

Power BI Boot Camp



Power BI College

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Introduction - Power BI

Power BI is a new cloud based Business Intelligence technology from Microsoft. The cloud based Power BI system provides an easy to use system for users to create online reports, analyse and visualize data, and create interactive dashboards.

Power BI also provides a Desktop Designer that is more powerful than the online cloud based solution. The files from the Desktop Designer can be easily uploaded to the cloud. The Desktop Designer also provides access to powerful tools that make it easy to import, transform and model data.

The Key Benefits of Power BI

- Cloud based infrastructure able to access reports and dashboards through laptops, tablets and smart phones
- Quick development process. New features are being released in PowerBI every month. The development process is not linked to the long development processes of Excel
- Microsoft is releasing new connections to a wide range of different data sources every month e.g. Google analytics, Facebook, SalesForce, Quicken and Acumatica
- Provides open source visualizations. Current visualizations include the standard line, column, bar, pie and area, but also provides treemaps, scatterplots and combination graphs. The Power BI Gallery makes it easy to also import and use a wide range of new visualizations
- Powerful filtering and highlighting capabilities. PowerBI makes it easy to use cross filtering and highlighting to get new insight and intelligence from your data
- Integration and possible integration into a wide range of Azure services such as Stream Analytics and AzureML (Azure Machine Learning)

Signing Up for PowerBI

Power BI provides a free sign up and usage within certain parameters. Power BI also provides a professional service which provides access to more sophisticated features especially in terms of refreshing data and storage. The professional version has a monthly fee.

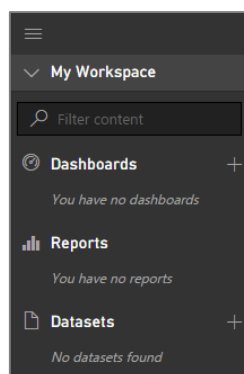
- Go to www.powerbi.com
- Enter the email address that you want to use for the system

PowerBI will take you through the registration and sign up process. Please follow the process to receive a login and password.



Using PowerBI

After you login into Power BI you are provided with the following options:



- **Datasets** – Load your data
- **Reports** – Create reports and visualizations
- **Dashboards** – Create dashboards from reports and visualizations in Reports

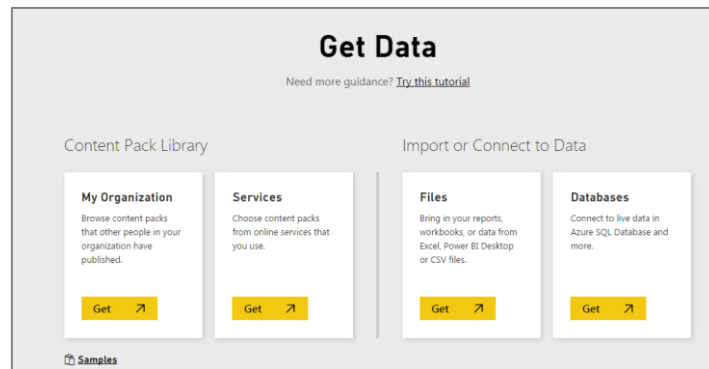
Downloads

The downloads option provides access to commonly downloaded files. You are able to download the following files:

- PowerBI for Mobile
- PowerBI Desktop
- Analysis Services Connector
- PowerBI Personal Gateway

Creating a Report in PowerBI

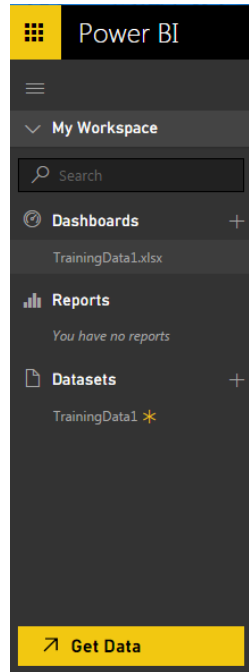
1. Select the **+** next to Data Sets
2. Select **Files**



3. Select **Local Files**
4. Load the **TrainingData1.xlsx** file

Power BI Interface

The data is loaded into the Power BI interface. The interface consists of three main areas:

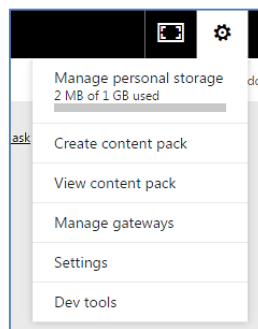


The left hand side provides a menu that allows easy access to your data sets, reports and dashboards. There is an option to hide the navigation pane which will provide more space when you are working. Next to the Power BI word is an icon that allows you to access Microsoft online software.

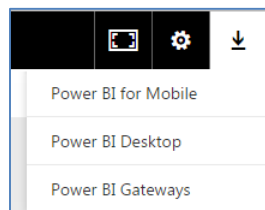
Top of the Menu Screen

On the top right hand side is menu that provides access to the following features:

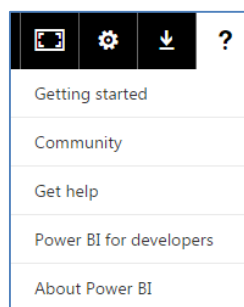
- **Display in full screen mode.** This is particularly useful when you are reviewing reports and Dashboards
- **Settings** – Create, manage and view content packs. Also manage different gateway settings for data access. The default settings for your Power BI environment and different development tools can be accessed from this menu option.



- **Downloads** for Power BI Desktop, Mobile and Gateway software



- **Help** – Access different Help resources

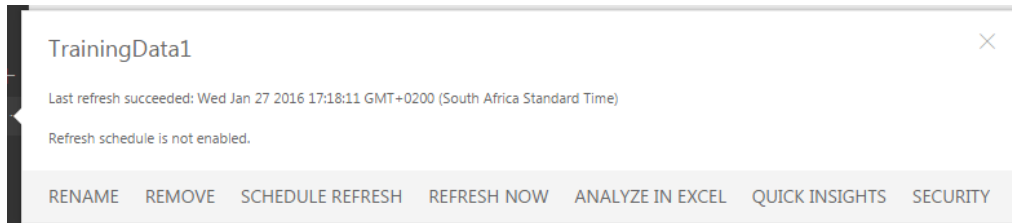


The last two options allow the user to provide feedback to Microsoft and to Sign Out.

Creating Reports in Power BI

The Training Data has been loaded into the Power BI model. This allows the user to easily create reports including tables and various forms of visualizations.

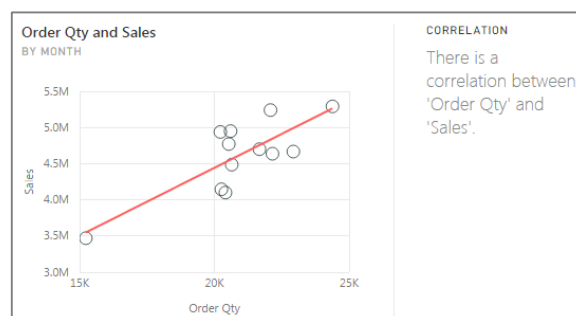
1. Select the ellipses next to the **TrainingData1** data source



Options include the following:

- **Rename** – Rename the Data Set name
- **Remove** – Remove the Data Set from Power BI
- **Schedule Refresh** – Schedule the refresh of the data source
- **Refresh Now** – Refresh the Data Source now
- **Analyze in Excel** – Users are able to analyse and use data from Power BI data sources in Excel.
- **Quick Insights** – Power BI will analyze your data and will present a list of insights that it determines from the data
- **Security** – Setup security against the data source. Security will ensure what records and data that users are able to view.

Select the **Quick Insights** option. Power BI reviews the data and displays a list of insights from patterns that are found in the data. The Insights are displayed Microsoft Power Point slide with a visualization and an explanation of the insight.

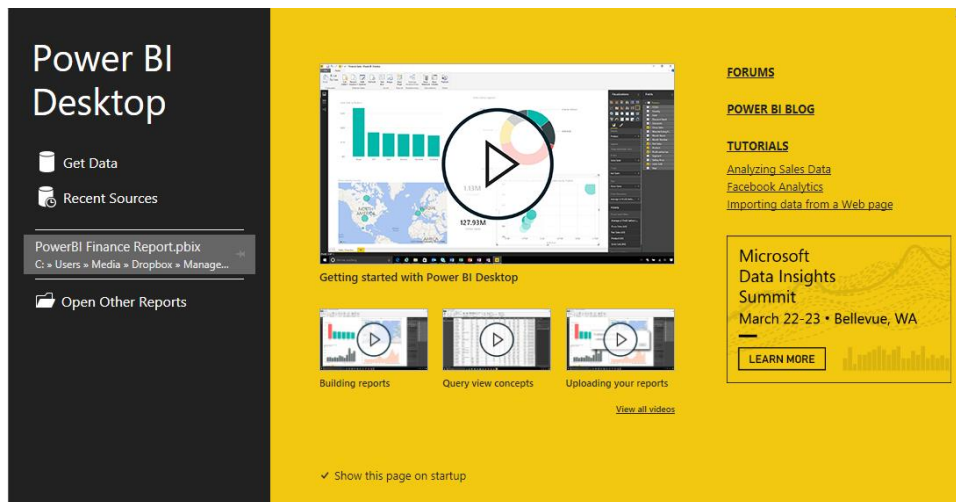


Overview and Interface Power BI Desktop

Overview and Interface

1. Open the **Power BI Desktop**

The Power BI Desktop interface opens.

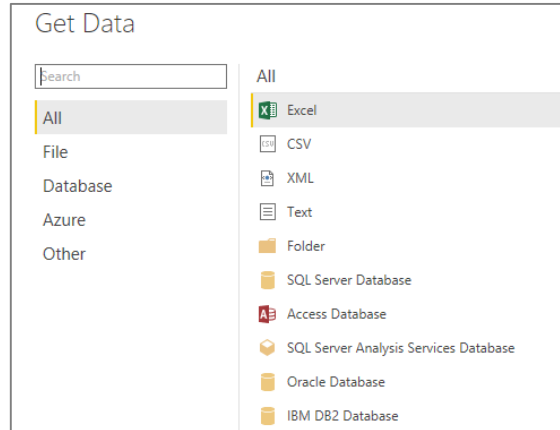


The Power BI splash screen provides access to a number of useful features:

- **Access the Power BI forums** – The forums are a great place to ask questions, get support and to collaborate with fellow Power BI users.
- **Power BI Blog** – The Power BI blog provides news and information on the latest updates and features that have been added to Power BI
- **Tutorials** – Complete easy to follow tutorials
- **Get Data** – Load or access data sources that you are going to use with Power BI
- **Recent Sources** – Display a list of recently saved Power BI reports
- **Open Other Reports** – Access other Power BI reports that have been saved

Accessing Data

Power BI allows data to be loaded from many different sources such as Excel, csv, SQL databases, Oracle and many others.



Different data sources include:

- Excel
- CSV and Text
- Databases such as SQL Server; Oracle; IBM DB2
- Azure data sources
- Other data sources such as online SAAS platforms

1. Select **Get Data**
2. Select **Excel** – Click on **Connect**
3. Select **TrainingData1.xlsx**
4. Select the **Data1 Table**
5. Select **Load**

Power BI Workspaces

The Power BI interface includes three different interfaces that the user is able to work with.



- **Reports** – Create reports, data analysis and dashboards
- **Data** – Review and model your data
- **Relationships** – Review and work with your relationships

Formatting Data in Power BI Desktop

The Power BI Desktop interface screen is opened. To start with we are going to learn to format our data and to create a couple of new fields.

1. Select the **Data** option
2. Select the **Modelling** menu option

The screenshot shows the Power BI Desktop interface with the 'Modelling' ribbon selected. The ribbon includes options for 'Manage Relationships', 'New Measure', 'New Column', 'New Table', 'Sort By Column', 'Sort', 'Data Type', 'Format', 'Home Table', 'Data Category', and 'Default Summarization'. Below the ribbon is a data table with the following columns: Order ID, Order Date, Unit Cost, Price, Order Qty, Cost of Sales, Sales, and Profit. The table contains 12 rows of data.

Order ID	Order Date	Unit Cost	Price	Order Qty	Cost of Sales	Sales	Profit
7103	Sunday, April 01, 2012	4.4279051601906	43.81	10	44.279051601906	438.1	393.82
6997	Thursday, April 25, 2013	1.37728659375704	46.99	10	13.7728659375704	469.9	456.1
252	Friday, April 27, 2012	9.2957076534494	39.99	10	92.957076534494	399.9	306.94
7312	Monday, April 16, 2012	16.3416168046819	42.99	10	163.416168046819	429.9	266.48
7366	Monday, March 05, 2012	20.7411895291945	28.99	10	207.411895291945	289.9	82.488
321	Monday, March 19, 2012	7.44411782901444	28.99	10	74.4411782901444	289.9	215.45
7494	Friday, September 19, 2014	25.1189411974634	49.99	10	251.189411974634	499.9	248.71
855	Thursday, April 25, 2013	12.115752997145	49.99	10	121.15752997145	499.9	378.7
7595	Tuesday, March 11, 2014	17.685845081946	22.99	10	176.85845081946	229.9	53.041
1089	Tuesday, April 10, 2012	9.50823326955624	42.99	10	95.0823326955624	429.9	334.81

Change the formatting of Fields

Power BI uses the formatting that has been setup in data model in reports and visualizations.

1. Click on the **Unit Cost** field
2. Select **Decimal number** and **2 decimal places**
3. Repeat for **Price**
4. **Sales, Cost of Sales** and **Profit** – Select thousands separator and no decimal places

Add Two New Fields

Later in the course we are going to learn about the DAX formula language for creating custom calculations. For now, we are going to add two simple fields to the data model to display the Year and Month Number of the Order Date.

1. Select **New Column**
2. Add the following columns
 - a. **Year = Year([Order Date])**
 - b. **Month = Month([Order Date])**

Two new fields for Year and Month are created in the data model.

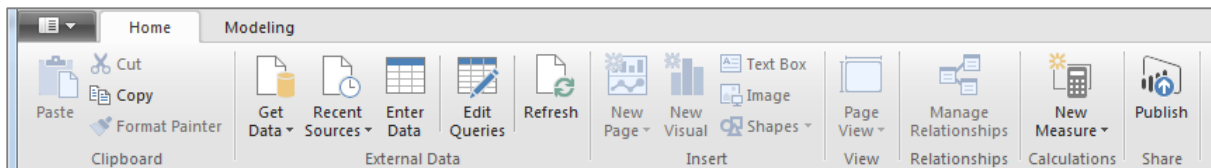
Product Category	Region	City	Country	Year	Month
Cell phones	North America	Wheat Ridge	United States	2012	4
Cell phones	North America	Lewisville	United States	2013	4
Cell phones	North America	Bayonne	United States	2012	4
Cell phones	North America	Stoughton	United States	2012	4
Cell phones	North America	La Porte	United States	2012	3
Cell phones	North America	Denver	United States	2012	3
Cell phones	North America	Denver	United States	2014	9
Cell phones	North America	Lynn	United States	2013	4
Cell phones	North America	Pasadena	United States	2014	3
Cell phones	North America	Spring	United States	2012	4
Cell phones	North America	New York	United States	2014	5
Cell phones	North America	Morristown	United States	2013	9
Cell phones	North America	Lewisville	United States	2012	5

Creating Reports in Power BI

In this section we are going to review how to create reports, tables and visualizations in Power BI. The process for creating reports is the same in the Cloud version and in the Desktop.

