki/QS\\_World\\_University\\_Rankings](https://en.wikipedia.org/wiki/QS_World_University_Rankings))

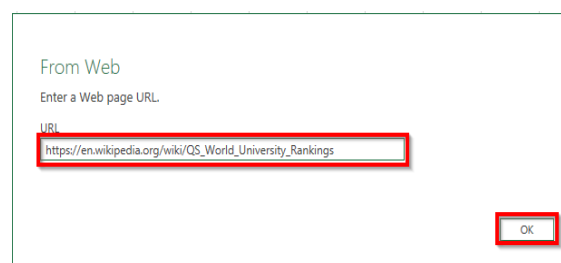


2. Open a blank Excel workbook
3. Navigate to the **Data** tab> **Get & Transform** group > **New Query**
4. From the drop down menu, select **From Other Sources** > **From Web**



This opens the dialogue box for you to enter the URL of the web page with the data you want to import

5. **Paste** the **URL** in the From Web dialogue box and click **OK**



The Navigator Pane will open with a list of data that can be imported into excel

#### Notes

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6. **Choose** the correct address just pasted and click **Connect**

7. Select the required data set in the left pane of the Navigator to preview it

NB: You can use the edit button to clean the data before importing

8. Click on **Load**

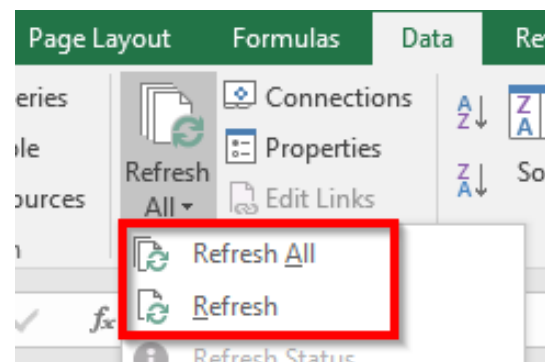
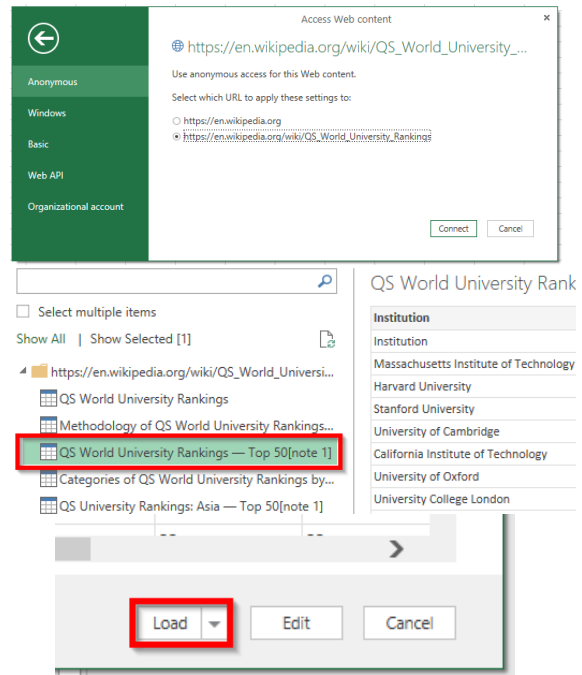
A connection will be created to the data on the website. This will ensure that refreshing your excel file will update the data to the latest version.

9. Save and close your workbook

### Refresh Linked Data

1. Open the excel file with the linked data
2. Click on any cell within the data table
3. Click on the **Data** tab > **Connections** group > **Refresh All**

NB: Refresh all will refresh all connections in the workbook. If you want to refresh data on a single sheet click Refresh



## Exercise 20.

## Year calculations

### Calculate Age from Date of Birth

**Note:** Subtracting a date of birth from the current date will display the number of days between the two dates. To find out the age in years, divide by 365.25 (the .25 allows for leap years).

1. Open the **Fees Extension** sheet
2. Select cell **E2**
3. Type in the following formula:  
**=ROUNDDOWN((TODAY()-D2)/365.25,0)**
4. Press **Enter**
5. Use the **AutoFill** tool to calculate the remaining results.

