Data Analysis Fundamentals Using Excel

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Module Overview

This module looks at how to turn data into eye-catching charts using Microsoft® Excel® 2016. One of the reasons that Excel is such a popular tool for data analysis is that you can very easily create colorful charts from your data. In this module, we consider some of the charts available in Excel, and how to use them.

Objectives

After completing this module, you will be able to:

- Create charts from data in Excel.
- Filter data, and format charts.
- Create Sparklines.
- Choose the most appropriate chart for your needs.

Lesson 1
Introducing Excel Charts

Charts make it easier to understand what data means; they are helpful whilst working with data, and when presenting conclusions. Charts bring numbers to life, graphically showing proportions, trends, and comparisons. They add color and interest to reports and presentations.

This lesson looks at Excel charts, and how to use them.

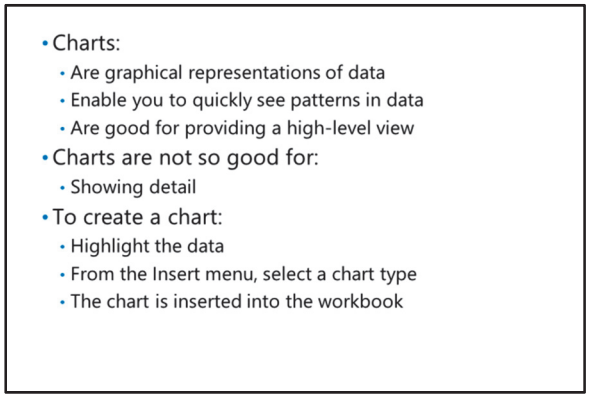
Lesson Objectives

After completing this lesson, you will be able to:

- Create a chart from data supplied to you.
- Understand the different chart types available in Excel.
- Select an appropriate chart type for your needs.

Creating a Chart

A chart is a graphical representation of data. A chart uses lines, bars, segments, or other graphics to show the relationship between data values. Charts normally have an X and Y axis, with the X axis on the horizontal, and the Y axis on the vertical.



Seeing Data Graphically

As a business person, you often need to see data at different levels of detail. At the top level, you want to identify trends and anomalies, such as differences between sales totals by divisions or whether this year's results are better than last year's. Presenting data as a chart enables a lot of information to be understood quickly, and for discrepancies to be identified at a glance. Having seen the high-level view, and identified what needs further investigation, you can then look at the data in more detail.

Charts are not so good, however, for seeing precise data values. A chart is good for quickly highlighting the fact that one division performed a lot better than another division, but you need the numbers to see the exact sales amounts. When there is a lot of data in a report, comparisons might not be so noticeable, so it is a good idea to use a combination of approaches. Using charts to present data in a "top-down" way is highly effective in communicating complex data.

How to Create a Chart in Excel

1. Highlight the data you want to use to create a chart.
2. From the **Insert** menu, click the **lower right arrow** to see all the available chart types.
3. Select either the **Recommended Charts**, or **All Charts** tab.
4. From the left-hand panel, select the type of chart you require.
5. From the right-hand panel, select the specific chart you require.

6. Click **OK**. The chart is inserted into the workbook.

Style and Color of Charts

After you have created your chart, and chosen the type, such as a pie chart or an area chart, you can then refine the presentation by selecting the correct style and colors for your chart. You can finish off by making your chart look attractive, or ensuring it is displayed in your corporate colors.

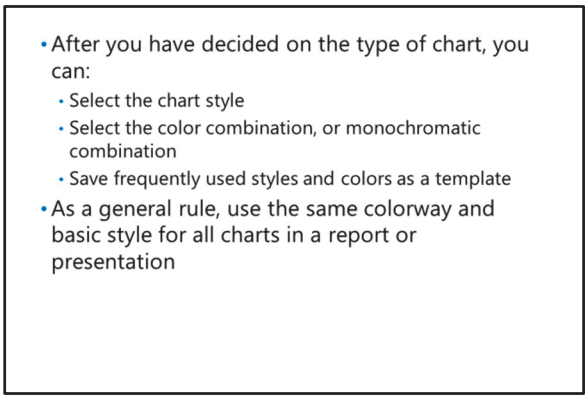


Chart Styles

Each chart type, such as pie, line, bar, column, and so on, has a number of different styles associated with it. There are three ways of seeing the styles associated with a particular chart type:

1. Highlight the data, click the **Insert** tab, and then click the **down arrow** on the **Charts** group to display the **Insert Chart** selection dialog box. Select the **All Charts** tab, click the chart type from the left-hand panel, and see the chart styles displayed on the right. Click a chart style to see a preview of your chart.
2. Highlight the data, click the **Insert** tab, and then click the **down arrow** next to one of the chart types displayed in the **Charts** group. A graphical list of the available chart types is displayed.
3. Highlight an existing chart, and click **Chart Styles** (a paint brush). A list of all the available chart styles for that chart type is displayed. You can also select colors for your chart from this menu.

Chart Colors

To select a predefined colorway for your chart, select the chart, click the **Chart Styles** icon and click the **Color** tab. Several colorful combinations are displayed, in addition to a number of monochromatic combinations. Click the color combinations to select one.

Note: The colorways are displayed when you click **Chart Styles**. These are based on the colorway used by the workbook. To change the workbook colorway, click the **Page Layout** tab, click **Colors**, and select the color palette you want to work with. Note that the color palette will then be changed for everything within the workbook.

Save As a Template

If you want to standardize on a particular chart type, style, and colorway, you can save a template. To create a chart template:

1. Create a chart and format it in the style, and colorway you require.
2. Right-click the chart and select **Save as Template**.
3. Type a file name for the template.
4. Either specify a folder for the template, or accept the default.
5. Click **Save**. The template is created.

To Use a Saved Template

After you have created one or more templates, they are then available to use from the Insert/Change Chart Type dialog box. To use a saved template:

1. Highlight your data.
2. Click the **Insert** tab.
3. From the **Charts** group, either click the **bottom right arrow**, or click **Recommended Charts** to display the **Insert Chart** dialog box.
4. Select the **All Charts** tab.
5. From the left-hand pane, select the **Templates** folder. A preview of your chart is displayed in the right-hand pane, using your named templates.
6. Click the template you want to use and click **OK**.

 **Best Practice:** If you are displaying a number of charts in the same presentation or report, use the same style and colorway for all of them. Although it is tempting to use different colors or styles to make something stand out, your presentation will be easier to read if they all follow the same style.

Formatting a Chart

You can easily create a chart by highlighting the data and selecting a suitable chart type. After the chart is created, however, you might want to make some changes so it's easier to understand.

- After you have created your chart, use **Chart Elements** to format it:
  - Chart title
  - Chart axes
  - Data labels
  - Data table
  - Error bars
  - Gridlines
  - Legend
  - Trendlines
- Highlight the chart and click +

Amending the Title

To change the title of the chart, double-click the label called **Chart Title**. Overtype the name of your chart.

Adding Axis Titles

A common requirement is to add titles to the X and Y axis. To add titles, highlight the chart, select **Chart Elements** (**+**), and click the box next to **Axis Titles**. Label boxes appear on the chart next to each axis. Double-click the label to type the correct axis title.

Adding or Removing Chart Elements

You can add or remove elements from a chart by clicking **Chart Elements** (**+**) when the chart is selected. A list of chart elements appears with a tick against elements that are currently displayed on the chart.

If you want to remove gridlines from the chart, for example, click **Chart Elements** to display the menu, and then select the **Gridlines** box. If you change your mind, and want gridlines to appear, click the box again to clear gridlines.

By selecting the chart, and clicking **Chart Elements**, you can add, remove or amend the following chart elements:

- **Axes**: add or remove vertical and horizontal axes. Click the **>** arrow to choose to have only the horizontal, or vertical axis. Click **More Options** for formatting options, such as the width and color of the axis lines.
- **Axis titles**: add or remove axis titles. Click the **>** arrow to choose only a horizontal or vertical title. Click **More Options** for formatting options, such as the color of the axis title, or alignment.
- **Chart title**: add or remove the chart title. Click the **>** arrow to select the position of the title, and click **More Options** for formatting options, such as the color of the chart title, and text style.
- **Data labels**: add or remove data labels. Click the **>** arrow to select the position of the data labels. Click **More Options** to format the numbers or borders.
- **Data table**: adds the data values to the chart. Click the **>** arrow to select with or without legend. Click **More options** to format the borders and fill lines around the data table.
- **Error bars**: add or remove error bars. Click the **>** arrow to select Standard Error, Percentage or Standard Deviation. Click **More Options** to format the error bars. If you want to know how Microsoft calculate the error amounts, see the link that follows.
- **Gridlines**: adds or removes the gridlines from the chart. Click the **>** arrow to select the type of gridlines you want. Click **More Options** to format the gridlines.
- **Legend**: adds or removes a legend from the chart. Click the **>** arrow to select the position of the legend. Click **More Options** to format the legend.
- **Trendline**: adds or removes a trendline. Click the **>** arrow to select the type of trendline or moving average you require. Choose from Linear, Exponential, Linear Forecast, or Two Period Moving Average. Click **More Options** to format the trendline. There are additional trendline options, plus options for displaying the trendline.

The exact options shown depend on the chart type.

Error Bars

For more details on how Microsoft calculate the error amounts for error bars, including the equations, see Office support documentation:

Add, change, or remove error bars in a chart

https://aka.ms/nlxg9c

Best Practice: If you want to display exact values on your chart, either select data labels to show the values on the chart graphics, or select a data table to provide data separate from the chart. One or other is sufficient—do not use both together.

Why Add a Trendline?

A trendline shows the general, or average, direction of the data over time. A straight line representing the data is overlaid onto the chart. Whilst a chart follows the fluctuations of the data, the line fits as closely as possible to the data, giving the effect of evening out fluctuations within the data.

For example, a person's weight might be measured and displayed day by day. A trendline shows the general direction, either up or down, over time. You can also extend the trendline forwards, based on the data. Not all chart types are suitable for trendlines. Use a trendline with bar, column and area charts, and

also with stock, scatter and bubbles charts. You cannot add trendlines to pie charts, stacked, 3-D or surface charts, or to doughnut charts.

The line represents the best fit through the data—to see how well the trendline represents the underlying data, you have the option to show the R-squared value on the chart. When the R-squared value is close to 1, the trendline is a good fit to the data. Select the **Display R-squared value on chart** box if you want to show this value on your chart.

Trendlines are a great way of providing high-level information, making it easy for someone to interpret the data you are presenting.

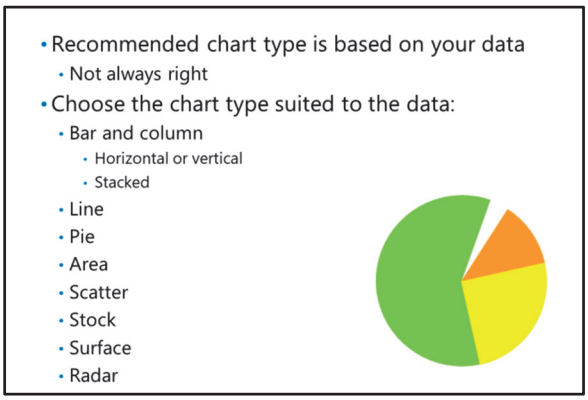
For more information about trendlines, how to choose the best type of trendline for your data, and how trendlines are calculated, see the Office support documentation:

Add a trend or moving average line to a chart

https://aka.ms/ipoy1n

Choosing a Chart Type

There are a number of different chart types available in Excel. As you have seen, producing the chart is quite easy. However, choosing the correct chart type for the data, and your audience, requires a little thought. In this topic, you will consider the different chart types available, and when each one might be used.



Excel includes the following different categories of chart types:

- Line charts
- Column charts
- Pie charts
- Bar charts
- Area charts
- Scatter charts
- Stock charts
- Surface charts
- Radar charts
- Treemap
- Sunburst
- Histogram
- Box and whisker
- Waterfall

In addition, you can combine chart types to show one set of data using one type of chart, and another set of data using a different chart type.

However, some chart types are better than others for representing data. The best chart type depends on your data.

Recommended Charts

Excel will recommend one or more chart types, depending on your data. To see which chart types Excel recommends for your data:

1. Highlight the data.
2. Select the **Insert** tab, and click **Recommended Charts**.
3. One or more recommended chart types will be displayed in the left-hand pane. The right-hand pane shows your data represented using the recommended chart type, together with an explanation of why that chart type has been chosen. There is often more than one recommended chart type, so click each one to see the preview chart.
4. If you don't want to use one of the recommended chart types, you can click the **All Charts** tab, and select a different type.
5. When you have decided which chart type to use, click **OK**. The chart will be inserted into the workbook.

Selecting an Appropriate Chart Type

It is worth considering which type of chart you use, because different chart types give very different representations of the data. A well designed chart will add clarity to the data, whereas the wrong chart type will make it more difficult to understand the data. This section discusses a few of the more popular chart types, and the type of data they are suited to.

Pie Charts

Pie charts are one of the most popular chart types. Like the pies they represent, they show parts of a whole. Consider a school describing the after school activities of their children. A pie chart would be good at showing that, for example:

- 55 percent of children play football.
- 25 percent of children do not partake in after school activities.
- 15 percent of children go to music lessons.
- 5 percent of children attend the school's drama group.

Pie charts work well with fewer categories, and when the categories make up a significant percentage of the whole. Many small segments can be difficult to interpret. Occasionally, however, you can make a dramatic statement using a small segment to emphasize a point. Consider the same school, but this time showing the age ranges of children taking part in after school activities:

- 67 percent of children using after school facilities are aged 15 years or older.
- 26 percent of children are aged 11-14.
- 6 percent of children are aged 9-11.
- 1 percent of children are aged 5-8.

This pie chart would dramatically illustrate the difficulty of including younger children in after school activities.

Two pie charts together can be an effective way of showing the different proportions between two or more sets of data—perhaps the different after school data sets of two schools. In this case, ensure that the data is in the same sequence and the same colors are used for each data segment for easy comparison.

Excel has both 2-D and 3-D pie charts, including "exploding" pie charts, where the segments are not contiguous. Select **More Options** to investigate setting the angle of the first slice—to make more than one pie chart easier to read—and point explosion.

Column and Bar Charts

Column and bar charts are another common chart type, mainly because they are so versatile. They are good for showing the relative size of one data set to another, and can accommodate many different values within the same chart. In Excel, a bar chart shows bars on the horizontal, and a column chart displays vertical. Column charts are better suited to charts with many bars, because the labels are easier to read. Column charts with vertical bars suit charts with few bars, and shorter labels.

Clustered column and bar charts are effective at showing comparisons, such as the monthly sales figures of two divisions, or annual sales by region for a number of years. You can easily see differences, and they provide a lot of information in a small space.

Variations on column and bar charts include stacked column or bar charts, and 3-D charts. Stacked column and bar charts include data for more than one data set in the same bar; 3-D column and bar charts are a visually striking way of presenting data, perhaps more suitable when you don't have many charts to present together.

Line Charts

Line charts can be used to represent many types of data, but are particularly effective in showing trends over time. A line going in an upwards direction, or a line going in a downwards direction both offer compelling stories. Consider a line graph if you want to highlight the price of something increasing over time; or the number of children passing exams over time; or the sales for a company or division over time. You can have a few different data sets on the same chart, each represented by a line in a different color. This is particularly effective when the lines are far apart, perhaps showing the direction in prices for high-priced items, mid-range items, and low-priced items. Avoid showing data sets with similar values using a line chart, because having too many lines close together can be difficult to read.

Consider combining a line chart with a bar chart to show data sets that are not comparable, but have similar values. This might work for sales totals by month shown as a bar chart, with a line chart showing gross profit by month. Although the gross profit will be much lower than the sales figures, this would be well understood by a business audience, and provides valuable additional information in the same chart. To create this chart, select the **Combo** chart type in **All Charts**, and then select the bar and line combination.

Area Charts

Area charts use solid blocks of color to represent data values, and so can be visually attractive. Area charts work best when two or more data sets are a different order of magnitude, such as sales and gross margin. The gross margin is displayed as a smaller area, overlaid on top of the larger area of sales.

Area charts work less well when data sets are unpredictable, and one data point is obscured by another. Excel gets round this problem by allowing you to set a level of transparency—but be sure that the final result is clear.

Treemap

This is a new chart type that is suitable for showing data in hierarchies.

Demonstration: Turning Data into Charts

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank workbook**.
4. Click **File**, **Open**, and then open **Demo1.xlsx** file in **D:\Demofiles\Mod01**.

Create a Chart

1. Highlight from cell **A2** to **C12**.
2. Click the **Insert** tab.
3. In the **Charts** group, click **Recommended Charts**.
4. Browse the recommended chart types by clicking on each chart type and displaying the chart preview.
5. Click the **Scatter** chart and discuss why this would be an inappropriate chart to use for this data. (Sales and profit data sets are treated the same, even though they are different—also, no relationship is shown between the two.)
6. Click the **Clustered Column** chart type and discuss why this would be appropriate. (Clear relationship between sales and profit, plus differences between regions.)
7. Click two more chart types and discuss with the class whether or not these chart types would be suitable for the data.
8. Click **Clustered Column**, preview the chart, and then click **OK**. The chart will be inserted into the workbook.

Format the Chart

1. Double-click the chart title, highlight the words **Chart Title**, and type **Adventure Works 2014 Results**. Click somewhere on the workbook to display the new title.
2. Click somewhere on the chart, and click **Chart Elements**.
3. Select the **Trendlines** box. When prompted, select **Sales** and click **OK**.
4. Click the chart, and click **Chart Elements**, and then click the **arrow** next to **Trendlines**. Note the different types of trendlines.
5. Click **More Options**. The Format Trendline options appear.
6. Click **Display R-squared value on chart.**

Resize and Position the Chart

1. Resize the chart to make it larger by clicking and dragging a corner.
2. Position the chart to a suitable place on the workbook.
3. Close the workbook without saving.
4. An example chart is in the **Demo1 Chart.xlsx** file in the **Solution** folder.

Question: Think of some data presentations that you have seen recently. Which ones presented data in an easily understandable way? Which ones were difficult to understand?

What was it about the good presentation that made the data meaningful?

Lesson 2
Filtering and Formatting Data

Many business managers rely on reports generated by the IT department to get the raw data they require. If you need to present a lot of data, it can be time consuming to ask for different variations of the data, formatted in different ways. It can be more efficient to ask the IT department to generate a report with all the data you need, so that you can filter and format it yourself.

In this lesson, you will look at how you can filter and format data, so that you can present charts in the way you want.

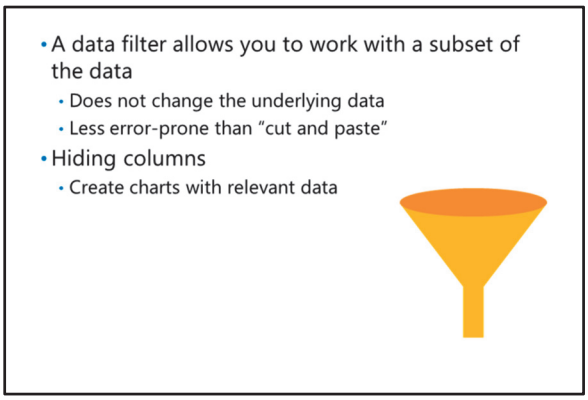
Lesson Objectives

After completing this lesson, you will be able to:

- Filter data to display only rows that should be included in the chart.
- Format data correctly.

Filtering Data

Adding a filter to your data means you can select certain rows for inclusion in your chart, without changing the underlying data. By adding a filter, you do not change the data, nor do you remove rows. You can use the filter to select what you do or do not want for each chart you produce.



When you work in Excel, filtering data is useful in many ways, and not only when producing charts. In this topic, you will see how to use filters to create relevant charts.

Adding a Data Filter

You can add a filter to a data set by:

1. Highlighting the data.
2. Selecting the **Data** tab.
3. Clicking **Filter**. An arrow symbol appears at the top of each column.

To apply a filter, click the **filter arrow**, and select the rows you want to display. The options shown on the filter menu change depending on the data, but include text filters, and number filters, with options to show the top n records. When a filter has been applied, a small dot appears next to the filter arrow. You can apply more than one filter criterion to one set of data.

To remove a filter, click the **filter arrow**, and select **Clear Filter**.

Hiding Columns

Hiding columns enables you to create charts from the original data, without the need to cut and paste. Although it is not necessarily time consuming to remove columns by cutting and pasting, it often leads to errors. By hiding columns, the original data stays intact, and the columns can then be displayed again when needed.

To hide one or more columns:

1. Highlight the column(s).
2. Right-click and select **Hide**.

When you want to display the column(s) again, highlight the columns adjacent to the hidden columns(s), right-click and select **Unhide**.

Formatting Data

Formatting data includes formatting number columns as currency, percentages, or rounding values. The advantage of formatting the raw data is that it is then correct in every chart you produce, so you only have to format it once. It also makes the meaning of the data clear.

- Format numeric data
  - Currency
  - Percentages
  - Rounding values
  - Dates
- Format the data, so it shows correctly in all charts
- Home tab, Number group, shows formatting options
- Or right-click and select Format Cells

Formatting Data

To format data, select the cells you want to format, click the **Home** tab, and then format the data using the **Number** group. You can format numbers as currency, percentages, add or remove separators, and set the correct number of decimal places. The formatting will then be reflected in charts, and data tables in your charts.

Formatting Dates

Dates are stored internally as numbers, but you can format them as short or long dates in a worksheet or for a chart. If you format a date value as a number, you will see the internal value held in Excel. This enables Excel to do calculations, such as the number of days or weeks between two dates.

 **Best Practice:** Although you can easily change the format of a value, it is good practice to format values correctly. This makes it easier to check your data, and reduces the possibility of introducing errors. Working in a tidy manner always pays dividends.

How to Format Data

1. Select the cell you want to format.
2. From the **Home** tab, go to the Number group.
3. Select the number style you want to use.
4. If the format you want is not displayed, click the diagonal arrow to display the format cells dialog box. Make your selection and click **OK**.

Alternatively, right-click a cell and select **Format Cells**.

Demonstration: Selecting Relevant Data

In this demonstration, a business manager working for Adventure Works Cycles has been asked to produce a report of sales for all territories in the USA. She had previously asked the IT department for a report of all Adventure Works Cycles' territories. In the demonstration, we will see how she filters and formats the data, before producing the charts required for her report.

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank workbook**.
4. Click **File**, **Open**, and open **Demo2.xlsx** file in **D:\Demofiles\Mod01**.

Filtering the Data

1. Highlight the data from cell **A2** to **N12**.
2. Click the **Data** tab, and then click **Filter**. Small arrow buttons appear at the top of each column of data.
3. Click the down arrow next to **Code** and inspect the filter menu. Note that the menu allows the rows to be sorted, or filtered on specific text, or selected using the check boxes.
4. Click **(Select All)** to remove the ticks from all boxes.
5. Click the **US** box to select US records, and then click **OK**. Note that only rows relating to US results are displayed.

Hiding Data Columns

1. Highlight columns **C** and **D**.
2. Right-click the selection and click **Hide**. The two columns are hidden.

Formatting Data

1. Select cells **E3** to **F12**.
2. Click the **Home** tab, and click the down arrow next to the currency symbol.
3. Select **English (United States)** to format the numbers as dollars.
4. Click **decrease decimal** twice to format the data to no decimal places.

Create a Chart with Revised Data

1. Select cells **B2** to **F12**.
2. Click the **Insert** tab.
3. Click **Recommended Charts** and select the **Clustered Column** chart. Click **OK**.
4. Overtype **Chart Tile** to rename the chart **Proseware Results Year on Year**.
5. Click **Chart Elements** and select **Data Table**. The data values are displayed on the chart correctly formatted.
6. To see the data formatted data, with an example chart, see **Demo2 Formatted.xlsx** in **D:\Demofiles\Mod01\Solution**.

7. Close Excel without saving the workbook.

Verify the correctness of the statement by placing a mark in the column to the right.

Statement	Answer
True or false? It is important to format data correctly to prevent errors in your analysis.	

Lesson 3
Sparklines

Sparklines are mini charts that fit into a single cell. They are a great way of illustrating a point, without taking up too much space.

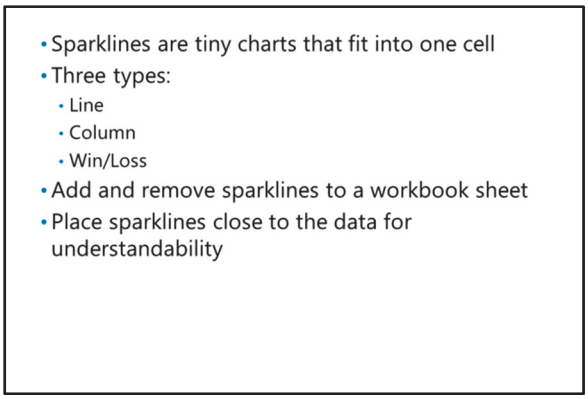
Lesson Objectives

After completing this lesson, you will be able to:

- Add a sparkline to your worksheet.
- Choose the correct sparkline for your needs.
- Remove a sparkline from your worksheet.
- Format a sparkline.

Sparklines

Sparklines look like very small charts that fit into a single cell. Although they are small, they can tell a big story. Sparklines were introduced with Microsoft Excel 2010, and add understandability and color to reports. Sparklines let you see data visually, but in a tiny space.



What Is a Sparkline?

Sparklines are not chart objects, even though they look like tiny charts. Sparklines are simple chart graphics displayed in the background of a cell. This means that you can enter text in the same cell that contains the sparkline, and the text will display on top of the sparkline. Each sparkline represents a row of data.

There are three types of sparkline:

- **Line**. Similar to the line chart type.
- **Column**. Similar to the bar or column chart type.
- **Win/Loss**. Suitable for highlighting positive and negative numbers.

Create a Sparkline

1. To create a sparkline, click the **Insert** tab, and select a sparkline from the **Sparklines** group. The **Create Sparklines** dialog box appears.
2. Either enter the data range you want to use, or click the **data range** icon and select the cells containing your data. When you have finished, click the **data range** icon again.
3. Either enter the cell reference where you want the sparkline to be displayed, or click the **data range** icon and select the cell where you want the sparkline to be displayed.
4. Click **OK**.

To Remove a Sparkline

If you have a sparkline that you want to delete:

1. Right-click the cell that contains the sparkline.
2. Click **Sparklines**, and then click **Clear Selected Sparklines**.

Using Sparklines

Sparklines illustrate patterns in data, drawing the eye to specific points of interest within the data. They make patterns and trends easier to see, and encourage people to look at the data that generated a sparkline. Like charts, they encourage engagement with the data by illustrating patterns.

Best Practice: You can display a sparkline anywhere in a workbook—it is good practice to display sparklines close to the data they illustrate. This makes it easier for people to understand the data, and how the sparkline was generated.

