Microsoft Excel Charting

Course objectives:

- Distinguish between Charts and Graphs
- Creating a basic chart and template
- Format and configure chart output
- Represent Time, Frequency and Proportions
- Combining Charts

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Open Excel Chart Exercises file. This file can be found on the Library website
Getting Started with Excel Charts

The terms chart and graph are often used interchangeably but do have one significant difference

A **chart** is a graphic representation of data.

A **graph** is a diagram of a mathematical function, but can also be used (loosely) about a diagram of **statistical** data.

### Exercise 1. Create Basic Charts

**a. Insert a chart**

1. Go to **Basic Chart** tab
2. Select any cell in the data

3. Go to Insert tab
4. On the Insert tab, click **Recommended Charts**

5. Click on **OK** for the default chart

A chart will display on the worksheet. However, this may not chart the expected data. It will chart all data including totals and averages

**b. Resize and reposition**

1. Click on the chart on the worksheet
2. Click and Drag the handles to resize the chart
3. Hover mouse on chart to change the pointer
4. Click and drag to reposition the chart on the worksheet

**c. Change Data**

1. Go to corner of highlighted area
2. Click and drag to exclude “**Totals**” cells
3. Click and drag to exclude “**Average**” cells

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**Exercise 2. Insert a chart from selected data**

**a. Via the keyboard**

1. Select cells to chart (**A1:F6**)  

2. Press **ALT + F1**  
   A chart will automatically appear, with all the default settings

**b. Add a chart to a new sheet**

1. Press **F11**  
   A chart will automatically appear, with all the default settings, on a new chart sheet
There may be occasions when data may be more beneficial displayed in an alternative layout. This is an option that should be attempted with all charts.

1. Click on the chart
   This should currently chart each loan type for each school.

2. Click **Switch Row/column** on the Chart Tools, Design tab.
   The chart will now reflect school loans for each loan type. Be aware this will not be successful for all chart types.

3. Click **Switch Row/column** on the Chart Tools, Design tab to revert back.

Charts will always be in sync with the data.

1. Change any cell value for loans
   The charts will automatically update to reflect the change.

Chart Tools

Exercise 5. Apply a predefined chart layout

1. Select a chart on the worksheet
2. Click on **Quick Layout** on the Chart Design tab
3. Hover over a layout
   A preview will show on the selected chart
4. Click any layout to apply changes
   Chart elements are added, depending on the layout. These will need customised.
Exercise 6. Change Chart Elements

a. Chart Elements

1. Click on the Chart Elements icon
2. Select the elements to include or exclude

Alternatively, Go to the Chart Design tab
3. Click the Add Chart Element button
4. Hover over the appropriate element: Axes Titles
5. Select any option to add or remove

6. Click on the Chart Elements icon
7. Click on the Legend arrow
8. Select Top to reposition the element

9. Click Chart Title marker
10. Select More Options…
   This will display a formatting pane at the right of the screen

2. Click Chart Title element
3. Enter a title – Library Loans
   Alternatively
4. Enter =
5. Click on cell A1
6. Press Enter
b. **Chart Styles**

1. Click on the **Chart Styles** icon
2. Select a new style for the selected chart
3. Click on the **Color** tab
4. Select new chart theme colours

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**Exercise 7.**

Save as a template

1. Right click on the **Chart**
2. Select **Save as Template**...
3. Enter filename - **NewColumnTemplate.crtx**

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**Exercise 8.**

Apply a template

1. Select the data range (A1:B7)
2. Press **Alt F1**
3. Click **Change Chart Type** on the **Chart Tools, Design** tab
4. Click on the **All Charts** tab
5. Click on the **Templates** folder
6. Select the **NewColumnTemplate** shown
7. Click on **OK**

**Exercise 9. Create a Pie Chart**

Pie charts are best used to chart only one category or data series.

1. Go to the **Pie Chart** sheet
2. Select the data (A2:C7)
3. Click the **Pie Chart** icon on the **Insert** tab
4. Select 2-D Pie
   The resulting chart will only display one data series - undergraduates
5. Click the **Switch Row/Column** button
   This will chart by year rather than by graduate
6. Click the **Switch Row/Column** button
7. Click the **Change Chart type** button
8. Select the **doughnut** chart
9. Apply a **Quick Layout** to add data labels
10. Click **data labels** in any data series

11. Click the **Label options** icon
12. Expand **Label Options**
13. Check the **Value**
14. Clear the **Percentage**

15. Click a **data series**
16. Click the **Series options** icon
17. Change the **Doughnut hole size** – 35%

18. Click the **Select Data** button on the **Chart Tools, Design** tab
19. Click on the **Postgraduates** data series
20. Click the **up arrow**
21. Click on **OK**
This changes the order of the data series in the chart and makes the representation of values more reliable.