E
Age
22
23
18
20

**Note:** The Rounddown function has the following structure. =Rounddown(number,num\_digits). In the above formula the number portion is generated by the formula (TODAY()-d2)/365.25. The num\_digits portion is designated zero meaning round down to zero e.g. 28.96 becomes 28.00.

### Notes

## Exercise 21. “NETWORKDAYS.INTL” Function

The NETWORKDAYS function returns the number of whole working days between a specified start\_date and end\_date. Working days exclude weekends and any dates identified as holidays. To calculate whole workdays between two dates by using parameters to indicate which and how many days are weekend days, use the **NETWORKDAYS.INTL** function. This function is useful in situations where work shifts may cause some employees’ non-work days to fall within Monday-Friday and result in Saturdays and Sundays being work days for others.

Weekend **number values** in the formula indicate the following weekend days:

1 or omitted	Saturday, Sunday	11	Sunday only
2	Sunday, Monday	12	Monday only
3	Monday, Tuesday	13	Tuesday only
4	Tuesday, Wednesday	14	Wednesday only
5	Wednesday, Thursday	15	Thursday only
6	Thursday, Friday	16	Friday only
7	Friday, Saturday	17	Saturday only

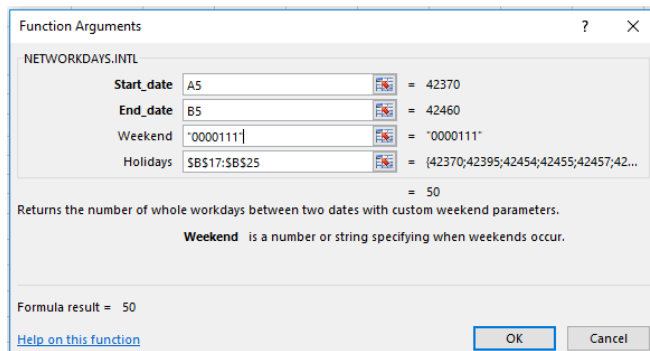
**TIP:** Weekend days can be added to the formula using a 7-character binary string, where **Zero (0)** represents **work days** and **One (1)** represents **non-work days**.

Each character represents a day of the week, starting from Monday. Thus a weekend value specified as “0000111” means Monday – Thursday are work days and Friday – Sunday are non-work days.

### Determine the number of workdays in a time period

1. Open the **Networkdays Extension** sheet and select cell **C5**
2. Click on the **Insert Function** icon to bring up the dialogue box
3. In the **Select a Function** area click on **NETWORKDAYS.INTL > OK**
4. Type in the following arguments:
  - **Start\_date:** A5
  - **End\_date:** B5
  - **Weekend:** “0000111”
  - **Holidays:** \$B\$17:\$B\$25
5. Click **OK**
6. Autofill down to obtain the number of working days for the other date ranges

NB: The quotation marks around the weekend number are important. Without them Excel will strip out the leading zeroes and return a #NUM error message.



Function Arguments

NETWORKDAYS.INTL

Start\_date: A5 = 42370

End\_date: B5 = 42460

Weekend: "0000111" = "0000111"

Holidays: \$B\$17:\$B\$25 = {42370;42395;42454;42455;42457;42...}

Returns the number of whole workdays between two dates with custom weekend parameters.

**Weekend** is a number or string specifying when weekends occur.

Formula result = 50

[Help on this function](#)

OK Cancel

### Notes

## Exercise 22.

## "IFNA" Function

Excel formulas can sometimes return errors depending on the formula being evaluated or the arguments provided. While some errors will require changes in the formula entered, others are merely because of unavailable data. Excel displays errors in a variety of ways including #N/A, #VALUE!, #REF!, #DIV/0!, #NUM!, #NAME? and #NULL!.

To display these errors in a more meaningful way, excel provides some logical functions that allow the user to define alternative text for the error. Two of the most popular ones are IFNA and IFERROR

IFNA tests if an expression returns the #N/A error and if so, returns an alternative specified value; Otherwise the function returns the value of the supplied expression.