For more information about sparklines, see the Office support documentation:

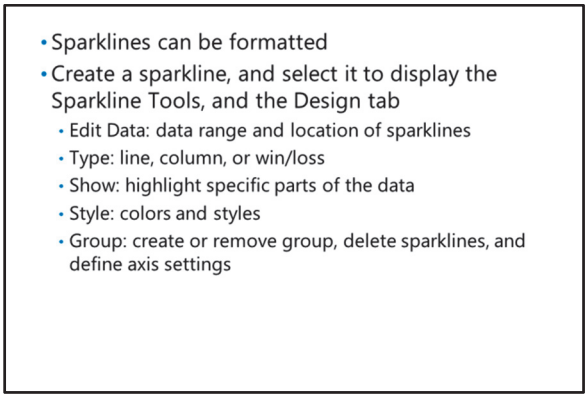
Use sparklines to show data trends

https://aka.ms/yyox1z

Formatting Sparklines

After creating a sparkline, select it to display **Sparkline Tools** on the menu. The **Design** tab gives you options to format your sparklines. There are five groups on the **Design** tab:

- Sparkline
- Type
- Show
- Style
- Group



Note: Sparklines can be grouped together so that they can be formatted together. Create a sparkline group in the Sparkline Tools **Design** tab.

Sparkline

The **Edit Data** option enables you to change the range of data used for sparklines, and the position of sparklines. Click the **down arrow** to display the following options:

- **Edit Group Location & Data**. You can amend the data range and location for a group of sparklines.
- **Edit Single Sparkline's Data**. You can amend the data range and location for a single sparkline.
- **Hidden & Empty Cells**. You can specify how empty cells should be handled, and whether or not data in hidden rows and columns should be included in the sparkline.

Type

All three sparkline types are displayed, meaning you can change the sparkline type for a specific sparkline, or for a sparkline group.

Show

You can draw attention to specific parts of the data using the options in this group:

- **High Point**. Highlights the highest value with a different color.
- **Low Point**. Highlights the lowest values with a different color.
- **Negative Points**. Highlights negative values with a different color.
- **First Point**. Highlights the first value with a different color.
- **Last Point**. Highlights the last value with a different color.
- **Markets**. Adds a marker for each data point. Used only with line graphs.

Style

You can use the style group to select colors, color intensity, and specific colors for highlighting data.

- **Style gallery**. You can select the style and color intensity for your sparkline.
- **Sparkline Color**. Select a specific color from the palette, or choose a custom color.
- **Marker Color**. You can specify a color for each different type of highlight, such as high point, low point, and so on.

Group

You can use the **Group** group (!) to group several sparklines together by highlighting them, and clicking **Group**. If you want to ungroup a number of sparklines, select the group, and then click **Ungroup**.

To delete a single sparkline, or a group of sparklines, highlight the relevant sparkline(s) and click **Clear**.

Use the Axis option to:

- Format the vertical axis for a single sparkline, or a group. This means you can define the same axis for many sets of data, allowing comparisons to be made against a standard.
- Set minimum and maximum values for sparkline axes.
- Specify whether the bars or lines are displayed from left to right, or right to left.

Demonstration: Adding Sparklines

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Click **File**, **Open**, and open **Demo3.xlsx** file in **D:\Demofiles\Mod01**.

Add Sparklines

1. Click in cell **G4**.
2. Click the **Insert** tab, and in the **Sparklines** group, click **Column**. The **Create Sparklines** dialog box appears.

3. Click the **Data Range** icon and select cells **C4** to **F4**. Click the **Data Range** icon again to enter the selection.
4. Note that the Location Range is **G4** because that cell was already highlighted.
5. Click **OK**.
6. Repeat steps 1 to 5, this time with cell **G2** selected and the data range **C5** to **F5**.
7. Highlight cells **G4** and **G5**, click ■ on the bottom right of the cells, and then drag to cell **G13**. A sparkline is created for each row.
8. Note how the sparklines highlight the differences between results for each year.

Create Win/Loss Sparklines

1. Click in cell **H4**.
2. On the **Insert** tab, in the **Sparklines** group, click the **Win/Loss** icon. The **Create Sparklines** dialog box appears.
3. Click the **Data Range** icon and select cells **C4** to **F4**. Click the **Data Range** icon again to enter the selection.
4. Note that the Location Range is **H4**, because the cell is already selected.
5. Click **OK**.
6. Click the ■ on the bottom right of the cell, and drag to **H10**. A win/loss sparkline is created for each row.
7. Note how the win/loss sparkline highlights the losses in the results.

Formatting a Sparkline

1. Highlight cells **G4** to **G10**.
2. Click **Group** to group them together.
3. Click **Line** in the **Type** group. Notice how all the sparklines are changed to the new type.
4. Click **High Point** in the **Show** group.
5. Click **Marker Color** in the **Style** group. Click **High Point** and select a bright color.
6. Click **Axis** in the **Group** group, and select **Plot Data Right-to-Left**.
7. Close the worksheet without saving.
8. An example of formatted sparklines is in the **Solution** folder.

Check Your Knowledge

Question	
Which option is available to format a sparkline?	
Select the correct answer.	
	Formatting a sparkline as a pie.
	Highlighting the highest value in the data set.
	Adding a pattern to sparkline bars.
	Showing values on a sparkline.
	Linking sparklines to data in a SQL Server database.

Lab: Presenting Data in Charts

Scenario

Sindy, the new VP of Marketing, has joined the Adventure Works Cycle company. You have been asked to provide some sales data to introduce her to the company. As it is her first day, you decide to present the information as a number of charts.

Objectives

After completing this lab exercise, you will be able to:

- Filter data to include only relevant data.
- Format data correctly.
- Choose the chart format most appropriate for your needs.
- Format charts in line with your company's branding.

Estimated Time: 60 minutes

Virtual machine: **10994B-MIA-BI**

User name: **Admin**

Password: **Pa55w.rd**

Exercise 1: Filtering Excel Data

Scenario

You work in the marketing department of the Adventure Works Cycle Company. After the VP of Marketing retired last month, the company has hired Sindy, an experienced marketing professional, who is expected to turn around the fortunes of the company. You have been asked to prepare some basic sales information to show her on her first day. You receive an email from the IT department with the data you requested. You now need to create some charts for your meeting with Sindy.

The main tasks for this exercise are as follows:

1. Filter Data

▶ Task 1: Filter Data

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab01\Starter** folder, open the **Lab1.xlsx** spreadsheet.
3. Filter the **Revenue by Territory** data that is suitable for the European report.
4. Filter again, this time for data that is suitable for the USA report.
5. Filter again, this time for data that is suitable for the Rest of the World report.
6. Remove the filter icon from the **Revenue by Territory** data range.
7. If you have time, practice adding and removing a filter to the **Revenue by Year** data.
8. Save the spreadsheet and leave it open for the next lab exercise.

Results: After completing this exercise, you will be able to:

Identify the data you need for your report.

Filter the data based on your requirements.

Exercise 2: Formatting Excel Data

Scenario

As you study the data more carefully, you realize that the revenue figures have not been correctly formatted. You decide to practice formatting data so that when you create the charts, each chart will appear correctly.

The main tasks for this exercise are as follows:

1. Formatting Data

▶ Task 1: Formatting Data

1. In the data range titled **Revenue by Year**, format the different values as follows:

1. Values as **currency** to **no decimal places**.
2. Totals as **currency** to **no decimal places**, and **bold**.
3. Percentage values as **percent**.
4. Format the values in **Revenue by Category** appropriately.
5. Format the values in **Revenue by Territory** appropriately.
6. Save the spreadsheet and leave it open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Identify data that is not formatted correctly.

Format numeric data appropriately.

Exercise 3: Creating Excel Charts

Scenario

You are feeling a little more confident now that you can filter and format the data as you want it. But with only an hour to go before your meeting with Sindy, you want to create some charts to bring the data alive, and make it easy for her to understand your presentation.

The main tasks for this exercise are as follows:

1. Create Charts

2. Formatting Charts

▶ Task 1: Create Charts

1. Select the data range for **Revenue by Category** and click **Recommended Charts** to view the different charts recommended by Excel.
2. Create a pie chart from the **Revenue by Category** data.

3. Select the data range for the **Revenue by Year** data and create a **Clustered Column** chart.
4. Select the data range for **Revenue by Territory** and filter it so that only USA territories are displayed.
5. Select the data range for **Revenue by Territory** and create a bar chart.
6. Save the spreadsheet and leave it open for the final lab exercise.

▶ Task 2: Formatting Charts

1. Format the **Revenue by Territory** chart:

1. Rename the title to **Revenue by Territory**.
2. Display the data values on the chart.
3. Display a trendline on the chart.

4. Format the **Revenue by Year** chart:

1. Rename the title to **Revenue by Year**.
2. Filter the data so that only the four most current years are displayed.
3. Change the colorway for the chart to orange monochromatic.

4. Format the **Revenue by Category** chart:

   a. Move the two small slices (accessories and clothing) out a little to give them emphasis.

   b. Show percentage values in white on each slice of the pie.

   c. Change the colorway for the chart to orange monochromatic to match the **Revenue by Year** chart.

5. Save changes and compare your spreadsheet with the one in the Solution folder.

Results: After completing this lab exercise, you will be able to:

Choose an appropriate chart for your data.

Create a chart.

Format a chart.

Check Your Knowledge

Question	
You want to create a chart to show revenue by product category and year. Which chart type is suitable?	
Select the correct answer.	
	Pie chart
	Clustered column chart
	Line chart
	Radar chart
	Area chart

Module Review and Takeaways

In this module, you have learnt how to filter data, and format it in preparation for creation charts. You have also learnt about the different chart types available in Excel, and how to choose the best chart type for the data.

Learning to work neatly with data pays dividends, and this module has covered some basics that will help you do just that:

- To get the data set you want, use the filter option. Don't copy and paste data, and make sure you delete unwanted rows. Having multiple copies of your data will lead to errors.
- Format data appropriately, even if it is only for your own benefit. Properly formatted data is easier to understand, and makes it less likely that you will make mistakes.
- Use charts to visualize the data. Visuals are easier to work with, and help you dig deeper into the analysis.

Review Question(s)

Question: What have you learnt in this module that you can apply to working with your own data? What will be most helpful and why?

Module 2

Excel Tables

Contents:

Module Overview

As managers are faced with more data than ever before, it is important to have a fast way of analyzing it. Microsoft® Excel® tables provide a fast and efficient way of understanding a large amount of data.

This module explores Excel tables; what they are, and how to use them.

Objectives

After completing this module, you will be able to:

- Describe what an Excel table is, and how it is useful.
- Create an Excel table.
- Use Excel tables for summarizing data.

Lesson 1
Introducing Excel Tables

This lesson introduces Excel tables, describing what they are and how they are useful.

Lesson Objectives

When you have completed this lesson, you will be able to:

- Describe the benefits of using Excel tables.
- Create and delete an Excel table.
- Identify the elements of an Excel table.

Benefits of Excel Tables

What Is an Excel Table?

An Excel table is a range of data that has been formatted to make it easier to analyze the data. It looks much like data in an Excel workbook, but with additional formatting. However, an Excel table has additional features that make data analysis easier.

- An Excel table is a range of cells formatted to help you analyze the data
- All cells are formatted together
- Shading is applied to make the data more understandable
- Filter buttons are applied for sorting and filtering
- You can add a totals row
- A fast way to get started with data analysis

What Does an Excel Table Look Like?

When you create an Excel table, your data immediately looks different. When you create an Excel table, your data is formatted with:

1. **Row shading** on the data, making it easier for the eye to follow rows across many columns, so it's less likely you that will make a mistake.
2. **Filters** on each column, encouraging you to filter and sort the data in different ways.
3. **Header shading**, which both improves the overall look of the data range, and makes it easier to distinguish between header titles, and the data.

The formatting of an Excel table is designed to help with data analysis, not just to make the data look pretty (although it does that, too). Well formatted data is easier to read, easier to understand, and allows you to start work on analyzing the data. Badly formatted data, on the other hand, is difficult to read, and difficult to understand, as anyone who has worked with poor quality data knows too well. The benefit of creating an Excel table is that you will have well formatted data to work with, enabling you to get on with the analysis.

Why Create an Excel Table?

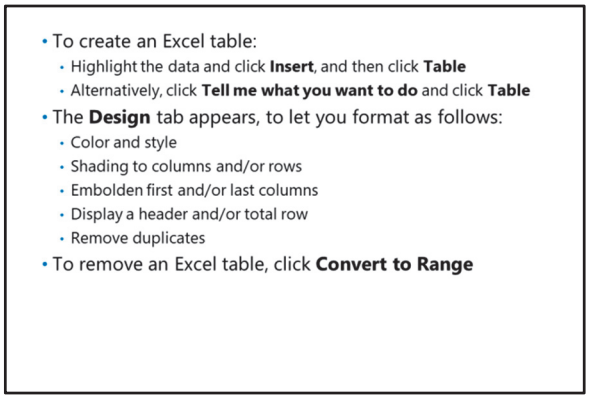
When you create an Excel table, all the data within the table is treated as a range, similar to a named range but with more functionality. This means that if you want to change the formatting, for example, you don't have to select the range again—Excel knows that you want to format the table.

An Excel table also provides much of the functionality that you might apply yourself to a data range, but it does it all for you with one click. The Excel table provides some consistency with formatting, and makes it quick to add all the analysis features you commonly need. This means that you don't have to think about what you need; you just create an Excel table and start working straight away.

Note: Do not confuse Excel tables (previously known as Excel lists) with Excel Data tables. They are two different features. This lesson discusses Excel tables.

Create an Excel Table

Creating an Excel table in the workbook that contains your data is quick and easy.



Create an Excel Table

To create an Excel table:

1. Highlight the data range you want to include in the Excel table.
2. Click **Insert**, and then click **Table**. The **Create Table** dialog box appears.
3. The data range appears in the **Where is the data for your table?** box. If this is not correct, click the **Data Range** icon and highlight the correct data range.
4. If your data has row titles, click **My table has headers**. Otherwise leave this clear.
5. Click **OK** to create the Excel table.

Alternatively, click **Tell me what you want to do** in the menu bar, and select **Insert Table**. The **Create Table** dialog box appears as described above. You can also select the **Home** tab, and select **Format as Table**.

Your data will be formatted as an Excel table. Alternate rows are shaded, making it easier to read across wide rows. Filter buttons are added to each column, allowing you to file and sort the data.

Your data must be in the same workbook, and on the same sheet. The data used to create your Excel table cannot itself be an Excel table.

Best Practice: Use the **CTRL-T** keyboard shortcut to create a table from a data range. You must have one or more cells selected, and Excel will prompt you to confirm or specify the data range.

Format Your Excel Table

After you have created an Excel table, you will see that a new tab appears called **Table Tools Design**. This includes options to allow you to format and work with your data.

To format your Excel table with different colors, click **Design**, and from the **Table Styles** group, select an alternative color or style. Note that some styles have borders, some shading, and some both borders and shading. The styles are grouped into light colors, medium colors, and dark colors.

Table Style Options

In the **Table Style Options** group, you can:

- Add a **Total Row**.
- Select **Banded Columns**, which shades alternate columns to make the data easier to read.
- You can keep **Banded Rows**, which shades alternative rows to make the data easier to read. Although you can choose both options simultaneously, using one at a time is probably better.

- Embolden the first or last column, which frequently contain row totals, by selecting **First Column** or **Last Column**.

Excel Table Tools

The **Tools** group allows you to add a slicer, create a pivot table from the data, and remove duplicates. Slicers and pivot tables are discussed in Modules 3 and 4.

Remove duplicates allows you to remove duplicate records, based on the column you specify. Consider a marketing manager who wants to create a profile of recent customers. From a data set of customer orders, she first filters the orders to only those in the last 12 months. She then removes duplicate customer rows based on the **CustomerID**, so that only one row per customer remains. She can then analyze the data based on geography, gender, and other demographic data, knowing that the data will not be skewed by having duplicate rows for customers.

The **Tools** group contains the option to **Convert to Range**. This converts the Excel table to a normal range of cells. This option retains all the data and formatting, but removes filter buttons and the **Design** tab associated with the Excel tables. **Convert to Range** removes the Excel table from your workbook, without removing the data. You can also right-click the table, click **Table**, and then click **Convert to Range**.

Sorting and Filtering

When you create an Excel table, filters are applied to each column. This makes it easy to explore large amounts of data. Depending on the type of data included in the Excel table, different types of filters will be applied:

- Filter buttons are added automatically
- Filter types
  - Criteria: select according to criteria you specify
  - Format: select according to cell formatting
  - List: select from a list
- Ensure data of only one type is in each column
- Sort data
  - High to low
  - New to old
  - Options vary according to the data
  - Create a custom sort order

Types of Filter

There are three types of filter that can be applied to many different types of columns. These filters are mutually exclusive, which means that if you apply one type of filter, you cannot apply another. Filters do, however, provide a very flexible way of filtering your data.

- **Criteria filter**. You can use a criteria filter to select between certain values, or rows after or before a certain value. You can also apply top n criteria, such as top 10 rows by item or percentage.
- **Format filter**. You can use a format filter to select by color, for example. This is useful if you have applied conditional formatting to values in a column.
- **List values**. If you have a limited number of values within a column, Excel will create a list and allow you to select one or more of the entries. This is useful when working with product categories, for example, or countries or regions. The values may be character or numeric.

Best Practice: Although Excel allows you to enter any value into a cell, you will get the best results when you only enter data of one type into a column. For example, a column entitled **Date** should only include date values, and a column entitled **Name** should only include character names. Although Excel will not stop you from entering a date value into a name column, your data analysis will be adversely affected.

Applying Filters and Sorts

To apply a filter or sort, click the down arrow on the column heading, and select the filter and sorts you require. When you apply a filter to a column, you will see that the filter button changes. Instead of a down arrow, a funnel symbol is displayed, and the down arrow is much smaller. This tells you that a filter has been applied to that column.

When you apply a sort to a column, an up or down arrow appears on the button, indicating that you have sorted on that column. You can have several filters within one Excel table, but just one sort order.

If you select both a filter and a sort order on a column, then the button will display both the funnel symbol and an up or down arrow, to indicate that both are selected.

These visual reminders of filters and sort orders help prevent mistakes in data analysis, because you can quickly see whether you are working with the full set of data, or a subset.

For more information about filtering data, see the Office support documentation:

Filter data in a range or table

https://aka.ms/sr4cxt

Sorting

The filter button also includes an option to sort data. You can sort data in ascending or descending order, selected on a particular column. It might be helpful to see customer records in data sequence, with the most recent orders first. In this case, select the **Date** column in your data range, then select the **filter button**, and click **Newest to Oldest**.

Alternatively, you might be analyzing sales by product, and want to see the highest valued orders first. In this case, select the **Revenue** column in your data range, then select the **filter button**, and click **Largest to Smallest**.

Note how the sort options adapt to the type of data in the column. You can only sort on one column at a time. You can also create a custom sort order for more complex algorithms.

For more information on sorting data, see the Office support documentation:

Sort data in a range or table

https://aka.ms/ako6b1

Demonstration: Using an Excel Table

In this demonstration, you will see how to create an Excel table, and explore the formatting and filter buttons that are added to the data range.

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank workbook**.
4. Click **File**, **Open**, and open **Demo2.xlsx** file in **D:\Demofiles\Mod02**.

Create an Excel Table

1. Examine the data on the sheet named **Data**.
2. Click somewhere within the data, then click the **Insert** tab, and then click **Table**. The **Create Table** dialog box appears.
3. Check that the data range is correct, and then click **OK**.
4. Note the new formatting, and new filter buttons that have been added.

Explore the Data Using the Excel Table

1. To see the distribution of orders over years, click the down **filter** button next to the **Year** column header. The list shows a summary of the years relating to the customer orders.
2. Click **Select All** to remove the selection from all years. Click the box next to **2016**, and then click **OK**. Only the orders from 2016 are displayed.
3. Click the **filter** button again, click **Select All**, and then click **OK**. All records are displayed.
4. To see which countries are included in the data set, click the **filter** button next to the **Country** heading. Note the list of countries.
5. Click **Select All** to remove the selection from all countries, and then click the box next to **France**, and click **OK**. Only the orders from French customers are displayed. Note the funnel symbol indicating that a filter has been applied.
6. Click the **filter** button next to the **State** heading. Note the list of French regions. Do not make a selection.
7. Click the **filter** button next to the Country heading. Click **Select All** to remove the filter, and then click **OK**. Notice that the funnel symbol is no longer displayed.
8. To find the order with the lowest revenue, click the **filter** button next to the **Revenue** heading.
9. Click **Smallest to Largest**. Note that the filter button now displays an up arrow, and the rows are sorted in **Revenue** sequence. Scroll down to see the largest revenue amount.
10. Click the **filter** button next to the **Date** heading and click **Newest to Oldest**. Note that a down arrow appears on the filter button, and the up arrow no longer appears on the revenue column. The table can only be sorted in one order at a time. Note also that you can only remove the sort order by sorting on a different column. The table rows must have a sequence.
11. With a cell in the table selected, click the **Design** tab, and click **Convert to Range** in the Tools group. When prompted **Do you want to convert the table to a normal range?** click **Yes.** This turns the Excel table back into an ordinary data range.
12. Close the file without saving it.

Verify the correctness of the statement by placing a mark in the column to the right.

Statement	Answer
True or false? Excel tables are only useful for formatting columns and rows in different colors.	

Lesson 2
Excel Functions

When you get data from another system, or another department, it is not always in the format you want. Excel has many different formulas to help you work with data, and make calculations. In this lesson, you learn how to add calculated columns to your data set.

Lesson Objectives

After completing this lesson, you will be able to:

- Add a new column to your dataset.
- Populate the column with a calculation using an Excel formula.

TEXT Function

In this section, you will learn how to use the TEXT function. You can use the TEXT function to format values in different ways.

- Create a column of values, calculated from other values in your spreadsheet
- TEXT function enables you to format numbers in different ways
- Syntax
  - =TEXT(value,format code)
- Example
  - = TEXT(C18, "DDD")
- Format codes
  - DD-MM-YYYY
  - 0.00% or 0.0%, and so on
  - HH-MM-SS

Text Function

The text function enables you to format a value in the way you specify. In these examples, C18 is the cell containing the data that you want to format.

Use the text function like this:

The TEXT Function

```
=TEXT(cell reference, format code)
```

Perhaps you have a column of dates, and you want to display just the year.

TEXT Function Formatting As Year

```
=TEXT(C18, "YYYY")
```

If you want to know which day of the week a certain date was (or will be) enter:

TEXT Function Formatting As Day

```
=TEXT(C18, "DDD")
```

TEXT Function Format Codes

When you know how to use the TEXT function, you can use different format codes. Here are some examples:

Formula	Result
=TEXT(C18, "0.0%")	Formats a number as a percentage, such as 45.5%. To format to no decimal places, type "0%".
=TEXT(C18, "# ?/4")	Formats a number as a fraction; in this case as quarters, such as ¾ or ¼.
=TEXT(C18,"0000-0000")	Formats a number split into two parts with a hyphen between. You can format numbers exactly as you want.
=TEXT(C18, "DD-MM-YYYY")	Formats a number as a date in the format DD-MM-YYYY. You can take any part of the date format to use as you want; for example, "DDD" for the day formatted as Mon, Tue, and so on. Or "YY" for the year formatted as "15" or "16".

There are many more formats you can use. For more information about the Text function, including a list of popular format codes, see the Office support documentation:

Text function

https://aka.ms/ngi052

IF Function

You can use the IF function to test for a condition, and then return a value based on whether the original value complied with the condition.

- Use the IF function to test if a condition is true
  - Return one result if true
  - Return something else if not true
- You can nest IF functions
- New IFS function allows you to test for more than one thing

IF Function

Suppose the value you want to test is in a column named Day of the Week, and it contains the day of the week that customers place their order. You dispatch every day except Friday, so you write a function to test whether or not the order should be prepared for dispatch.

The basic syntax for the IF function is:

IF Function

```
=IF(Condition is True, Do This, Otherwise Do This)
```

In this example, you test to see if an order should be prepared for dispatch, based on what day the order was placed.

IF Function to Test for Day of Week

```
=IF(C18="Fri", "Do not Dispatch", "Dispatch Order")
```

You can see that the IF function might be useful in many different situations where you want to automate decisions, or prepare data for further analysis. There are occasions, however, when you might want to test for more than one condition. You can nest the IF function, but Microsoft have introduced a new function called IFS that allows you to test for more than one condition.

For more information about the IF function, see the Office support documentation:

IF Function

https://aka.ms/db4ywq

IFS Function

The IF function is used a great deal in Excel, and frequently needs to be nested so that more than one condition can be tested. The IFS function is new, and means you can test for more than one condition, within the same statement.

The basic syntax is:

IFS Function

```
=IFS(Test 1, Return if True, Test 2, Return if True, Test 3, Return if True)
```

This could be used to make two tests in the product dispatch scenario. If orders are received on Friday, you do not dispatch; if orders are received on Thursday, they are dispatched using an Express service, to ensure they arrive before the weekend.

Using the IFS function to make two tests:

IFS Function

```
=IFS(C18 = “Fri”, “Do not Dispatch”, C18 = “Thu”, “Express Service”)
```

For more information about the IFS function, see the Office support documentation:

IFS function

https://aka.ms/xtqwt6

DATEDIF Function

The DATEDIF function is used to calculate the difference between two dates. Although it is a legacy function, it is still useful in many situations. You might want to calculate someone’s age from their birth date; or the number of years that a customer has been purchasing from you.

- =DATEDIF(start_date, end_date, unit) calculates the difference between two days
- A legacy function that is still useful
- Returns a number, formatted according to the unit you specify
- “Y” = Year
- “M” = Month
- “D” = Day

DATEDIF function

The general syntax for the DATEDIF function is:

DATEDIF

```
=DATEDIF(start_date, end_date,format)
```

As with the TEXT function, there are different format codes you can use, such as “Y” to return the number of years, “M” to return the number of months, and “D” to return the number of days.

You can also use the Excel function TODAY() for either the start date, or the end date. This is helpful if you want to calculate the number of days or months before an event.

For more information on the DATEDIF function, see the Office support documentation:

DATEDIF function

https://aka.ms/fyd0xz

Lesson 3
Summarizing Data

Data is only useful if you can extract meaning from it, and summarizing data can help you do that. You need to summarize appropriately, thereby looking "behind" the numbers to appreciate what they mean.

This lesson considers how to summarize data to make it more understandable.

Lesson Objectives

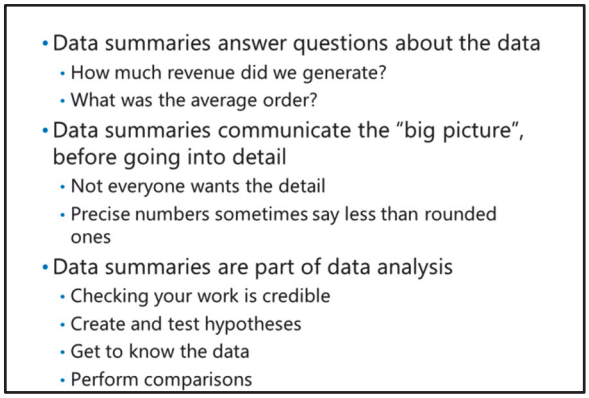
After completing this lesson you will be able to:

- Explain the importance of summarizing data.
- Explain appropriate ways of summarizing different types of data.
- Summarize data in an Excel table using the Total Row.