### Chart undergraduates

1. Select data range to chart *(A2:B7)*

2. On the Insert tab, click Recommended Charts

3. Select the sample **Pie Chart**

4. Click on **OK**

5. Click the **Add Chart Element** button

6. Hover over **Data Labels**

7. Select **Data Callout**

   This displays the category and percentage to the chart

8. Double click on the chart

   This will display a formatting pane at the right of the screen

9. Click on any data label
10. Click the **Label Options** icon

11. Clear the **Category Name**

b. **Chart postgraduates**

1. Select Data range to chart (C2:C7)

2. On the **Insert** tab, click **Recommended Charts**

3. Select the sample **Pie Chart**

4. Click on **OK**

   The chart displayed does not have the correct legend

5. On the **Chart Tools, Design** tab, click **Select Data**

6. Click the **Edit button**

7. Select the range (A3:A7)

8. Click on **OK**

1. Select a single **data point** in the series (A wedge)

2. Go to the Format task pane
   a. **Rotate the chart using the “Angle of first slice”**
   b. **Extract a data value using the “Point explosion”**
c. Chart Totals (optional)

3. Repeat the process to create a Totals chart
   a. Select a data series
   b. Insert a pie chart
   c. Select Data to add the correct category range
   d. Adjust the labels and formats to suit

Exercise 10. Move a chart

1. Click on a chart
2. On the Chart Tools, Design tab, click Move chart
3. Select the New Sheet option
4. Add a new name – Totals Chart
5. Click on OK

The totals chart will be placed on its own sheet

Different Chart Types

Exercise 11. Create a Line Chart

A line chart is most often used to visualise a change of data over a period of time.

a. Create Chart

1. Go to Line Chart sheet
2. Click in data
3. On the Insert tab, click Recommended Charts
4. Select the Line chart
5. Click on OK
6. Resize and Reposition, as necessary
7. Double click on the data series
8. Click the Fill and Line icon
9. Click Marker
10. Expand Marker Options
11. Select Built-in:
   a. Select a type
   b. Set a size

b. Add Error Bars

1. Click the Chart Elements icon
2. Click arrow beside Error Bars
3. Select Standard Error
   Error Bars will be added to data points on chart
4. Click the Chart Elements icon
5. Click arrow beside Error Bars
6. Select More Options…
7. Change error bar direction to Plus
8. Change Error amount to Percentage
   Adjust this % value as necessary

c. Add drop lines

1. Click Add Chart Element
2. Hover over Lines
3. Select Drop Lines
4. Double click on the drop lines
5. Select a colour

Exercise 12. Scatter Chart

Depending on the layout of the source data, a scatter chart should be created in a particular way to ensure the results are correct. The most reliable way in Excel is to create a scatter chart from scratch. Selecting data to insert a scatter chart may provide unreliable results.

1. Go to the Scatter Chart tab
2. Click into an empty cell
   Ensure the empty cell is surrounded by blank cells. Excel will chart any connecting data

3. On the Insert tab, click on the Scatter chart
4. Select the Scatter chart
   This will provide a blank chart canvas

5. Click the Select Data button

6. Click on Add
7. Add the Series details below
   a. **Series Name**: 
      Click *Sugar Content in Fruit* cell
   b. **Series X Values**: 
      Select Fibre % values - B3:B23
   c. **Series Y values**: 
      Clear the cell content
      Select *Fructose* % values - C3:C23
   
   Do NOT include the column headings or the chart will be incorrect.