The Power BI Interface

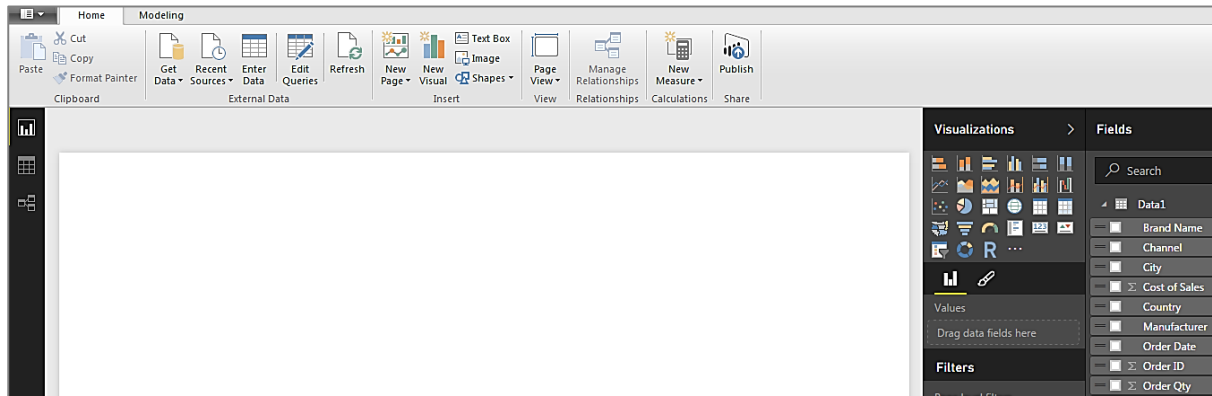
The menu bar in Power BI looks very similar to the Excel interface. At the top there is a ribbon which provides easy access to common functions.



- **Clipboard** – Cut or Copy any items within the Power BI canvas. The Format Painter can also be used to copy the formatting of an item
 - **External Data** – Access new data sources or recently accessed data sources; enter new tables of data; edit and transform the current table of data or refresh with any new data from the data source
 - **Insert** – Insert visualizations; pages; text boxes; images and shapes
 - **Visuals** – Edit methods of interaction between visualizations; arrange, distribute and align the items
 - **View** – Change the Page View options
 - **Relationships** – Create and manage relationships between tables of data in Power BI
 - **Calculations** – Create new Measures using the DAX formula language in Power BI
 - **Share** – Publish your reports and dashboards to the cloud Power BI interface
-
-
-

Creating a Table

The Report editor consists of a canvas area to the left of the screen. On the right hand side is a list of the fields that are available in the data source. In the middle section is a list of Tables and Visualizations that are available to the user.



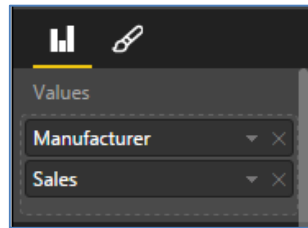
1. Drag the **Manufacturer** field to the Canvas
2. Drag the **Sales** field on top of the **Manufacturer** field

Power BI will create a Table displaying the Total Sales by Manufacturer.

Manufacturer	Sales
A. Datum Corporation	4,404,982
Adventure Works	7,467,704
Contoso, Ltd	9,996,750
Fabrikam, Inc.	12,054,281
Litware, Inc.	2,134,837
Northwind Traders	136,572
Proseware, Inc.	5,996,829
Southridge Video	3,112,730
The Phone Company	4,386,164
Wide World Importers	5,700,910
Total	55.391.760

Formatting the Table

In the Fields section of Power BI; the list of fields in the Table are displayed.



1. Select the **Format** option

The Format option displays a number of configuration options:

- **General** – Change General settings of the Table
 - **Totals** – Turn Totals on and off
 - **Auto Size Column Widths**– Automatically change the size Table columns
 - **Text Size** – Change the Text Size of the Table
 - **Positioning** – Change the positioning of the Table
- **Title** – Add a Title to the Table
 - Change the Text, Font Colour, Size, Alignment for the Title
- **Background** – Change the Colour and Transparency of the background
- **Lock Aspect** – Lock the aspect ratio of the Table, when the Table size is being changed.
- **Border** – Apply a border and border colour to the Table

Sorting Tables

To Sort the Table click on the Header of the field in the Table. Numeric fields will sort from highest to lowest and lowest to highest; Text fields will sort from A to Z and Z to A and Date fields will sort from Oldest to Newest and Newest to Oldest.

1. Sort the **Sales** column from highest to lowest and lowest to highest
2. Sort the **Manufacturer** column from A to Z, Z to A

Creating Multiple Measures

Multiple Measures such as **Sales**, **Profit** and **Order Quantity** can also be in a report structure.

1. Add the **Profit** and **Order Quantity** fields to Values

Manufacturer	Sales	Profit	Order Qty
A. Datum Corporation	4,404,982.01	2,608,508.25	16601
Adventure Works	7,467,703.69	4,158,548.24	16300
Contoso, Ltd	9,996,750.02	5,670,159.66	124133
Fabrikam, Inc.	12,054,281.48	7,158,976.97	19599
Litware, Inc.	2,134,836.83	1,120,286.89	4020
Northwind Traders	136,571.97	73,528.01	2664
Proseware, Inc.	5,996,829.03	3,513,124.65	19330
Southridge Video	3,112,730.48	1,610,013.07	18339
The Phone Company	4,386,164.26	2,476,148.28	15744
Wide World Importers	5,700,910.02	3,198,143.27	14396
Total	55,391,759.79	31,587,437.29	251126

Challenge 1

The Sales Manager would like to know the answer to the following questions:

1. Which **Manufacturer** has the highest **Sales**?

2. Which **Product Category** has the lowest **Profit** value?

3. Which **Channel** has the highest **Cost of Sales**?

4. Which **Manufacturer** has the highest **Profit**?

5. Which **Promotion Name** has the highest **Sales**?

6. Which **Product Sub Category** has the highest **Profit**?

Formatting Options and Table Styles

New table styles have been introduced that makes it easy to format tables quickly and easily in Power BI.

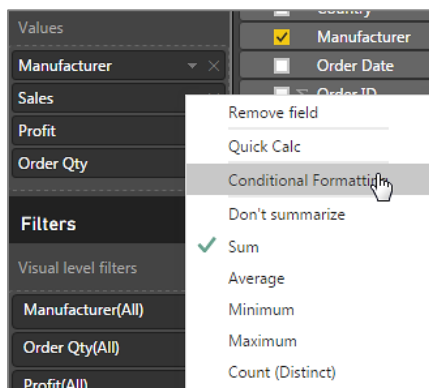
1. Create a Table with **Manufacturer**, **Sum of Sales**, **Sum of Profit** and **Sum of Order Quantity**
2. Select the **Format** icon
3. Select **Table Style** – Experiment with different Table Styles
4. Select the **Bold Table Style**
5. In **Column Headers** – Change the **Font Colour to Black** and the **Background to light blue**
6. In the **Values** select the same light blue for the background and alternating background colours
7. In the **Total** section also select the same light blue for background

Manufacturer	Sales	Profit	Order Qty
A. Datum Corporation	4,404,982	2,608,508	16,601
Adventure Works	7,467,704	4,158,548	16,300
Contoso, Ltd	9,996,750	5,670,160	124,133
Fabrikam, Inc.	12,054,281	7,158,977	19,599
Litware, Inc.	2,134,837	1,120,287	4,020
Northwind Traders	136,572	73,528	2,664
Proseware, Inc.	5,996,829	3,513,125	19,330
Southridge Video	3,112,730	1,610,013	18,339
The Phone Company	4,386,164	2,476,148	15,744
Wide World Importers	5,700,910	3,198,143	14,396
Total	55,391,760	31,587,437	251,126

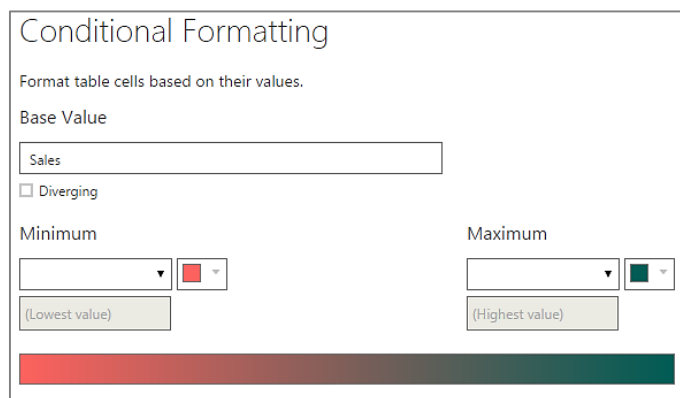
Conditional Formatting

A new conditional formatting option has been added to Power BI. The conditional formatting feature allows the background colours to be changed to range of colours.

1. Select the **Fields** icon
2. Select the **Sales** field
3. Select **Conditional Formatting**



The Conditional Formatting dialog box opens.



1. Set Maximum to Highest Value and select a green color
2. Set Minimum to Lowest Value and select a red color

Manufacturer	Sales	Profit	Order Qty
A. Datum Corporation	4,404,982	2,608,508	16,601
Adventure Works	7,467,704	4,158,548	16,300
Contoso, Ltd	9,996,750	5,670,160	124,133
Fabrikam, Inc.	10,054,280	7,158,977	19,599
Litware, Inc.	2,134,837	1,120,287	4,020
Northwind Traders	136,572	73,528	2,664
Proseware, Inc.	5,996,829	3,513,125	19,330
Southridge Video	3,112,730	1,610,013	18,339
The Phone Company	4,386,164	2,476,148	15,744
Wide World Importers	5,700,910	3,198,143	14,396
Total	55,391,760	31,587,437	251,126

The Sales values are now formatted according to the range of colours that are in the conditional formatting. Experiment with different colours and also use diverging.

Different Methods of Aggregation

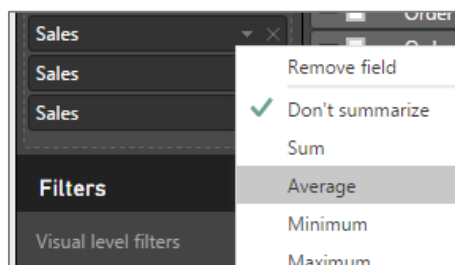
The method of aggregation can be easily changed for numeric fields in Values. The method of aggregation allows different calculations to be easily created .

The following methods of aggregation are supported:

- **Sum**
- **Average**
- **Minimum**
- **Maximum**
- **Count (Distinct)**
- **Count**
- **Standard Deviation**
- **Variance**
- **Median**

In this example the Sales Manager would like to know the what is the **Total Sales**, **Avg Sales**, **Highest Sale**, **Lowest Sale**, **Number of different types of Products sold** and **Number of Orders processed** for each Product Sub Category.

1. Drag the **Product Sub Category** on to the canvas
2. Drag four copies of the **Sales** field into the Table
3. Drag the **Product Name** field into the Table
4. Drag the **Order ID** field in to the Table
5. Change the method of aggregation by clicking on the dropdown icon next to the **Sales** fields



The Distinct Count aggregation is particularly powerful. The Distinct Count function will go through the data set and count each unique occurrence of the data in the set. So for example in this case Power BI will count how many Products each Product Sub Category has. In the second case each unique Order ID will be counted.

Challenge 2

The Sales Manager would like to see the following reports.

1. Create a new Table showing total **Sales** by **Product Name**

- Sort the Table from highest **Sales** to lowest **Sales**. Which **Product** has the highest sales?
-

- Sort the Table from lowest **Sales** to highest **Sales**. Which **Product** has the lowest sales?
-

- Which **Product** is sold in the most **Cities**?
-

2. Create a new Table showing total **Sales** by **Country**

- Change the summarisation method to:
 - **Average** – Which **Country** has the highest average **Sales**?
-

- **Min** – Which **Country** has the lowest minimum **Sales**?
-

- **Max** – Which **Country** has the highest max **Sales**?
-

3. Create a new Table displaying the **Profit by City**

- Which **City** has the highest number of transactions?

- Which **City** has the lowest average **Profit**?

- Which **City** sells the most different types of **Products**

Tables and Cards

Creating a Matrix Table

The Matrix Table allows the user to add fields to Rows and Columns within a Table structure. Users who are familiar with Pivot Tables will recognise the same approach to using Rows and Columns.

1. Create a new Table displaying **Sales by Manufacturer**
2. Add the **Region** field to the Table
3. Change the **Table** to a **Matrix**
4. Place the **Region** field in Column

Manufacturer	Asia	Europe	North America	Total
A. Datum Corporation	1,095,334.34	787,910.52	2,521,737.14	4,404,982.01
Adventure Works	1,641,526.24	1,468,547.30	4,357,630.16	7,467,703.69
Contoso, Ltd	2,189,424.69	1,833,012.39	5,974,312.95	9,996,750.02
Fabrikam, Inc.	2,665,951.48	2,111,089.77	7,277,240.24	12,054,281.48
Litware, Inc.	442,080.44	382,569.57	1,310,186.82	2,134,836.83
Northwind Traders	34,129.32	23,041.98	79,400.66	136,571.97
Proseware, Inc.	1,330,451.05	1,084,498.92	3,581,879.06	5,996,829.03
Southridge Video	626,604.23	570,135.91	1,915,990.34	3,112,730.48
The Phone Company	954,290.95	858,373.56	2,573,499.75	4,386,164.26
Wide World Importers	1,432,552.32	1,076,677.80	3,191,679.90	5,700,910.02
Total	12,412,345.06	10,195,857.72	32,783,557.02	55,391,759.79

Multiple levels of reports can be easily created by placing fields in a nested hierarchy.

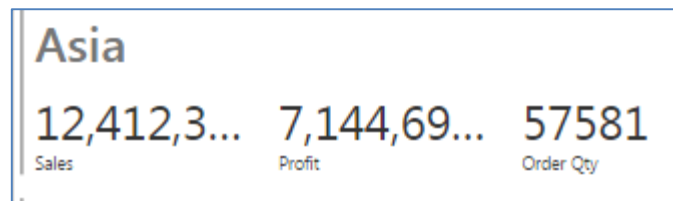
5. Place the **Channel** field after the **Manufacturer** field in Rows

Manufacturer	Channel	Asia	Europe	North America	Total
A. Datum Corporation	Catalog			366,076.97	366,076.97
	Online	423,495.68	304,896.09	308,348.35	1,036,740.13
	Reseller	242,590.36	122,112.42	189,628.15	554,330.93
	Store	429,248.31	360,902.01	1,657,683.66	2,447,833.98
	Total	1,095,334.34	787,910.52	2,521,737.14	4,404,982.01
Adventure Works	Catalog			596,046.60	596,046.60
	Online	433,488.85	559,791.78	641,124.24	1,634,404.87
	Reseller	355,006.33	236,693.58	309,221.37	900,921.27
	Store	853,031.06	672,061.94	2,811,237.94	4,336,330.94
	Total	1,641,526.24	1,468,547.30	4,357,630.16	7,467,703.69
Contoso, Ltd	Catalog			1,014,299.14	1,014,299.14
	Online	754,524.32	612,567.52	888,343.94	2,255,435.79
	Reseller	371,564.08	348,778.19	525,713.06	1,246,055.32
	Store	1,063,336.29	871,666.67	3,545,956.80	5,480,959.76
	Total	2,189,424.69	1,833,012.39	5,974,312.95	9,996,750.02

Creating a Multi Row Card

The Multi row Card is an effective Table for displaying key metric calculations for groups of data such as **Region**, **Product Category** and **Manufacturer**.

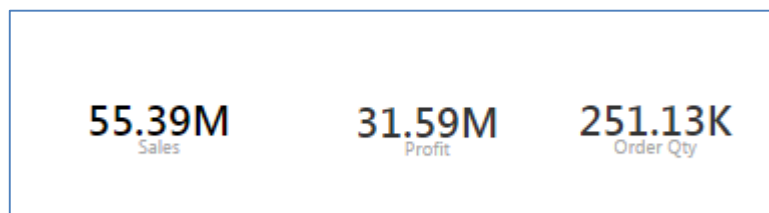
1. Clear any existing **Tables**
2. Create a Table displaying **Region**, **Sales**, **Profit** and **Order Quantity**
3. Change the Table to a **Multi Row Card**
4. Experiment with the different **Font Sizes** and other formatting options



Creating a Card

The Card is also used to display key metric calculations. The Card visualization is only able to display one field.