**Prevent the INDEX and MATCH function from displaying #N/A error if no value is provided for Student and Semester**

1. Open the **Fees Extension** sheet and select cell **L75**
2. Modify the INDEX and MATCH function as follows:

```
=IFNA(INDEX(L2:U62,MATCH(L73,C2:C62,0),MATCH(L74,L1:U1,0)),"Student Name or Semester not provided")
```

3. Press **Enter**
4. **Delete** the **Semester value** from cell **L74**

All #N/A errors will now be displayed as "Name or Semester value not provided."

The difference between IFERROR and IFNA function is that IFNA only works on #N/A errors whereas IFERROR works on all other error types

## Exercise 23.

## "IF" Function

The IF function will analyse data and provide results defined by the user. The analysis returns either a true or false answer. The displayed results can be text or calculated values.

**Using IF statement to display Final GPA**

1. Open the **Exams Extension** sheet and Go to cell **I2**
2. Enter formula =**IF(H2>85, 7,"?")**  
IF(Logical test, Value if True, Value if False)
3. AutoFill down to other student grades

Final Mark	FINAL GPA	RHD Status
94	=IF(H2>85,7,"?")	
87		

Notes

## Exercise 24.

## Using nested 'IF' statements

If more than two results are required from the logical test, then Excel can retest the data by using another IF statement in either the Value if True or the Value if False portions of the formula. This is known as a nested "IF" statement. A maximum of 64 "IF" statements can be nested in any one cell. As a general rule you will always need one less IF statement than the number of outcomes possible. So an IF statement that can choose from 5 possible results will have 4 nested IFs.

1. Open the **Exams Extension** sheet and Go to cell **I2**
2. Edit the formula to include another "IF" statement in the *Value\_if\_False* parameter for GPA's
  - >75 is a 6,
  - >65 is a 5,
  - >55 is a 4,
  - >50 is a 3,
  - >40 is a 2 and less than 40 is a 1

Final Mark	FINAL GPA	RHD Status	Position
94	=IF(H2>85,7,IF(H2>75,6,IF(H2>65,5,IF(H2>55,4,IF(H2>50,3,IF(H2>40,2,1))))))		
87			

3. AutoFill down to other student grades

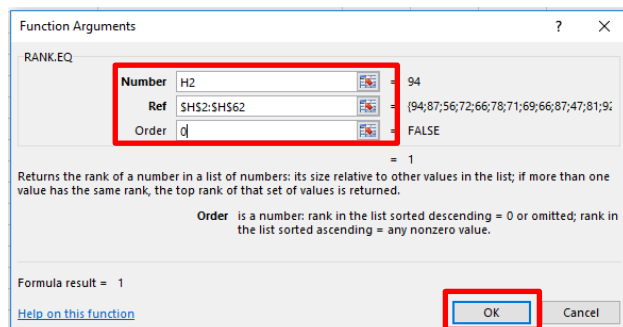
## Exercise 25.

## "RANK.EQ" Function

The **RANK.EQ** function returns the rank of a number in a list of numbers. Its size is relative to other values in the list; if more than one value has the same rank, the top rank of that set of values is returned. This means that RANK.EQ gives duplicate numbers the same rank. However, the presence of duplicate numbers affects the ranks of subsequent numbers. For example, in a list of integers sorted in ascending order, if the number 10 appears twice and has a rank of 5, then 11 would have a rank of 7 (no number would have a rank of 6).