About Data Summaries

Summarizing the data gives you the big picture. Faced with a mountain of numbers, a summary quickly gives you an idea of what you are looking at. Data summaries answer questions such as:

- How many customers bought from us this year?
- What is the total revenue for the year?
- What was the average order value this year?
- What was the highest order value?
- What was the lowest order value?
- What variation is there in our data?



You create data summaries for two primary reasons:

- To help you understand the data.
- To communicate the meaning of the data to others.

Educate Your Audience

It is helpful to give people the "big picture" first, before going into detail. Although people often need to see detailed information, familiarizing them with a summary will help them to understand the information that follows. A summary puts detailed information in context.

Think about a recent news item that included data. Often a headline figure is given, such as *"Almost 30 percent of schoolchildren fail their maths exam"*. This number is often purposefully rounded, and designed to get across a message. The real number may be 28.49 percent of children in four states, but this is too much detail to communicate quickly. A figure of 30 percent is instantly recognizable, memorable, and more useful than providing an accurate (but difficult to assimilate) number in the headline.

In a business setting, not everyone wants the detail. It might be enough to know that sales are 5 percent above target, without providing the exact breakdown of sales for the month.

Educate Yourself

Although data summaries are often used when conveying a message about the data, they are just as valuable during the analysis phase. You can use them to:

- **Check your work**. For example, you might check that an average isn't greater than the total.
- **Test hypotheses**. You might think you know which region is best for performance. You can test this idea by creating summary totals on revenue, profit, and then revenue and profit by salesperson for each region.
- **Get to know the data**. When faced with a large spreadsheet, creating summary totals is a good way to understand the data. You may not use all the summary totals in your reports, but by creating summaries, you can formulate questions for further analysis.
- **Perform comparisons**. For example, calculating totals for different regions, different years, and different product ranges, provides a great deal of information, and also forms the basis for further investigation.

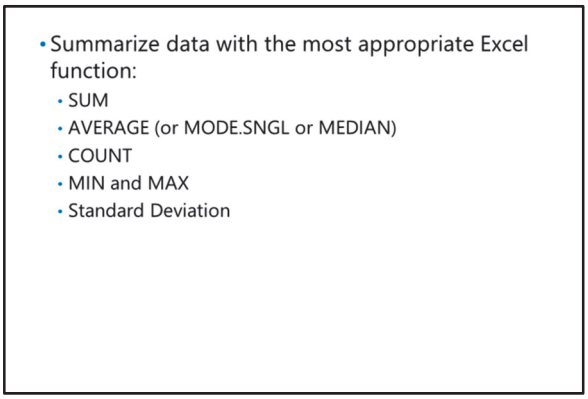
Data summaries are an important part of data analysis, both to convey meaning to your audience, and as part of your analysis. In the next lesson, you will look at how Excel tables make it easy to create a variety of different data summaries.

Total Row

You have the option to add a total row to your Excel table. This enables you to quickly add totals, averages, counts, and other summary totals to your data columns.

The total row includes different options to summarize data. The available options for a numeric column are:

- None (no total)
- Average
- Count
- Count numbers
- Max
- Min
- Sum
- StdDev
- Var
- More functions



SUM

The most useful function in Excel is the **SUM** function, which adds together the values in a range of cells. Whilst **SUM** is easy to use, it is not suitable for all columns. Consider the marketing manager who is analyzing sales by customer. Creating a total for the revenue column will give her the total sales for the year, but this is probably not very useful. The question is not so much "*how much revenue did the*

company generate?" for a particular year, but "*what type of customers should the company be marketing to in order to maximize revenue?*". To do that, the marketing manager will have to dig a little deeper.

To use the SUM function, type **=SUM(cell range)**; for example, **=SUM(A2: A14)**. Alternatively, select it from the drop-down list in the totals row of an Excel table.

Average

The average function returns an average of the numbers within the range you select. An average is the total of the numbers contained within the range, divided by the count of those values. If any of the cells within your range contain text or are empty, they will be ignored. However, if any of the cells contain zeros, they are included.

You might summarize a number of orders for a customer demographic by calculating the average revenue. This could be contrasted with the average revenue for all customers; for example, the average order value for 18- to 25-year-olds is $249, compared with an average order value of $150 for all customers in the sample.

To use the Average function, type **=AVERAGE(cell range)**; for example, **=AVERAGE(A2: A12)**.

An arithmetical average might not always be what you want to show, so there are two other types of average, called a median and a mode.

- **Median** is the middle value in a group of numbers, and is calculated in Excel with the function **=MEDIAN(cell range)**; for example, **=MEDIAN(A2: A12)**.
- **Mode** is the number that appears most often within your range of numbers, and is calculated in Excel with the function **=MODE.SNGL(cell range)**; for example, **=MODE.SNGL(A2: A12)**.

Average is an option within the total row of an Excel table. Although **MEDIAN** and **MODE.SNGL** are not on the main list when you select the drop-down box on the totals row, select **More functions ...** and then **Search for a function**. Type the name of the function you require, and then select it from the list. Click **OK** when you have selected the function you want to use.

 **Best Practice:** The three ways of calculating an average that you have discussed can produce very different results, depending on your data. It is good practice to say which calculation you have used, particularly if you are not using **AVERAGE**, which is the most common way to calculate an average. Note that **AVERAGE** (also called mean), **MEDIAN**, and **MODE** are all legitimate ways of calculating an average.

Count

Count gives you the number of items within a range. This is useful to provide a sense of scale. Taking our previous example of the average order value, if the number of 18- to 25-year-olds is small when compared to the total number of all customers, then the average value will not be helpful. The fact that, on average, orders from 18- to 25-year-olds were three times the value of everyone else's is of little concern if only three orders were placed by that age group. The greater the number of values within a population, the more helpful a value, such as an average, will be. If you count the number of customers you are analyzing, and then count each subgroup, you will provide more context to the other summary values that you produce.

To use the **COUNT** function in Excel, type **=COUNT(cell range)**; for example, **=COUNT(A2:A12)**. Count is provided as an option within the total row of an Excel table.

Count number gives you a count of the numbers within a column, when text and numbers are in the same column.

Max and Min

Max and Min give you the maximum and minimum values within a range. Like **COUNT**, these provide context to your data. Use them to sense-check conclusions, demonstrate variability in your data, or show outliers.

Standard Deviation

Standard deviation tells you the range within which most (about two thirds) of values lie from the mean. A low standard deviation tells you that most of the values are close to the mean, whereas a high deviation tells you that most of the values are dispersed far from the mean.

Consider a situation where you have analyzed your orders for the year: mean order size is 100 and the standard deviation is 15. This means that approximately two thirds of your orders were between 85 and 115.

Var

Var is the square of standard deviation and a measure of how spread out your data is.

 **Note:** When using StdDev or Var, ensure that all the values in the range represent a coherent population such as the same region, the same company, or the same product range. When data from different populations are mixed together, the standard deviation or variance is likely to be high, and not meaningful.
In statistical terms, all values should be distributed on a single normal curve. For example, the average heights of boys and girls in a class have different normal distributions and different mean heights. So that, when boys and girls are measured together, their standard deviations and variances are higher than when measured separately.

Demonstration: Adding a Total Row

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank workbook**.
4. Click **File**, **Open**, and open **Demo2.xlsx** file in **D:\Demofiles\Mod02**.
5. Click somewhere in the data, click the **Insert** tab, and then click **Table**. The **Create Table** dialog box appears.
6. Check that the data range is correct, and then click **OK**.

Add a Total Row

1. Click somewhere in the table, and from the **Design** tab, **Table Style Options** group, select **Total Row**. A totals row is added to the table.
2. Click the arrow next to the **Revenue** total. Note this is a SUM of the revenue column.
3. Select cell **N113038** and click the arrow. Select **Average** from the list. Explain that a total of Cost Price values would not be a useful summary, whereas Average is useful.

4. Select cell **C113038** and click the arrow. Select **Count** from the list. Explain that this gives a count of the records. Note that this is not a count of customers because CustomerIDs may appear more than once.

Combining Filters and Totals

1. Click the **Country Filter** and click **Select All** to clear everything, then click **United Kingdom**. Click **OK**. Note the reduced number of records.
2. Select cell **K113038** and click the arrow. Select **Average** from the list.
3. Click the **Country Filter** again, clear **United Kingdom**, and then select **Canada**. Click **OK**. Note that Canada has a higher average order quantity than the UK.
4. Close the spreadsheet without saving.

Real-world Issues and Scenarios

How many different ways do you summarize data? Totals and averages are commonly used in data analysis, but adding further information, such as counts, minimums and maximums, can also be helpful. Sorting data in different ways, looking at subsets of the data and making comparisons, can all be helpful in getting a better understanding of your data.

Lab: Analyzing Customer Demographics

Scenario

After receiving the high level sales information, Sindy has asked for some more detailed data. In particular, she wants a demographic profile of customers, together with how much they spend. The IT department has provided you with some data. You need to analyze the data in time for your meeting with Sindy, first thing in the morning.

Objectives

After completing this lab exercise, you will be able to:

- Create an Excel table.
- Format the data appropriately.
- Add filters and a total row.
- Provide summaries based on the data.

Estimated Time: 45 minutes

Virtual machine: **10994B-MIA-BI**

User name: **Admin**

Password: **Pa55w.rd**

Exercise 1: Create an Excel Table

Scenario

Sindy wants demographic data about the Adventure Works customers—and she needs it quickly. Luckily, the IT department can supply you with a spreadsheet, but you need to analyze it to provide Sindy with some conclusions. To get this done quickly, you decide to create an Excel table.

The main tasks for this exercise are as follows:

1. Create an Excel Table

▶ Task 1: Create an Excel Table

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab02\Starter** folder, open **Lab02.xlsx**.
3. Create an Excel table from the data.
4. Note three things provided in Excel tables that help you to analyze data.
5. Select **First Column** and **Last Column**. Note the effect that this has on the table, and think of different ways in which you would use this.
6. Select different styles for the table. Which styles work best, and why?
7. Add a **Total Row** to the table, add an average for **TotalPurchaseYTD**, and format it to zero decimal places.
8. Save the spreadsheet, and leave it open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Create an Excel table from data provided to you.

Add a total row to an Excel table.

Exercise 2: Work with Excel Table

Scenario

After creating an Excel table, you now want to work with the table ready to analyze the data.

The main tasks for this exercise are as follows:

1. Format the Data

2. Calculated Columns

▶ Task 1: Format the Data

1. Format the **DateFirstPurchase** column as **Short Date**.
2. Format the **BirthDate** column as **Short Date**.

▶ Task 2: Calculated Columns

1. Insert a new column between **DateFirstPurchase** and **BirthDate** and title it **MonthFirstPurchase**.
2. In cell **D2**, calculate the month name for cell **C2** using the **TEXT** function. The column is populated with month names.
3. Insert a new column between **MaritalStatus** and **BirthDate** and title it **Age**. Populate the column with the age.
4. In cell **F2**, calculate the age for cell **E2** using the **DATEDIF** function. The column is populated with ages.
5. Insert a new column between **MaritalStatus** and **Age** and name it **AgeGroup**.
6. Use a nested IF statement to calculate which age group each person falls into:
   - < 21 = "Young Person"
   - > 66 = "Mature"
   - Everyone else = "Adult"
7. Format the **Age** column to zero decimal places.
8. Save the spreadsheet, and leave it open for the next exercise.

Results: After completing this lab exercise, you will be able to:

Format columns within the table.

Add calculated columns.

Exercise 3: Analyze the Data

Scenario

Sindy has sent you an email message saying that she will only have 15 minutes available for your meeting. She has asked if you could summarize the data for her, so she can quickly understand it in time for her meeting with the CEO.

The main tasks for this exercise are as follows:

1. Demographics Analysis

▶ Task 1: Demographics Analysis

1. Navigate to **D:\Labfiles\Lab02\Starter** and open **Lab02b.xlsx** and **Analysis.xlsx**.
2. For each of the calculations below, enter the amounts in the **Analysis.xlsx** spreadsheet.
3. Calculate the **AveragePurchaseYTD** for the following:
   a. Each Yearly Income band
   b. Each Age Group
   c. Each season
4. Create appropriate charts for each table.
5. Compare your results with the solution in the **D:\Labfiles\Lab02\Solution** folder.

Results: After completing this lab exercise, you will be able to:

Use an Excel table to analyze and summarize data.

Draw conclusions about the data.

Question: To what degree did it help to add charts to the analysis?

Check Your Knowledge

Question	
Based on the results of your demographic data analysis, which conclusion is correct?	
Select the correct answer.	
	Young people are an ideal target market for Adventure Works Cycles.
	Autumn and Christmas are an ideal time to promote Adventure Works Cycles.
	Adventure Works should focus on the mature market, because these people need to get fit using bicycles.
	Targeting middle income households is optimal for Adventure Works Cycles.
	Advertising should be targeted at men, because they are more likely to buy bicycles.

Module Review and Takeaways

This module introduced Excel tables, and how you can use them to quickly analyze and summarize data. Several Excel functions were introduced, and they were used to create calculated columns to enhance the data analysis. You learnt how to filter and sort data, and to create charts from your findings.

 **Best Practice:** Use Excel tables to quickly analyze and summarize any data. You can easily remove the table by selecting **Convert to Range**.

Module 3

PivotTables and PivotCharts

Contents:

Module Overview

PivotTables are one of the most powerful features of Microsoft® Excel®, and for anyone whose job includes data analysis, they are an essential tool. PivotTables enable you to quickly organize and analyze data, and do more in-depth analysis, because you can work with your data in different ways.

This module introduces both PivotTables and PivotCharts, showing you how to use them to get more out of your data.

Objectives

When you have completed this module, you will be able to:

- Describe what a PivotTable is, and how to use it.
- Work with PivotTables, including designing your own reports.
- Create and amend PivotCharts.
- Use PivotTables and PivotCharts to analyze data.

Lesson 1
PivotTables

This lesson introduces PivotTables.

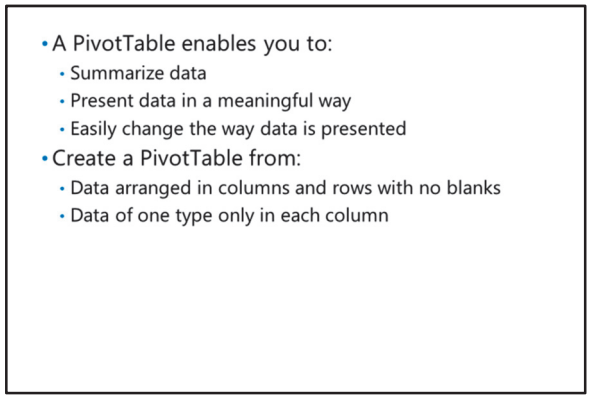
Lesson Objectives

After completing this lesson, you will be able to:

- Describe a PivotTable and what it is used for.
- Create a PivotTable in one of two ways.
- Work with PivotTables.

What Are PivotTables?

A PivotTable is a data analysis tool that helps you to summarize data, enabling you to create meaningful reports. They are called PivotTables because you can change the way you look at your data—first one way, then another, as if you were pivoting the data. Like Excel tables, PivotTables add functionality that makes it easier to work with complex or large amounts of data.



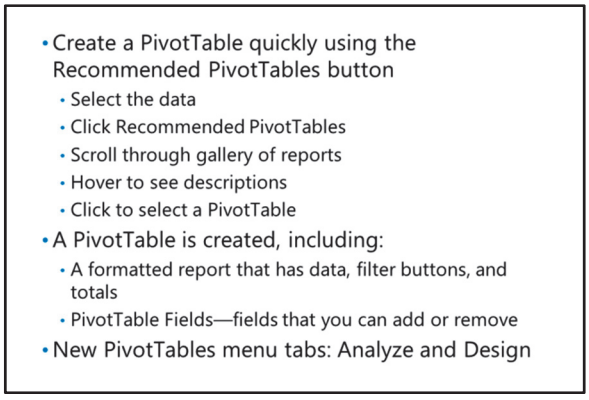
You can create a PivotTable manually, or Excel can create a PivotTable based on your data. You will learn about each option in the following topics.

Data for a PivotTable

To create a PivotTable, you need suitable data. The data must be in a tabular format, arranged in columns and rows with no blank columns or rows. A good source of data for a PivotTable is an Excel table, as discussed in the previous module. As with all tables, you should have only one type of data in a column. That means that a column titled **Date** will only contain formatted date values. A column titled **Revenue** will only contain currency values. And neither column will contain text, symbols, hyperlinks, or anything else.

Recommended Pivot Tables

A Recommended PivotTable is one that is preconfigured, based on your data. This is a good place to start with PivotTables, because it takes just a couple of clicks to create a report you can work with straight away.



Creating a Recommended PivotTable

To create a PivotTable using the Recommended PivotTables option:

1. Select a cell within the data range you want to use to create a PivotTable.
2. Click the **Insert** tab, and from the **Tables** group, click **Recommended Pivot Tables**. The **Recommended PivotTables** gallery is displayed. The left-hand pane displays previews of your data in a PivotTable.
3. Hover over a preview in the left-hand panel to get a description of the PivotTable. The description comprises the columns that have been summarized, and how they have been summarized. An example might be "Sum of Revenue by Country", or "Sum of Revenue by Customer Age and Gender". Not all recommended PivotTables will be suitable.
4. Notice that a dotted line appears around your data range—if this is incorrect, click **Change Source Data...** to define the correct data range.
5. Click the PivotTable preview you wish to use, and then click **OK**. The PivotTable will be created on a different sheet.
6. Alternatively, if none of the preview PivotTables meet your needs, click **Blank PivotTable** to create a PivotTable manually. Creating PivotTables is covered in the next topic.

Exploring a PivotTable

The PivotTable created using the Recommended PivotTable option is configured according to the preview you selected. There are two parts to the PivotTable:

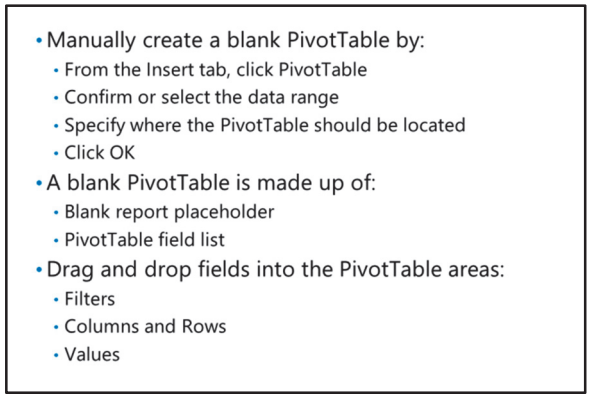
- **Formatted report**: including data, filter buttons, and totals.
- **PivotTable Fields**: the list of available fields you can add or remove from the report. The column headings from your data source are now fields you can use in the PivotTable.

Also, two new PivotTable Tools menu tabs appear—**Analyze** and **Design**.

Recommended PivotTables are a great way of getting up and running quickly. Almost everything is done for you—all you have to do is work with the data.

Manually Creating a PivotTable

This topic considers how to manually create a PivotTable from tabular data. The process is similar to Recommended PivotTables, but instead of the PivotTable report being created, you define the layout of the report. This gives you many more options in the way you analyze data.



To Manually Create a PivotTable

To manually create a PivotTable:

1. Click somewhere within your data set.
2. From the **Insert** tab, click **PivotTable**.
3. Check the data range is correct, or click the **data range** button to select a different data range.
4. Select where you want to place the PivotTable; you can either create a new worksheet, or place it on the existing worksheet.
5. You also have the option to add the data to a Data Model. You will learn about Data Models in Module 6.
6. Click **OK**. A blank PivotTable is created.

Exploring a Blank PivotTable

A blank PivotTable has two parts:

- **Blank report placeholder**: this will contain data when you make your selections.
- **PivotTable Fields**: these are the fields that you can use to create your PivotTable. The column headings from your data source are now fields that you can use in your PivotTable.

To create a PivotTable, drag fields into the boxes for **Filters**, **Columns**, **Rows**, and **Values**. As you move fields into each box, the PivotTable is immediately updated. If you make a mistake, or want to see the data in a different way, remove the field from a box by clicking and dragging it out of the box. You can try lots of combinations before deciding how you want your PivotTable report to look.

Best Practice: You are not limited to creating just one PivotTable from a data set. To analyze the data from multiple perspectives, you might want to create several PivotTables.

Working with PivotTables

You have looked at two methods of creating PivotTables:

- Create a preconfigured PivotTable using **Recommended PivotTables**.
- Create a blank PivotTable using **PivotTable**.

Whichever method you use, the options available for working with PivotTables are the same. In both cases, a new menu group is created called **PivotTable Tools**; it has two tabs—**Analyze** and **Design**. The **PivotTable Fields** options are the same for both.

- PivotTables comprise:
  - Columns
  - Rows
  - Values
- You use PivotTables to create reports such as:
  - Population gender (row) by country (column); population count is the value
  - Population band (column) by town (row and value); population count is the value
- Drag field names to either column or row to preview the PivotTable

This section looks at how to work with PivotTables, including adding and removing fields, and working with PivotTable values.

PivotTable Basics

PivotTables present data by analyzing something by one or more criteria. For example, populations might by analyzed by country. In this simple example, population is the single row value, and the column values are the country names: UK, France, USA, China, Angola, and so on. The intersection between population and country name is the number of people living in that country. This is a familiar and intuitive way of analyzing data.

Consider the same example, but with the population split into age bands. The rows are now titled "Under-fives", "five- to 12-year-olds", 13- to 21-year-olds", and so on. Now the intersection gives the number of people aged between five and 12-years-old living in the UK, or USA, and so on. This gives a more detailed, and more useful analysis of the population of countries.

In this example, you can either have the countries as columns, or as rows. For analysis purposes, it does not matter. However, if there are many countries, and not many age bands, it might be more convenient to have the countries listed as rows, and age bands as columns, because people are more used to reading down a page than across it.

PivotTables are elegant because you can easily swap columns and rows, changing how your data is presented. This is where the name PivotTable came from—indicating the ease with which data can be pivoted, or rotated, in different ways.

Adding and Removing Columns

Select a field for column headings by dragging it to the box called **Columns**. As soon as the field is added to this box, the column headings appear in the PivotTable. To remove a field from being a column heading, click the field and drag it away from the **Column** area.

Adding and Removing Rows

Select a field for a row heading by dragging it into the **Row** box. As you have already seen, your choice as to whether a field should be a column or row heading will be determined by how many columns or rows are needed to display the data—and the emphasis you want to give to different aspects of the data.

Column or row headings tend to be things like countries, regions, months, years, and so on. If you have already created column headings, when you create rows, both the rows and values will be entered into the PivotTable. This is because you have defined the intersection between columns and rows.

Working with Values

Values represent the information you are analyzing—for example, the number of people in a country, or the revenue generated by month. Drag a value field to the values box and the PivotTable will be automatically previewed.

Demonstration: Creating PivotTables

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank Workbook**.
4. Click **File**, **Open**, and then open **Demo03.xlsx** in **D:\Demofiles\Mod03**.

Create a Recommended PivotTable

1. On the **Sheet1** tab, click somewhere in the data range.
2. Click the **Insert** tab.
3. Click **Recommended PivotTables**. The **Recommended PivotTables** dialog box appears with a list of PivotTable options in the left panel. Widen the dialog box to see the full previews.
4. Click each option to display a preview of the PivotTable in the right panel.
5. Discuss which PivotTable options are useful, which are not, and why.
6. Select the first option—**Sum of TotalPurchaseYTD by YearlyIncome**. Click **OK**.
7. Explain each part of the PivotTable:
   - Report
   - PivotTable Fields
   - Quadrant for fields
8. Click the arrow next to **Sum of TotalPurchaseYTD** in the **Values** quarter.
9. Click **Value Field Settings**.
10. In the **Summarize value field by** list, select **Average**, and then click **OK**.
11. Highlight cells **B4** to **B9**, right-click and select **Number Format**. Click the **Number** category, and click the **Decimal places** down arrow twice to format the values to no decimal places, and then click **OK**.
12. Drag **Gender** from the list of PivotTable Fields to the **Columns** quarter.

Create a PivotTable Manually

1. Click **Sheet 1** and click somewhere in the data range.
2. Click the **Insert** tab, and click **PivotTable**.
3. The **Create PivotTable** dialog box appears. Keep the defaults and click **OK**.

4. Explain each part of the new PivotTable:
    - Blank report
    - PivotTable Fields
    - Empty Quadrant for fields
5. From the list of **PivotTable Fields**, drag:
    a. **Gender** into the **Columns** quarter
    b. **TotalPurchaseYTD** into the **Values** quarter
    c. **YearlyIncome** into the **Rows** quadrant
6. Click the arrow next to **Sum of TotalPurchaseYTD** in the **Values** quarter.
7. Click **Value Field Settings**.
8. In the **Summarize value field by** list, select **Average**, and then click **OK**.
9. Highlight cells **B5** to **D10**, right-click and select **Number Format**. Click **Number**, and click the **Decimal places** down arrow twice to format to no decimal places, and then click **OK**.
10. Compare the values in this PivotTable with the Recommended PivotTable on **Sheet2**.
11. Close the spreadsheet without saving.

Verify the correctness of the statement by placing a mark in the column to the right.

Statement	Answer
True or false? You should be careful when you use Recommended PivotTable or PivotTable, because they are difficult to change after they have been created.	

Lesson 2
PivotCharts

You use PivotCharts to create charts that help you and your audience make sense of your data. PivotCharts are primarily used to visualize the data in a PivotTable, although you can use them independently. Like PivotTables, one of the biggest strengths of PivotCharts is the ease with which data can be manipulated in different ways.

This lesson explores PivotCharts, including what they are, how to create them, and how to format them.

Lesson Objectives

After completing this lesson, you will be able to:

- Understand what a PivotChart is, and when to use one.
- Recognize the different elements of PivotCharts, and how to work with them.
- Choose the correct PivotChart for your needs.
- Format a PivotChart appropriately.

Introduction to PivotCharts

PivotCharts are like ordinary Excel charts, but with more functionality. The benefits of PivotCharts are similar to those of PivotTables:

Speed. Create a well formatted chart very quickly.

Agility. Change the values for the X and Y axes.

Presentation. Format many aspects of PivotCharts.