1. Delete the **Multi Row Card**
2. Click on the **Card** visualization and then select **Sales**
3. Repeat the process for **Profit** and **Order Quantity**



Experiment with the Data Label display and level of precision.

Challenge 3

Experiment with different types of aggregations.

1. Create the following Card visualizations
 - a. Sum of Sales
 - b. Average Sales
 - c. Highest Sale
 - d. Lowest Sale
 - e. Number of Products that have been sold
 - f. Number of Countries that Products have been sold in
2. Create the following Table
 - a. Display for each Product Category the following
 - i. Total Profit
 - ii. Average Profit
 - iii. Highest Profit
 - iv. Lowest Profit
 - v. Number of Products that are Sold
 - vi. Number of Countries that the Products are Sold in
3. Create the following Matrix Table
 - a. Profit by Product Category and Region
 - b. Order Quantity by Manufacturer and Channel
4. Create the following Multi Card visualizations
 - a. Sales and Profit by Product Category
 - b. Sales, Profit and Order Quantity by Channel

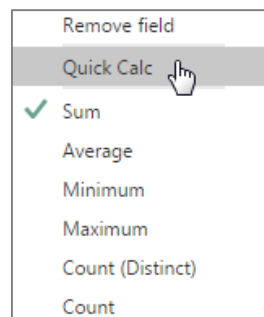
Quick Calc Option

The Quick Calc option allows the user to easily create percentage calculations from tables of data.

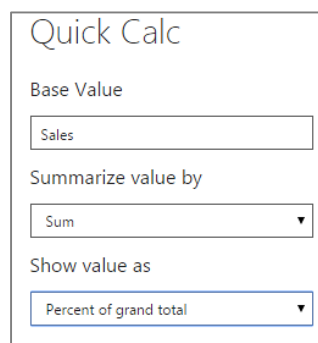
1. Create a Matrix Table
 - a. **Product Category** in Row
 - b. **Channel** in Column
 - c. **Sales** in Values

In this example we now want to understand how much each value contributes to the total.

2. Select the **Sales** field and Select **Quick Calc**



The Quick Calc dialog option is displayed.



3. Select **Show Value as – Percentage of Grand Total**

Product Category	Catalog	Online	Reseller	Store	Total
Audio	0.10%	0.45%	0.29%	1.03%	1.86%
Cameras and camcorders	2.96%	6.35%	3.49%	17.98%	30.78%
Cell phones	0.95%	2.01%	1.53%	6.06%	10.55%
Computers	3.04%	7.75%	5.50%	22.18%	38.47%
Music, Movies and Audio Books	0.20%	0.34%	0.33%	1.05%	1.91%
TV and Video	1.78%	3.87%	1.82%	8.98%	16.44%
Total	9.03%	20.76%	12.95%	57.27%	100.00%

Filtering Data

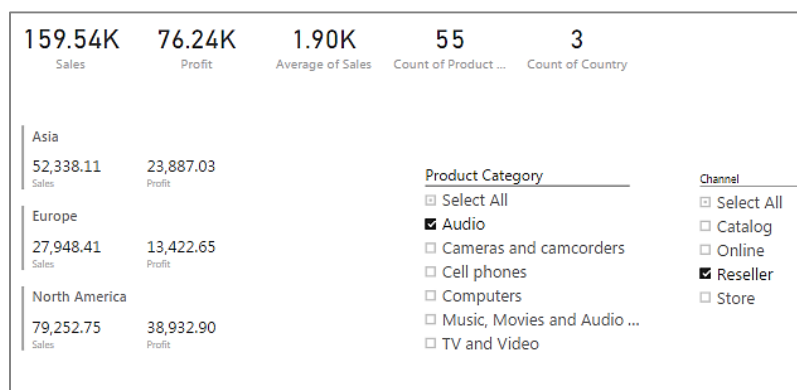
Power BI provides a number of powerful methods to filter data in reports. These methods include the following:

- Slicers
- Table filters
- Page filters
- Report filters
- Cross filters (from specific visualizations)

Slicers

The Slicer is a powerful filtering mechanism that is added within the report

1. Create the following Card visualizations
 - a. **Sum of Sales**
 - b. **Sum of Profit**
 - c. **Average Sales**
 - d. **Number of Products Sold**
 - e. **Number of Countries Sold into**
 - f. Use a **Height of 150** and **Width of 150**
2. Create a Multi Row Card displaying **Sum of Sales, Sum of Profit** for each **Region**
3. Create a Slicer for **Product Category**
4. Add another Slicer for **Channel**
5. Change the **Font Size** on the **Slicers**



Filters

There are three types of filters that can be applied within Power BI. The Visual Filters will filter the Tables and Visualizations for the current Table. The Page filters will filter all the visualizations on a specific page and the Report filters will filter all the Pages within a Report.

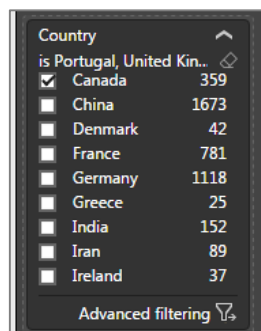
Visual Filters

Visual filters will filter a specific table or visualization.

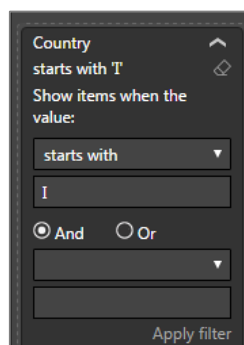
Text Filters

Text filtering allows simple filtering whereby the user can select individual items or more advanced filtering such as items that Start With or Contain specific strings of text.

1. Create a Table displaying **Sales** by **Country**
2. Use the filter to find the following **Countries** – **United Kingdom, Portugal** and **Canada**



3. Filter to display all **Countries** starting with **I**
 - a. Select the **Advanced Filter** and enter **Starts With I**
 - b. Click on the **Apply Filter** button



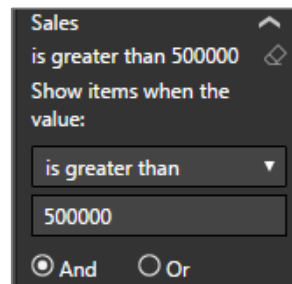
4. Filter the Table to display all **Audio** in the **Product Category** field

- a. Drag the **Product Category** field to Filters
- b. Select **Audio**
- c. Experiment with different **Product Categories**

Numeric Filters

Numeric filters make it easy to filter tables and visualizations according to numeric values. Numeric values use logic such as is equal to, greater than and less than.

1. Display all **Countries** with **Sales** greater than **500 000**

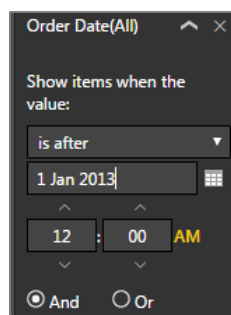


2. Display all **Countries** with **Sales** greater than **100 000**
3. Display all **Countries** with **Sales** less than **80 000**

Dates Filters

Date filters use a date fields to filter the data. Data filters can use logic such as is on, is after or is before.

1. Drag the **Order Date** to the Visual Filter
 - a. Select all dates after the 1 January 2013



2. Drag the **Year** field to the Visual Filter
3. Drag the **Month** field to the Visual Filter

Page Filters and Report Filters

Page Filters will filter all the tables and visualizations that are on a specific Page in Power BI and Report Filters will filter data across all the Pages in a Power BI Report.

1. Go back to the first page of the report

The screenshot shows a Power BI report with a KPI card at the top and a table below. The KPI card displays five metrics: Sales (55.39M), Profit (31.59M), Average of Sales (3.69K), Count of Product ... (1638), and Count of Country (34). Below the KPI card is a table with three rows representing regions: Asia, Europe, and North America. Each row shows Sales and Profit values.

	Sales	Profit	Average of Sales	Count of Product ...	Count of Country
Asia	12,412,345.06	7,144,693.83			
Europe	10,195,857.72	5,773,912.94			
North America	32,783,557.02	18,668,830.51			

2. Delete any additional tables
3. Create a **New Page**
4. Create a Table displaying **Sales** by **Manufacturer**
5. Drag **Country** to Page Filters
6. Experiment with the following:
 - a. **Canada**
 - b. **United Kingdom**
 - c. **Canada** and **United States**
 - d. All **Countries** beginning with I

Challenge 4

The Sales Manager would like you answer the following questions:

1. How many **Cities** have **Profit** over 150 000 and what is the **Total Profit**?

2. What is the **Total Profit** for **Cities** that begin with the letter **S**?

3. Create a table displaying the **Sales** for each **Product Name**. What is the **Total Sales** for **Audio (Product Category)** and how many **Products** are in the **Audio Category**?

4. How many **Products (Product Name)** contain the word **Contoso** and have **Sales** greater than 100 000?

5. What was the **Total Sales** for **1 Jan 2013 to 30 June 2013**?

6. How many **Countries** sold over **50 different types of Products (Product Name)**?

Visualizations

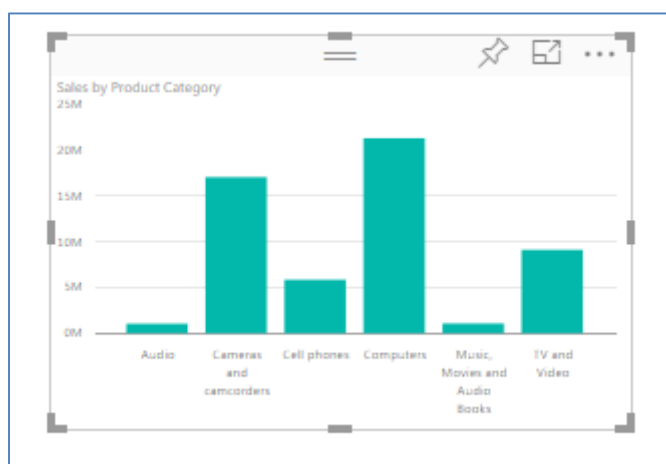
Power BI provides a wide range of different visualizations which assist in understanding, interpreting and gaining insight from your data. It is important to learn what types of visualizations should be used for what type of data. For example, if you want to know which items are biggest or smallest then a column or bar visualization is a good option. If you want to know what the trend is for a specific item over time, then a line or area visualization will be a good option.

Column Graphs

Column graphs are the most effective method for displaying which items are highest, which are lowest and how much larger one item is than another. Column graphs therefore allow us to easily understand the magnitude difference between items,

Column and Bar graphs are therefore used for comparison analysis. Comparison analysis is the most common form of analysis. Whenever we do reports such as Sales by Branch; Sales by Product Category or Sales by Customer Name; we are performing comparison analysis.

1. Create a Table displaying **Sales by Product Category**
2. Change to a **Clustered Column** chart



Review the Formatting Options

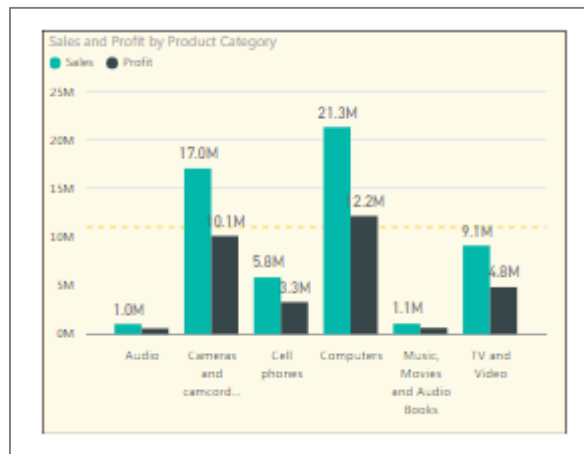
- **X Axis** – Review the X axis options
- **Y Axis** – Review the Y axis options
- **Reference Line** – Create a reference line on the graph. Enter a value of 11 000 000.
- **Data Colours** – Change the colour of the data bars
- **Data Labels** – Turn on and change the font to size 12 and the decimals to 1

- **Title** – Turn on the Title of the graph and other formatting options
- **Background** – Change the background colour and transparency level
- **Lock Aspect** –
- **General** – Change the position, height and width of the graph
- **Border** – Place a border around the graph

More Than One Measure

More than one Measure can be added to a visualization. For example, you could have Sales and Profit both on your graph.

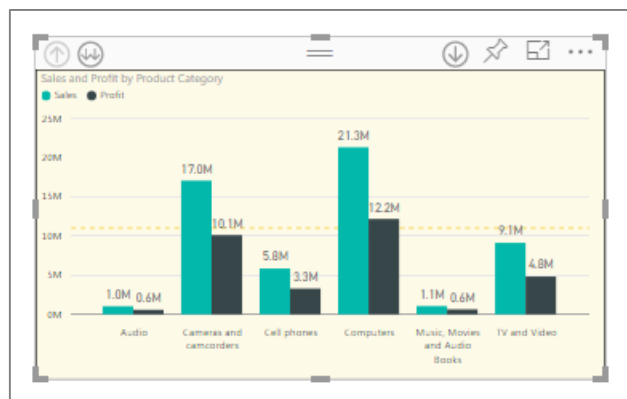
1. Add the **Profit** field to the Values



More Than One Dimension

It is also possible to have more than one Dimension in a visualization. Power BI will only display one field at a time. To access the additional fields; the drill down capability is used. The drill down capability is activated in the top left hand corner of the visualization.

1. Drag the **Product Sub Category** to the Axis under the Product Category



The Legend

The Legend allows an additional field to be added to the graph. In this example the Region field is added which displays the Sales for each Product Category and also for each Region. The Legend allows the user to highlight specific columns of data within the graph.

1. Remove the **Profit** field
2. Drag the **Region** field to the Legend



3. Select the **Asia Region** on the Legend. The **Asia** will be highlighted on the graph

Stacked Bar Graphs

The Stacked Bar graph displays the combined values for the legend. Therefore, it displays the total for the Product Category and how much each Region contributes to the overall total.

The Stacked Bar graph is useful for displaying how much item has contributed to the total.

1. Change the **Clustered Column** to **Stacked Column**

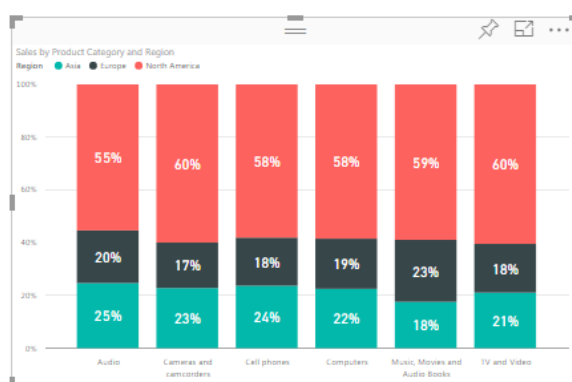


2. Turn the Data Labels on
3. Experiment with highlighting the different Regions

100% Stacked Column Graph

The 100% Stacked Column graph provides a new method to visualize how much a specific item is contributing to the total of the item. In this example you are able to visualize how much each Region contributes to each Product Category. This provides a powerful method of understanding the relative contribution of each Region to the total of the Product Category.

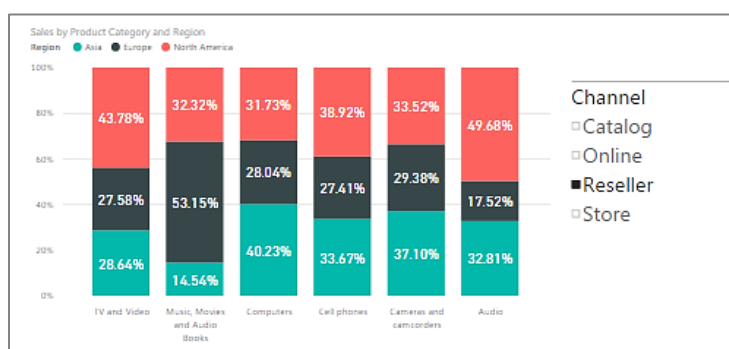
1. Change the visualization to the **100% Stacked Column**
2. Turn on the **Data Labels**
3. Use the **Legend** to highlight items



Working with Slicers

Slicers add new functionality to the visualizing the data. In this example the Reseller channel is selected and the relative contribution of each Region is displayed for each Product Category.