8. Click on OK

   A scatter chart will display

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d. **Adjust chart elements**

Go to the **Chart, Design** tab

1. Click on **Add Chart Element**
2. Hover over **Axis Title** Click on **Primary Horizontal**
   Repeat for Primary Vertical Axis Title

3. Click on the horizontal **Axis Title** object (X-Axis)

4. Click in the Formula bar
5. Enter =
6. Click on the Fibre % cell B2
7. Press Enter
8. Repeat for the vertical **Axis Title** object, choose the Fructose % cell C2
9. Press Enter
10. Click Chart Elements icon
11. Click **data labels** arrow
12. Select More options…
13. Click the **Label Options** icon
14. Expand **Label Options**
15. Clear **Y value** option
16. Check **Value From Cells**

17. Select the data range with fruit names – *(A3:A23)*
18. Click on **OK**
19. Change the label position to **Below**

**e. Chart Sugar content in Vegetables (Optional)**

1. Repeat the steps above to create a scatter chart for **Sugar Content in Vegetables**

**Exercise 13. Combine Scatter charts**

1. Select the **Sugar Content in Fruit** chart
2. Press **CTRL D** to duplicate
3. Click **Chart Elements** icon
4. Clear **Data Labels**

5. Click the **Select Data** button
6. Click the **Add** button
7. Complete the details below:
   a. **Series Name:**
      *Click Sugar in Vegetables* cell
   b. **Series X Values:**
      *Select Fibre % values - F3:F23*
   c. **Series Y values:**
      *Clear the cell content*
Select Fructose % values - G3:G23
Do NOT include the column headings or the chart will be incorrect.

8. Click on OK
9. Click on OK again

Exercise 14. Scatter chart with time

1. Go to the Scatter with time sheet
2. Click any cell in data
3. Click Scatter chart on Insert tab
4. Select the Scatter chart

The chart will be displayed.
5. Double click the horizontal axis (X Axis)

6. Change the Axis Options
   a. Bounds Minimum = 15

When Excel records times and dates it used the value one to refer to an entire day, and so times of days are portions of one

7. Click the vertical axis (Y Axis)
8. Change the Axis Options to begin the time at 40 minutes

   In Excel 24 hours = 1, therefore 1 hour = 1/24
   As we need to start at 40 mins we need 2/3 of 1 hour:
   \[=\frac{\text{2}}{\text{3}}\left(\frac{\text{1}}{\text{24}}\right)\]
   \[=0.027778\]
   a. Change Bounds Minimum to 0.027778
9. Change the Axis Options to have 10 minute intervals

   In Excel 24 hours = 1, therefore 1 hour = 1/24
   We need 10 mins intervals so we need 1/6 of 1 hour:
   \[
   \frac{1}{6} \times \frac{1}{24} = 0.0069444
   \]

   a. Change the Units Major to 0.0069444

   The Axes will change to display required settings

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**Exercise 15. Combination Chart**

A **combination chart** is a chart that combines two or more chart types in a single chart. We have seen this already with the basic chart as a clustered column with the averages represented as a line. However, there will be instances where not only will different charts will be required but different axis scales too.

a. **Create Chart**

   Go to the **Combination Chart** tab

   1. Select the data range (A2:B7)
   2. Press **ALT F1**

b. **Edit Chart Elements**

   1. On the **Chart Tools, Design** tab, click **Select Data**
2. Click the Add button

3. Select Series Name (C2)
4. Clear Series Values field
5. Select (C3:C7)
6. Click on OK
7. Click on OK again

8. Click Edit under Horizontal axis
9. Select cells (A3:A7)
10. Click on OK

11. Click the new data series
12. Click the Change Chart Type button
13. Change the Graduates Employed series to a Line Chart
14. Click on OK

Repeat Steps 1–6 for the Higher degrees (E2) & (E3:E7)
Repeat Steps 1–6 for the Unemployed (G2) & (G3:G7)

When adding subsequent data series they should be the same type as the last one used, so new data added should automatically be line charts

15. Click on OK
16. Double click a data series line
17. Click the Fill & line icon
18. Check Smoothed line
   Repeat for other data series lines

Exercise 16. Add a secondary axis
A secondary axis works well in a chart that shows a combination of column and line charts.

1. Select the combo chart
2. Press CTRL D to duplicate
3. Apply different chart colour
4. Resize and Reposition, as necessary
5. Click the Select Data button

6. Click on the Graduates Employed data series
7. Click Edit
8. Clear Series Values
9. Select percentages (D3:D7)
10. Click on OK
   Repeat for Higher Degrees (F2:F7) & Unemployed (H2:H7)
11. Click on OK
   This will change the display of the chart
12. Click the **Change Chart Type** button
13. Check **Secondary Axis** boxes for *line* charts
14. Click on OK
The chart will adjust to display a new axis scale at the right side

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**Exercise 17.**  
*Empty cells and hidden cells*

The default setting in Excel charting is to remove any content in hidden cells and to show zero values as gaps. This can be changed to amend what the chart displays.