- PivotCharts are as easy and flexible as PivotTables
  - Fast to create a chart
  - Ability to change how data is visualized
  - Lots of options for formatting the chart
- Create a PivotChart from the Insert menu
  - Click PivotChart
  - Select the data range
  - Specify where the PivotChart should be located
  - Click OK and the chart is created

To Create a PivotChart

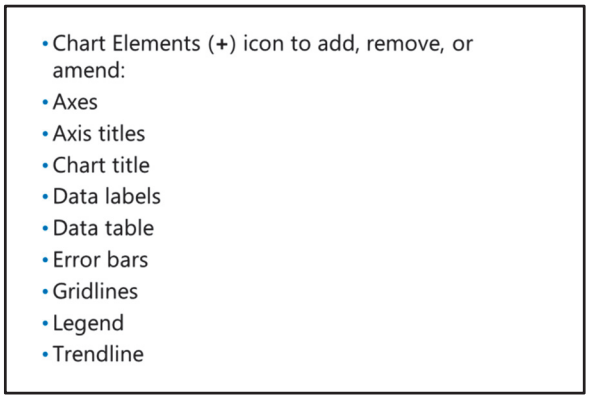
1. Highlight the data that will be used to create a chart.
2. Click the **Insert** tab, and from the **Charts** group, click **PivotChart**. The **Create PivotChart** dialog box appears.
3. Confirm or select the data range, and then select the location for the PivotChart.
4. Click **OK**. A blank PivotChart is created.

When you create a PivotChart, a new set of tabs appears called **PivotChart Tools**. These are **Analyze**, **Design**, and **Format**. These tabs include a great deal of functionality when you work with PivotCharts. The next few topics cover this functionality in detail.

 **Best Practice:** Like PivotTables, your data must be arranged in tabular format, with no blank columns or rows. Ensure you have meaningful column or row headings.

PivotChart Elements

After the chart has been created, you might want to change some of its elements. For example, you will probably need to alter the title to make it more descriptive. Just like regular Excel charts, PivotCharts allow you to amend the various elements that make up the chart.



Adding or Removing Chart Elements

You can add or remove elements from a chart by clicking the **Chart Elements** icon (**+** symbol) when the chart is selected. A list of chart elements appears with a tick against elements that are currently displayed on the chart.

To remove the chart title, for example, click the box next to **Chart Title** to remove the tick, and the title is removed from the chart. If you change your mind, and want the title to appear again, click the box and the title box appears. Double-click the title box to amend the text.

By selecting the chart, and clicking the **Chart Elements** icon, you can add, remove or amend the following chart elements:

- **Axes**. Add or remove vertical and horizontal axes. Click the **>** arrow to choose to have only the horizontal, or vertical axis. Click **More Options** for formatting options, such as the width and color of the axis lines.
- **Axis titles**. Add or remove axis titles. Click the **>** arrow to choose only a horizontal or vertical title. Click **More Options** for formatting options, such as the color of the axis title, or alignment.
- **Chart title**. Add or remove the chart title. Click the **>** arrow to select the position of the title, and **More Options** for formatting options, such as the color of the chart title, and text style.
- **Data labels**. Add or remove data labels. Click the **>** arrow to select the position of the data labels. Click **More Options** to format the numbers or borders.
- **Data table**. Adds the data values to the chart. Click the **>** arrow to select with or without legend. Click **More options** to format the borders and fill lines around the data table.
- **Error bars**. Add or remove error bars. Click the **>** arrow to select **Standard Error**, **Percentage** or **Standard Deviation**. Click **More Options** to format the error bars.
- **Gridlines**. Adds or removes the gridlines from the chart. Click the **>** arrow to select the type of gridlines you want. Click **More Options** to format the gridlines.
- **Legend**. Adds or removes a legend from the chart. Click the **>** arrow to select the position of the legend. Click **More Options** to format the legend.
- **Trendline**. Adds or removes a trendline. Click the **>** arrow to select the type of trendline or moving average you require. Choose from **Linear**, **Exponential**, **Linear Forecast**, or **Two Period Moving Average**. Click **More Options** to format the trendline. There are additional trendline options, plus options for displaying the trendline.

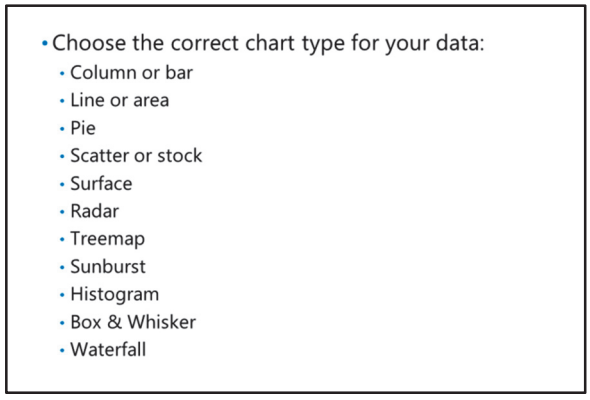
The exact options shown depend on the chart type.

Note: Note the **Add Chart Element** icon, located on the **Design** tab within **PivotChart Tools**. This also allows you to add, remove, and amend chart elements.

PivotChart Types

To best communicate an understanding of the numbers you need to choose the best chart type for the data, you can create PivotCharts of different types, and in different styles. You can:

- Choose the chart type when you create a PivotChart.
- Change the chart type of an existing PivotChart by selecting **PivotChart Tools**, **Design** tab, **Change Chart Type**.



Note: When you create a PivotTable and PivotChart at the same time, you must select the chart type later. You cannot specify the chart type when the PivotChart is being created.

Chart Types

As with regular Excel charts, you have different chart types available:

- Column charts
- Line charts
- Pie charts
- Bar charts
- Area charts
- Scatter charts
- Stock charts
- Surface charts
- Radar charts
- Treemap
- Sunburst
- Histogram
- Box & Whisker
- Waterfall

In addition, you can create combo charts, which combine more than one chart type.

To select the correct chart type for your data, think about how visuals represent the data. Although each different chart type might technically convey the meaning of the data, some visuals are better than others. A pie chart is perfect for showing percentages, providing there are not too many “slices”, making it difficult to read. Similarly, a line chart might show a trend better than a column chart. Try out different chart types to see which is most appropriate.

Chart Style

After you have selected the right chart type, you can then select a style. Styles include whether the chart has a background or not, shading, and other devices. Choosing an appropriate style helps a chart stand out, and creates a feeling of consistency if you have lots of charts in your report.

To select an appropriate style for your chart, select the PivotChart and click the **Chart Styles** icon (paintbrush). Select a style from the gallery.

Best Practice: Beware of having too many styles in a report. Keeping the same colorway and style throughout a report or presentation helps the reader focus on the message, and not the formatting. Too many different colors or styles can be distracting.

PivotChart Layouts

PivotChart layouts are a quick way to apply a layout to a chart. You have seen how to create a PivotChart, and to change the chart type, in addition to the various chart elements. PivotChart layouts are an even faster way to apply layout elements to your chart.

- Use Quick Layout to quickly apply your preferred formatting options
- Preselected layouts

Apply PivotChart Layout

To use PivotChart layouts:

1. Select the **PivotChart** you created.
2. Click the **PivotChart Tools Design** tab.
3. In the **Chart Layouts** group, click **Quick Layout**.
4. Select the layout you require.

Note: All of the options in Quick Layout are available through other menus. Quick Layout provides a fast way of creating a chart with your preferred options.

Demonstration: Creating PivotCharts

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank Workbook**.
4. Click **File**, **Open**, and open **Demo03a.xlsx** in **D:\Demofiles\Mod03**.

Create a PivotChart

1. Click **Sheet 2** and click somewhere in the **PivotTable**.
2. Click the **Insert** tab.
3. Click **PivotChart** in the **Charts** group. The **Insert Chart** dialog box appears.
4. Select **Bar** in the left-hand list. Select **Clustered Bar** in the top panel. Note that not all chart types are supported with PivotTable data. Click **OK**.
5. Click the **Yearly Income** filter and click **Select All** to clear everything. Select **50001 – 75000**, **75001 – 1000000** and **greater than 1000000.** Click **OK**.
6. Click the **Gender** filter.
7. Click **M** to select **F.** Click **OK**.
8. Remove both filters by clicking on the YearlyIncome filter, and then click **Select All.** Click the **Gender** filter and click **Select All**. Click **OK**.
9. Close the spreadsheet without saving.

Check Your Knowledge

Question	
What options are not available when you format a PivotChart?	
Select the correct answer.	
	Color combinations and monochromatic color schemes.
	Adding a data table.
	Adding pictures.
	Adding a trendline.
	Showing error bars.

Lesson 3
Editing PivotTables and PivotCharts

You can enhance PivotTables and PivotCharts and improve the analysts' ability to gain meaningful insights by editing your spreadsheets. By adding timelines you can enhance time-based analysis and by adding aggregations you can summarize data to make the data more understandable.

Lesson Objectives

After completing this lesson, you will be able to:

- Add a timeline
- Analyze your data

Timelines

A timeline is a type of filter that you can add to a PivotTable or PivotChart to help you analyze time-related data. Adding a timeline is an alternative to adding individual filters to your report, and has the advantage that you can easily change the granularity of the time period you see in the report.

Consider how often you might need to analyze revenue or costs by year or month. Or perhaps analyze sales by day of the week. Most organizations have a requirement to analyze data over time.

- A timeline is an easy way to analyze data by time period
- Much data contains a time dimension
- To add a timeline:
  - Select a PivotTable or PivotChart
  - From the Analyze tab, click Insert Timeline
  - Select the fields you want to use
- To use a timeline:
  - Select the time period you want to use
  - Use the slider bar to select the time period
  - Change as required
- Format a timeline using the Options tab

Add a Timeline

To use a timeline filter your data must include one or more columns with time-related data.

1. Click somewhere on your PivotTable, or PivotChart.
2. Click the **Analyze** tab, and then click **Insert Timeline**.
3. The **Insert Timelines** dialog box appears, displaying time-related fields from your data.
4. Click to select the fields you want to use. Click **OK**.

Using a Timeline

Having added a timeline to your report, you can now use it to filter what is displayed in the PivotTable and PivotChart. Use the top-right down arrow to select the time period you want to use, then use the slider bar to narrow or widen the time period you wish to view. To remove the filter, click the funnel icon again.

Using the timeline to view different parts of the data is easy, and ideal to use in presentations or include as part of a report. You can move the timeline to wherever you want in the worksheet, and even change the size by dragging the sizing handles.

Timeline Options

When you have added a timeline to your worksheet, the Timeline Tools group is added to the menu bar, together with the Options tab. Options include:

- Change the timeline caption.
- Change the connection to a PivotTable.
- Change the colorway and style.
- Position the timeline within the worksheet, and specify the size.
- Specify the elements shown on the timeline.

A timeline is a good addition to a PivotTable or PivotChart, because most data contains a time dimension.

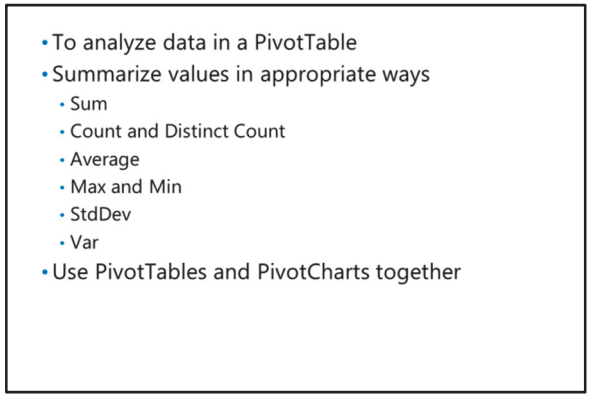
For more information about PivotTable timelines, see the Office support documentation:

Create a PivotTable timeline to filter dates

https://aka.ms/a469ld

Analyzing Data

Now that you have learnt how to create PivotTables and PivotCharts, how can you use them to analyze your data?



Summarizing Values

You have already seen how PivotTables organize information into columns and rows, with a value at the intersection of the two. This value, however, might be one of a number of different summaries.

Consider a PivotTable analyzing revenue by year and customer gender. This analysis might help you decide whether your marketing should be more appealing to men or women. But what value will you display to help you make that decision? The default is sum of revenue—but how meaningful is this? If the total revenue for men is higher than the total revenue for women, what does this tell you? It might be something or nothing. Consider instead:

- **Average revenue**. This might show that men spend more than women, or vice versa.
- **Count of revenue**. This will tell you whether more men place orders than women, or vice versa.
- **Min or max revenue**. This might tell you whether men or women are responsible for placing very large or small orders.

In reality, all these numbers might be interesting. You can change the way a value is summarized by clicking the down arrow next to the value, and then selecting **Value Field Settings**. This has two tabs:

- **Summarize Values By**. This allows you to choose the type of summary, such as Count, Sum, Average, and so on. You can also format the number on this tab.
- **Show Values As**. This allows you to make comparisons, such as rankings, or display a percentage of another value.

Use these options to explore your data. Each summary value provides insight, and poses questions which you can try to answer.

For more information on summarizing values in your PivotTable, see the Office support documentation:

Create a PivotTable to analyze worksheet data

https://aka.ms/wx1aw5

Use PivotTables and PivotCharts Together

PivotTables and PivotCharts are complementary.

Demonstration: Add a Timeline

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank Workbook**.
4. Click **File**, **Open**, and open **Demo03b.xlsx** in **D:\Demofiles\Mod03**.
5. Click the **PivotTable** tab.
6. Examine the PivotTable. **TerritoryID** are column headings, **ShipDate** are the row headings, and **SumofTotalDue** is the value.

Add a Timeline

1. Click the **PivotTable Tools Analyze** tab.
2. Click **Insert Timeline**. Select **ShipDate** and click **OK**.
3. The ShipDate timeline appears on the PivotTable.
4. Change the time period from **months** to **years**.
5. Select **2012** to **2014** using the slider. Examine the data in the PivotTable.
6. Change the time period to **quarters**. Select **Q1** to **Q4** of **2012** using the slider. Examine the data in the PivotTable.
7. Close the spreadsheet without saving.

   Question: Do you have to analyze time-related data in your work? What particular issues arise when working with time-related data? How might the Timeline functionality help?

Lab: Creating PivotTables and PivotCharts

Scenario

Sindy is settling into her new role as VP of Marketing at the Adventure Works Cycle company. She is particularly pleased with the information you have provided so far. As she was leaving the last meeting, she asked you for some information that she could look at over the weekend.

Objectives

After completing this lab exercise, you will be able to:

- Create a PivotTable from data provided to you.
- Create different PivotTable variations from the same data.
- Create a PivotChart from your PivotTable.

Estimated Time: 60 minutes

Virtual machine: **10994B-MIA-BI**

User name: **Admin**

Password: **Pa55w.rd**

Exercise 1: Create a PivotTable

Scenario

Sindy was delighted with the data you presented at the meeting. She apologized for having so little time, and asked if you could prepare some data for her to look at over the weekend. You decide to create a PivotTable for her, so she can work with the data herself.

The main tasks for this exercise are as follows:

1. Create a PivotTable

2. Create a Different PivotTable

▶ Task 1: Create a PivotTable

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab03\Starter** folder, double-click **Lab3.xlsx** to open it.
3. Create a **PivotTable** on a new worksheet.
4. Create a PivotTable with:
    a. Column headings of **Year**, subdivided by **Month**
    b. Row headings of **Country**, subdivided by **State**
    c. Values of total **Revenue**
5. Examine the PivotTable by expanding and collapsing the row and column headings.

▶ Task 2: Create a Different PivotTable

1. In the **D:\Labfiles\Lab03\Starter** folder, double-click **Lab3_2.xlsx** to open it.
2. Create a **PivotTable** that analyzes revenue by **Age Group**, subdivided by Customer **Age** and **Product Category** subdivided by **Sub Category**.

3. Make recommendations to Sindy about marketing. Which Product Category do you recommend for marketing, and to which Age Group(s)?
4. Leave the spreadsheet open for the next lab exercise.

Results: After completing this lab exercise, you will have:

Created a PivotTable.

Created a variation on the data.

Exercise 2: Create a PivotChart

Scenario

Having created the PivotTables, you feel confident that Sindy will have enough data to analyze. You still have some time, so you decide to add a PivotChart to the spreadsheet.

The main tasks for this exercise are as follows:

1. Create a PivotChart

▶ Task 1: Create a PivotChart

1. If you have not completed the last lab exercise, in the **D:\Labfiles\Lab03\Starter** folder, double-click **Lab3_3.xlsx** to open it.
2. Click somewhere in the data, then create a **PivotChart** of the most appropriate type.
3. Use the filter buttons on the chart to explore the data.
4. What recommendations would you make to Sindy regarding marketing now?

Results: After completing this lab exercise, you will be able to:

Create a PivotChart based on PivotTable data.

Use the PivotChart to filter information.

Exercise 3: Editing PivotTables and PivotCharts

The main tasks for this exercise are as follows:

1. Edit the PivotTable and PivotChart

▶ Task 1: Edit the PivotTable and PivotChart

1. If you have not completed the last lab exercise, in the **D:\Labfiles\Lab03\Starter** folder, double-click **Lab3_4.xlsx** to open it.
2. Change **Sum of Revenues** to **Average of Revenues**.
3. Format all the values in the PivotTable to no decimal places.
4. Add a **Customer Gender** filter to the PivotChart.
5. Add a **Year** filter to the PivotChart.
6. Add a **Data Table** to the PivotChart.
7. Close the spreadsheet without saving.

Results: After completing this lab exercise, you will be able to:

Amend a PivotTable.

Format a PivotChart.

Question: Why are PivotTables powerful?

Question: When would you not create a PivotChart from a PivotTable?

Module Review and Takeaways

In this module, you have learned how to work with PivotTables and PivotCharts. You have seen how quick and easy it is to create PivotTables and PivotCharts, and how simple it is to amend them.

PivotTables are one of the most powerful and flexible features in Excel, so it is worth spending some time to get comfortable with using them.

 **Best Practice:** Make use of PivotCharts to make data more understandable, and easier to work with.

Review Question(s)

Question: Do you have data in your work that is suitable for a PivotTable? How will PivotTables make working with your data easier?

Module 4

Dashboards

Contents:

Module Overview

Microsoft® Excel® dashboards are special reports that visualize data relating to one subject. Dashboards typically contain multiple PivotCharts and PivotTables that display summary data related to a specific objective. Using slicers and filters, controls can be added to dashboards to enable people viewing the dashboard to view different aspects of the data, such as a particular category or region.

Objectives

When you have completed this module, you will be able to:

- Describe what a dashboard is.
- Understand the benefits of using Excel to create a dashboard.
- Design and create a dashboard.
- Add slicers and filters to a dashboard.
- Use PivotTables and dashboards to analyze data.

Lesson 1
Creating a Dashboard

Dashboards enable you to visualize data and relationships between sets of data, by displaying only the data you are interested in. Dashboards use visual devices to ensure the important aspects of a project or objective are not missed. The result is a powerful data reporting tool that enables managers to understand key elements of a business or project, at a glance.

This lesson examines dashboards and some options for data analysis using PivotTables.

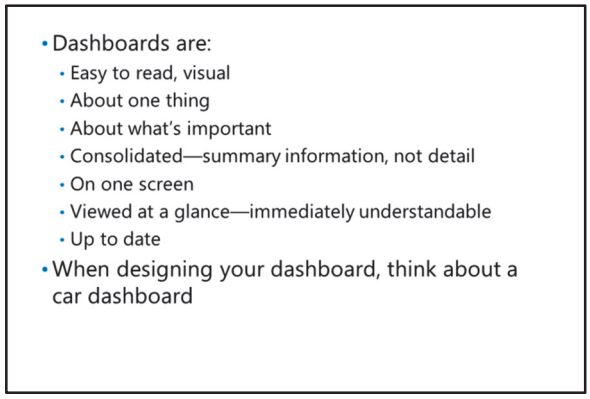
Lesson Objectives

After completing this lesson, you will be able to:

- Understand what a dashboard is, and when it is useful.
- Create a dashboard from constituent components.
- Understand the purpose of a slicer.
- Create and link slicers to reports.

What Is a Dashboard?

An Excel dashboard is a special type of report that contains data, tables, and charts relating to a specific objective. Dashboards are named after car or aircraft dashboards—the idea being that everything you need to know is in one, at-a-glance report.



Dashboards should be:

- **Easy to read**. They are visual, making good use of charts and graphics so you can take in information very quickly. Think about a car's fuel gauge. Is the fuel tank full, half full, or empty? I don't want a report that tells me the capacity of the tank, how many gallons I bought last time I filled up, and my miles per gallon. That might be relevant and interesting, but it doesn't give the big picture of whether I need to stop at the next service station. Similarly in business, dashboards aim to give good visual information at a high level, so that corrective action can be taken quickly without someone having to study a report.
- **About one thing**. A car dashboard has information about the performance of the car, such as the current speed, the amount of fuel in the tank, engine temperature, and so on. A business dashboard might be about a business achieving revenue targets, or performance of a project. All the activities needed to achieve revenue targets or complete the project are shown on the dashboard.
- **About what's important**. A car dashboard doesn't show information about whether the carpets are clean, or the last time the car was washed. It just contains the important data needed to drive the car. Is the engine about to overheat? Is the car about to run out of fuel? Backup information is certainly needed, but it belongs on other reports. The dashboard just shows summary information about what is critical for success.

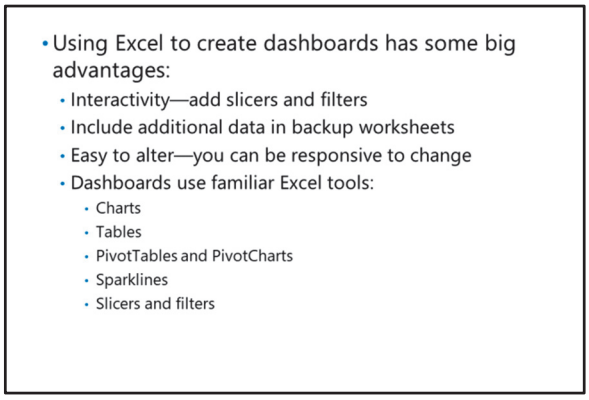
- **Consolidated**. A dashboard summarizes the important points from background data. Whilst a lot of data is very interesting, dashboards are not designed for providing detail. Other reports can be designed to show the background information.
- **On one screen**. The dashboard is designed to be seen at a glance—so everything must fit onto one screen. The space limitation doesn't make the car's dashboard any less effective; if anything, it makes it more effective. Designing an Excel dashboard to show critical information on one screen is a good discipline that will produce better results.
- **Viewed at a glance**. This is obviously important in the car—you should be able to see such things as your speed without taking your eyes off the road. Whilst there is no such limitation in business, dashboards are designed for busy people with full schedules. A CEO should be able to take one look at a dashboard and understand what's happening with a business, or a project.
- **Up to date**. A dashboard should show up-to-date data, without the user having to do anything. Just as you would expect a fuel gauge to decrease as you drive, so a business dashboard should reflect the latest information. You cannot always show data that's absolutely up to date. However, it's a good idea to show the date at which the data is up to date somewhere on the dashboard.

The car analogy is useful when thinking about designing your own dashboard. Although you have more options in Excel, without the physical constraints of a car, the test of whether or not the data should be on the dashboard is very similar.

By collecting data together into one place, and displaying it visually, a manager can see everything they need to know without having to open many different Excel workbooks.

Advantages of Excel Dashboards

Although the idea of a dashboard report is based on dashboards in cars or aircraft, you have many more options when working with Excel. Creating an Excel dashboard is both powerful and flexible and allows you to show summary data in an attractive way.



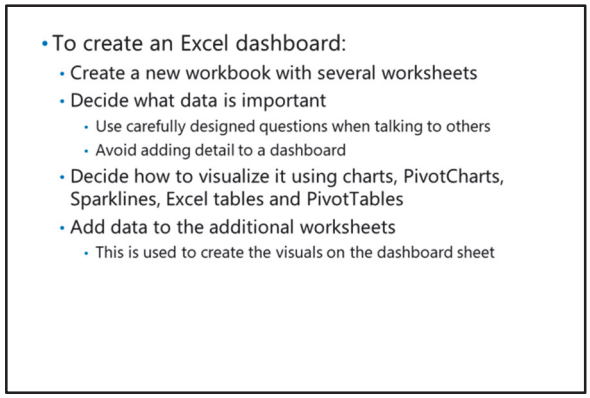
These are some of the advantages of working with Excel when creating dashboards:

- **Interactivity**. Most dashboards are read only—there is only a small amount of interactivity. However, with an Excel dashboard, you can add filters and slicers to change the display. Let's say a summary chart shows revenue by month for the company but you also want to show revenue for one division. You can add a filter or slicer so a user can change the display. It's a good rule, however, that users shouldn't need to change anything to get the high level information they need—all important measures should be displayed without any user interaction.
- **Additional data**. In the car, you can't look behind the dashboard to check whether the fuel gauge reading is correct—you have to take it on trust. But with Excel, you can go to another worksheet and see the detail, either to check or just to get more information. This makes Excel a good tool for creating dashboards—you can show both the big picture and include the detail in other sheets.
- **Easy to alter**. You can change the way an Excel dashboard looks, and be responsive to business changes. Perhaps you have a new measure you want to add, or perhaps an old measure wasn't as useful as you first thought. You can add the table with the data, and create a suitable graphic.

Dashboards use familiar Excel tools. Dashboards don't use anything you don't already know about—the gauges are charts, PivotCharts and Sparklines. The data is held in PivotTables and Excel tables. These are all devices you know; a dashboard is simply a powerful way of putting them all together.

Creating an Excel Dashboard

To create a dashboard in Excel, you will need to create a new workbook. You then need to add at least one worksheet. The first worksheet will be used to display the dashboard, and additional worksheets will hold data in Excel tables and PivotTables. You use the data in the additional worksheets to create charts and tables on the dashboard worksheet.



Decide What's Important

The first, and perhaps the most difficult task, is to decide what's important in achieving the objective. You will probably want to talk to people within the organization to get a view of what's important, and what is backup information. You will also need to decide where the data will come from, and the frequency with which it is available.

Some useful questions to ask when deciding what should be included on a dashboard:

- What is the dashboard designed to do?
- Who will use the dashboard?
- How will we know if we are on track to achieve our objective?
- How will we know if we are not going to achieve our objective?
- What are the important initiatives that will contribute to achieving our objective?
- What processes must be followed to achieve our objective?
- What measures can we use to keep us on track?

Once you know what data you need, and where it will come from, you can then design your dashboard.

Decide How to Visualize It

Dashboards are designed to show all the key pieces of information on one screen. The eye is immediately drawn to large and colorful visuals, so you should display the most important information using appropriate charts and PivotCharts. You can add detail, such as the date when the information was last updated, or where the information came from, in smaller text.

Group similar things together, such as data relating to revenue, or data relating to products. Grouping is an easy way to improve understanding. Even if you need to fit a lot of information into a small area, leave enough space between logical groups to make the dashboard easier to use.

You can then add filters and slicers as appropriate.

Add the Data

You may have some data that is displayed directly on the dashboard, but most of it will be in additional worksheets. Dashboards show consolidated and summarized data, rather than the detail.

Use the data from the additional worksheets to create charts, PivotCharts, and Sparklines on the dashboard sheet. You can then either save the workbook as it is, or hide the additional sheets.

Demonstration: Adding and Moving PivotTables and PivotCharts

In this demonstration, you will be shown the following tasks:

- Creating a table.
- Creating a staging worksheet and PivotTables.
- Creating a dashboard and adding PivotCharts.