1. Add **Channel** to the Canvas
2. Change to **Slicer**
3. Review the Formatting options for the **Slicer**
 - a. Review the Selection options
 - b. Change the **Font Size** to **18**

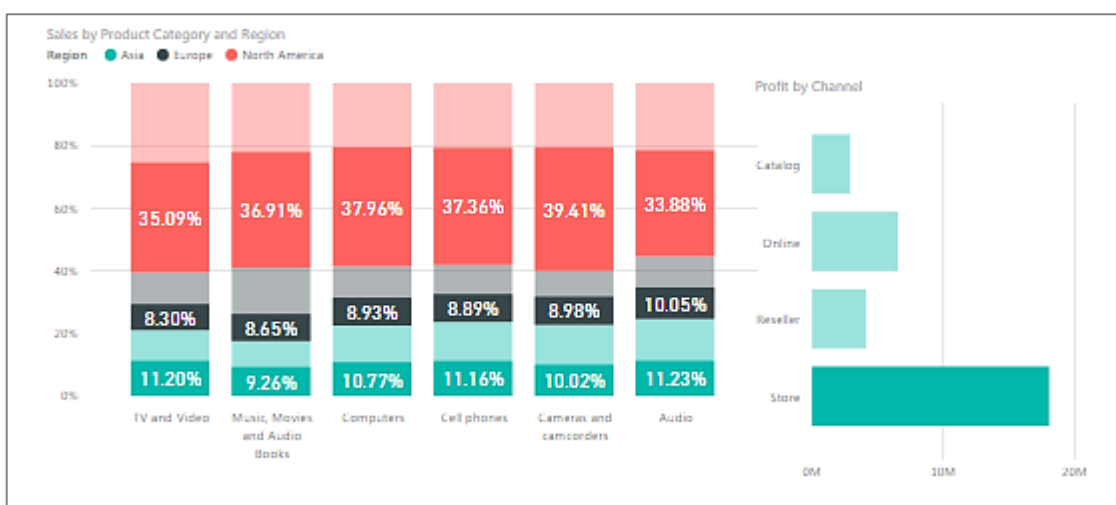


Cross Filtering Between a Column Graph and Bar Graph

Power BI provides powerful cross filtering capabilities between graphs and other graphs; and graphs and tables.

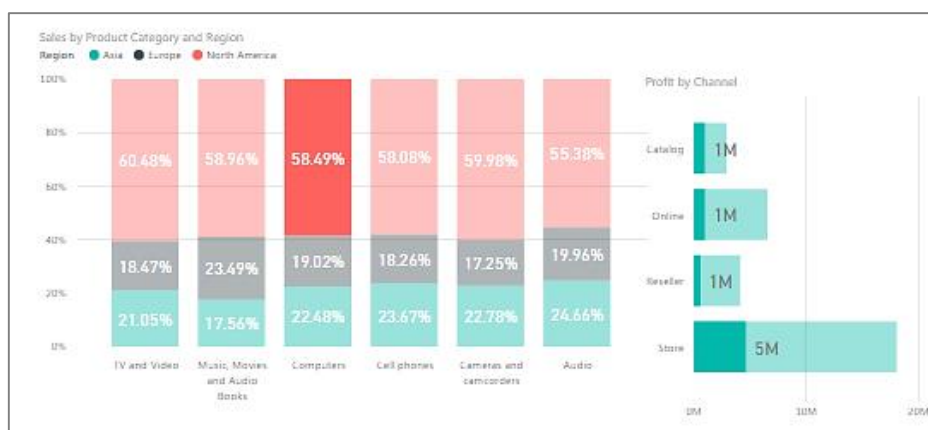
The Bar graph provides the same capabilities as a Column graph and is also used for Comparison analysis. The Bar graph is a Column graph that is horizontal.

1. Remove the **Slicer**
2. Create a Bar graph displaying **Profit** by **Channel**
3. Select the **Store Channel**



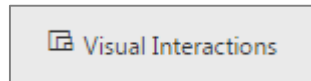
The graph can also be filtered by selecting one of the Product Categories and Regions.

1. Click in the white space of the Bar graph
2. Turn on **Data Labels** for the Bar graph
3. Select the **Computer Product Category and North America Region**

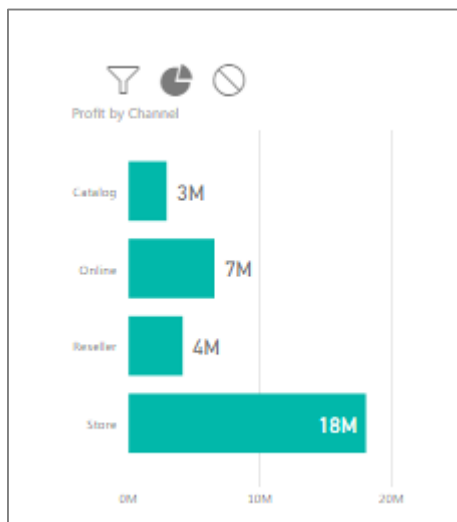


Filtering and Highlighting

The default behaviour is for the graph that is being filtered is to highlight filtered data. The default can be changed to filter the second graph or to have no interaction. The Edit Visual Interactions button allows the user to select how each of these interactions occur.



1. Click the **Visual interactions** button
2. Select the **Sales by Product Category and Region** graph



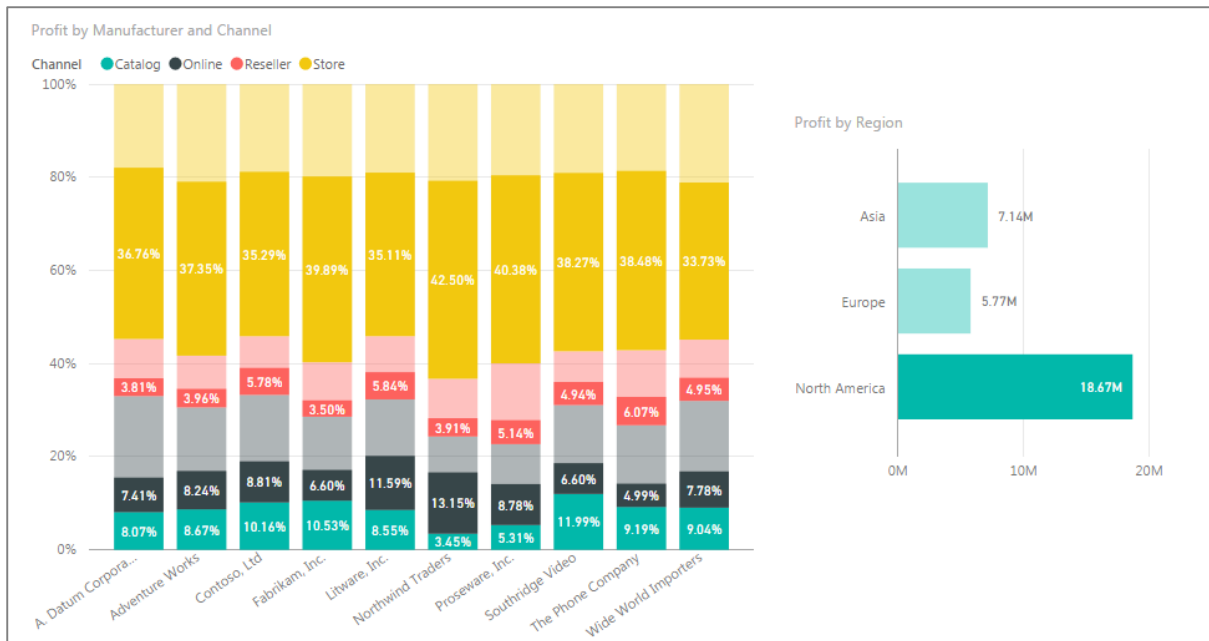
The Bar graph will display the **Filter**, **Highlight** or **No Selection** options.

3. Experiment with each of the three options

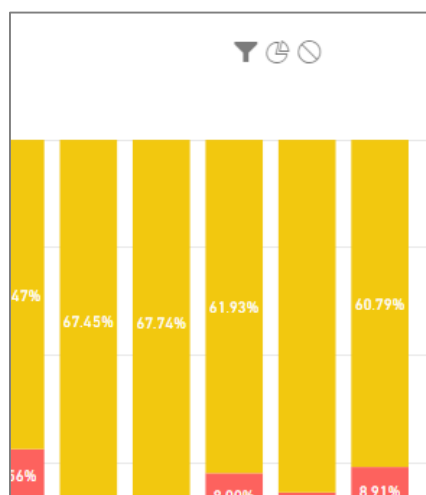
Challenge 5

The Sales Manager has requested the following report to be created:

1. A **100% Stacked Column** graph displaying **Sales** by **Manufacturer** with **Channel** in the Legend
2. A **Profit by Region** Bar graph



3. Edit the **100% Stacked Column** graph so that it is filtered when an item on the Bar graph is selected

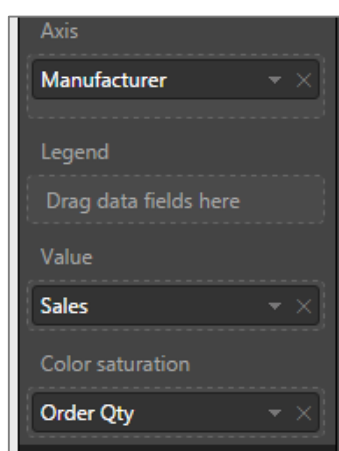


Graph Options

Using Color Gradients

Colour Gradients are a really useful feature to highlight your data according to a different Measure that is not currently part of the graph. For example, you may want to create a Column graph displaying Sales by Manufacturer, but then color the graph according to the Order Quantity sold or the Profit.

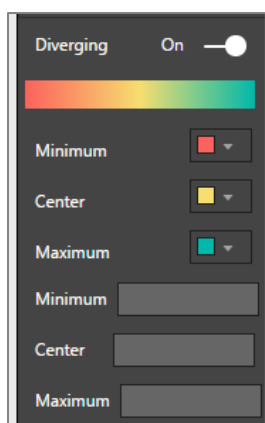
1. Create a Column graph displaying **Sales** by **Manufacturer**
2. Place **Order Quantity** in the **Color Saturation** box



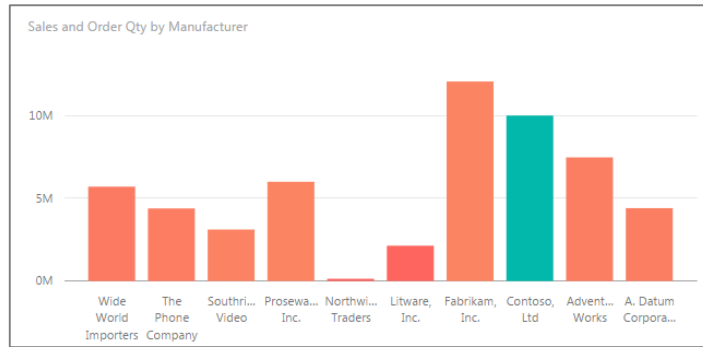
Changing the Color Saturation Gradient

The color saturation colours can be changed in the Format menu option.

1. Select **Data Colors** under the Format menu option
2. Turn diverging on
3. Select Red as the Minimum, Yellow as Centre and Green as Maximum



The resulting graph will display the columns as the selected colors.



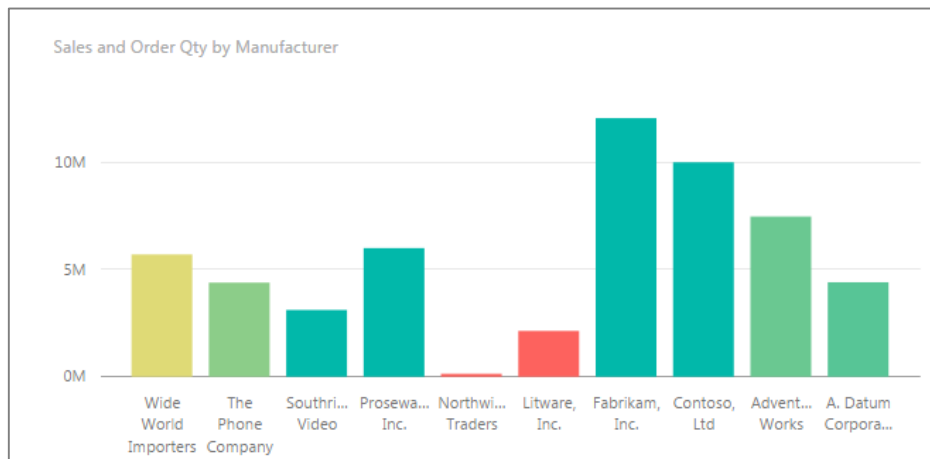
Changing the Rules for Colors

Underneath the data color options there is the ability to enter values for the Green, Yellow and Red. Firstly, let's review the actual Order Quantity for each Manufacturer.

1. Create a new Table displaying **Order Quantity by Manufacturer**

After reviewing the Table lets decide that all Manufacturer who have sold over 18000 are Green, all Manufacturers between 10000 and 18000 are Yellow and less than 10000 are Red.

2. Enter 10000 into Minimum
3. Enter 18000 into Maximum
4. Enter 14000 into Centre

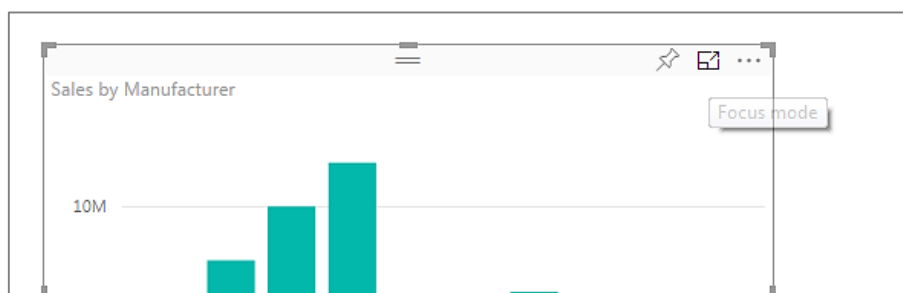


Accessing the Data behind a Graph

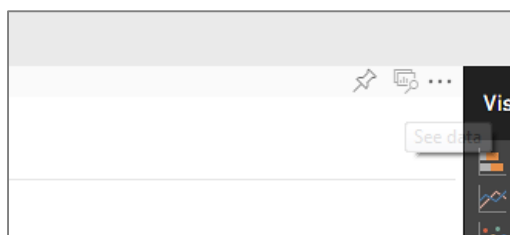
Graphs are great at providing a visual overview of the data and many insights can be created from the use of visualizations. However sometimes you may also wish to view a table of the data for the visualization.