**Find the position of each student based on their final mark**

1. Open the **Exams Extension** sheet and select cell **K2**
2. Click on the **Insert Function** icon to bring up the dialogue box
3. In the **Select a Function** area click on **RANK.EQ** then **OK**
4. Type in the following arguments:
  - Number: H2
  - Ref: \$H\$2:\$H\$62
 (Press F4 key to lock cells as absolute)
  - Order: 0



Function Arguments

RANK.EQ

Number: H2

Ref: \$H\$2:\$H\$62

Order: 0

Formula result = 1

OK

**Order:**

0 – Descending, 1 – Ascending

5. Click on **OK**
6. AutoFill down for the other ranks

Notes

## What-If Analysis

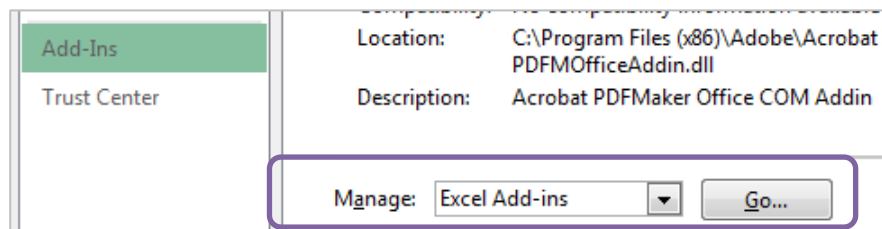
What-if analysis is the process of changing the values in cells to see how those changes will affect the outcome of formulas on the worksheet. What-if analysis tools in Excel include Scenarios, Goal Seek and Solver. Scenarios take sets of input values and determine possible results. Goal Seek and Solver takes a result and determines possible input values that produce that result. To be able to perform some kinds of analysis (eg. Solver), additional add-ins are required.

## Add-ins for Excel

If you choose to utilise Excel for additional analysis such as advanced statistics or what-if analysis using Solver, you may expand its functionality by including add-ins. An add-in, as the name suggests, is a small program specifically designed to support a larger program. Add-ins cannot run on their own but are required to be *added-in* to Excel to extend its available features.

### Exercise 26.

### Including Add-ins

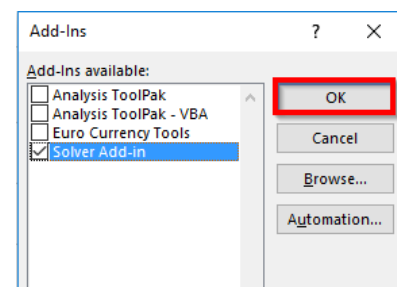


#### To activate add-ins in Excel:

1. Click the **File** tab in the ribbon
2. Click on **Options**
3. Click on **Add-Ins**
4. Select Excel Add-ins
5. Click **Go...**

In Add-Ins dialogue box,

1. Check **Solver Add-in**
2. Click on **OK**



### Exercise 27.

### Excel Solver

In Excel, Solver is part of a suite of commands sometimes called what-if analysis tools. With Solver, you can find an optimal (maximum, minimum or exact) value for a formula in one cell - called the objective cell - subject to constraints, or limits, on the values of other formula and/or cells on a worksheet. Solver works with a group of cells - called **decision variable cells** - that participate in computing the formulas in the **objective** and **constraint cells**. Solver adjusts the values in the decision variable cells to satisfy the limits on constraint cells and produce the result you want for the objective cell.

The objective, constraint and decision variable cells, and the formulas interrelating them form a **Solver model**; the final values found by Solver are a solution for this model. Solver uses a variety of methods, from linear programming and nonlinear optimization to genetic and evolutionary algorithms, to find solutions.

Notes

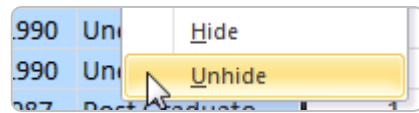
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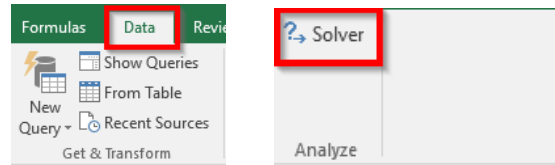
### Display hidden data

1. Open the **Networkdays Extension** sheet
2. Select column **C** and column **J**
3. Right click on selection
4. Select **Unhide**



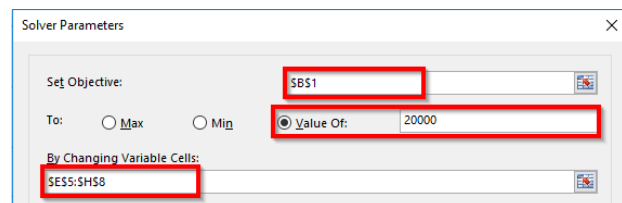
### Estimate optimal spending to achieve savings of \$20,000.