Demonstration Steps

Create a Table

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Demofiles\Mod04** folder, double-click **Demo4.xlsx** to open it.
3. On the **Data** worksheet, select cell **A1**.
4. On the ribbon, on the **Insert** tab, click **Table**.
5. In the **Create Table** dialog box, ensure that **My table has headers** is selected, and then click **OK**.

Create a Staging Worksheet and PivotTables

1. Click the **New sheet** button.
2. Right-click **Sheet1**, click **Rename**, type **Staging**, and then press Enter.
3. On the **Staging** worksheet, select cell **A1**.
4. On the ribbon, on the **Insert** tab, click **PivotTable**.
5. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
6. From the PivotTable fields, drag:
    a. **Revenue** to **Values**.
    b. **Customer Gender** to **Rows**.
7. On the ribbon, on the **Analyze** tab, click **PivotTable**; in the **PivotTable Name** box, type **SalesByGender**.
8. Select cell **H1**.
9. On the ribbon, on the **Insert** tab, click **PivotTable**.
10. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
11. From the PivotTable fields, drag:
    a. **Revenue** to **Values**.
    b. **Product Category** to **Columns**.

c. **Year** to **Rows**.

12. On the ribbon, on the **Analyze** tab, click **PivotTable**, in the **PivotTable Name** box, type **YearlySalesByCategory**.

Create the Dashboard and Add PivotCharts

1. On the **Staging** worksheet, select cell **A1**.
2. On the ribbon, on the **Analyze** tab, click **PivotChart**.
3. In the **Insert Chart** dialog box, click **Pie**, then click **OK**.
4. Right-click the chart, and click **Cut**.
5. Click the **New sheet** button.
6. Right-click **Sheet2**, click **Rename**, type **Dashboard**, and then press Enter.
7. Right-click cell **B2**, under **Paste Options**, click **Use Destination Theme (H)**.
8. Switch to the **Staging** worksheet.
9. Select cell **H1**.
10. On the ribbon, on the **Insert** tab, click **PivotChart**.
11. In the **Insert Chart** dialog box, click **Column**, then click **OK**.
12. Right-click the new chart, and click **Cut**.
13. Switch to the **Dashboard** worksheet.
14. Right-click a cell to the right of the existing chart, under **Paste Options**, click **Use Destination Theme (H)**.
15. Keep Excel open for the following demonstration.

Adding a Slicer

Slicers are visual ways of filtering data, and so are useful additions to dashboards. Slicers create a friendly user interface for a dashboard, and make it interactive.

- Slicers and filters add interactivity to a dashboard
- Slicers
  - More obvious, and more visual; good for dashboards
  - Work well with fewer categories
  - Can affect more than one PivotTable or PivotChart
- Filters
  - Take up less space; good for more advanced users
  - Work well with more categories
  - Affect only one PivotTable or PivotChart
- A field can be in both a slicer and a filter at the same time

Adding a Slicer to a PivotTable

To add a slicer to a PivotTable:

1. Select a cell in the PivotTable.
2. On the **Analyze** tab on the ribbon, click **Insert Slicer**.
3. Select the appropriate field or category for the slicer, and then click **OK**.
4. Drag the slicer to the appropriate position on the worksheet.

You can also add a field as a slicer by right-clicking the field in the field list of the PivotTable, and selecting **Add as Slicer**.

After adding the slicer, you can change the way the slicer is displayed by using the **Options** tab on the ribbon. Visually, you can change the design and coloring of the slicer, and you can use the columns setting to control whether the slicer values appear as a vertical list, a horizontal list, or as a grid.

Connecting Slicers to Multiple PivotTables

You can also configure a single slicer to affect multiple PivotTables or PivotCharts, when the PivotTables or PivotCharts have similar fields. Consider two PivotTables: one shows revenue by product category, the other shows revenue by country—yet both PivotTables have a field for year. You can add a slicer for year to the first PivotTable, and then connect the slicer to the second PivotTable. When someone selects a year on the slicer, both PivotTables will be updated to reflect the selected values.

To connect an existing slicer to an additional PivotTable or PivotChart:

1. Select the slicer that you want to apply.
2. On the ribbon, on the **Options** tab, click **Report Connections**.
3. In the **Report Connections** dialog box, select the PivotTable or PivotChart you want the slicer to affect, and then click **OK**.

Slicers or Filters

You can use either slicers or filters to filter data, because they work in similar ways. Deciding whether to use a filter or a slicer is the most suitable option for a given PivotTable or PivotChart.

Use the following table to compare when to use slicers or filters:

Slicers	Filters
Slicers are a more obvious visual control.	Filters take up less dashboard space.
Slicers work well when there are fewer category values, such as “product category”.	Filters work well when there are lots of category values, such as “product name”.
Slicers can affect more than one PivotTable or PivotChart.	Filters only work with one PivotTable or PivotChart.

Typically, you would either use a slicer or a filter, but you can configure a field in both. In this case, the controls are smart enough to reflect the correct settings, so if a user selects certain years in a filter, they are then shown in the slicer—and the other way around.

Demonstration: Filtering Data Using a Slicer

In this demonstration, you will be shown the following tasks:

- Adding a filter.
- Adding a slicer.
- Connecting the slicer to another PivotTable.

Demonstration Steps

Add a Filter

1. Switch to the **Dashboard** worksheet.
2. Select the pie chart.
3. In the **PivotChart Fields** panel, drag **Sub Category** to the **Filters** area.
4. Click the **Sub Category** drop-down menu on the pie chart. Show the search box, and show the ability to select multiple items from the list.

Add a Slicer

1. In the **PivotChart Fields** panel, right-click **Country**, and then click **Add as Slicer**.
2. Select the slicer object in the worksheet.
3. On the ribbon, on the **Options** tab, in the **Columns** box, type **6**, and press Enter.
4. Drag the width of the slicer object out to make the slicer wider, so the buttons are all shown side-by-side.
5. Drag the slicer object so that it is placed above or below both chart objects.
6. In the slicer object, click **Canada**. Make sure students can see that only the pie chart changes.

Connect the Slicer to Another PivotTable

1. On the ribbon, on the **Options** tab, click **Report Connections**.
2. In the **Report Connections (Country)** dialog box, select the check box for **YearlySalesByCategory**, and then click **OK**.
3. In the slicer object, click **Germany**. Make sure that students observe that both charts now change according to the slicer.

Categorize Activity

Categorize the characteristics of slicers and filters into the appropriate category. Indicate your answer by writing the category number to the right of each item.

Items	
1	More obvious visual control
2	Occupy less dashboard space
3	Work well for categories with fewer values
4	Work well for categories with many values
5	Occupy more dashboard space
6	Less obvious visual control
7	Can affect more than one PivotTable/PivotChart
8	Can affect one PivotTable or PivotChart

Category 1		Category 2
Slicers		Filters

Lesson 2
Data Analysis in Excel PivotTables

PivotTables and PivotCharts enable you to start creating dashboards that can show a wide range of data in a variety of ways. Visualizing data in this way can make it easier and more accessible. However, simply creating PivotTables and PivotCharts from the existing data you have available, is not always enough. Sometimes you will need to provide additional data that is not present in the source data, but can be calculated from the source data, by using calculated columns or calculated fields. You might also want to provide additional ways to visualize some of the data on the dashboard with conditional formatting.

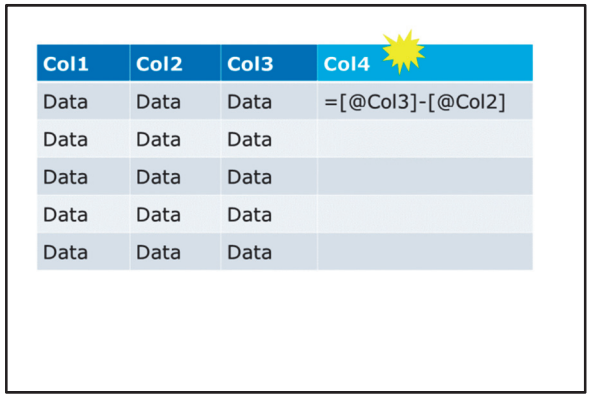
Lesson Objectives

After completing this lesson, you will be able to:

- Add a calculated column to a table.
- Add a calculated field to a PivotTable.
- Apply conditional formatting.
- Understand how to identify anomalies in data.

Adding Calculated Columns

There might be occasions when you will want to show data that is not present in the original table, but can be calculated from the existing data. If the additional data you want to analyze can be calculated from existing data in the table, you can add one or more calculated columns to the source table to perform further analysis.



Add a Calculated Column to a Table

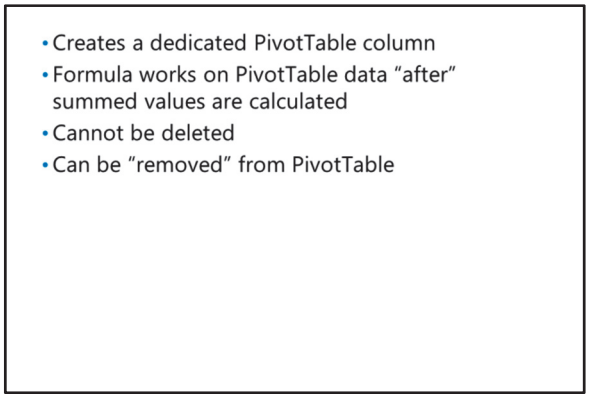
To add a calculated column to a table:

1. Select the cell in the header row of the column immediately to the right of the existing table.
2. Type the name of the field you want to add (the header name for the new column).
3. Select the cell below the header row in the new column.
4. Type **=**, type the formula for the column (or select the appropriate cells from the rest of the table), and then press ENTER. Excel will complete the formula automatically for the other cells in the column.
5. Optionally, select the formatting options for the new column.

Note: When using a formula in a defined table, Excel uses column header references, such as *[@Revenue]-[@Cost]* rather than cell references, such as *A2-B2*.

Note: To use the new field in an existing PivotTable, you must refresh the PivotTable.

Using Calculated Fields



There are occasions when adding a calculated column to a table does not give you the correct results when the data is brought into a PivotTable. One example of this is percentages—if you create a column in your original table to calculate a percentage value such as a margin on a product (or category), when that table is added to the PivotTable or PivotChart, Excel adds all the percentage values together to give totals. However, this is not the way that individual percentage values should be summed up. In these scenarios, you can create a calculated field in the PivotTable to perform the calculations after the totals for the other fields have been calculated.

Creating a Calculated Field

To create a calculated field in a PivotTable:

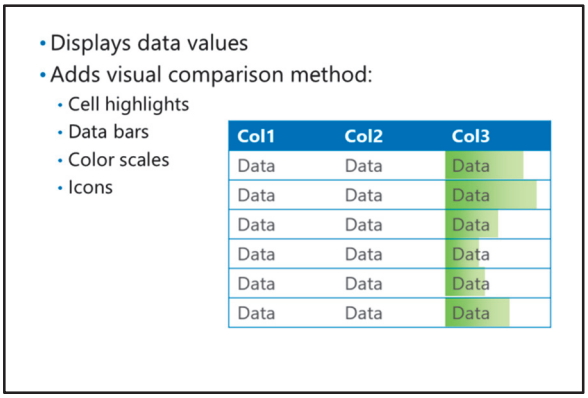
1. Select a cell in the PivotTable.
2. On the ribbon, on the **Analyze** tab, click the **Fields, Items & Sets** menu, and then click **Calculated Field**.
3. In the **Insert Calculated Field** dialog box, in the **Name** box, enter the name of the field you want to calculate, add fields and operators to the **Formula** box to make the calculation, and then click **OK**.
4. Right-click a cell in the new column, and then click **Value Field Settings**.
5. In the **Value Field Settings** dialog box, click **Number Format**.
6. In the **Format Cells** dialog box, select the correct formatting option for the values in the new column, and then click **OK**.
7. In the **Value Field Settings** dialog box, click **OK**.

Note: The new column created from a calculated field will be automatically added to the fields and values sections of the PivotTable.

You cannot "delete" a calculated field from the PivotTable after it has been created, without recreating the PivotTable, but you can remove the field from view if you no longer need the values to be shown.

Using Conditional Formatting

You can use conditional formatting to provide graphical context and highlights to table cells containing values. Conditional formatting is very useful when you need to show values in a table, but you want to make particularly high or low values stand out to the reader in an obvious way—or you want to show some level of trend information visually by comparing the values in the selected column.



Conditional Formatting Options

There are several ways in which you can apply conditional formatting to a column in a table:

- Highlighting specific cells with a color when the value matches or meets a threshold.
- Applying data bars to comparative values. This fills the cell in a color from left to right like a bar chart, with higher value cells being filled further to the left.
- Applying color scales to comparative values will color or shade the cells in a range of different colors according to the value; for example, the highest value cells might be red, and the lowest value cells green.
- Adding icons to the cells to indicate how the value compares with others in the column, such as a green circle or red triangle.

Conditional formatting is applied by creating rules for the formatting type and any threshold values you require, and then applying the rules to the column data. Multiple rules can be applied if required.

Applying Conditional Formatting

This example applies data bars to a range of data:

1. Highlight the cells in one column that should have data bars applied.
2. On the ribbon, on the **Home** tab, click the **Conditional Formatting** menu, point to **Data Bars**, and then click one of the color options.

When applying conditional formatting to a PivotTable, you can automatically apply the rule to all cells or values on the same type of row (such as category) by adding conditional formatting to one example of that cell. You then click the **Formatting Options** pop-out menu at the right side of the selected cell, and select **All cells showing "<example value>" for "<Category>"**, where <example value> is the name of the column and <Category> is the name of the row type field where you want to apply the conditional formatting.

Removing Conditional Formatting

You can remove conditional formatting by removing the rules applied to the data. To manage the rules you have created for conditional formatting:

1. Select a cell in the table with conditional formatting.
2. On the ribbon, on the **Home** tab, click the **Conditional Formatting** menu, and then click **Manage Rules**.

Demonstration: Adding Advanced Dashboard Components

In this demonstration, you will be shown the following tasks:

- Create a calculated column; for example, to show profit.
- Create a calculated column for margin (revenue\profit)—add to PivotTable to show incorrect (summed) values.
- Create calculated field for margin.
- Add conditional formatting to margin column.

Demonstration Steps

Create a Calculated Column

1. Switch to the **Data** worksheet.
2. Select cell **P1**, type **Profit**, and then press Enter.
3. In cell **P2**, type **=[@Revenue]-[@Cost]**, and then press Enter. Check that all cells in column P are automatically completed.

Add a New PivotTable to Show Profit

1. Switch to the **Dashboard** worksheet.
2. Select an empty cell, then on the ribbon, on the **Insert** tab, click **PivotTable**.
3. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
4. From the PivotTable fields, drag:
   a. **Revenue** to **Values**.
   b. **Profit to Values (under Revenue).**
   Note: if the Profit field does not appear, on the ribbon, on the Analyze tab, click the Refresh button.
   c. **Product** to **Rows**.

Add a Calculated Field for Profit Margin

1. On the ribbon, on the **Analyze** tab, click the **Fields, Items & Sets** menu, then click **Calculated Field**.
2. In the **Insert Calculated Field** dialog box, in the **Name** box, type **Profit Margin**, in the **Formula** box, type **= Profit/Revenue**, and then click **OK**.
3. Right-click a cell with a value in the **Sum of Profit Margin** column, and then click **Value Field Settings**.
4. In the **Value Field Settings** dialog box, click the **Number Format** button.
5. In the **Format Cells** dialog box, select **Percentage**, and then click **OK**.
6. In the **Value Field Settings** dialog box, click **OK**.

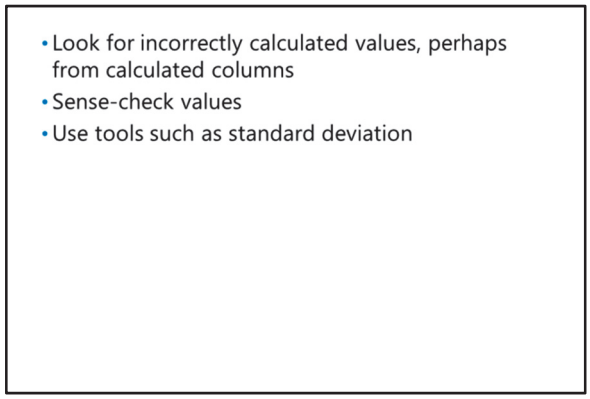
Adding Conditional Formatting

1. Select the **Sum of Profit Margin** cell in the row for **All-Purpose Bike Stand**.
2. On the ribbon, on the **Home** tab, click the **Conditional Formatting** menu, point to **Data Bars**, and click **Green Data Bar**.

3. In the selected cell, click the **Formatting Options** drop-down menu, and then click **All cells showing "Sum of Profit Margin" values for "Product"**.
4. Close Excel, saving any changes.

Finding Anomalies

When you are working with a lot of data, it is important to ensure that the values make sense, and that anomalies have not been entered in the source data. Such errors will skew some of the report values that you display on your dashboard.



- Look for values that have been calculated incorrectly, such as percentage values that are added together into the totals column.
- Sense-check your values. Look for values that are either very high or very low—this could be valid data, but it should make sense; you would not expect the largest volume of sales to come from the smallest regions. Equally, you might expect the profit margin for both those regions to be similar.
- Use tools such as standard deviation to identify values that are a significant departure from the mathematical mean of all values.

For more information on standard deviation, see *STDEV function*:

STDEV function

https://aka.ms/nkfqdn

Verify the correctness of the statement by placing a mark in the column to the right.

Statement	Answer
True or false? Once you have added a calculated field to a PivotTable, you cannot delete it.	

Question: What external factors might you choose to consider when selecting colors when you use conditional formatting for emphasis in a dashboard?

Lab: Creating a Dashboard

Scenario

Sindy, the new VP of Marketing at Adventure Works, now wants to start analyzing some of the data you have provided a little more deeply. After using the PivotTables and PivotCharts you created for her previously, she wants to see if there are some additional ways to compare the data.

Objectives

After completing this lab exercise, you will be able to:

- Create a dashboard using PivotCharts and slicers.
- Perform a more detailed analysis using dashboards with calculated fields and conditional formatting.

Estimated Time: 60 minutes

Virtual machine: **10994B-MIA-BI**

User name: **Admin**

Password: **Pa55w.rd**

Exercise 1: Create a Dashboard

Scenario

After the PivotTables and PivotCharts you created for her last time, Sindy has asked if you can show more information on one sheet, and if you can provide some ways to easily filter all related data. You decide to create a dashboard for Sindy.

The main tasks for this exercise are as follows:

1. Create a Data Table

2. Create PivotTables to Support the Dashboard

3. Create the Dashboard

4. Add a Slicer to the Charts

▶ Task 1: Create a Data Table

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab04** folder, double-click **Lab4.xlsx** to open it.
3. Create an Excel table named **Table1** using the data in the worksheet.

▶ Task 2: Create PivotTables to Support the Dashboard

1. Create a new worksheet.
2. On the worksheet, create a new PivotTable from the table data.
3. From the PivotTable fields, drag:
    a. **Revenue** to **Values**.
    b. **Country** to **Rows**.
    c. **State** to **Rows** (under **Country**).
4. Name the PivotTable **SalesbyCountry**.

5. Add another PivotTable to the worksheet, also using **Table1** as the source.
6. From the PivotTable fields, drag:
    a. **Revenue** to **Values**.
    b. **Product Category** to **Rows**.
    c. **Sub Category** to **Rows** (under **Product Category**).
7. Name the PivotTable **SalesbyCategory**.

▶ Task 3: Create the Dashboard

1. Create a PivotChart from the **SalesbyCountry** PivotTable. Use the pie chart type.
2. Collapse the fields to only show countries, not states.
3. Cut the new chart and paste it onto a new worksheet called **Dashboard**.
4. Return to the worksheet with the PivotTables.
5. Create a new PivotChart for the **SalesbyCategory** PivotTable, using the bar chart type.
6. Move the bar chart to the **Dashboard** worksheet.

▶ Task 4: Add a Slicer to the Charts

1. Add a slicer for **Year** to the pie chart.
2. Connect the same slicer to the **SalesbyCategory** PivotChart.
3. Check that changing the slicer changes both the PivotCharts.

Results: After completing this lab exercise, you will have:

Created a data table for a dashboard.

Created PivotTables to support a dashboard.

Created a dashboard.

Added a slicer and connected the slicer to two charts.

Exercise 2: Performing More Detailed Analysis with Dashboards

Scenario

Sindy likes the look of the dashboard you have created, and has found it very useful. However, she has raised some questions about the data it contains. Sindy has asked for profit data to be included in the analysis, along with a way to visually compare profit margin between different product categories.

The main tasks for this exercise are as follows:

1. Add a Calculated Column to the Table
2. Add a PivotTable to the Dashboard
3. Add a Calculated Field to a PivotTable
4. Add Conditional Formatting to a PivotTable

▶ Task 1: Add a Calculated Column to the Table

1. On the **Data** worksheet, add a column for **Profit**. Profit is calculated as Revenue minus Cost.
2. Add another column for **Profit Margin**. Profit margin is Profit divided by Revenue.
3. Format the Profit Margin column as a Percentage with two decimal places.

▶ Task 2: Add a PivotTable to the Dashboard

1. Add a new PivotTable to the **Dashboard** worksheet, using Table1 for the source data.
2. From the PivotTable fields, drag:
    a. **Profit Margin** to **Values**.
    b. Note: if the Profit Margin field does not appear, on the ribbon, on the **Analyze** tab, click the **Refresh** button.
    c. **Product Category** to **Rows**.
    d. **Sub Category** to **Rows** (under **Product Category**).
3. Do the values in the Profit Margin column appear valid? What issue has occurred with the Profit Margin column?

▶ Task 3: Add a Calculated Field to a PivotTable

1. Remove the Profit Margin field from the PivotTable.
2. Create a calculated field in the PivotTable called **Margin**. Margin is Profit divided by Revenue.
3. Set the Margin values to display as a Percentage with two decimal places.

▶ Task 4: Add Conditional Formatting to a PivotTable

1. Add conditional formatting to all the **Sub Category** rows, using **Light Blue Data Bars**.
2. What product subcategory has the lowest profit margin? How could you find out which product has the lowest margin?
3. Close Excel, saving any changes.

Results: After completing this lab exercise, you will be able to:

Add a calculated field.

Add conditional formatting.

Question: How could you find out which product has the lowest margin?

Module Review and Takeaways

In this module, you have seen how to create Excel dashboards to help visualize several sets of related data at the same time. You also saw how to add tools such as slicers, which enable people to interact with a dashboard and view specific aspects of the data.

Review Question(s)

Check Your Knowledge

Question	
You have a PivotTable displaying data that is split into more than 50 categories. How would you make it easy for a user to focus on a single category of the data?	
Select the correct answer.	
	Drag the category field to the rows area in the PivotTable field options.
	Drag the category field to the filters area in the PivotTable field options.
	Drag the category field to the values area in the PivotTable field options.
	Drag the category field to the columns area in the PivotTable field options.
	Right-click the category field and select Add as Slicer.

Module 5

Hierarchies

Contents:

Module Overview

Hierarchies provide convenient levels at which to view your data. If you keep all your sales data by store, you might not always want to view the data by each store at a time; sometimes you will want to see a summary overview of all store sales in one city, or all store sales in one state, together. It's important to consider the creation of these hierarchies when you are putting together PivotTables, PivotCharts, dashboards, and other tools that help people to visualize the data.

You must also consider what time and date data you have, and how this should be represented. Time and date information is stored in a specific way in Microsoft® Excel®—understanding how it is stored, how it is represented, and how it can be manipulated, is an important part of preparing your data.

Objectives

When you have completed this module, you will be able to:

- Create and visualize different kinds of data hierarchies, using different field types.
- Identify and manipulate time and date information in Excel.

Lesson 1
Hierarchies

Hierarchies are an important way of accessing data in manageable ways, without having too much detail when it is not necessary. You can also use hierarchies to provide additional detail when required without overloading a user with too much information—so that the user loses focus. Identifying, planning, and creating data hierarchies is important when considering who will work with or review your data, tables, and charts.

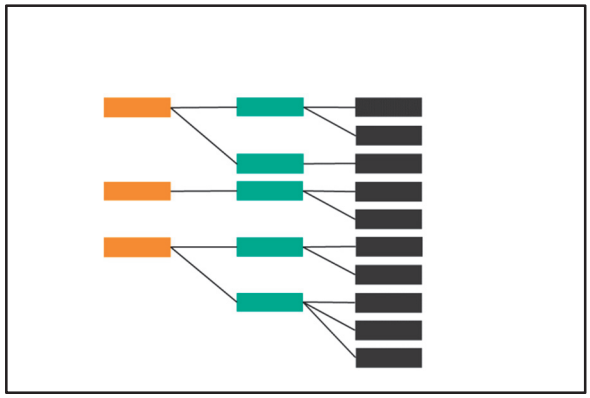
Lesson Objectives

After completing this lesson, you will be able to:

- Identify a data hierarchy.
- Design hierarchy levels.
- Identify Excel charts for displaying hierarchies.
- Identify hierarchy chart requirements.

What Are Hierarchies?

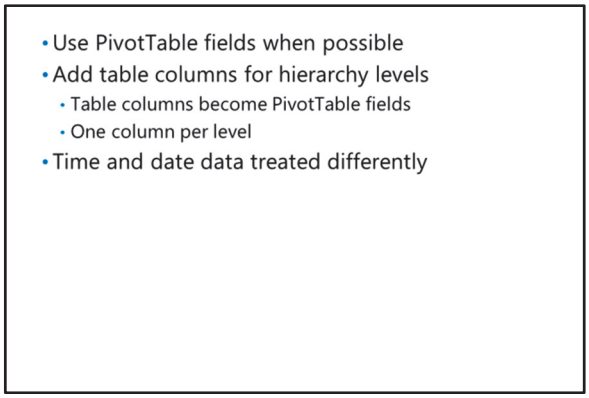
Hierarchies represent ways of grouping data that fit into larger or smaller categories of the same type. An example of a hierarchy might be geographic regions: you might want to view sales data by country, but within a country, such as the United States, you might want to view sales data for a state, such as Oregon. Within the state level, you might want to view sales data for an individual city, such as Portland, or perhaps an individual store. These fields or filters (country, state, city, store), represent a hierarchy of different levels that are all geographic in nature.



Hierarchies can naturally exist within many aspects of your data, and you might sometimes wish to introduce a hierarchy to mask a level of detail that is not immediately necessary. For example, you might have some sales data that includes the numeric age of the customer as a discrete value. This could lead to perhaps 60 separate discrete values for your table or chart to display. Instead, you might choose to group these into ranges of six years each, so that your table or chart has less clutter and only shows 10 initial entries, but allows viewers to expand each range to show the discrete values if required.