1. Create a Column graph displaying **Sales by Manufacturer**
2. Select the **Focus Mode** icon

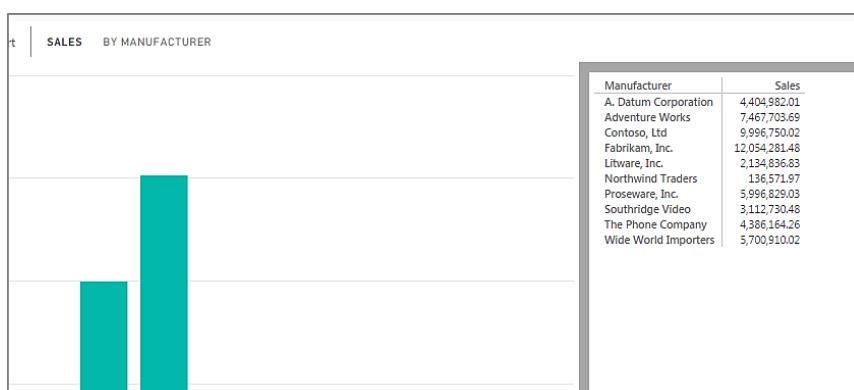
The Focus mode icon will increase the size of the visualization to be the size of the page.



3. Select the **See Data** icon



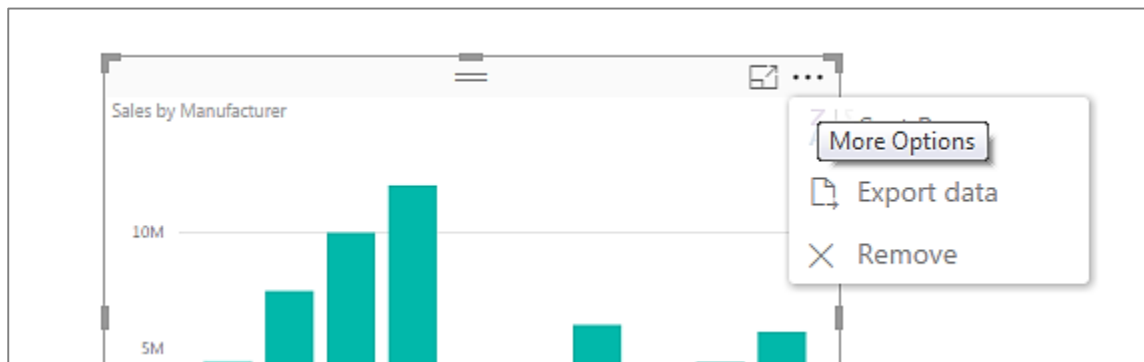
The data is displayed in a Table format and can be displayed in a horizontal or vertical view.



Export Data

Data can be exported from any table or visualization into .csv files.

1. Select the **More Options** in the Top Right hand corner of the graph
2. Select **Export Data**



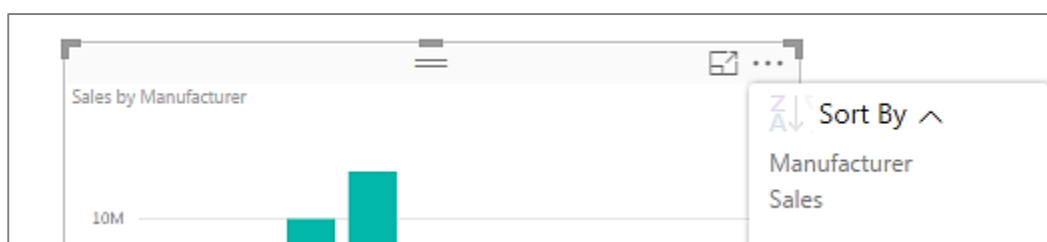
The Save dialog box will open and allow the user to enter a file name for the data.

3. Enter **ManufacturerSales** as the file name

Sorting Options

In the top right hand corner under More Options Power BI also provides the ability to Sort by different fields.

1. Select the **More Options** in the Top Right hand corner of the graph
2. Select



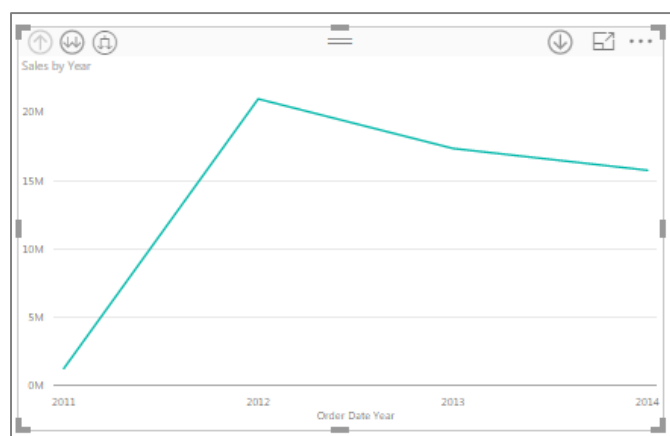
3. Experiment with **Manufacturer** and **Sales**

Trend Analysis – Time Intelligence

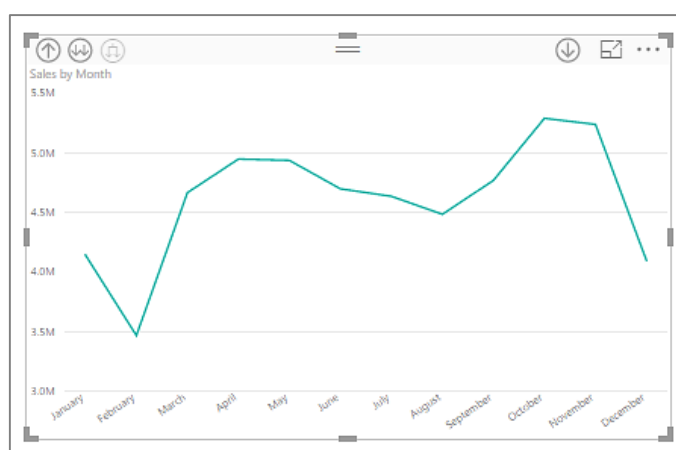
Trend analysis is the ability to see how data changes over time. By analysing how data changes over different time periods; new insight can be gained such as; is Sales climbing, decreasing, staying steady or volatile.

Line charts are effective at displaying how data changes over time. In the data set you will see that there are the following fields - Order Date field, Year and Month. The Year and Month field were created earlier in the course and later in the course we will see how we can create custom fields to represent different elements.

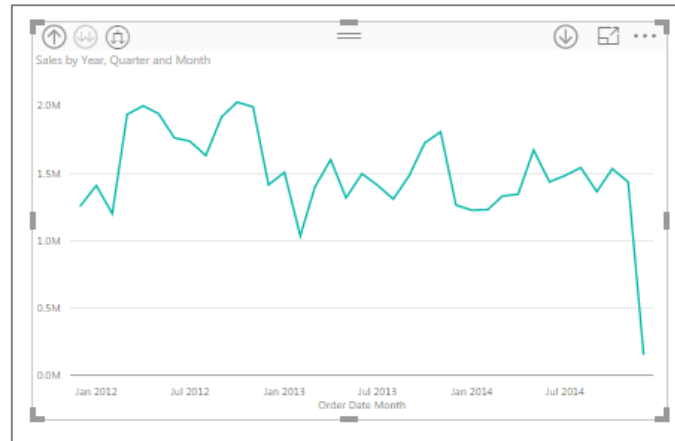
1. Remove any existing graphs
2. Drag the **Order Date** and **Sales** fields into the canvas
3. Select the **Line graph**



4. Select the **Drill Up** and **Drill Down** options

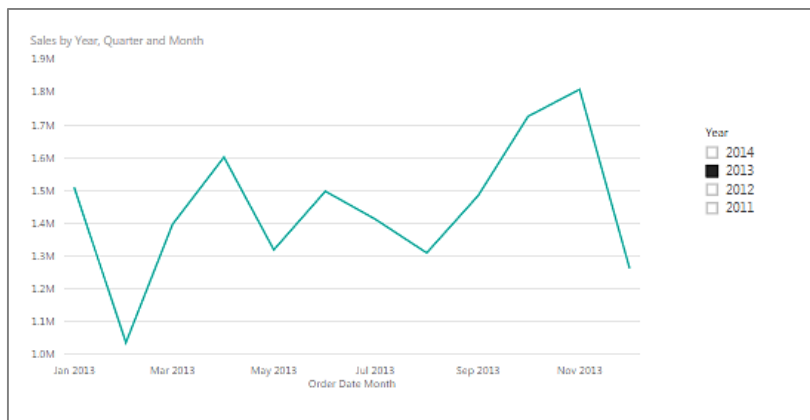


The Inline drill down allows the user to easily drill down to a combination of your dates. For example, Year and Quarter or Year, Quarter and Month.



Time intelligence functions also works well with Slicers.

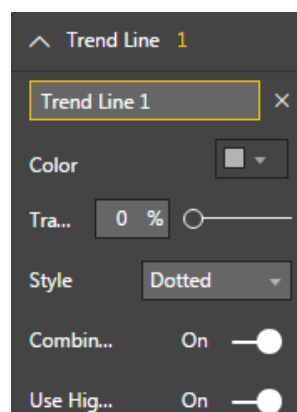
5. Create a Slicer for Year



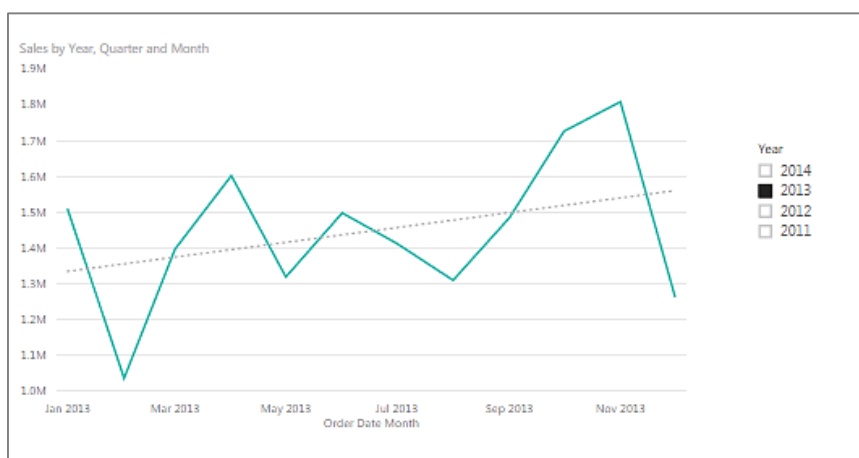
Trend Lines

Linear trend lines can be added to the line graph.

1. Select the **Analytics pane** – Select **Trend line**
2. Add a new trend line to the line graph



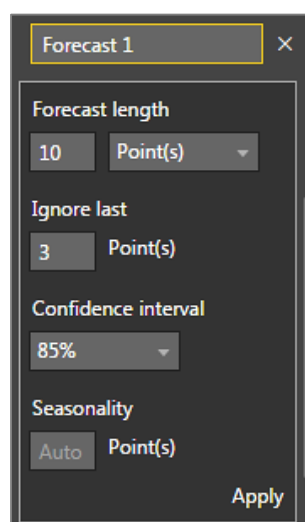
The new trend line is added to the line graph. Experiment with Slicers and also placing different fields in the Legend.



Forecasting

Forecasting provides a future view of data going forward. Forecasting uses the past data to calculate the likely future values for the data.

1. Select the **Analytics pane** – Select **Forecasting**

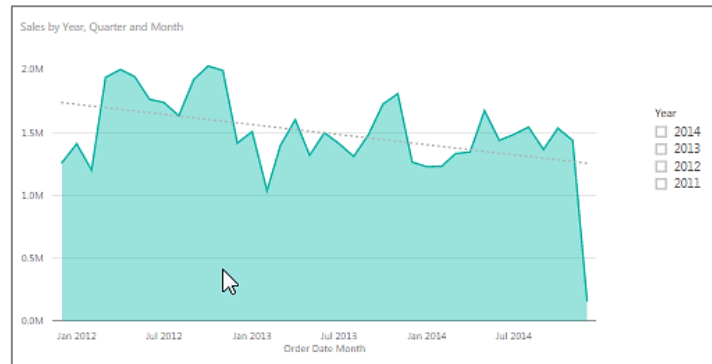


2. Enter the following:
 - a. Forecast length 10 points i.e. Produce a forecast 10 time intervals into the future
 - b. Ignore the last 3 points. This is useful when you do not have complete periods of data and you want to ignore them
 - c. Experiment with different confidence intervals. Confidence interval is a calculation that provides a level of accuracy to the data

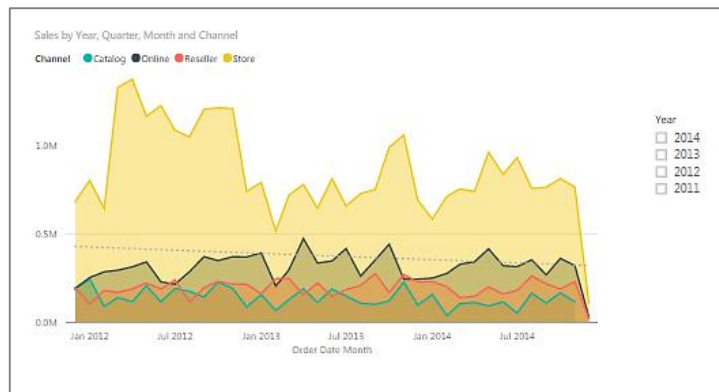
Area Graphs

The Area graph is a useful analysis tool. The Area graph combines the line graph and also colours in the area like a column graph. This is useful as the line provides an understanding of the trend and the coloured area provides an understanding of the magnitude of contribution.

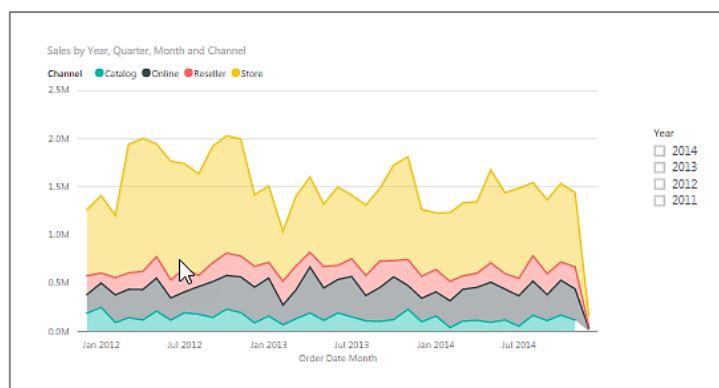
1. Change to the **Area graph**



2. Place the **Channel** field into Legend



3. Change to the **Stacked Area graph**

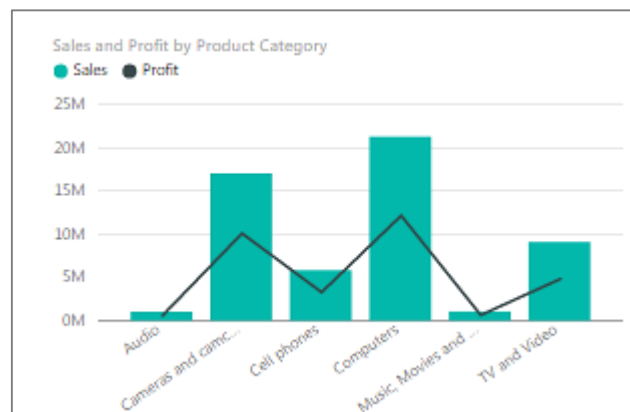


Additional Graph Types

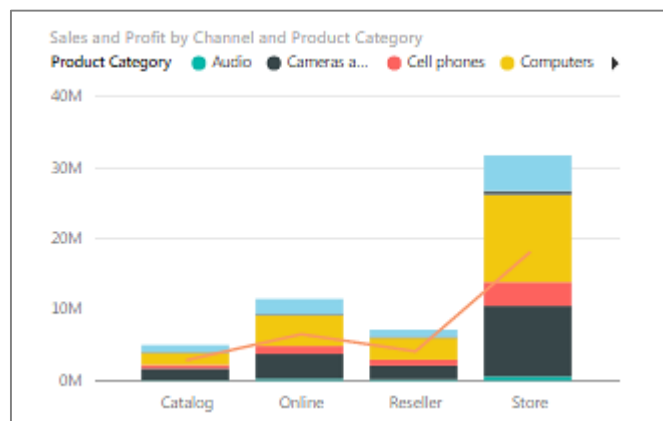
Combination Graph

The combination graph allows a column and line graph to be combined into one graph. For example, you may want to display **Sales** and **Profit** by **Product Category** and to display the **Sales** as a column and **Profit** as a line.