**a. Hidden data**

1. Select **column C**
2. Right click on the selected column
3. Select **Hide**

The chart will no longer display the hidden column

4. Click on the single axis chart
5. Click **Select Data** button on the **Chart Tools, Design** tab

6. Click **Hidden and Empty Cells**
7. Check **Show data in hidden rows and columns**
8. Click on **OK**
This will display hidden data only for the selected chart
b. **Empty cells**

1. Right click beside Column C heading
2. Select **Unhide**
3. Delete cell content C6, E4 & G5

This will change the display of the chart to the default setting which shows empty cells as gaps

4. Click on the single axis **Chart**
5. Click the **Select Data** button
6. Click **Hidden and empty cells**
7. Select Show empty cells as: **Zero**
8. Click on **OK**
9. Click on **OK** again
   This will drop the line chart to zero for any empty cell in the data
10. Click the **Select Data** button
11. Click **Hidden and empty cells**
12. Select Show empty cells as: **Connect data points with line**
   This will connect point directing ignoring empty cells
13. Click on **OK**
14. Click on **OK** again

This will ignore empty cells and connect values before and after the empty cell. The problem with this is that empty cells will display an “estimated” value based on other data.
15. Go to the data cells
16. Enter values **4273** in **C6**, **835** in **E3** & **873** in **G4**

### Exercise 18.

**Go to the Picture Chart tab**

1. Select the data range *(A2:F2)*
2. Press **ALT F1**
3. Click the **Select Data** button
4. Click the **Edit** button under Horizontal Axis Labels
5. Select cells *(B1:F1)*
6. Click **OK**
   
   This will add the years to the X-Axis
7. Click on **OK** again
8. Double click on the data series
9. Click the **Fill and Line** icon
10. Select **Picture or Texture fill**

   This will fill the columns with the default fill
11. Click on a button to choose an image
12. Click the **File**... button
13. Locate and select an image file: **currency.png**

   These are best kept as simple and as small as possible
14. Select the **Stack** option to adjust the image

The chart will display the image in the data series column

15. Click the **Series Options** icon
16. Change the **Gap width** to **100%**

Repeat for 2 other faculties of your choice
17. Click on data series
18. Press **CTRL C** to copy
19. Click on **Business, Economics and Law Chart**
20. Repeat for another chart

21. Click **Add Chart Element** button
22. Click **Legend**
23. Select **Bottom**

The icons will be shown in the legend

**Using Graphs**

Graphs are only different from charts as they create a diagram of mathematical functions

**Differences between Histograms and Bar Charts**

There are three principle differences between histograms and bar charts:

1. Histograms are used to show **distributions** of variables while bar charts are used for **comparison** of variables.
2. Histograms plot binned **quantitative** data while bar charts tend to plot **categorical** data.
3. Bars can be reordered in bar charts but not in histograms.

**Histograms**

A histogram is a graph used to display the frequency distribution of data in graphical form. It is able to show the proportion of data that fits into specific categories or bins. For example, we may want to find out how many students are a particular age.
Exercise 19. Creating a histogram

a. Create a histogram

1. Select column B
2. Click the Statistic chart on the Insert tab

A histogram will display representing the number of students of a particular age. Resize and reposition as necessary.

b. Adjust Chart Elements

1. Double click the X Axis (horizontal)
2. Change the Number of Bins to 10
3. Press Enter
   This will provide 10 columns(bins) in our histogram. The X-Axis distributions will change automatically to suit.

4. Change the Bin Width to 10
   This means the distributions will be in 10 year groupings. This will also change the number of bins automatically

5. Change the underflow value to 20
   This will be the starting age of the distributions. This should be higher than the minimum and will be the bin starting point

6. Change the overflow value to 60
   This will be the last age of the distributions, which will be the bin ending point
7. Add Data Labels to **Outside End**

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**Exercise 20. Graphing Quadratic Equations**

**a. Prepare Data**

Go to the worksheet "**Quadratic Equations**"