Designing Hierarchy Levels

Hierarchy levels can be added to your tables and PivotTables in several ways. For PivotTables, you can add hierarchy levels by adding fields to the rows area in the PivotTable Fields panel. You can add more than one field to the rows area of the PivotTable. Excel automatically indents and provides expand/collapse capabilities for each additional row you specify after the first row. Reorganizing the order of the fields in the rows area will control which field is considered at the top of your hierarchy, and which fields are lower down.



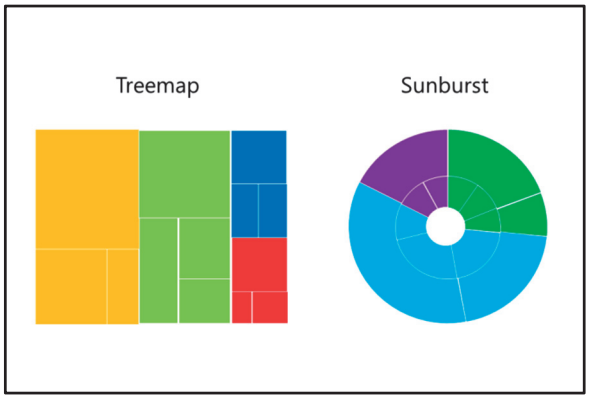
To create a hierarchy with related levels, you will need the data to have different levels recorded as different fields in your source data. This means that a separate column in the source data table is required for each level in the hierarchy you want to provide. For example, if you want a geographic hierarchy representing country, state, and city, that would require three columns in the source table—a column for country, a column for state, and a column for city. The order of the columns in the table is not important because the order can be changed when the data is presented in the PivotChart.

Because Excel handles time and date data differently, separate columns are not always required, and Excel might be able to automatically create a time- and date-based hierarchy in a PivotTable or PivotChart. Handling time and date data is covered in the next lesson.

Representing Hierarchies Visually

Excel 2016 contains two new chart types, called Treemap and Sunburst, which are designed to represent multiple hierarchical layers of data simultaneously.

Both of these new chart types require that the data table is arranged by using a tabular layout, and cannot be used with PivotTables at the time of writing.



Note: Both of these chart types are only available to Excel 2016 and later. PivotTable support might be added to these chart types in the future.

Tabular Layout

With a tabular layout, each level in the hierarchy is represented by an entry in a separate column. If there are three levels in your hierarchy, there would be three columns for the hierarchy elements with additional columns for the data itself. The following example shows a tabular layout for the items sold by a grocery store:

Section	Category	Subcategory	Revenue	Profit
Food	Fresh Food	Fresh Vegetables	$ 45,098.00	$ 18,039.20
Food	Fresh Food	Fresh Fruit	$ 39,274.00	$ 15,709.60
Food	Fresh Food	Prepared Salad	$ 15,689.00	$ 6,275.60
Food	Canned Food	Canned Vegetables	$ 12,365.00	$ 2,473.00
Food	Canned Food	Canned Fruit	$ 14,562.00	$ 2,912.40
Food	Sauces	Pasta Sauces	$ 30,816.00	$ 13,867.20
Food	Sauces	Curry Sauces	$ 25,649.00	$ 11,542.05
Food	Sauces	BBQ Sauces	$ 37,462.00	$ 16,857.90
Food	Sauces	Hot Sauces	$ 15,684.00	$ 7,057.80
Non-food	Cleaning	Bleach	$ 20,058.00	$ 5,014.50
Non-food	Cleaning	Detergent	$ 27,462.00	$ 6,865.50
Non-food	Cleaning	Multisurface	$ 22,897.00	$ 5,724.25

Note that the Section, Category, and Subcategory columns are filled in for each row, and there are no gaps or empty cells for these categories in the hierarchy.

Create the Hierarchy Chart

To create the chart, highlight the table on your worksheet then, on the **Insert** tab of the ribbon, click **Recommended Charts**. In the **Insert Chart** dialog box, on the **All Charts** tab, click **Treemap** or **Sunburst**, and then click **OK**.

Demonstration: Creating a Treemap Chart

In this demonstration, you will be shown the following tasks:

- Creating a PivotTable for structure.
- Creating a tabular data layout using SUMIFS().
- Creating a treemap chart.

Demonstration Steps

Create a PivotTable for Structure

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Open the **D:\Demofiles\Mod05\Demo5.xlsx** file.
3. On the **Data** worksheet, select cell **A1**.
4. On the ribbon, on the **Insert** tab, click **Table**.
5. In the **Create Table** dialog box, ensure that **My table has headers** is selected, and then click **OK**.
6. Click the **New sheet** button.
7. On the **Sheet1** worksheet, select cell **A1**.
8. On the ribbon, on the **Insert** tab, click **PivotTable**.
9. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
10. From the PivotTable fields, drag:
    a. **Revenue** to **Values**.
    b. **Product Category** to **Rows**.
    c. **Sub Category** to **Rows** (under **Product Category**).
11. On the ribbon, on the **Design** tab, click the **Report Layout** menu, and then click **Show in Tabular Form**.
12. On the ribbon, on the **Design** tab, click the **Report Layout** menu, and then click **Repeat All Item Labels**.
13. On the ribbon, on the **Design** tab, click the **Subtotals** menu, then click **Do Not Show Subtotals**.
14. On the ribbon, on the **Design** tab, click the **Grand Totals** menu, and then click **On for Rows Only**.

Create a Tabular Data Layout

1. Select cells **A1-C18**, right-click the highlighted cells and click **Copy**.
2. Select cell **E1**, right-click cell **E1**, and under **Paste Options**, click **Values**.
3. Increase the width of columns E, F, and G to clearly display the cell contents.
4. Highlight cells **G2-G18**, right-click the highlighted cells, and click **Clear Contents**.
5. Select cell **G2**, type **=SUMIFS(Table1[Revenue],Table1[Sub Category],$F2)**, and then press Enter.
6. Select cell **G2**, then click and drag the lower-right corner of the cell down to cell G18 to fill all the relevant cells. Check that the value in the filled cells matches the corresponding values in the PivotTable.

Create a Treemap Chart

1. Highlight cells **E1-G18**.
2. On the ribbon, on the **Insert** tab, click **Recommended Charts**.
3. In the **Insert Chart** dialog box, on the **All Charts** tab, click **Treemap**, and then click **OK**.

   Question: You have a dataset of sales information by US city that you wish to summarize with a hierarchy. Location information is presented in a single column in the format <city name>, <state code>—for example, **Richmond, VA**. How would you need to process the data to enable the hierarchy to have city and state levels?

Lesson 2
Time Data

Time and date information is stored in a very specific way in Excel. This method requires some understanding before attempting to manipulate these values, or identify values in user-friendly ways, such as days of the week, or months of the year.

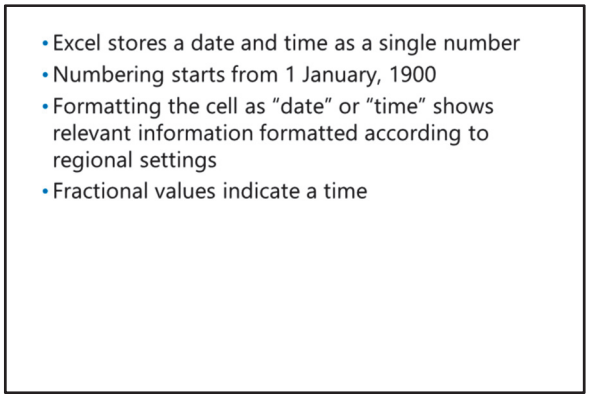
Lesson Objectives

After completing this lesson, you will be able to:

- Understand how time and date information is stored in Excel.
- Identify functions that can manipulate time and date values.
- Calculate time and date values in Excel.

Why Is Time Data Different?

In Excel, time data is stored as a number, starting from January 1, 1900, which is represented by the number 1. Each day since that date is represented by adding 1 to the number—so 2 would represent January 2, 1900, 3 would represent January 3, 1900, and so on. January 1, 2016 is represented by 42370. When you choose to format a cell as a date, Excel will display the date represented by the number in a region-friendly way, such as 01/01/2016 if you choose the short date format.



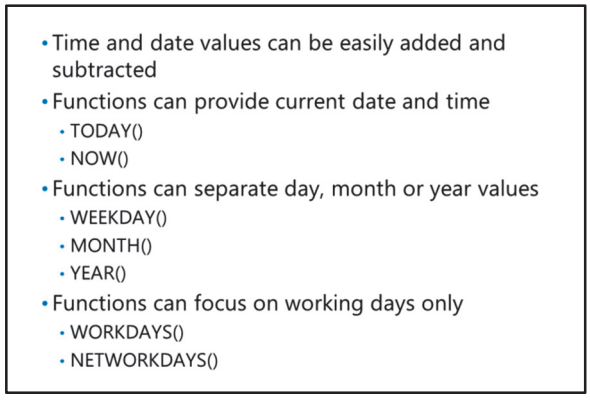
It is also important to understand that Excel has knowledge of the calendar, so Excel knows how many days are in each month, how many days in each year, and which days are weekdays or weekends. This enables several powerful function-based capabilities when working with dates, such as being able to determine how many days, weeks, or working days there are between two given dates.

Adding Time Data

Time data is handled in a similar way—if adding 1 to the number representing the date adds one day, then effectively 1 also represents 24 hours. This means that 0.5 represents 12 hours, 0.25 represents 6 hours, 0.041666 represents 1 hour, 0.00069444 represents 1 minute, and 0.00001157407 represents 1 second. Time values can exist in the same number (and field) as a date; for example, 42370.75 would be 18.00 on January 1, 2016.

Working with Time Data

Excel has many functions to manipulate date and time data, and because the data is stored as a number in Excel, incrementing or decrementing the date (or time) is easy. For example, if you have a shipping date stored in cell C4, and you want cell D4 to hold the payment due date—which is 30 days after the shipping date—you would enter the following formula into cell D4: =C4+30.



Functions to Retrieve the Current Date and Time

Excel provides the TODAY function to retrieve the current date. If you enter =TODAY() into a cell in the worksheet, Excel will display today's date whenever you open the worksheet. You can also use this function to compare to other dates to determine how many days ahead or past a given date is. For example, cell F5 has a future deadline date—in cell G5, you enter the following formula: =F5-TODAY() and format cell G5 as a number with no decimal places. Cell G5 now tells you how many whole days there are before the deadline date, and will automatically refresh the number each time the workbook is opened.

Excel also provides the NOW function to represent the current date and time. This works in a similar way to the TODAY function, but also includes the time value, whereas the TODAY function has the time value set to 0 (representing 12:00).

Determining Weekday, Month, and Year

If you have been provided date information as a single value, but you want to compare information in different months or years, then you might wish to extract the month or year values separately, to use in a table or PivotTable.

To determine the weekday of a date, you can use the WEEKDAY function. For example, to show the weekday of a date in cell B5, you can use =WEEKDAY(B5). Note that the value returned by the function is also a number: by default, 1 represents Sunday, 2 represents Monday, and so on.

The MONTH function returns a number that represents the month of a given date, and the YEAR function returns the year portion of a date.

Calculations Based on Working Days Only

Excel also has functions that are designed to focus only on working days when performing comparisons or calculations, and ignore the weekends, for example.

You can count ahead a number of working days by using the WORKDAY function. If you have a date in cell A2 and you want the date in eight working days' time, you can use the following formula: =WORKDAY(A2,8). For countries or regions that define different days as nonworking in the week, you can use the WORKDAY.INTL function in a similar way.

If you need to calculate the number of working days between two given dates, then you can use the NETWORKDAYS function. For example, to show the number of working days between a date in cell A2 and another date in cell B2, you would use the following formula: =NETWORKDAYS(A2,B2). Again, there is a NETWORKDAYS.INTL function to calculate working days between two dates where days other than Saturday and Sunday are nonworking days of the week.

 **Note:** The WORKDAYS, WORKDAYS.INTL, NETWORKDAYS, and NETWORKDAYS.INTL functions can all have additional holidays considered as nonworking days, such as Christmas Day, or Thanksgiving, by using advanced options within the respective function.

Demonstration: Working with Date and Time Data

In this demonstration, you will be shown the following tasks:

- Inputting and displaying a date value.
- Inputting a time value.
- Adding to a time and date.
- Using the TODAY() function.
- Using the MONTH() function.
- Using the NETWORKDAYS() function.

Demonstration Steps

Input and Display a Date Value

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In Excel, click the **New sheet** button.
3. On the **Sheet2** worksheet, select cell **A1**.
4. In cell A1, type a date in MM/DD/YY, and then press Enter.
5. Select cell **A1**. Point out that Excel automatically formats the cell (note the default YYYY format for the year value).
6. On the ribbon, on the **Home** tab, in the **Number** drop-down menu, select **General**. Point out that Excel stores a numerical value to represent the date.

Input a Time Value

1. Edit cell **A1**, type **.5** at the end of the existing number.
2. On the ribbon, on the **Home** tab, in the **Number** drop-down menu, select **More Number Formats**.
3. In the **Format Cells** dialog box, under **Category**, click **Custom**. Under **Type**, click **m/d/yyyy hh:mm**, and then click **OK**.
4. Increase the width of column A to display the contents of cell A1. Point out that the time is now visible and shows midday (0.5 representing halfway through the day).

Adding to a Time and Date

1. In cell B1, type **=A1 + 1.25**, and then press Enter.
2. Point out that Excel has formatted the cell in the same way as cell A1, and the date and time have both increased.

Using the TODAY() Function

1. In cell A2, type **=TODAY()**, and then press Enter.
2. Select cell **A1**, on the ribbon, on the **Home** tab, click **Format Painter**, and then click cell **A2**.

3. Right-click cell **B1** and then click **Copy**.
4. Right-click cell **B2**, then under **Paste Options**, click **Paste**.
5. Point out that there is a similar result to the previous example—the time offset has occurred because the TODAY() function does not give the current time, but defaults to midnight (00:00) on the given date.

Using the MONTH() Function

1. In cell C2, type **=MONTH(A2)**, and then press Enter.
2. Point out that the returned value for month is also a number.
3. In cell D2, type **=IF(C2=1,"January",IF(C2=2,"February",IF(C2=3,"March",IF(C2=4,"April",IF(C2=5,"May",IF(C2=6,"June",IF(C2=7,"July",IF(C2=8,"August",IF(C2=9,"September",IF(C2=10,"October",IF(C2=11,"November",IF(C2=12,"December")))))))))))**, and then press Enter.

Using the NETWORKDAY() Function

1. In cell A3, type **=A2+13**, and then press Enter.
2. In cell A4, type **=NETWORKDAYS(A2,A3)**, and then press Enter.

Check Your Knowledge

Question	
Which function would you use to get the current date and time?	
Select the correct answer.	
	TODAY()
	MONTH()
	NOW()
	TIME()
	NETWORKDAYS()

Lab: Working with Data Hierarchies

Scenario

Sindy was pleased with the dashboard that you created for her and has used the charts to great effect. However, she now has some additional questions and tasks for you. Sindy wants to display some hierarchical data graphically so she can present it to her team. Sindy wants to display revenue information broken down by both gender and age group, but she is not sure how to create the age groups.

She also wants to break down sales by day across all revenue data, to determine if certain days of the week have the slowest sales for Adventure Works products.

Objectives

After completing this lab exercise, you will be able to:

- Create a hierarchy chart from tabular data.
- Perform analysis by manipulating time and date data.

Estimated Time: 40 minutes

Virtual machine: **10994B-MIA-BI**

User name: **Admin**

Password: **Pa55w.rd**

Exercise 1: Create a Sunburst Chart

Scenario

Sindy has seen some examples of a sunburst chart, and would like to use this kind of chart to present information to her team. She would like to show revenue by gender further broken down by age grouping; however, there are currently no age groups in the data, only the individual ages of customers. You should create age groups for Sindy, and then create the chart.

The main tasks for this exercise are as follows:

1. Create Age Ranges for the Hierarchy

2. Create a Tabular Layout of the Data

3. Create the Sunburst Chart

▶ Task 1: Create Age Ranges for the Hierarchy

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Open the **D:\Labfiles\Lab05\Lab5.xlsx** file.
3. Create an Excel table called **Table1** using the data in the worksheet.
4. Create a new column to the left of the **Customer Gender** column, titled **Age Group**.
5. In the new column, create a formula using nested IF() statements to group customers into the following age groups:
    - Under 21
    - 21-29
    - 30-39

- 40-49
- 50+

▶ Task 2: Create a Tabular Layout of the Data

1. Create a new worksheet called **Sheet1**.
2. On the new worksheet, create a PivotTable from **Table1**, with the following fields:
   a. **Revenue** under **Values**.
   b. **Customer Gender** under **Rows**.
   c. **Age Group** under **Rows** (under **Customer Gender**).
   d. **Product Category** under **Filters**.
3. Display the PivotTable in tabular layout, repeat the item labels, and remove the column totals.
4. Copy the PivotTable and paste values only to cell **A16**.
5. Clear cells **C17-C26**.
6. Enter the following formula to cell **C17**: **=SUMIFS(Table1[Revenue],Table1[Customer Gender],$A17,Table1[Age Group],$B17,Table1[Product Category],IF(B1="(All)","*",B1))**.
7. Fill from cell **C17** down to cell **C26**.
8. In the PivotTable, remove the **Revenue**, **Customer Gender**, and **Age Group** fields.
9. Delete the intervening cells, so that your recreated table is moved up under the Product Category filter.

▶ Task 3: Create the Sunburst Chart

1. Use your newly created table to create a sunburst chart.
2. Check that the filter control applies to the chart.

Results: After completing this lab exercise, you will have:

Created age ranges in a hierarchy

Created a tabular layout of your data

Created a sunburst chart

Exercise 2: Perform Year and Day Data Analysis

Scenario

Sindy would like to perform some additional analysis, by using time and date data. She would like to compare revenue figures from different years to determine if there has been growth in sales. In addition, Sindy would also like to see whether sales of certain categories are different for different days of the week.

The main tasks for this exercise are as follows:

1. Create a Tabular Layout of Yearly Sales Data

2. Isolate the Day of the Week

▶ Task 1: Create a Tabular Layout of Yearly Sales Data

1. Create a new worksheet called **Sheet2**.
2. Switch to **Sheet2**.
3. Create a PivotTable from **Table1**, using:
   a. **Revenue** to **Values**.
   b. **Country** to **Rows**.
   c. **Year** to **Columns**.
4. Copy the PivotTable contents except the totals.
5. Paste the PivotTable contents as values to cell **A12**.
6. Delete the revenue figures, leaving only the structure of the new table.
7. Name the new table **Growth**.
8. Add the following formula to cell **C14**:
   =(SUMIFS(Table1[Revenue],Table1[Country],$A14,Table1[Year],C$13)-SUMIFS(Table1[Revenue],Table1[Country],$A14,Table1[Year],B$13))/SUMIFS(Table1[Revenue],Table1[Country],$A14,Table1[Year],B$13).
9. Fill from cell **C14** down to **C19**.
10. Change the cell formatting to **Percentage Style** with two decimal places.
11. Copy the formula from the cells in column C to column D, and to each column for every year.
12. Create a line chart from the resulting table.

▶ Task 2: Isolate the Day of the Week

1. Switch to the **Data** worksheet.
2. Insert a new column after **year**, called **Day**.
3. Add the following formula to cell **C2**:
   =IF(WEEKDAY([@Date])=1,"Sunday",IF(WEEKDAY([@Date])=2,"Monday",IF(WEEKDAY([@Date])=3,"Tuesday",IF(WEEKDAY([@Date])=4,"Wednesday",IF(WEEKDAY([@Date])=5,"Thursday",IF(WEEKDAY([@Date])=6,"Friday",IF(WEEKDAY([@Date])=7,"Saturday"))))))).
4. Create a new worksheet called **Sheet3**.

5. On **Sheet3**, create a new PivotTable from **Table1**, using:
    a. **Revenue** under **Values**.
    b. **Country** under **Rows**.
    c. **Day** under **Columns**.
6. Create a PivotChart from the PivotTable, using the **Column** chart type.

Results: After completing this lab exercise, you will have:

Created a tabular layout of your data

Isolated weekdays

Question: Why did the formula to isolate the weekday require the IFS() function?

Question: Some organizations like to analyze data such as sales on a weekly basis. What function in Excel could assist with this kind of analysis?

Module Review and Takeaways

In this module, you have seen how to create hierarchies to present data at different levels, allowing users to identify overarching trends or dig deeper into detailed information. You have also seen how to create tabular table layouts that support hierarchical charts, such as the sunburst and treemap chart types. And you have seen how Excel stores date and time information, and several of the functions available to work with time and date values.

Review Question(s)

Verify the correctness of the statement by placing a mark in the column to the right.

Statement	Answer
True or False? Treemap and sunburst charts are available in all versions of Excel.	

Module 6

The Excel Data Model

Contents:

Module Overview

This module introduces Excel Data Models, a way of bringing data from different tables to create a relational data source.

Objectives

After completing this module, you will be able to:

- Explain what an Excel Data Model is, and when to use it.
- Create an Excel Data Model.
- Understand the relationships in an Excel Data Model.
- View data in a Data Model, and work with it.
- Work with external data and Excel Data Models.

Lesson 1
Using an Excel Data Model

This lesson introduces you to Excel Data Models.

Lesson Objectives

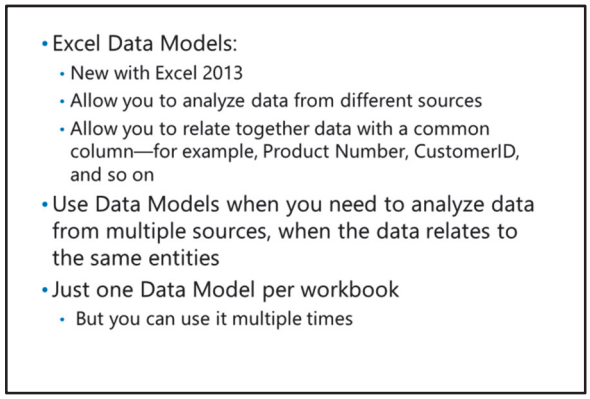
After completing this lesson you will be able to:

- Understand what an Excel Data Model is, and know when to use one.
- Understand tables and relationships in Excel Data Models.
- View and work with data in an Excel Data Model.

What Is an Excel Data Model?

What Is an Excel Data Model?

Data Models were introduced with Excel 2013 and, when it comes to making complex data analysis easier, they represent a great step forward. For the first time, Data Models bring database functionality into a spreadsheet, making it possible to relate data tables to each other. This is very useful, and means you don't have to worry about functions such as VLOOKUP or SUMIF.



Why Create an Excel Data Model?

Consider a marketing manager who wants to analyze some data she has collected from her colleagues. Each spreadsheet belongs to a different department, and each spreadsheet contains data that is potentially useful. By bringing all of this data together into a Data Model, she can link together data that relates to the same subject.

She might have a list of products from the Production department. She creates an Excel table from this data and names it *Production*. She notes that it contains a Product Number, Product Name, Product Description and Product Category. The spreadsheet from Accounts contains customer orders, and each order contains a Product Number. She creates an Excel table from the Accounts data, and names it *Orders*. Using an Excel Data Model, she can now relate these two tables to each other, using the Product Number that is common to both tables.

Note: Although you need the Power Pivot in Microsoft® Excel® add-in installed on your machine if you want to work with the Data Model directly, you do not need it installed if you are just using the Data Model as a source of data.

If you want to work with the Data Model directly, you must have first installed the Microsoft Office PowerPivot for Excel 2013 add-in. You can check whether this add-in is installed by clicking **File**, then **Options**, and then **Add-Ins**. A list of all installed add-ins is displayed.

For more details about how to install this add-in, see the Microsoft Office documentation:

Start the Power Pivot in Microsoft Excel add-in

https://aka.ms/sryhdu

In the following lessons we will look more closely at how Excel Data Models work.

For more information about Excel Data Models, see the Office support documentation:

Create a Data Model in Excel

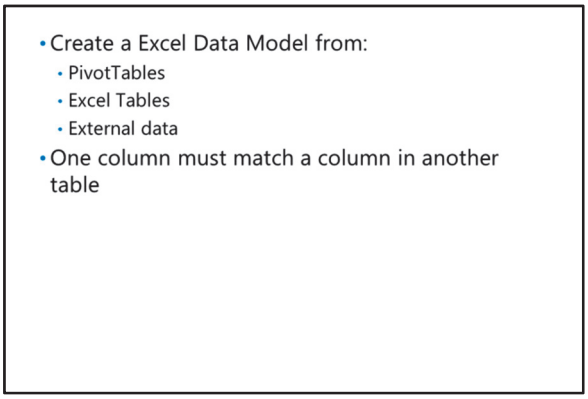
https://aka.ms/flhtkg

Each workbook can contain only one Data Model, but you can use the data from the Data Model in multiple worksheets and in multiple places.

Tables in an Excel Data Model

Data for an Excel Data Model can come from Excel tables or PivotTables that have already been created. Excel tables were discussed in Module 1 of this course, and PivotTables were discussed in Module 3. Both Excel tables and PivotTables use data from just one data range. But what if you wanted to create a report from more than one data range?

We are now going to see how these tables can be combined to create an Excel Data Model.



Best Practice: Give Excel tables a name to make your Data Model more understandable, and to reduce the possibility of making errors as you work.

Issues with Data

Data comes from many different sources; sometimes it comes from systems used by other departments. Many systems now provide an "Export to Excel" option. When the data is exported, however, it might include codes or abbreviations that are used within that system. Product code, department number, and management level are all codes commonly used in systems. To create a meaningful and useful report from this data, you need to combine more than one table together.

Create an Excel Data Model with Excel Tables

First, convert each of your data ranges to an Excel table.

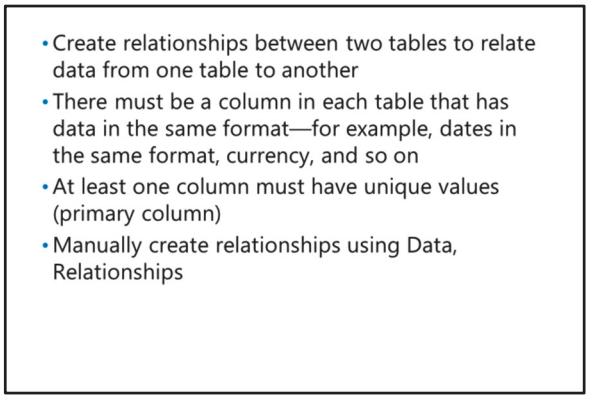
1. Click the **Insert** tab, then select the data range.
2. Click **Table** to convert the data range to an Excel table.
3. Name the table by clicking somewhere in the table, and amending the **Table Name** in the **Properties** group.
4. Repeat steps 2 to 4 for each data range that you want to include in the Data Model.

Second, create a Data Model.

1. Click the **Data** tab, and then click **Connections** in the **Connections** group.
2. Click the down arrow on the **Add** button, and then click **Add to the Data Model**. The **Existing Connections** dialog box is displayed.
3. Click the **Tables** tab, select a table, and then click **Open**.
4. A Data Model called ThisWorkbookDataModel is created, with the table name appearing beneath it.
5. You can add more tables by repeating steps 1 to 4.