1. Create a Table with **Sales** and **Profit** by **Product Category**
2. Change the visualization to **Combination Graph**



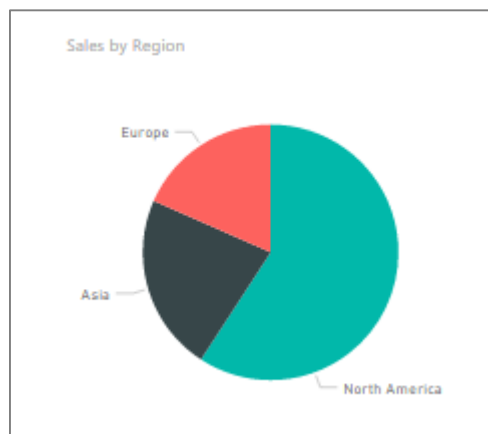
3. Move **Product Category** to Column Values
4. Drag **Channel** to Shared Axis
5. Experiment with a Stacked Column Combination Graph



Pie and Donut Graphs

Pie and Donut graphs are normally used to show how much an item contributes to the total. Pie and Donut graphs should therefore be used to display and visualize percentages. Pie and Donut should also only be used with a few items otherwise they become difficult to read and understand.

1. Create a Table displaying **Sales by Region**
2. Select the **Pie** graph

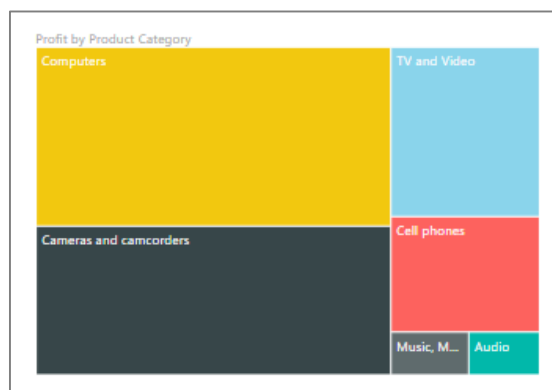


3. Experiment with the **Donut** graph
4. Experiment with cross filtering the Pie graph with a Column graph displaying Sales by Product Category

Treemap Graph

The Treemap graph is another form of visualization that displays the magnitude of the item via the size that it represents in the graph.

1. Create a Table displaying **Profit by Product Category**
2. Select the **Treemap** visualization



Geographical Analysis - Mapping

Geographical analysis allows the user to easily plot data such as **Country**, **City**, **States** and **Zip Codes** on a Map. PowerBI uses the Bing mapping engine to automatically geocode data and to place it on the map.

1. Place **Country** and **Sales** on the canvas
2. Change the visualization to **Map**



3. Experiment with **Channel** in Legend
4. Place **Profit** into **Color** Saturation

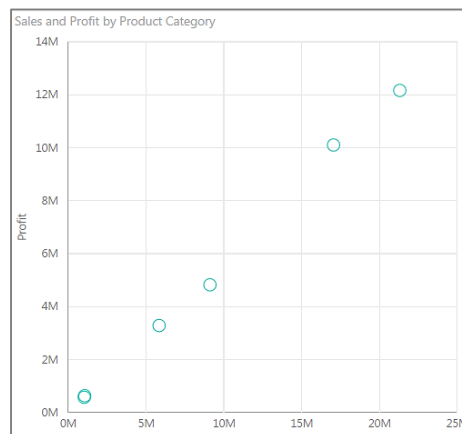
ScatterPlots and BubblePlots

Scatterplots and Bubbleplots are great visualizations for understanding correlations between data. If there is a correlation between as one variable increases, there will also be an increase in the secondary variable. For example, if the Sales value increases we would expect that there would be a corresponding increase in Profit.

Scatterplots are also useful for identifying outliers in data. For example, you may have items with high Sales and low Profit. These maybe items that you would want to focus on.

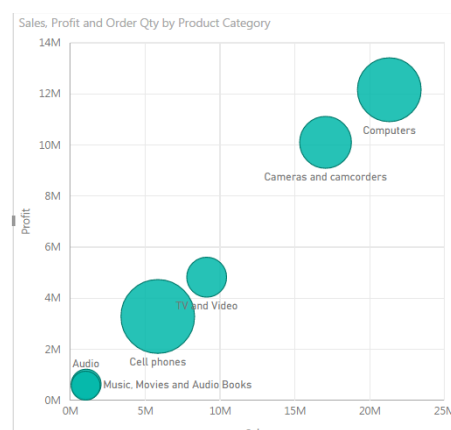
1. Select the Scatterplot visualization
2. Place **Sales** into X-Axis and **Profit** into Y axis
3. Place **Product Category** into Details

A data point is created for each Product Category on the Scatterplot.



The size can also be used to create a bubbleplot visualization.

1. Place **Order Quantity** in the Size field
2. Turn **Category Label** on



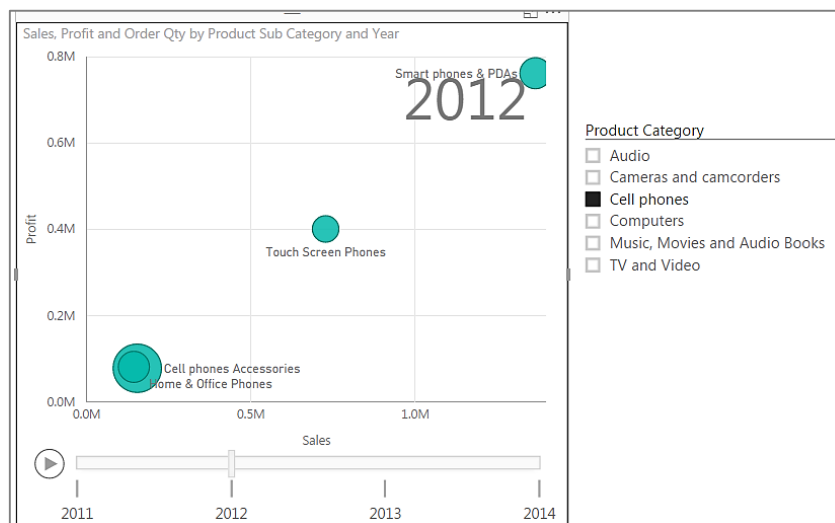
In this example we are going to use the Product Name field with the Manufacturer as a Slicer. This allows the user to easily pick up trends within the data for different Manufacturers. Use the tooltip to display the details of specific data.



The Play Timeline

The Play box allows a date orientated field to display the change of data over time.

1. Place **Product Sub Category** in Details
2. **Sales** in X-Axis and **Profit** in Y-Axis
3. **Order Quantity** in Size
4. Use **Product Category** as a Slicer – Select
5. Place **Year** in Play
6. Turn **Category Labels** on



Challenge 8

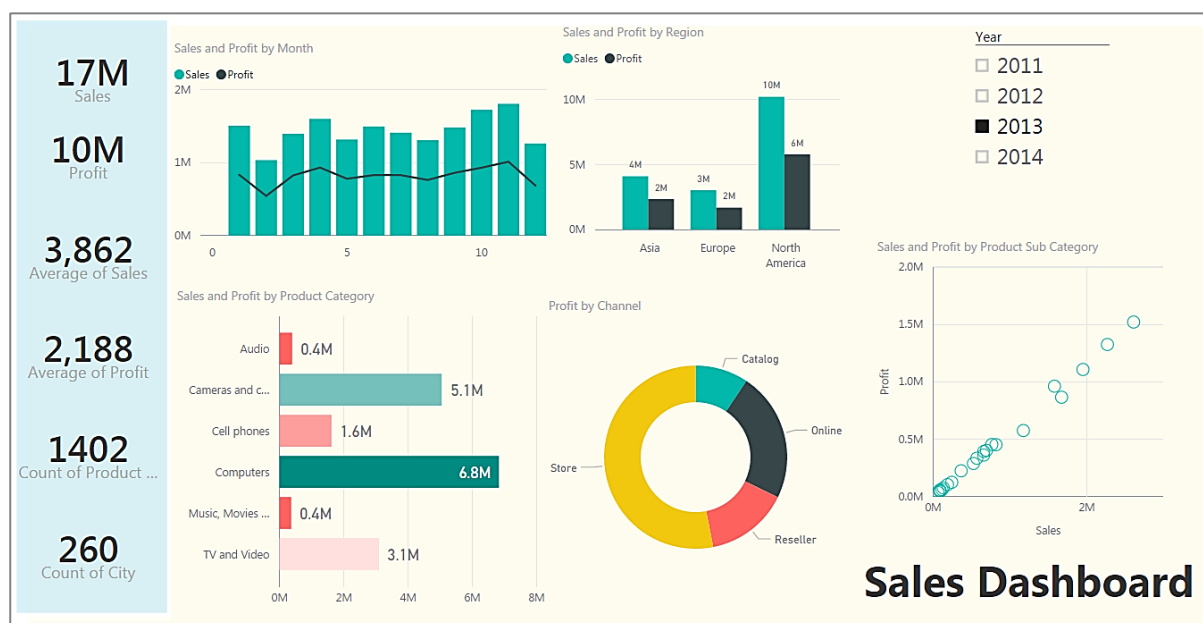
1. Load the **World Bank Indicators** data file
2. Create a Scatter graph comparing **Life expectancy at Birth** to **Finance GDP**
– use the Average aggregation
 - a. Place **Year** in Play axis
 - b. Place **Country** in Details
 - c. Place **Population Total** in Size

3. Compare **Health Mortality under 5** and **Population Urban Count**

4. Compare **Business Phone Subscriptions** and **Business Internet Users**

Creating an Interactive Dashboard

In this activity you are going to create the following interactive dashboard.

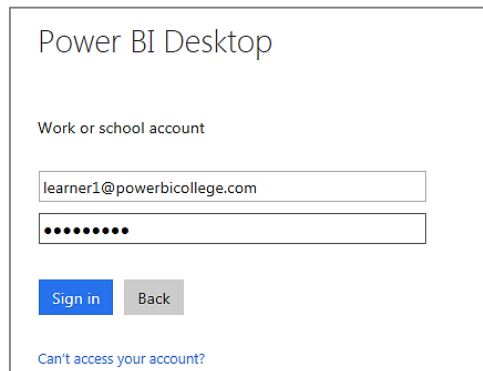


- Create the following Card Visualizations
 - Total Sales
 - Total Profit
 - Average of Sales
 - Average of Profit
 - Number of Products Sold (Product Name)
 - Number of Cities that have been Sold into (Cities)
- Column and Line Graph displaying **Sales** (Column) and **Profit** (Line) by **Month**
- Bar Graph displaying **Sales** by **Product Category** and **Profit** is used for color saturation
- Sales** and **Profit** by **Region** – Column graph
- Profit** by **Channel** – Donut Graph
- Year** as a Slicer
- Sales** and **Profit** as a Scatterplot with **Product Sub Category** in Details
- Add rectangle with different colors to create backgrounds
- Add a Text box to create a heading

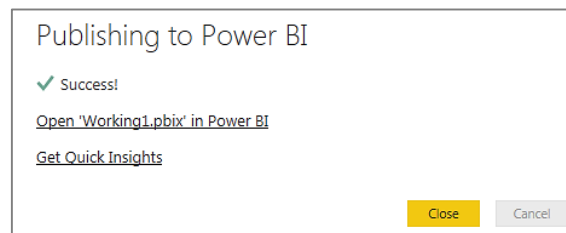
Publishing the Dashboard

Dashboards are published to the Power BI Cloud service.

1. Select the **Dashboard** created in the previous exercise
2. Select **Publish Dashboard**
3. Sign into **Power BI**



The Power BI Desktop sign in will appear. Enter your Power BI login and password details. Power BI will publish the Reports and Data Set to the Cloud Power BI.

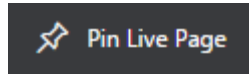


1. Login to **powerbi.com**

You will notice that the data set has been uploaded and that the report is available. The report and data set will be called the same name as you saved the Power BI workbook.

Pinning Visuals to a Dashboard

Tables and visualizations are pinned to dashboards. An entire report can be pinned to the dashboard using the Pin Live Page option.

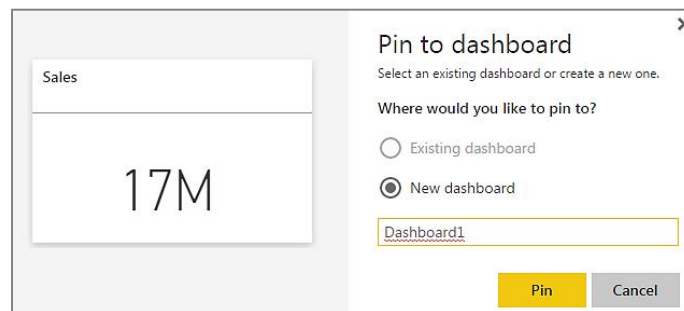


To Pin Individual Tables and Visualizations

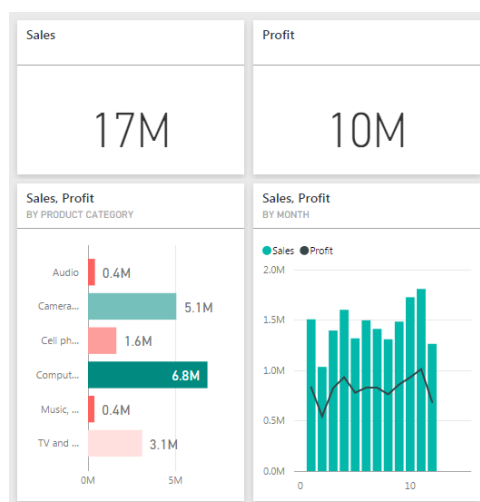
1. At the top of the visualization – Select **Pin Visualizations** for the **Total Sales**



2. Create a new **Dashboard – Dashboard 1**



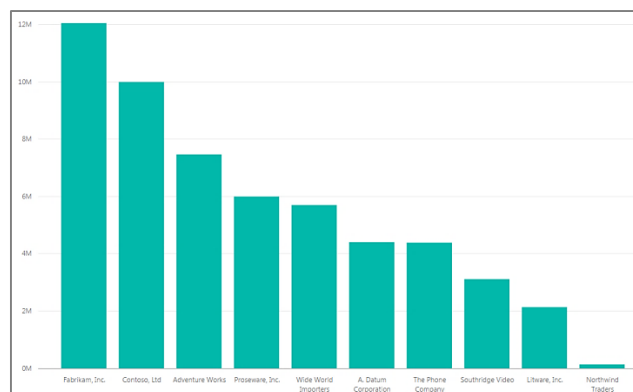
3. Repeat the process for **Total Profit, Sales and Profit by Month and Sales and Profit by Product Category** – Select Existing Dashboard – Dashboard1
4. Go to the **Dashboard** screen



Q & A Feature

The Q & A feature allows users to easily ask questions about the data. Enter the following questions into the Q & A feature:

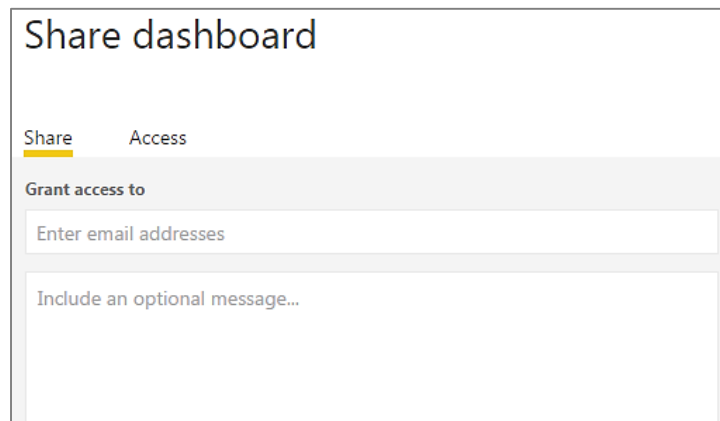
1. Total Sales
2. Total Profit
3. Profit by Channel as Pie
4. Total Sales for United States
5. Total Profit for China
6. Total Sales by Country as Table
7. Total Profit and Total Sales by Country as Table
8. Distinct Count Product Name by City
9. Total Profit by Product Category as Donut
10. Total Sales by Region as multi row card
11. Distinct Count of Product Name by Country as Table
12. Experiment with your own questions



Inviting Other Users

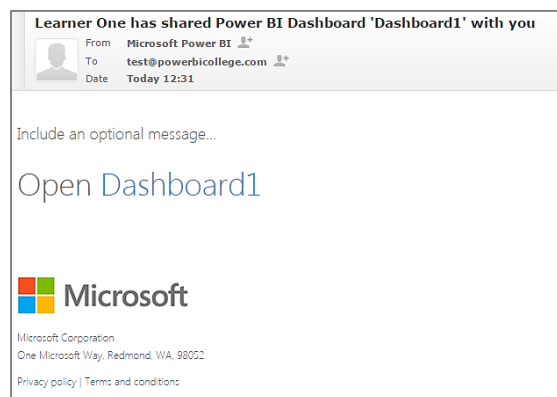
The Share function allows you to invite other users to use the dashboard. In this example you are going to invite a test user to view your dashboard.