Solving the equation $3X^2 + 2X + 3$

1. Go to cell **B5**
2. Enter $=3*A5^2+2*A5+3$
3. Autofill down to **B17**

**b. Create Chart**

1. Select data range (A5:B17)
2. Click **Recommended Chart** on the **Insert** tab
3. Select the **Scatter** chart
4. Click Chart Title element
5. Enter **Equation 1**

**c. Edit Chart Elements**

1. Click **Insert** tab
2. Select **Text box**
3. Enter equation: $3X^2 + 2X + 3$
4. Resize and reposition

**d. Add data series**

5. Select data range (A21:B33)
6. Click **Recommended Chart** on the **Insert** tab
7. Select the **Scatter** chart
8. Click Chart Title element
9. Enter **Equation 2**
1. Click on **Equation 1** Chart
2. Press CTRL D to copy
3. Click on the data series in **Equation 2** Chart
4. Press CTRL C to copt data series
5. Click on New chart
6. Press CTRL V to paste data series
7. Click on **Chart Tile** element
8. Press =
9. Click on cell A1
10. Press Enter

Although Excel may not appear to offer the required chart they can often be created as a variation of another chart.

**Exercise 21.** **Tornado/Butterfly Chart**

A Butterfly chart is a technique for comparing two data series side by side. Excel doesn't provide the option for a butterfly/tornado chart and it is created by adjusting a 100% stacked bar chart.

### a. Prepare data

You need to have at least 5 columns of data to create the tornado chart

1. Go to the **Butterfly** sheet
2. Go to cell **B15**
3. Enter the formula **=1000-C15**
4. Autofill down to **B24**
5. Go to cell **F15**
6. Enter the formula **=1000-E15**
7. Autofill down to cell **F24**
b. **Create Chart**

1. Select the data range (A14:F24)
2. Click on **Recommended Charts** on the **Insert** tab
3. Select **Stacked Bar** chart
4. Click on **OK**
5. Resize and reposition the chart as necessary

c. **Adjust Chart Elements**

1. Double-Click on the first data series in the chart
2. **Format Data Series**
   a. No fill
   b. No line
3. Repeat for the last data series
4. Repeat for the **Gap** data series
5. Right click on the Gap data series
6. Select **Add Data Labels**
7. Right click on a gap data label
8. Select **Format Data Labels**…
9. Check **Category Name**
10. Clear **Value**
    The category cannot fit into the gap width and will need adjustment
11. Go to cell **D15**
12. Change the data to **250 or 300 or 600**
13. Autofill down to **D24**
14. Click on the Y Axis
15. Press delete
16. Repeat for the X Axis

17. Click on the NO data series
18. Click the Series Option icon
19. Reduce the Gap Width to 50%

20. Click on any data series
21. Click Add Chart Element
22. Hover over Data Labels
23. Select Inside Base
24. Repeat for other data series but choose Inside end

25. Click the Chart Elements icon
26. Clear Gridlines option

27. Click the Chart Title Element
28. Type =
29. Click on cell A14
Exercise 22. Box and Whisker Chart

A Box and whisker chart is the most commonly used in statistical analysis. A box and whisker chart shows distribution of data into quartiles, highlighting the mean and outliers. The boxes may have lines extending vertically called “whiskers”.

a. Create a chart

Go to the Box and Whisker sheet

1. Click a cell in the Faculty Expenses data
2. Click the histogram icon on the Insert tab
3. Select the Box and Whisker chart

Excel scans the data and displays a chart with a data series for each different category:

- The box represents half the entries in a series.
- The centre line marker represents the average value in a series.
- The Whiskers represent the largest and smallest entries in a series

b. Edit Chart elements

1. Click on the chart elements icon
2. Select Data Labels
The numbers we see here at the top and bottom of the box represent the range that covers the middle number of entries.

The numbers at each end of the whiskers represent the minimum and maximum values of entries.

**Charts in Other Applications**

**Exercise 23. Charts in Word or Powerpoint**

There are two main ways to use an excel chart in other files, either as a static image or a dynamic linked object.

1. Go to the **basic chart** sheet
2. Right click on the formatted clustered column
3. Select **Copy**
4. Go to destination application - *(Word or Powerpoint)*

5. Click on the down arrow on the **Paste** button
6. Select one option:
   a. Use destination theme and **embed** workbook
   b. Keep source formatting and **embed** workbook
   c. Use destination theme and **link** data
   d. Keep source formatting and **link** data
   e. Picture

Any embedded or picture chart will not update. Any linked data will update if the original excel data changes.