Having created a Data Model, use Workbook Connections to add or remove tables.

Relationships in an Excel Data Model



Now that you have added tables to your Data Model, you can define relationships between them. If you are familiar with databases, you will understand how data tables are related to each other. Even if you are not familiar with databases, this feature is still quite intuitive. In fact, when Excel recognizes the relationships between tables, it automatically creates the relationships for you.

To create a relationship, the two tables must share a common column, for example ProductID, CustomerID, or DeptNo. Both columns must contain data of the same type—for example, dates in the same format, or currency values—and one of these two columns must not contain any duplicate values. This enables Excel to match values from one table to another.

Excel Data Types

When we work in Excel, we do not normally have to consider data types. We think about how the data is presented, not how it is stored. But it is helpful to know a little about how Excel Data Models handles data, and the data types it uses. Excel converts data to one of the following data types:

- **Whole numbers**: positive or negative numbers with no decimal places; for example, 2983 or -25.
- **Decimal numbers**: positive or negative numbers up to 15 decimal places; for example, 322.46.
- **True/False**: true or false Boolean value.
- **Text**: Unicode character strings up to 268,435,456 Unicode characters.
- **Dates**: correctly formatted dates and times after January 1, 1900.
- **Currency: positive or negative numbers up to four decimal places. Allowed values are between -922,337,203,685,477.5808 and 922,337,203,685,477.5807.**
- **Blank**: similar to a SQL null, or DAX blank.

 **Best Practice:** It is better not to have blanks or NULLs in your data, although it is sometimes unavoidable. If you spot cells that do not contain a value, check to see if the value can be completed.

You do not need to remember these data types, or the maximum sizes allowed (unless you are working with very large values). But be aware that Excel is converting your data to one of these data types. This awareness will help you to spot data within a column that has inconsistent data types.

To learn more about data types, and how to work with them in Excel Data Models, see the Office support documentation:

Data Types in Data Models

https://aka.ms/blfza8

Manually Creating a Relationship

1. On the **Data** tab, click **Relationships** in the **Data Tools** group. The **Manage Relationships** dialog box appears.
2. Click **New**. The **Create Relationships** box appears.
3. From the drop-down lists, select a **Table** and a **Related Table**.
4. From the drop-down lists, select the column that will match to the related table. The **Related Column (Primary)** is the column with unique values. The **Column (Foreign)** is the column that matches to the **Related Column (Primary)**.
5. When you have finished, click **OK**. You will get an error message if one column does not contain unique values.

You can also remove unwanted relationships using **Manage Relationships**.

It is not always necessary to manually create a relationship between tables, because Excel can often identify the matching data, and create the relationship for you.

Note: If you know how to use VLOOKUPs, relationships will be familiar, because the idea is the same. You must have columns with matching data so that you can match a value from one column to another, thereby accessing the data in that row.

For more information about creating relationships in an Excel Data Model, see the Office support documentation:

Create a relationship between tables in Excel

https://aka.ms/cl1o6f

Viewing Data in an Excel Data Model

Once you have created a Data Model, you can then view the data through a PivotTable. You create the PivotTable in the normal way, but instead of selecting a data range, you select the Data Model.

- View data from the Data Model through a PivotTable
- When prompted for the data range, select **Use this workbook's Data Model**
- Fields are available from all the tables added to the Data Model
- Create reports that include fields from several tables

Create a PivotTable from a Data Model

1. Click somewhere on one of the tables.
2. Click **Insert**, then **PivotTable**. The **Create PivotTable** dialog box appears.
3. Select **Use this workbook's Data Model**.
4. When the PivotTable is created, you will see that there are fields from all of the tables included in the Data Model.
5. Expand the field list from each table to add to the PivotTable quadrants.

It is no more difficult to create a PivotTable from a Data Model than it is to create one from a single table. However, you can select fields from different tables, keeping the relationships between rows.

Create Reports from Several Tables

Data within a database is split into different tables, according to the nature of the data. That means that all customer information is in one table, and all information relating to orders is in another. By joining the tables together in a Data Model, you can create a report that shows both customers and orders, thereby creating a more meaningful report.

Demonstration: Working with an Excel Data Model

In this demonstration, you will see how to create a Data Model that contains three tables.

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank Workbook**.
4. Click **File**, **Open**, and then open the following files from **D:\Demofiles\Mod06**:

1. SalesOrderDetail.xlsx
2. SalesOrderHeader.xlsx
3. Product.xlsx

Create Three Tables

1. Click somewhere in **SalesOrderHeader.xlsx** then, from the **Insert** tab, click **Table**. Click **OK** to create an Excel table.
2. In the **Properties** group, rename **Table1** to **SalesOrderHeader**.

3. Click somewhere in **SalesOrderDetail.xlsx**.
4. Click **Insert**, and then click **Table**. Click **OK**.
5. In the **Properties** group, rename **Table1** to **SalesOrderDetail**.
6. Click somewhere in **Product.xlsx** and, from the **Insert** tab, click **Table**, and then click **OK**.
7. In the **Properties** group, rename **Table1** to **Product**.

Create a Data Model

1. From the **SalesOrderDetail** table, on the Ribbon, click **Data**, and in the **Connections** group, click **Connections**.
2. Click the down arrow next to **Add** and click **Add to the Data Model**.
3. In the **Microsoft Excel Security Notice** dialog box, click **OK**.
4. In the **Existing Connections** dialog box, click the **Tables** tab. Select **SalesOrderHeader** and click **Open**.
5. **ThisWorkbookDataModel** appears in the **Workbook Connections**, with the **SalesOrderHeader** table beneath it.
6. Repeat steps 2-4 to add the **SalesOrderDetail** table and then the **Product** table. All table names will appear under **ThisWorkbookDataModel**.
7. Click **Close**.

Create a PivotTable

1. Click **Insert** and **PivotTable** to display the **Create PivotTable** dialog box.
2. Click **Use an external data source** and click **Choose Connection**.
3. Click the **Tables** tab, and select **Tables in Workbook Data Model**. Click **Open**.
4. The **Create PivotTable** dialog box now shows the Connection name as **ThisWorkbookDataModel**. Click **OK**.

Work with the Data Model

1. Notice that **PivotTable Fields** have all tables listed. Expand **SalesOrderHeader** and drag the following field:

   TerritoryID to **Columns**.

2. Collapse **SalesOrderHeader** and expand **SalesOrderDetail**. Drag the following field:

   LineTotal to **Values**.

3. If a **Relationships between tables may be needed** message appears in the **PivotTable Fields** section, click **Close**.
4. Collapse **SalesOrderDetail**, and expand **Product**. Drag the following field:

   Name to **Rows**.

Create Relationships

1. In the **PivotTable Fields** section, note the message **Relationships between tables may be needed**. Click **Create**.
2. In **Table**, select **SalesOrderDetail** and in **Column (Foreign)** select **SalesOrderID**.

3. In **RelatedTable**, select **SalesOrderHeader** and in **Related Column (Primary)** select **SalesOrderID**. Click **OK**.
4. Click **Create** again.
5. In **Table**, select **SalesOrderDetail** and in **Column (Foreign)** select **ProductID**.
6. In **Related Table**, select **Product** and in **Related Column (Primary)** select **ProductID**. Click **OK**.

   You have created a PivotTable with fields from three separate tables, related together and part of the Workbook Data Model.
7. Close Excel, saving any changes.

Check Your Knowledge

Question	
What is the benefit of creating a Data Model?	
Select the correct answer.	
	You can create charts more easily.
	It is easier to work with financial data in Data Models.
	Calculations are performed faster within a Data Model.
	You can create relations between data from more than one source.
	Data Models enable you to create maps within Excel.

Lesson 2
External Data

In this lesson, you will learn how to import data from different data sources, including Microsoft Access® and text files. Excel includes extensive functionality to help you work with different data sources, whilst still being easy to use.

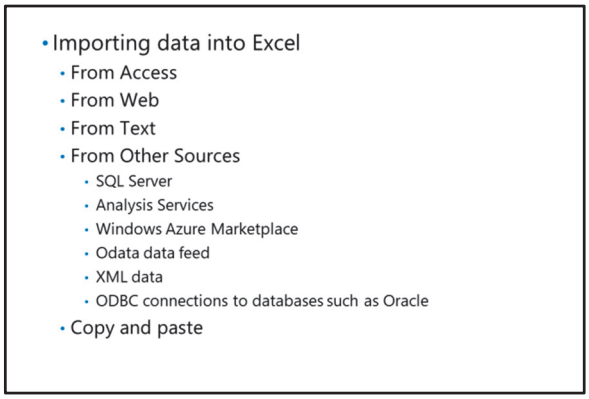
Lesson Objectives

After completing this lesson, you will be able to:

- Identify the type of data you can import into Excel.
- Understand the difference between importing data, and linking to external data.

Importing External Data

The data you need might not always be in an Excel workbook. Sometimes you have to import data from a database such as Microsoft SQL Server®, or Microsoft Access. Excel makes it easy to import data from a wide variety of different data sources.



The **Data** tab includes a group called **Get External Data**. This group includes options to enable you to import data from different sources. In this lesson, we will consider each one.

From Access

Many organizations hold data in Microsoft Access because it is so quick to set up, and so easy to use. Using the **Import from Access** button, you can import data from tables or views.

To import data from Microsoft Access:

1. From the **Data** tab, and the **Get External Data** group, click **From Access**. The **Select Data Source** dialog box appears.
2. Navigate to the Access database you want to use. Click on the database name (Microsoft Access databases have a **.mdb** extension), and click **Open** (or double-click the database name). The **Select Table** dialog box appears.
3. The **Select Table** dialog box lists all the views and tables in the database. The views appear at the top of the list with a different icon (two tables, rather than the single table icon). Select the view or table you want to use and click **Open** (or double-click the name). The **Import Data** dialog box appears.
4. Select how you want to import the data, and where in the worksheet you want to put the data. You also have the option to **Add this data to the Data Model**. Make your selections and click **OK**.

Note: What are Views? Views are like tables, but include information from more than one table. They are useful because views often include all the information needed for a specific purpose.
As an example, consider a situation where you have three tables that all contain information you need. The customer table includes CustomerID and Customer Name. The products table includes

ProductID and Product Name. The orders table includes CustomerID, ProductIDs and order amount. Although you could work with all three tables separately, a view can join them together to include customer name, product name, in addition to order amount. In this case, a view would be easier to work with.
Alternatively, you can add each table to an Excel Data Model.

For more information about connecting to an Access database, see the Office support documentation:

Connect an Access database to your workbook

https://aka.ms/qm2qwx

From Web

Some websites include statistics that are useful to add to reports. These include national statistics, and data published by government agencies. Such websites offer options to **download to .csv** or **download to .xls**. However, you can also import direct from a webpage.

To import from a webpage:

1. From the **Data** tab, and the **Get External Data** group, click **From Web**. **The New Web Query** dialog box appears.
2. Copy the URL of the website into the **Address** box. The webpage appears in the dialog box. Click the correct arrow to import a table, or the entire page.
3. Click **Import** to import the data into your worksheet.

From Text

Data is commonly presented in .csv format (comma separated values). You can import text files in various formats using the **From Text** option.

To import from a text file:

1. From the **Data** tab, and the **Get External Data** group, click **From Text**. The **Import Text File** dialog box appears.
2. Navigate to the text file you want to use. If the text file does not appear, click the down arrow to display all text files formats, and select **All Files (*.*)**.
3. The **Text Import Wizard** appears. This allows you to specify the format of you file, and how you want it to be imported. As you specify the format, you can see a preview of the data. When you are happy with the data format, click **Finish**.

From Other Sources

Excel provides an impressive number of options to import data from other sources. There is support for:

- SQL Server
- Analysis Services
- Windows Azure® Marketplace
- OData data feed
- XML data

You can also set up an ODBC connection to connect to Oracle or other data sources.

For more information about importing data into Excel, see the Office support documentation:

Tutorial: Import Data into Excel, and Create a Data Model

https://aka.ms/agym58

Copy and Paste

Whilst not exactly an import option, you can, of course, copy and paste data into an Excel spreadsheet. This is sometimes the quickest and simplest solution. You can copy data from a wide variety of sources, and for the most part, Excel makes a good job of handling it.

Linking to External Data

As an alternative to importing data into your spreadsheet, you can link to external data. This has the advantage that if the data changes, it will be updated in your spreadsheet. You can decide how frequently to refresh the data.

- In addition to importing data, you can link to external data
- When the data changes, click **Refresh** to get the latest version of the data
- Create a connection to the data, such as Microsoft Access or SQL Server
- When prompted, select **Only Create Connection**
- From **Existing Connections**, select a connection, then **Open** to import data into the workbook

Data Connections

Data connections enable you to access external data. The data connection describes where to find the data, log in, and access the data. Once you have created the connection, you can also refresh the data to get the latest changes and import the data into your workbook.

Create a Data Connection

In this example, we create a data connection to a Microsoft Access file.

1. From the **Data** tab, click **From Access**.
2. Navigate to the Access file you want to connect to. You will be prompted to select a table or view.
3. Select the table or view you require. The **Import Data** dialog box is displayed.
4. Select **Only Create Connection** and click **OK**.
5. Click **Existing Connections** to view the connection. The new connection is displayed.
6. To work with the data in your workbook, click **Open**.
7. The **Import Data** dialog box is displayed. Click **OK** to import the data into your workbook.

View Data Connections

1. Click the **Data** tab, and in the **Connections** group, click **Connections**.
2. Click **Add**. The **Existing Connections** dialog box is displayed.

Data connections can be stored within a specific workbook, or on your computer.

For more information about data connection, see the Office support documentation:

Create, edit, and manage connections to external data

https://aka.ms/lp1lbp

You can also link data to a Data Model, for more information, see the Office support documentation:

Add worksheet data to a Data Model using a linked table

https://aka.ms/pwxfpu

Verify the correctness of the statement by placing a mark in the column to the right.

Statement	Answer
Importing or linking external data to your Data Model is a deprecated feature.	

Lesson 3
Import from CSV

One of the most common data formats you will come across is a CSV file. It stands for "comma separated values"—because each value is separated by a comma. It is a plain text file, which means that it can be read by most software applications, including Excel.

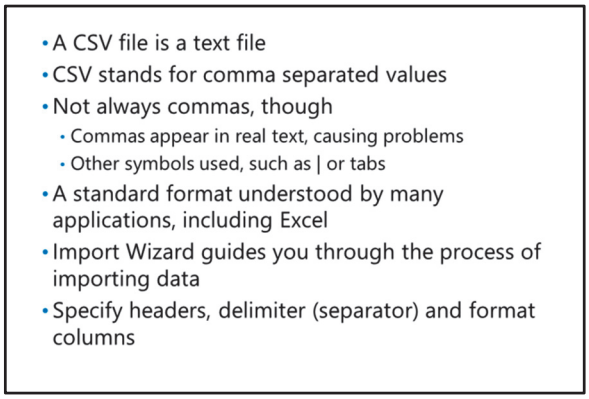
Lesson Objectives

After completing this lesson, you will be able to:

- Recognize the format of a CSV file.
- Import a CSV file into Excel.

Import a CSV File

As one of the most commonly used data formats, it is useful to be able to import CSV files into Excel. When it's in an Excel spreadsheet, the data can be used in the same way as any other Excel data.



CSV File Format

Although the name CSV, or comma separated value, suggests that the values are always separated by a comma, this is not the case. A comma may be used, but there is the problem that data might include a comma. The first line of an address, for example, might be formatted as "23, Acacia Avenue". Unless the comma is enclosed in quotation marks to indicate that it is a real comma, and not a separator, the data cannot be parsed correctly.

To get around the problem of "real" commas, data can be separated using other symbols, commonly a bar (|) or a tab. Excel copes with these, in addition to other options.

Import a CSV File

To import a CSV file into Excel:

1. Click the **Data** tab, and in the **Get External Data** group, click **From Text**.
2. Navigate to the CSV file and click **Import**. The **Text Import Wizard** opens.
3. Select the **Delimited** file type.
4. Specify the **row number** to import records from.
5. Specify the **file origin**. Most will be Windows (ANSI).
6. Specify whether or not the data has a header row.
7. Review the data in the preview window and click **Next**.
8. Specify the **delimiter** used in the file. This may be tab, semicolon, comma, a space, or another symbol.

9. Specify the **text qualifier**. This is the charter used to enclose values in a file, such as "—to enclose a real comma.
10. Select whether your delimiter has two characters together. In which case, select **Treat consecutive delimiters as one**.
11. Review the data in the preview window and click **Next**.
12. Select the **column data format** for each column individually.
13. The **Advanced** options allow thousands of separators to be specified. If not specified, your country defaults will be used.
14. Click **Finish**.
15. The **Import Data** dialog box appears. You can specify where the data should be located, and whether it should be added to an existing Data Model. Click **OK** to import the data.

Inspect the data to ensure it has been imported correctly. For more information about using the Text Import Wizard, see the Office support documentation:

Text Import Wizard

https://aka.ms/cjnixf

For more information about importing CSV files into Excel, see the Office support documentation:

Import or export text (.txt or .csv) files

https://aka.ms/m1ttq3

Demonstration: CSV Import Demo

Demonstration Steps

Prepare the Environment

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Start **Excel 2016**.
3. Click **Blank Workbook**.
4. Click **File**, **Open**, **Browse**, then in the **All Excel Files** list, click **All Files (*.*)**.
5. Navigate to the **D:\Demofiles\Mod06** folder, and double-click the **Customers.csv** file.
6. The **Text Import Wizard** is displayed.
7. Click **Delimited**, and then click **My data has headers**.
8. Inspect the data in the **Preview** window. Click **Next**.
9. From the **Delimiters** list, click **Other** and type **|** (bar). Deselect **Tab**.
10. Inspect the data in the **Preview** window. Click **Next**.
11. Format the **BirthDate** column as **Date**, then in the list, click **YMD**.
12. Click **Finish**.
13. The **Import Data** dialog box appears. Click **OK**.

14. Inspect the data to ensure it has imported correctly.
15. Close the spreadsheet without saving any changes.

Lab: Explore an Excel Data Model

Scenario

Sindy has become more enthusiastic about working with the data you have provided. You decide to create a Data Model for her, so she can explore the data.

Objectives

After completing this lab, you will be able to:

- Add tables to a Data Model.
- Create relationships between the tables.
- Add external data to the Data Model.
- View the Data Model through a PivotTable.

Estimated Time: 60 minutes

Virtual machine: **10994B-MIA-BI**

User name: **Admin**

Password: **Pa55w.rd**

Exercise 1: Add Multiple Tables

Scenario

Sindy is delighted with how things are progressing, and has requested some more in-depth data to work with. You decide to create a Data Model, along with some existing Excel tables.

The main tasks for this exercise are as follows:

1. Add Tables to a Data Model

▶ Task 1: Add Tables to a Data Model

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. Navigate to the **D:\Labfiles\Lab06\Starter** folder and open:
    a. SalesOrderDetail.xlsx
    b. SalesOrderHeader.xlsx
    c. Product.xlsx

Create Three Excel Tables

- Create an Excel table with the data in each spreadsheet. Name the table with the name of the file (without the extension).

Create a Data Model

1. Add all the tables to a Data Model. Hint: use **Data**, **Connections**.
2. When you have added all three tables, click **Close**.
3. Leave the spreadsheets open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Add tables to a Data Model.

Exercise 2: Create Relationships

Scenario

You have created a Data Model with three tables. Each table has a key column that links the data in that table, to data in another table. In this exercise, you will create relationships

The main tasks for this exercise are as follows:

1. Create Relationships Between Tables

▶ Task 1: Create Relationships Between Tables

Create Relationships

1. Create a relationship between the **SalesOrderDetails** table and the **SalesOrderHeader** table, using the **SalesOrderID**.
2. Create a relationship between the **SalesOrderDetail** table and the **Product** table, using the **ProductID**.
3. Check the relationships in **Manage Relationships**.
4. Leave the spreadsheets open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Create relationships between tables in an Excel Data Model.

Exercise 3: Add External Data

Scenario

Sindy has specifically requested that demographic data be included in the data you provide for her. You can only get this data in a CSV file. You need to import the data into Excel, and add it to the Data Model.

The main tasks for this exercise are as follows:

1. Import Customers.csv

2. Add Customers to the Data Model

3. Add a Relationship

▶ Task 1: Import Customers.csv

1. Create a new workbook and import **Customers.csv**.
2. Check the data when it has been imported.
3. Create an **Excel table** from the Customer data. Rename the table to **Customers**. When prompted if you want to remove external connections, click **Yes**.
4. Leave the spreadsheets open for the next lab exercise.

▶ Task 2: Add Customers to the Data Model

1. Add the **Customers** table to the Data Model.
2. Check that the Data Model now contains four tables.
3. Leave the spreadsheet open for the next lab exercise.

▶ Task 3: Add a Relationship

1. Create a relationship between the **Customers** table and the **SalesOrderHeader** table.
2. Leave the spreadsheets open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Import a CSV file into Excel.

Add the table to your Data Model.

Exercise 4: Create a PivotTable

Scenario

You have created a Data Model and added four tables to it, including one with imported CSV data. You now want to create a PivotTable so that you can explore the data from all four tables.

The main tasks for this exercise are as follows:

1. Create a PivotTable
2. Create a PivotTable Report

▶ Task 1: Create a PivotTable

1. Using the **SalesOrderDetail.xlsx** file, create a **PivotTable** using the Data Model as the data source.
2. When the PivotTable is created, check that the PivotTable fields include the four tables in your Data Model.
3. Leave the file open for the next lab exercise.

▶ Task 2: Create a PivotTable Report

1. Create a PivotTable report using the following fields:
    a. **Column** heading of **Education** from the **Customers** table.
    b. **Row** heading of **Name** from the **Product** table.
    c. **Value** of **LineTotal** from the **SalesOrderDetail** table.
    d. **Filter** of **TerritoryID** from the **SalesOrderHeader** table.
2. Explore the PivotTable report.
3. Close all the spreadsheets without saving.

Results: After completing this lab exercise, you will be able to:

Create a PivotTable based on a Data Model.

Create a PivotTable report based on data from several related tables.

Question: Is it necessary to name the Excel tables?

Module Review and Takeaways

In this module, you have learned how to create Data Models from Excel files, in addition to working with external data. You have seen how you can relate tables to each other using a common key to make richer and more meaningful reports.

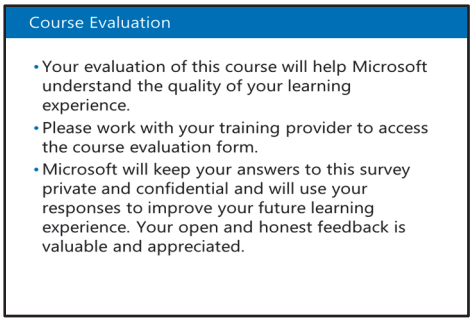
Best Practice: Requesting source data, and relating data together in a Data Model, gives you the power to do more complex analysis. Excel Data Models give you the power of a database, and the ease of using Excel.

Practice using Data Models so you become comfortable with how they work. This will give you more power to work with different types of data.

Review Question(s)

Question: How will you use Excel Data Models in your work?

Course Evaluation



Your evaluation of this course will help Microsoft understand the quality of your learning experience.

Please work with your training provider to access the course evaluation form.

Microsoft will keep your answers to this survey private and confidential and will use your responses to improve your future learning experience. Your open and honest feedback is valuable and appreciated.

Module 1: Reporting in Excel

Lab: Presenting Data in Charts

Exercise 1: Filtering Excel Data

▶ Task 1: Filter Data

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab01\Starter** folder, double-click **Lab1.xlsx** to open it.
3. Find the data titled **Revenue by Territory**, and click somewhere in the data range.
4. Click the **Data** tab, and then the **Filter** icon in the **Sort & Filter** group. Filter buttons appear on the column headings.
5. Click the **Filter** button on the **Name** column, and click the **Select All** box to clear all the boxes.
6. Select the following countries, and then click **OK**:
    a. France
    b. Germany
    c. United Kingdom
7. Repeat steps 5 and 6, this time selecting regions in the USA:
    a. Central
    b. Northwest
    c. Southwest
    d. Southeast
    e. Northeast
8. Repeat steps 5 and 6, this time selecting regions in the rest of the world:
    a. Australia
    b. Canada
9. Remove the filter from the data by clicking the **Filter** icon again.
10. If you have time, practice adding a filter to the **Revenue by Year** data.
11. Remove the filter from the **Revenue by Year** data.
12. Save the spreadsheet and leave it open for the next lab exercise.

Results: After completing this exercise, you will be able to:

Identify the data you need for your report.

Filter the data based on your requirements.

Exercise 2: Formatting Excel Data

▶ Task 1: Formatting Data

1. Locate the data titled **Revenue by Year**. Identify the different types of numbers in this data range:
   a. Values in **C4** to **H6**.
   b. Totals in **I4** to **I7**, and **C7** to **I7**.
   c. Percentages in **J4** to **J6**, and **C8** to **H8**.
2. None of these numbers are formatted, making the data range difficult to understand and analyze.
3. Select the range **C4** to **H6**.
4. Click the **Currency** icon in the **Number** group. All the values are formatted to two decimal places with a currency symbol.
5. In the **Number** group, click the **Decrease Decimal** icon twice, to format the numbers to no decimal place.
6. Select the range **C7** to **H7**. These are totals for each year. Repeat steps 4 to 5 to format the values as currency to no decimal places.
7. Select the range **I4** to **I7.** Format these cells as currency to no decimal places, and make them bold.
8. Select the range **C8** to **H8**. In the **Number** group, click the **Percent** icon.
9. Select the range **J4** to **J6** and format as Percentages.
10. Format the values in **Revenue by Category** as currency to two decimal places.
11. Format the values in **Revenue by Territory** as number to two decimal places.
12. Save the spreadsheet and leave it open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Identify data that is not formatted correctly.

Format numeric data appropriately.

Exercise 3: Creating Excel Charts

▶ Task 1: Create Charts

1. Select the data range **B11** to **C15**, click **Insert** and in the **Charts** group, select **Recommended Charts**.
2. Click each of the previews in the left-hand panel to show how the data would look with each chart type. Select the pie chart type, and then click **OK**.
3. Drag the pie chart to the right side of the spreadsheet.
4. Select the data range **B3** to **H6**, click the **Insert** tab, and in the **Charts** group, click the **Column** icon, and then click **Clustered Column**.
5. Drag the clustered column chart to a location under the pie chart.
6. Click somewhere in the **Revenue by Territory** data range.
7. Click the **Data** tab, and in the **Sort and Filter** group, click the **Filter** icon.
8. Click the **Filter** button on the **Name** column, click **Select All** to clear everything, and then select the USA territories:
    a. Central
    b. Northeast
    c. Northwest
    d. Southeast
    e. Southwest
9. Click **OK**.
10. Select the data range **C22** to **D29**, click the **Insert** tab, and in the **Charts** group, click the **Column** icon, and then click **Clustered Bar**.
11. Position the bar chart next to the clustered column chart.
12. Save the spreadsheet and leave it open for the final lab exercise.