1. Select the Share icon
2. Enter test@powerbicollege.com into the email address



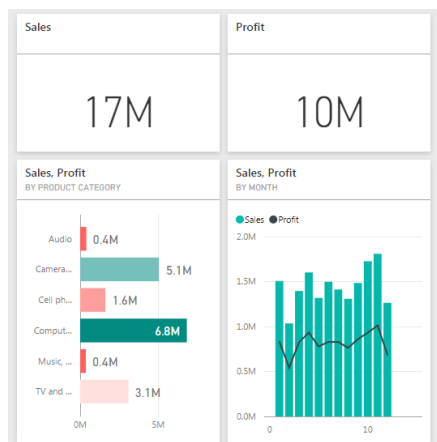
3. Click **Share**

The user will receive an email stating that a Power BI dashboard has been shared with them.



Accessing a Shared Dashboard

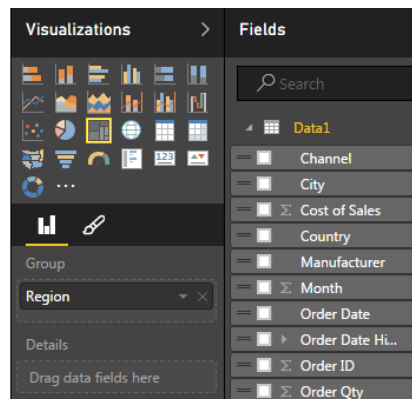
1. Go to Powerbi.com site and login as test@powerbicollege.com



The Dashboard that has been shared is available and the user is also able to use the Q & A feature.

2. Ask the following questions using Q & A
 - a. Total Sales by Product Category as Column
 - b. Total Profit by Region as Treemap

The user is also able to create their own visualization and tables using the fields and visualizations which are to the right hand side.



3. Create the following tables and visualizations
 - a. Matrix displaying Sales by Product Category and Region
 - b. Stacked Column displaying Profit by Region and Channel
 - c. Table displaying Total Sales, Total Profit, Average Sales, Highest Sale and Lowest Sale by Product Name

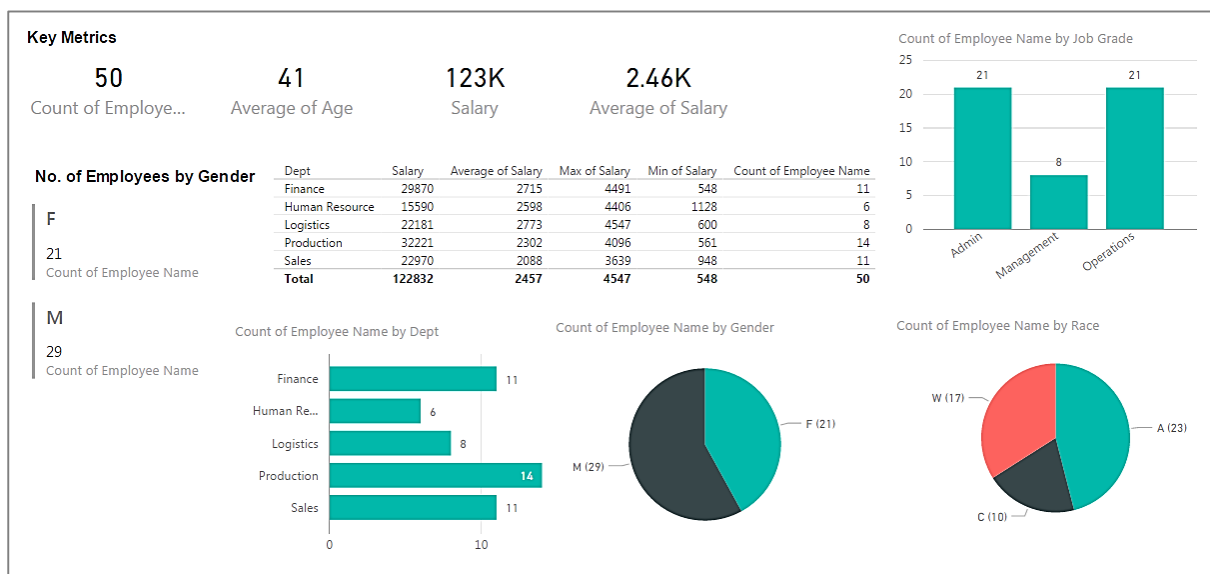
Assignment

The management of your company would like you to analyze the Employee Master spreadsheet file. In the spreadsheet file there are two sheets – Master and Workshops. In this assignment you will only be using the Master sheet.

The management would like you to create the following Cards, Tables and Visualizations in the Power BI Desktop and then to publish the resulting dashboard to the Power BI cloud.

Please create the following dashboard:

1. Cards displaying the following:
 - a. Total number of Employees
 - b. Average Age
 - c. Number of Female Employees
 - d. Number of Male Employees
 - e. Total Salary
 - f. Average Salary
2. A table displaying for each Department the following:
 - a. Total Salary
 - b. Average Salary
 - c. Highest Salary
 - d. Lowest Salary
 - e. Number of Employees
3. A Column graph displaying the Number of Employees per Job Grade
4. A Bar graph displaying the Number of Employees per Department
5. A Pie graph displaying Number of Employees by Gender
6. A Pie graph displaying the Number of Employees by Race



Enhancing Power BI - DAX Formulas

DAX Formula Language

DAX stands for Data Analysis Expressions and is the new formula language for PowerPivot. DAX can use common operators such as addition, subtraction and also includes 135 different functions with a number of functions being similar to Excel.

To add DAX formulas a new column is added to PowerPivot. Each column may only have one DAX formula.

Operators in DAX

DAX uses the standard operators found in Excel. Which makes it easy to create calculations using Excel type logic.

- + addition, - subtraction, * multiplication and / division
- & for text concatenation
- ^ for exponents
- =, >, <, >=, <=, <> as comparison operators
- && creates an AND condition between two expressions that each have a true / false result
- || creates an OR condition between two expressions that each have a true / false result
- ! is a NOT operator. Will turn true into False and False into True

Simple Calculations in DAX

In this exercise we are going to review how to create simple calculations such as multiplication, division, addition and subtraction. In this data source we have to multiply the ListPrice and OrderQty to get the total Sales. We also need to multiply the UnitPrice with the OrderQty to get the total Cost and then deduct the Cost from the Sales to calculate the Profit.

1. Load the **TrainingSample2.xlsx** file into Power BI Desktop Designer
2. Select **Table1** and Select **Load**
3. Go to **Data** – Select the **Modelling** menu option

Region	SubRegion	Market	Customer	Business Segment	Category	Model	Color	SalesDate	ListPrice	UnitPrice	OrderQty
North America	United States	Southwest	Fitness Toy Store	Bikes	Road Bikes	Road-650	Red	10 January 2002	782.99	419.46	
North America	United States	Southwest	Separate Parts Corporation	Bikes	Road Bikes	Road-650	Red	15 January 2002	782.99	419.46	
North America	United States	Southwest	Separate Parts Corporation	Bikes	Road Bikes	Road-650	Red	01 January 2002	782.99	419.46	
North America	United States	Southwest	Separate Parts Corporation	Bikes	Road Bikes	Road-650	Red	24 January 2002	782.99	419.46	
North America	United States	Southwest	Separate Parts Corporation	Bikes	Road Bikes	Road-650	Red	10 January 2002	782.99	419.46	
North America	United States	Southwest	Bike Dealers Association	Bikes	Road Bikes	Road-650	Red	22 January 2002	782.99	419.46	
North America	United States	Southwest	Bike Dealers Association	Bikes	Road Bikes	Road-650	Red	27 January 2002	782.99	419.46	
North America	United States	Southwest	Bike Dealers Association	Bikes	Road Bikes	Road-650	Red	06 January 2002	782.99	419.46	

1. Select **New Column**
2. **Sales = [OrderQty]*[ListPrice]**

Create new Columns for **Cost** and **Profit**

3. Select New Column
4. **Cost = [UnitPrice]*[OrderQty]**
5. Select New Column
6. **Profit = [Sales]-[Cost]**

Creating Time Intelligence Functions

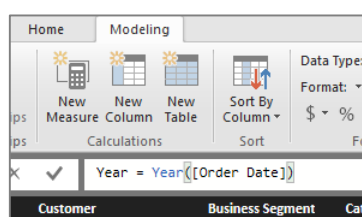
PowerPivot includes a wide range of Date functions. Date functions provide new ability to understand your data over time, to understand trends. The Date functions are very similar to Excel.

Common Date functions

- **Year([field])** – The Year of the Date field
- **Month([field])** – Please note that PowerPivot will return the number of the month i.e. 1 for January, 5 for May etc.
- **Day([field])** – The Day of the month from the Date field
- **Hour([field])** – The hour from the Date field
- **Minute([field])** – The minute from the Date field
- **Second([field])** – The second from the Date field
- **Now()** – Current date and time
- **Today()** – Current date
- **Weekday([Date])** – Returns a number from 1 to 7 identifying the day of the week of a date. By default 1 is equal to Sunday
- **WeekNum([Date])** – Returns the week number of the Year

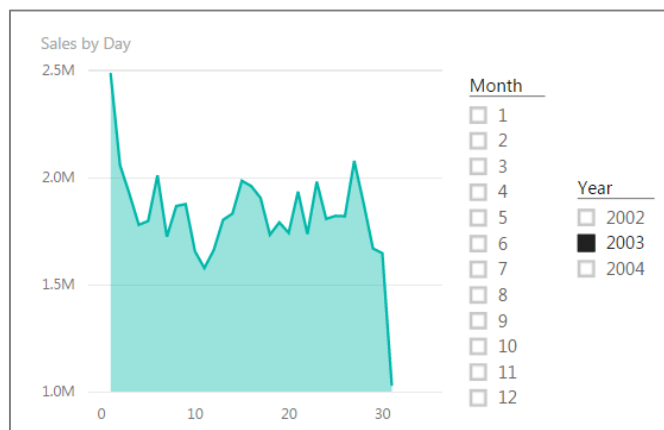
Create the following fields:

1. **Year = Year([Order Date])** – Creates a field for Year
2. **Month = Month([Order Date])** – Creates a field for the Month number
3. **Day = Day([Order Date])** – Creates a field displaying the day of the month
4. **WeekDay = Weekday([Order Date])** – Creates a field displaying the day of the week
5. **WeekNum = WeekNum([Order Date])** – Creates a field displaying the week number of the year.



Challenge

1. Create a Table displaying **Sales** by **Year** and **WeekNum**
2. Create a Column Graph displaying **Profit** by **WeekDay**
3. Create a Column Graph displaying **Sales** by **Product Category** and use **Weekday** as a Slicer
4. Create an Area Graph displaying **Sales** by **Day** – **Year** and **Month** as Slicer



Formatting the Month Number

It is not easy to understand the months being formatted as 1,2,3 etc. It would be much easier to read the Months as January, February, March etc.

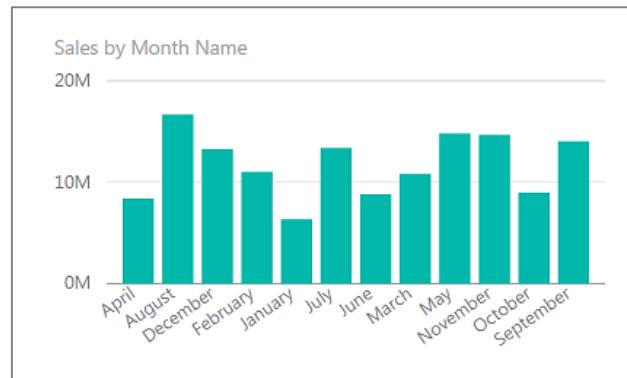
1. Create a formula **Month Name** column
2. `=Format(trainingsample2[SalesDate],"MMMM")`

Formatting the Day Number

1. Create a formula **WeekDay Name** column
2. `=Format(trainingsample2[SalesDate],"DDDD")`

A problem with Month Name and Week Day name is that Power BI does not know the correct order for displaying the Month Names or Week Day names and will display them in alphabetical sequence.

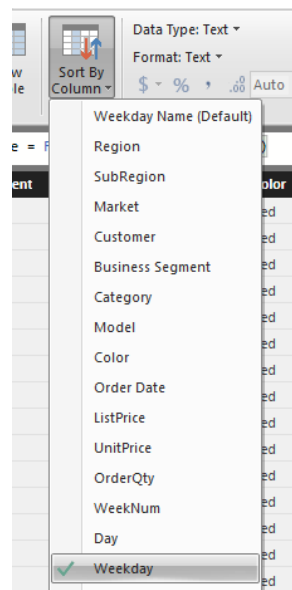
1. Create a Matrix displaying **Sales** by **Year** and **Month Name**
2. Create a Table displaying **Profit** by **Weekday**



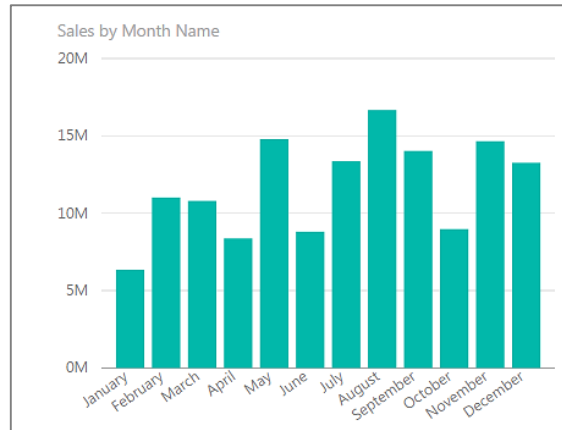
Using the Sort by Column

A method to resolve the problem of month names and weekday names sorting alphabetically is to use the Sort by Column option on the ribbon – under the Modelling menu.

1. Select the **Data** view and the **Modelling** menu
2. Select the **WeekDay Name** column
3. Select **Sort By Column**
4. Select **Sort By – WeekDay**



5. Repeat the process for the **Month Name** column
6. Create a Column graph displaying **Sales** by **Month Name** and **Profit** by **Weekday Name**



Challenge

Please create the following tables and visualizations:

1. **Sales** and **Profit** by **Year** and **Month Name**
2. Area chart displaying **Sales** by **Month Name** with **Year** as a Slicer
3. Column Chart displaying **Profit** by **Product Category** with **WeekDay Name** as a Slicer
 - a. Turn Data Labels on
4. Line Chart displaying **Sales** by **Channel** by **Day** add **Month Name** as a Slicer

Creating a Date Table

To save time when you are creating Date orientated calculations, a master date file can be created. This master file is then linked to the data file and the date fields can be used in Power BI reports.