1. Open the **NetworkDays Extension** sheet and select cell **B1**
2. Click on the **Data** tab > **Analyze** group > **Solver** to bring up the **Solver Parameters** dialogue box



### Set Objective and Decision Variables

3. Add the following parameters
  - **Set Objective:** Select cell **B1**
  - **Value of:** 20000
  - **By Changing Variable Cells:** select cells **E5:H8**



These parameters will calculate a new savings value of \$20,000 by modifying the values in cells E5 to H8

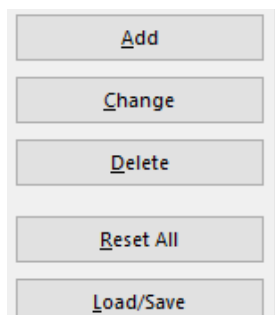
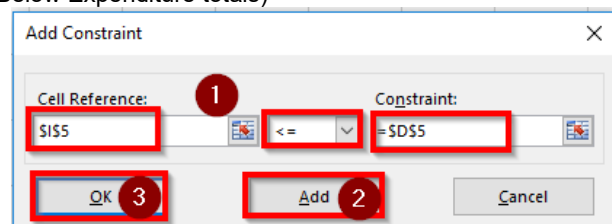
### Constraints

The constraints for this exercise are as follows:

- a. The **Total** expenditure for each date range must not exceed the **Amount Earned** for that same period (Total <= Amount Earned)
- b. The total for each expenditure item (Phone, Furniture, Computer & Living) must not exceed the set budget restrictions (Below Expenditure totals)

### Set Constraints

4. Click on **Add** in the **Subject to Constraints** section to display the **Add Constraint** dialogue box
5. For **Cell Reference** select cell **I5**
6. Select the <= operator
7. For **Constraint** select cell **D5**
8. Click on **Add** to add additional constraints for the remaining date ranges and the expenditure items
9. When the last constraint is added click **OK**

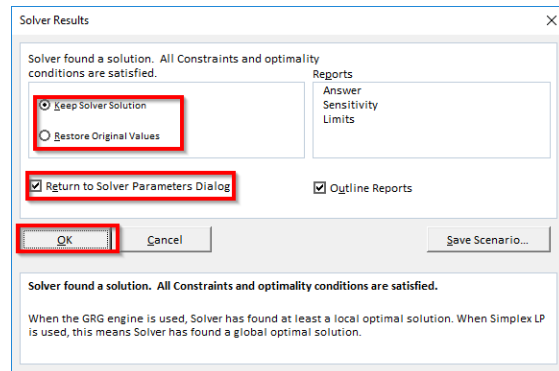
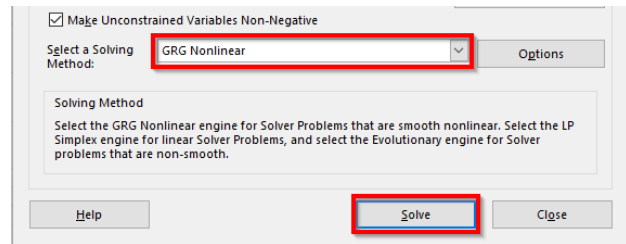


To modify any constraint, select the appropriate one and click change. You can also delete or reset the whole model

### Notes

## Set Solving Method

10. In the **Select a Solving Method** dropdown list, choose **GRG Nonlinear**
11. Click on **Solve** to see the results of your model
12. The Solver Results dialogue box will be displayed.
13. If you are satisfied with the results, select **Keep Solver Solution** and click **OK**.
14. If you want to modify the results
  - tick the **Return to Solver Parameters Dialog**
  - Select **Restore Original Values**
  - Click **OK**
15. Alternatively, click on the cancel button



NB: It is a good practice to have a copy of the data you are working on when using solver because once executed, the operation cannot be undone.

Notes

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