▶ Task 2: Formatting Charts

1. Click somewhere on the **Revenue by Territory** chart.
2. Double-click the chart title and overtype **Revenue by Territory**.
3. Click **Chart Elements** (**+**) and select **Data Table** to show the values under the chart.
4. Click **Chart Elements** (**+**) again, and select **Trendline** to show a trendline on the chart.
5. Click somewhere on the **Revenue by Year** chart.
6. Double-click the chart title and overtype **Revenue by Year**.
7. Click **Filter** and clear 2011 and 2012. Click **Apply**.
8. Click **Chart Styles**, and then click **Color**. Select the orange monochromatic colorway.
9. Click somewhere on the **Revenue by Category** chart.
10. Click the **accessories** slice of the pie and drag it out a little to give it emphasis.
11. Click the **clothing** slice of the pie and drag it out a little to give it emphasis.

12. Click **Chart Styles** and choose the style that shows percentage values in white on each slice.
13. Click **Chart Styles**, and then click **Color**. Select the orange monochromatic colorway to match the **Revenue by Year** chart.
14. Save your changes and compare your spreadsheet with the one in the **Solution** folder.

Results: After completing this lab exercise, you will be able to:

Choose an appropriate chart for your data.

Create a chart.

Format a chart.

Module 2: Excel Tables

Lab: Analyzing Customer Demographics

Exercise 1: Create an Excel Table

▶ Task 1: Create an Excel Table

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab02\Starter** folder, double-click **Lab02.xlsx** to open it.
3. Click somewhere in the data, then click the **Insert** tab, and click **Table**.
4. Make a note of three things Excel tables provide that help you to analyze data.
5. On the **Design** tab, select **First Column**. What affect does selecting **First Column** have? When might you use this?
6. On the **Design** tab, select **Last Column**. What effect does selecting **Last Column** have? When might you use this?
7. On the **Design** tab, select a different style for the table. Which styles are most suited to the data, and why?
8. On the **Design** tab, select **Total Row** to add a total row to the table.
9. In the total row, add the following:
    a. TotalPurchaseYTD – Average.
    b. On the **Home** tab, and the **Number** group, click the **Decrease Decimal** until no decimal places are displayed.
10. Save the spreadsheet, and leave it open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Create an Excel table from data provided to you.

Add a total row to an Excel table.

Exercise 2: Work with Excel Table

▶ Task 1: Format the Data

1. Click the heading **DateFirstPurchase** to select the column.
2. From the **Home** tab, and the **Number** group, select the **Short Date** format.
3. Click the heading **BirthDate** to select the column, and format it as a **Short Date** by repeating step 2.

▶ Task 2: Calculated Columns

1. Highlight the **BirthDate** column, then from the **Home** tab, and the **Cells** group, click **Insert**. Select **Insert Sheet Columns** from the list. A new column is inserted.
2. Double-click the column heading and type **MonthFirstPurchased**.
3. In cell **D2** type **=TEXT(C2, "MMMM")**. The month of the first purchase is displayed in the column.
4. Highlight the **MaritalStatus** column, right-click and select **Insert**. A new column is inserted.
5. From the **Home** tab, and the **Number** group, select the **Number** format.
6. Double-click the heading of the new column and name it **Age**.
7. In cell **F2**, type **=DATEDIF(E2,TODAY(),"Y")**. The age is displayed in the column.
8. Highlight the **MaritalStatus** column, right-click and select **Insert**. A new column is inserted.
9. Double-click the heading of the new column and name it **AgeGroup**.
10. In cell **G2**, type **=IF(F2<21, "Young Person", IF(F2 >66,"Mature", "Adult"))**.
11. Highlight the **Age** column and from the **Home** tab, **Number** group, click **Decrease Decimal** twice to format the column to zero decimal places.
12. Save the spreadsheet, and leave it open for the next exercise.

Results: After completing this lab exercise, you will be able to:

Format columns within the table.

Add calculated columns.

Exercise 3: Analyze the Data

▶ Task 1: Demographics Analysis

1. Navigate to **D:\Labfiles\Lab02\Starter** and open **Lab02b.xlsx** and **Analysis.xlsx**.
2. Filter on the **YearlyIncome** column to calculate the **AveragePurchaseYTD** for yearly income of:
    a. Less than 25,000
    b. 25001 to 50000
    c. 50001 to 75000
    d. 75001 to 1000000
    e. Greater than 1000000
3. Enter the average purchase YTD for each band in the **Analysis.xlsx** spreadsheet.
4. Filter on the **MonthFirstPurchase** column to calculate the **AveragePurchase YTD** for each season:
    a. Jan, Feb and Mar (Winter)
    b. Apr, May and Jun (Spring)
    c. Jul, Aug, and Sep (Summer)
    d. Oct, Nov, and Dec (Autumn)
5. Enter the average purchase YTD for each band in the **Analysis.xlsx** spreadsheet.
6. For each table, highlight the data range and on the **Insert** tab, in the **Charts** group, select an appropriate chart type to create a chart.
7. Save your spreadsheet and compare it with the solution in the **D:\Labfiles\Lab02\Solution** folder.

Results: After completing this lab exercise, you will be able to:

Use an Excel table to analyze and summarize data.

Draw conclusions about the data.

Module 3: PivotTables and PivotCharts

Lab: Creating PivotTables and PivotCharts

Exercise 1: Create a PivotTable

▶ Task 1: Create a PivotTable

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab03\Starter** folder, double-click **Lab3.xlsx** to open it.
3. Click somewhere in the data, then click **Insert**, and then click **PivotTable**. Click **OK**.
4. From the list of PivotTable fields, drag the following:
    a. **Country** field to the **Rows** quarter
    b. **State** field to the **Rows** quarter (below the **Country** field)
    c. **Year** field to the **Columns** quarter
    d. **Month** field to the **Columns** quarter (below the **Year** field)
    e. **Revenue** field to the **Values** quarter
5. Examine the PivotTable by expanding and collapsing the column and row headings.

▶ Task 2: Create a Different PivotTable

1. In the **D:\Labfiles\Lab03\Starter** folder, double-click **Lab3_2.xlsx** to open it.
2. Click somewhere in the data, then click **Insert**, and then **PivotTable**. Click **OK**.
3. From the PivotTable fields, drag:
    a. **Age Group** to **Rows**
    b. **Customer Age** to **Rows** (under **Age Group**)
    c. **Product Category** to **Columns**
    d. **Sub Category** to **Columns** (under **Product Category**)
    e. **Revenue** to **Values**
4. Which is the best-selling Product Category?
5. Which Age Group(s) would you recommend targeting the marketing to?
6. Leave the spreadsheet open for the next lab exercise.

Results: After completing this lab exercise, you will have:

Created a PivotTable.

Created a variation on the data.

Exercise 2: Create a PivotChart

▶ Task 1: Create a PivotChart

1. If you have not completed the last lab exercise, in the **D:\Labfiles\Lab03\Starter** folder, double-click **Lab3_3.xlsx** to open it.
2. Click somewhere in the data, click **Analyze**, and then click **PivotChart**. View each of the chart previews, then select **Clustered Column** and click **OK**.
3. Use the filter buttons on the chart to explore the data.
4. What recommendations would you make to Sindy regarding marketing now?

Results: After completing this lab exercise, you will be able to:

Create a PivotChart based on PivotTable data.

Use the PivotChart to filter information.

Exercise 3: Editing PivotTables and PivotCharts

▶ Task 1: Edit the PivotTable and PivotChart

1. If you have not completed the last lab exercise, in the **D:\Labfiles\Lab03\Starter** folder, double-click **Lab3_4.xlsx** to open it.
2. Click **Sum of Revenues** in **Values**, select **Value Field Settings**, and then **Average**. Click **OK**.
3. Highlight cells **B6** to **E10**. On the **Home** tab, click **Decrease Decimal** in the **Numbers** group until the values appear to no decimal places.
4. Drag the **Customer Gender** field to **Filters**.
5. Drag the **Year** field to **Filters**.
6. With the PivotChart selected, click **Chart Elements** and select **Data Table**.
7. Close the spreadsheet without saving.

Results: After completing this lab exercise, you will be able to:

Amend a PivotTable.

Format a PivotChart.

Module 4: Dashboards

Lab: Creating a Dashboard

Exercise 1: Create a Dashboard

▶ Task 1: Create a Data Table

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab04** folder, double-click **Lab4.xlsx** to open it.
3. On the **Data** worksheet, select cell **A1**.
4. On the ribbon, on the **Insert** tab, click **Table**.
5. In the **Create Table** dialog box, ensure that **My table has headers** is selected, and then click **OK**.

▶ Task 2: Create PivotTables to Support the Dashboard

1. In Excel, click the **New sheet** button.
2. On the **Sheet1** worksheet, select cell **A1**.
3. On the ribbon, on the **Insert** tab, click **PivotTable**.
4. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
5. From the PivotTable fields, drag:
   a. **Revenue** to **Values**.
   b. **Country** to **Rows**.
   c. **State** to **Rows** (under **Country**).
6. On the ribbon, on the **Analyze** tab, click **PivotTable**, in the **PivotTable Name** box, type **SalesbyCountry**.
7. Select cell **H1**.
8. On the ribbon, on the **Insert** tab, click **PivotTable**.
9. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
10. From the **PivotTable** fields, drag:
    a. **Revenue** to **Values**.
    b. **Product Category** to **Rows**.
    c. **Sub Category** to **Rows** (under **Product Category**).
11. On the ribbon, on the **Analyze** tab, click **PivotTable**, in the **PivotTable Name** box, type **SalesbyCategory**.

▶ Task 3: Create the Dashboard

1. On the **Sheet1** worksheet, select cell **A1**.
2. On the ribbon, on the **Analyze** tab, click **PivotChart**.
3. In the **Insert Chart** dialog box, click **Pie**, then click **OK**.
4. In the lower right of the new chart, click the **Collapse Entire Field** button.

5. Right-click the chart, and click **Cut**.
6. Click the **New sheet** button.
7. Right-click **Sheet2**, click **Rename**, type **Dashboard**, and then press ENTER.
8. Right-click cell **B2**, under **Paste Options**, click **Use Destination Theme (H)**.
9. Switch to the **Sheet1** worksheet.
10. Select cell **H1**.
11. On the ribbon, on the **Insert** tab, click **PivotChart**.
12. In the **Insert Chart** dialog box, click **Bar**, then click **OK**.
13. Right-click the new chart, and click **Cut**.
14. Switch to the **Dashboard** worksheet.
15. Right-click a cell to the right of the existing chart, under **Paste Options**, click **Use Destination Theme (H)**.

▶ Task 4: Add a Slicer to the Charts

1. Select the pie chart.
2. In the **PivotChart Fields** panel, right-click **Year**, and click **Add as Slicer**.
3. On the ribbon, on the **Options** tab, click **Report Connections**.
4. Select the check box for **SalesbyCategory**, and then click **OK**.
5. On the slicer, click **2015**, and check that both charts change values.

Results: After completing this lab exercise, you will have:

Created a data table for a dashboard.

Created PivotTables to support a dashboard.

Created a dashboard.

Added a slicer and connected the slicer to two charts.

Exercise 2: Performing More Detailed Analysis with Dashboards

▶ Task 1: Add a Calculated Column to the Table

1. Switch to the **Data** worksheet.
2. Select cell **P1**, type **Profit**, and then press ENTER.
3. In cell **P2**, type =[@Revenue]-[@Cost] and then press ENTER. Check that all cells in column P are automatically completed.
4. Select cell **Q1**, type **Profit Margin**, and then press ENTER.
5. In cell **Q2**, type =[@Profit]/[@Revenue], and then press ENTER.
6. Highlight column Q, then on the ribbon, on the **Home** tab, in the **Number** section, click the **General** drop-down menu, and then click **Percentage**.

▶ Task 2: Add a PivotTable to the Dashboard

1. Switch to the **Dashboard** worksheet.
2. Select an empty cell, then on the ribbon, on the **Insert** tab, click **PivotTable**.
3. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
4. From the PivotTable fields, drag:
   a. **Profit Margin to Values.**
   Note: if the Profit Margin field does not appear, on the ribbon, on the Analyze tab, click the Refresh button.
   b. **Product Category** to **Rows**.
   c. **Sub Category** to **Rows** (under **Product Category**).
5. Do the values in the Profit Margin column appear valid? What issue has occurred with the Profit Margin column?

▶ Task 3: Add a Calculated Field to a PivotTable

1. In the **PivotTable** Fields panel, clear the **Profit Margin** check box.
2. On the ribbon, on the **Analyze** tab, click the **Fields, Items & Sets** menu, then click **Calculated Field**.
3. In the **Insert Calculated Field** dialog box, in the **Name** box, type **Margin**. In the **Formula** box, type = Profit/Revenue, and then click **OK**.
4. Right-click a cell with a value in the **Sum of Margin** column, and then click **Value Field Settings**.
5. In the **Value Field Settings** dialog box, click the **Number Format** button.
6. In the **Format Cells** dialog box, select **Percentage**, and then click **OK**.
7. In the **Value Field Settings** dialog box, click **OK**.

▶ Task 4: Add Conditional Formatting to a PivotTable

1. Select the **Sum of Margin** cell in the row for **Bike Racks**.
2. On the ribbon, on the **Home** tab, click the **Conditional Formatting** menu, point to **Data Bars**, and click **Light Blue Data Bar**.
3. In the selected cell, click the **Formatting Options** drop-down menu, and then click **All cells showing "Sum of Margin" values for "Sub Category"**.

4. What product subcategory has the lowest profit margin?
5. Close Excel, saving any changes.

Results: After completing this lab exercise, you will be able to:

Add a calculated field.

Add conditional formatting.

Module 5: Hierarchies

Lab: Working with Data Hierarchies

Exercise 1: Create a Sunburst Chart

▶ Task 1: Create Age Ranges for the Hierarchy

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab05** folder, double-click **Lab5.xlsx** to open it.
3. On the **Data** worksheet, select cell **A1**.
4. On the ribbon, on the **Insert** tab, click **Table**.
5. In the **Create Table** dialog box, ensure that **My table has headers** is selected, and then click **OK**.
6. Select cell **E1**.
7. Right-click cell **E1**, point to **Insert**, then click **Table Columns to the Left**.
8. Select cell **E1**, type **Age Group**, and then press Enter.
9. Select cell **E2**, type =IF([@[Customer Age]]<21,"Under 21",IF([@[Customer Age]]<30,"20-29",IF([@[Customer Age]]<40,"30-39",IF([@[Customer Age]]<50,"40-49","50+")))), and then press Enter. The Age Group column should now be populated with age group labels.

▶ Task 2: Create a Tabular Layout of the Data

1. In Excel, click the **New sheet** button.
2. On the **Sheet1** worksheet, select cell **A1**.
3. On the ribbon, on the **Insert** tab, click **PivotTable**.
4. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
5. From the PivotTable fields, drag:
   a. **Revenue** to **Values**.
   b. **Customer Gender** to **Rows**.
   c. **Age Group** to **Rows** (under **Customer Gender**).
   d. **Product Category** under **Filters**.
6. On the ribbon, on the **Design** tab, click the **Report Layout** menu, and then click **Show in Tabular Form**.
7. On the ribbon, on the **Design** tab, click the **Report Layout** menu, and then click **Repeat All Item Labels**.
8. On the ribbon, on the **Design** tab, click the **Subtotals** menu, then click **Do Not Show Subtotals**.
9. On the ribbon, on the **Design** tab, click the **Grand Totals** menu, and then click **On for Rows Only**.
10. Select cells **A3-C13**, right-click the highlighted cells and click **Copy**.
11. Select cell **A16**, right-click cell **A16**, and under **Paste Options**, click **Values**.
12. Highlight cells **C17-C26**, right-click the highlighted cells, and click **Clear Contents**.

13. Select cell **C17**, type **=SUMIFS(Table1[Revenue],Table1[Customer Gender],$A17,Table1[Age Group],$B17,Table1[Product Category],IF(B1="(All)","*",B1))**, and then press Enter.
14. Select cell **C17**, click and drag the lower-right corner of the cell down to cell **C26** to fill all the relevant cells. Check that the value in the filled cells matches the corresponding values in the PivotTable.
15. Select cell **A3**. In the **PivotTable Fields** panel, clear the **Age Group**, **Customer Gender**, and **Revenue** fields to remove them from the PivotTable (this will also remove the PivotTable, except for the filter).
16. Highlight rows **3-15**, right-click the highlighted rows, and then click **Delete**.
17. Adjust the width of columns A, B, and C so that the column values can be seen easily.

▶ Task 3: Create the Sunburst Chart

1. Highlight cells **A3-C13**.
2. On the ribbon, on the **Insert** tab, click **Recommended Charts**.
3. On the **Insert Chart** dialog box, on the **All Charts** tab, click **Sunburst**, then click **OK**.
4. Change the product category filter to ensure that the chart changes accordingly.

Results: After completing this lab exercise, you will have:

Created age ranges in a hierarchy

Created a tabular layout of your data

Created a sunburst chart

Exercise 2: Perform Year and Day Data Analysis

▶ Task 1: Create a Tabular Layout of Yearly Sales Data

1. In Excel, click the **New sheet** button.
2. On the **Sheet2** worksheet, select cell **A1**.
3. On the ribbon, on the **Insert** tab, click **PivotTable**.
4. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
5. From the PivotTable fields, drag:
    a. **Revenue** to **Values**.
    b. **Country** to **Rows**.
    c. **Year** to **Columns**.
6. Select cells **A1-G8**, right-click the highlighted cells and click **Copy**.
7. Select cell **A12**, right-click cell **A12**, and under **Paste Options**, click **Values**.
8. Highlight cells **B14-G19**, right-click the highlighted cells, and click **Clear Contents**.
9. Select cell **A12**, type **Growth**, and press Enter.

10. Select cell **C14**, type **=(SUMIFS(Table1[Revenue],Table1[Country],$A14,Table1[Year],C$13)-SUMIFS(Table1[Revenue],Table1[Country],$A14,Table1[Year],B$13))/SUMIFS(Table1[Revenue],Table1[Country],$A14,Table1[Year],B$13)**, and then press Enter.
11. Select cell **C14**, then click and drag the lower-right corner of the cell down to cell **C19** to fill all the relevant cells.
12. With cells C14-C19 still highlighted, on the ribbon, on the **Home** tab, click **Percent Style**.
13. With cells C14-C19 still highlighted, on the ribbon, on the **Home** tab, click the **Increase Decimal** button twice.
14. With cells C14-C19 still highlighted, right-click the highlighted cells, and click **Copy**.
15. Select cell **D14**, right-click cell **D14**, and under **Paste Options**, click **Paste**.
16. Repeat step 15 for each year's column.
17. Select cell **A1**. In the PivotTable Fields panel, clear the **Year** and **Country** fields to remove them from the PivotTable.
18. Right-click **column B**, and then click **Hide**.
19. Highlight cells **A13-G19**, then on the ribbon, on the **Insert** tab, click **Recommended Charts**.
20. In the **Insert Chart** dialog box, on the **All Charts** tab, click **Line**, and then click **OK**.

▶ Task 2: Isolate the Day of the Week

1. Switch to the **Data** worksheet.
2. Right-click cell **C1**, point to **Insert**, and then click **Table Columns to the Left**.
3. Select cell **C1**, type **Day**, and then press Enter.
4. Select cell **C2**, type **=IF(WEEKDAY([@Date])=1,"Sunday",IF(WEEKDAY([@Date])=2,"Monday",IF(WEEKDAY([@Date])=3,"Tuesday",IF(WEEKDAY([@Date])=4,"Wednesday",IF(WEEKDAY([@Date])=5,"Thursday",IF(WEEKDAY([@Date])=6,"Friday",IF(WEEKDAY([@Date])=7,"Saturday")))))))**, and then press Enter.
5. Click the **New sheet** button.
6. On the **Sheet3** worksheet, select cell **A1**.
7. On the ribbon, on the **Insert** tab, click **PivotTable**.
8. In the **Create PivotTable** dialog box, in the **Table/Range** box, type **Table1**, and then click **OK**.
9. On the ribbon, on the **Analyze** tab, click **Refresh**.
10. From the PivotTable fields, drag:
    a. **Revenue** to **Values**.
    b. **Country** to **Rows**.
    c. **Day** to **Columns**.
11. On the ribbon, on the **Insert** tab, click **Recommended Charts**.
12. In the **Insert Chart** dialog box, on the **All Charts** tab, click **Column**, and then click **OK**.

Results: After completing this lab exercise, you will have:

Created a tabular layout of your data

Isolated weekdays

Module 6: The Excel Data Model

Lab: Explore an Excel Data Model

Exercise 1: Add Multiple Tables

▶ Task 1: Add Tables to a Data Model

1. Ensure the **10994B-MIA-BI** virtual machine is running, and then log on as **Admin** with the password **Pa55w.rd**.
2. In the **D:\Labfiles\Lab06\Starter** folder, double-click each of the following spreadsheets to open them:
    a. SalesOrderDetail.xlsx
    b. SalesOrderHeader.xlsx
    c. Product.xlsx

Create Three Excel Tables

1. Click somewhere in **SalesOrderHeader.xlsx**. From the **Insert** tab, click **Table**, and then click **OK** to create an Excel table.
2. On the Ribbon, click the **Design** tab, in the **Properties** group, and rename **Table1** to **SalesOrderHeader**.
3. Click somewhere in **SalesOrderDetail.xlsx**.
4. Click **Insert**, click **Table**, and then click **OK**.
5. On the Ribbon, click the **Design** tab, then in the **Properties** group, rename **Table1** to **SalesOrderDetail**.
6. Click somewhere in **Product.xlsx**, from the **Insert** tab click **Table**, and then click **OK**.
7. On the Ribbon, click the **Design** tab, then in the **Properties** group, rename **Table1** to **Product**.

Create a Data Model

1. From the **SalesOrderDetail** table, click **Data**, and in the **Connections** group click **Connections**.
2. Click the down arrow next to **Add** and click **Add to the Data Model**. The **Existing Connections** dialog box appears.
3. Click the **Tables** tab. Select **SalesOrderHeader** and click **Open**.
4. **ThisWorkbookDataModel** appears in the Workbook Connections, with the **SalesOrderHeader** table beneath it.
5. Repeat steps 2 and 3 to add the **SalesOrderDetail** table, and then the **Product** table. All three table names will appear under **ThisWorkbookDataModel**.
6. Click **Close**.
7. Leave the spreadsheets open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Add tables to a Data Model.

Exercise 2: Create Relationships

▶ Task 1: Create Relationships Between Tables

Create Relationships

1. From the **SalesOrderDetails** table, click the **Data** tab, and **Relationships**. The **Manage Relationships** dialog box is displayed.
2. Click **New** and in **Table** select **SalesOrderDetail**, and in **Column (Foreign)** select **SalesOrderID**.
3. In **Related Table**, select **SalesOrderHeader** and in **Related Column (Primary)** select **SalesOrderID**. Click **OK**.
4. Click **New** again.
5. In **Table**, select **SalesOrderDetail** and in **Column (Foreign)** select **ProductID**.
6. In **Related Table**, select **Product** and in **Related Column (Primary)** select **ProductID**. Click **OK**.
7. Check the relationships and then click **Close**.
8. Leave the spreadsheets open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Create relationships between tables in an Excel Data Model.

Exercise 3: Add External Data

▶ Task 1: Import Customers.csv

1. Click **File**, **New**, **Blank workbook**. Select cell **A1**.
2. On the Ribbon, click **Data**, **Get External Data**, **From Text**, and navigate to **D:\Labfiles\Lab06\Starter**, then select **Customers.csv**. Click **Import**.
3. The **Text Import Wizard** is displayed.
4. Click **Delimited**, and then click **My data has headers**.
5. Inspect the data in the Preview window. Click **Next**.
6. From the **Delimiters** list, click **Other** and type **|** (bar). Deselect **Tab**.
7. Inspect the data in the Preview window. Click **Next**.
8. Using the horizontal scroll bar, select the **BirthDate** column, then in the **Column data format** list, select **Date** and select **YMD**.
9. Click **Finish**.
10. The **Import Data** dialog box appears. Click **OK**.
11. Inspect the data to ensure it has imported correctly.
12. Save the workbook as **MyCustomers.xlsx**.
13. Click somewhere in the data, on the Ribbon click **Insert**, and then click **Table**.
14. The **Create Table** dialog box appears. Click **OK**.

15. A warning appears: **Your selection overlaps one or more external data ranges. Do you want to convert the selection to a table and remove all external connections?** Click **Yes**.
16. On the Ribbon, click **Design**, then in the **Properties** group, rename the **Table Name** to **Customers**.
17. Leave the spreadsheets open for the next lab exercise.

▶ Task 2: Add Customers to the Data Model

1. Select **SalesOrderDetail.xlsx** and on the **Data** tab, select **Connections**.
2. Click the down arrow next to **Add**. Click **Add to the Data Model**.
3. In the **Microsoft Excel Security Notice** dialog box, click **OK**.
4. Click **Tables** and select the **Customers** table. Click **Open**.
5. Check that the Data Model now contains four tables, and click **Close**.
6. Leave the spreadsheet open for the next lab exercise.

▶ Task 3: Add a Relationship

1. Select **SalesOrderDetail.xlsx**.
2. On the **Data** tab, click **Relationships**. Click **New**.
3. In **Table**, select **SalesOrderHeader**. In **Column (Foreign)** select **CustomerID**.
4. In **Related Table** select **Customers**. In **Related Column (Primary)** select **CustomerID**.
5. Click **OK**.
6. Check the relationships and click **Close**.
7. Leave the spreadsheets open for the next lab exercise.

Results: After completing this lab exercise, you will be able to:

Import a CSV file into Excel.

Add the table to your Data Model.

Exercise 4: Create a PivotTable

▶ Task 1: Create a PivotTable

1. Select **SalesOrderDetail.xlsx**.
2. On the **Insert** tab, click **PivotTable**. The **Create PivotTable** dialog box is displayed.
3. Select **Use an external data source**.
4. Click **Choose Connection**. The **Existing Connections** dialog box is displayed. Click **Tables** and select **Tables in Workbook Data Model**. Click **Open**.
5. The Create PivotTable dialog box displays the Connection name as **ThisWorkbookDataModel**. Click **OK**.
6. A PivotTable is created with PivotTable fields from the four tables in your Data Model.
7. Leave the file open for the next lab exercise.

▶ Task 2: Create a PivotTable Report

1. Use the PivotTable you created in the last lab exercise, then create a report using the following fields:
   a. From **Customers**, drag the **Education** field to **Columns**.
   b. From **Product**, drag the **Name** field to **Rows**.
   c. From **SalesOrderDetail**, drag the **LineTotal** to **Values**.
   d. From **SalesOrderHeader**, drag the **TerritoryID** field to **Filters**.
2. Explore the PivotTable report to see how the fields from all tables work together.
3. Close all the spreadsheets without saving.

Results: After completing this lab exercise, you will be able to:

Create a PivotTable based on a Data Model.

Create a PivotTable report based on data from several related tables.