This functionality uses the Power BI ability to create relationships between tables to allow the user to easily create date orientated tables and visualizations. We are going to look at relationships in more detail in the next section.

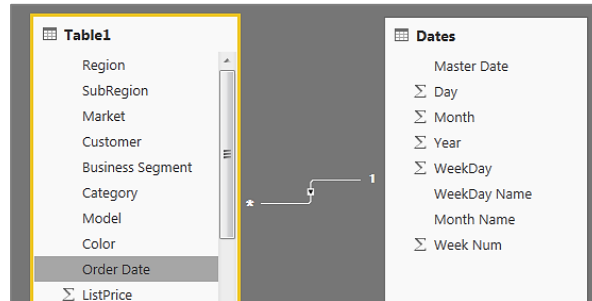
1. The **Date Table** is created in an Excel spreadsheet

Master Date	Day	Month	Year	WeekDay	WeekDay Name	Month Name	Week Num
01-Jan-01	1	1	2001	2	Monday	January	1
02-Jan-01	2	1	2001	3	Tuesday	January	1
03-Jan-01	3	1	2001	4	Wednesday	January	1
04-Jan-01	4	1	2001	5	Thursday	January	1
05-Jan-01	5	1	2001	6	Friday	January	1
06-Jan-01	6	1	2001	7	Saturday	January	1
07-Jan-01	7	1	2001	1	Sunday	January	2
08-Jan-01	8	1	2001	2	Monday	January	2
09-Jan-01	9	1	2001	3	Tuesday	January	2
10-Jan-01	10	1	2001	4	Wednesday	January	2
11-Jan-01	11	1	2001	5	Thursday	January	2
12-Jan-01	12	1	2001	6	Friday	January	2
13-Jan-01	13	1	2001	7	Saturday	January	2

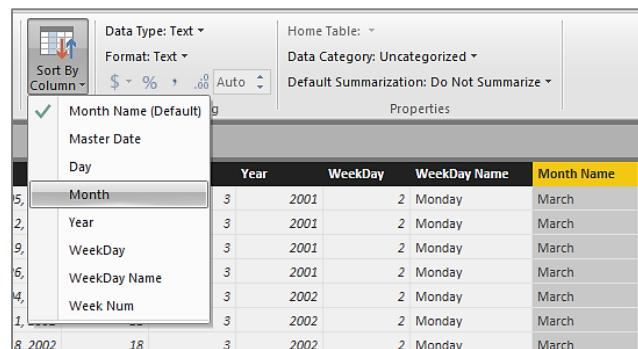
The following formulas are used to create the Date Master:

- **Master Date** – The Master Date must be a continuous range of dates starting with a date that is before the first date in your data source and ending with a date that is larger than the last date in your data source
- **Day** – Calculates the Day of the Month from the Master Date =Day formula
- **Month** – Calculates the Month of the Year from the Master Date =Month formula
- **Year** – Calculates the Year of the Master Date = Year formula
- **Weekday** – Calculates the Weekday number from the Master Date =Weekday formula
- **WeekDay Name** – Calculates the Name of the Weekday from the Master Data =Text formula
- **Month Name** – Calculates the Month Name from the Master Data =Text formula
- **Week Num** – Calculates the week number from the Master Data =Weeknum formula

2. The **Date Master** sheet is loaded into the Power BI Desktop
3. A relationship needs to be created between the **Order Date** and the **Master Date**



4. The Sort By Column for Week Day Name and Month Name needs to be correctly set
 - a. **Weekday Name** sorted by **Weekday**
 - b. **Month Name** sorted by **Month**



5. Create the following:
 - a. Area graph displaying **Sales** by **Month Name**
 - b. Bar graph displaying **Profit** by **Weekday Name**
 - c. Table displaying **Sales** and **Profit** by **Year** and **Weeknum**
 - d. **Year** as a **Slicer**

DAX Measures

DAX measures allow more efficient and powerful calculations to be created in Power BI. The immediate benefit of measures is that the calculation is only performed at the result level and not the table level. If you have two million rows and create a new calculated column, the new column will need to perform the calculation two million times to populate the column. Whereas, a DAX measure will only create one calculation.

For example, if we have 15 000 rows in a data source and we have a Sales column. When we create a Report showing Sales by Manufacturer there will be 15 000 calculations. However, if we use a Measure field there would only be 10 calculations (there are 10 Manufacturers).

There are many different types of DAX formulas, however most of the basic formulas are very close to Excel formulas – which makes it easy to get started.

A list of common DAX formulas:

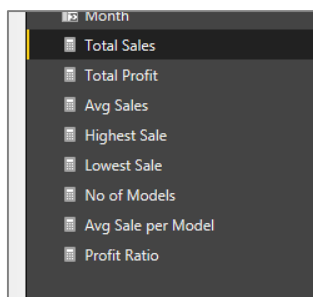
- **Sum - =SUM([Field])**
- **Count - =COUNT([Field])**
- **DistinctCount - =DISTINCTCOUNT([Field])**
- **Average - =AVERAGE([Field])**
- **Min - =MIN([Field])**
- **Max - =MAX([Field])**
- **Divide - =DIVIDE(Numerator[Field], Denominator[Field])**

Getting Started

In this example you will use the Data view and the modelling menu option to create the following Measures:

1. **Total Sales** = Sum([Sales]) – Set the formatting as thousands separator and no decimal
2. **Total Profit** = Sum([Profit])
3. **Avg Sales** = Average([Sales])
4. **Highest Sale** = Max([Sales])
5. **Lowest Sale** = Min([Sales])
6. **DCount Customers** = DistinctCount([Customer])
7. **Avg Sale per Customer** = Divide([Total Sales],[Dcount Customers])
8. **Profit Ratio** = Divide([Total Profit],[Total Sales]) – Set as Percentage

The following list of Measures will be created in your table.



In the Report view you will notice that Measures such as Total Sales and Total Profit will be very similar to using the Sales and Profit field. You will notice with the Measure that you are not able to change the method of aggregation. Most people may see this as a disadvantage. However, remember that the Measure is far more efficient in terms of number of calculations and also that Measures can be used in other Measure calculations.

This is shown by the creation of the **Avg Sale per Customer** and **Profit Ratio** calculations. Previously we would not have been able to create these calculations in our reports.

1. Create a Matrix displaying **Avg Sales per Customer** by **Business Segment** and **Region**
2. Create a Matrix displaying **Profit Ratio** by **Category** and **Region**

Business Segment	Europe	North America	Pacific	Total
Accessories	27,558	91,661	6,672	124,223
Bikes	1,250,749	6,619,291	394,442	7,777,667
Clothing	50,444	204,577	12,165	256,899
Components	57,191	288,547	11,335	350,616
Total	216,412	1,281,864	58,744	1,516,960

Category	Europe	North America	Pacific	Total
Bib-Shorts	40.1 %	40.3 %		40.3 %
Bike Racks	41.8 %	41.1 %	40.2 %	41.3 %
Bottles and Cages	41.4 %	41.2 %	40.1 %	41.2 %
Bottom Brackets	40.0 %	40.0 %	40.0 %	40.0 %
Brakes	40.1 %	40.1 %	40.0 %	40.1 %
Caps	41.8 %	42.3 %	41.3 %	42.2 %
Chains	40.2 %	40.1 %	40.0 %	40.1 %
Cleaners	41.3 %	41.0 %	40.0 %	41.1 %
Cranksets	40.0 %	40.1 %	40.0 %	40.1 %
Derailleurs	40.2 %	40.1 %	40.0 %	40.1 %

The Calculate Formula

The Calculate formula is one of the most useful formulas in DAX. The Calculate formula calculates an aggregation and then filters the result according to the specified criteria. The Calculate formula is often referred to as a supercharged SumIF statement. The syntax for the Calculate formula is as follows:

=Calculate(<aggregate expression>, <filter>,<filter>)

The aggregate expression can include the following:

- **Sum**
- **Average**
- **Count**
- **Min**
- **Max**
- **Distinct Count**

The Calculate formula can therefore be used to create a number of calculations using filters.

For Example

Calculate the total **Sales** for **Australia**

Sales Australia = CALCULATE(sum([Sales]),Table1[SubRegion]="Australia")

Create a Table displaying **Business Segment** and **Total Sales**. Add the new **Sales Australia** field:

Business Segment	Total Sales	Sales Australia
Accessories	993,788	40,032
Bikes	116,665,011	2,366,651
Clothing	3,082,793	72,988
Components	20,335,703	340,053
Total	141,077,295	2,819,725

In this next example, we want to create a calculation displaying only the Profit for 2003. In this example instead of using the =Sum expression, we are able to use the Measure within the Calculate formula.

Calculate the total **Profit** for the **Year 2003**

Profit 2003 = CALCULATE([Total Profit],Table1[Year]=2003)

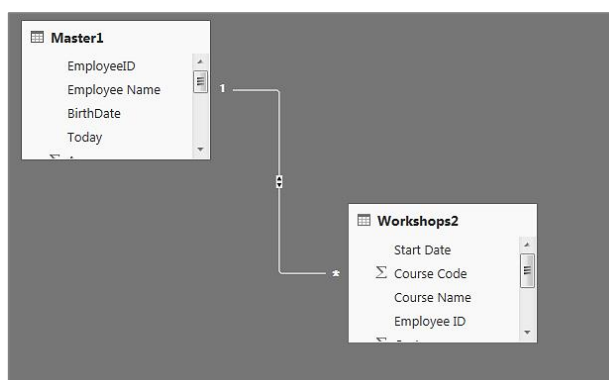
Relationships

In this example we are going to use a Human Resource data source. The data source contains two tables. The first table is a Master table and contains a list of the 50 employees. The second table contains a list of training that Employees have attended.

In this example the **Employee ID** is in both fields so we are going to use the **Employee ID** to create a relationship between the two tables.

1. Start a new session of Power BI
2. Load the **Employee Master** Excel file through the **Get Data** interface

Both tables are loaded into the Power BI data model. Power BI automatically picks up that there is a relationship between the two tables and creates the necessary relationship.



Power BI creates a many to one relationship between the Workshops table and the Master table.

Power BI has named the tables – **Master1** and **Workshops2**. To change the names of the tables:

1. Double click on the Table name – Change the names to **Master** and **Workshop**



Employee Master Challenge

Fields can be used from the two tables to create an interactive dashboard. Create the following dashboard:



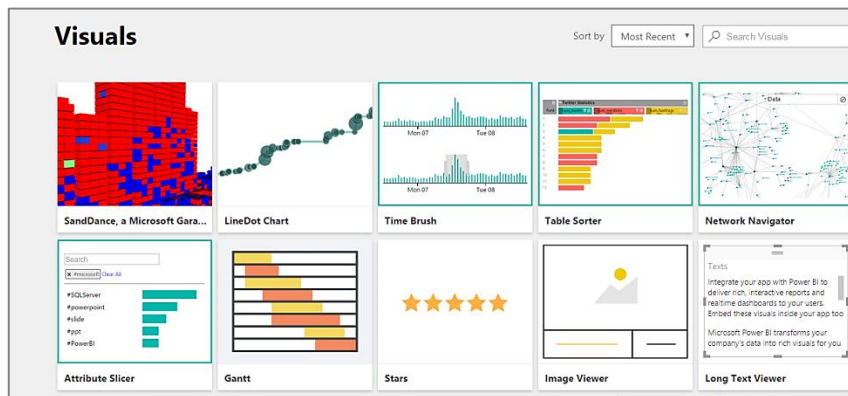
- Create the following calculations:
 - Total Training Cost** – Sum of Cost
 - No of Employees** – Distinct Count of Master Employee ID
 - No of Employed Employees Trained** – Calculates the number of employed employees that have attended training
 - No of Employees Trained** – Counts the number of employees that have attended training. There are 50 employees in the company, but many have the employees have attended training more than once
 - Average Training Cost** – Average of the Cost field
 - Avg Training Cost per Employee** – The Total Training Cost divided by the number of Employed Employees Trained
- Area graph displaying **Training Cost by Month**
- Area graph displaying the **Number of Employees** trained by **Month**
- Column graph displaying the **Training Cost by Dept**
- Pie graph displaying the **Count of Employees** who attended training by **Gender**
- Bar graph displaying the **Cost by Course Name**
- Slicer displaying the **Year**

Creating Custom Visualizations

Power BI provides an open framework for the creation of new visualizations which can be imported into Power BI and used in reports and dashboards.

Power BI Visualization Gallery

1. Go to <https://app.powerbi.com/visuals/>



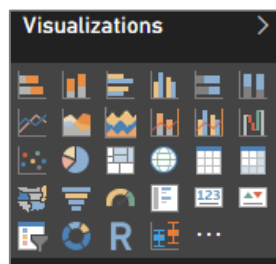
In this example we are going to download a Box and Whisker plot visualization.

2. Select the **Box and Whisker (Brad)** visualization and download

In Power BI Desktop go to the Visualizations option and select the last option which displays ellipses.

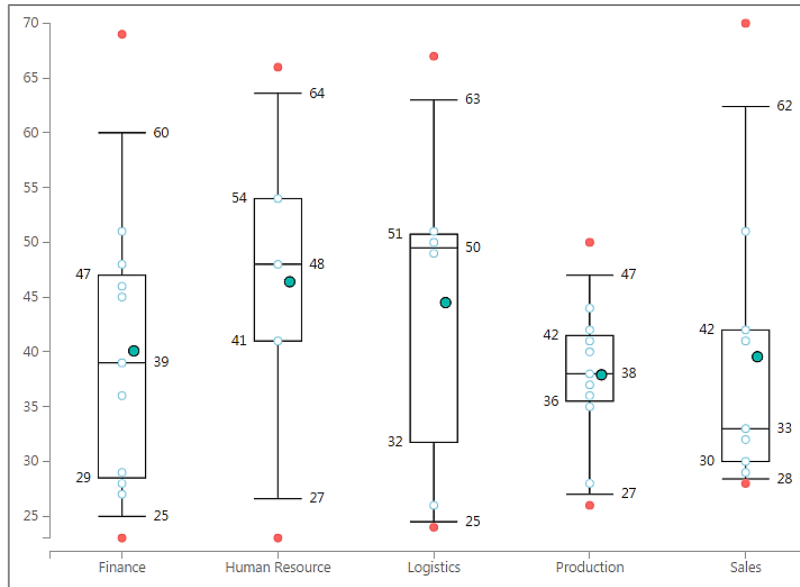
3. Select **Import Visual** – Select the **Box and Whisker visualization** that has been downloaded

The new visualization is displayed on the visualization display.



Creating a Custom Visual

1. Delete the Bar graph displaying the **Cost** by **Course Name**
2. Click on the **Box and Whisker** visualization to select it
3. Place **Dept** in the axis box and **Age** in values



4. Experiment with **Salary**
5. Filter the Box and Whisker using other options such as **Gender**

Enhancing Your Power BI Data

In this last section we are going to review some features that allow you to edit, manipulate and transform your data in Power BI. These features are available in the Power BI Desktop and are available under the Edit Queries icon.

Anybody who is familiar with Excel Power Query will recognise the features. The features in Power BI Edit are exactly the same as Power Query.

Transforming Data

A common task in data analysis is converting and transforming your data so that you can easily create reports and dashboards. Common examples of transformations include:

- Changing the data type i.e. Text, Numeric and Date
- Renaming field names
- Changing the case of text fields
- Replacing values, for example M is Male
- Creating new fields, for example Year and Month from a Date field

In this example we are going to use the Employee Data.csv file

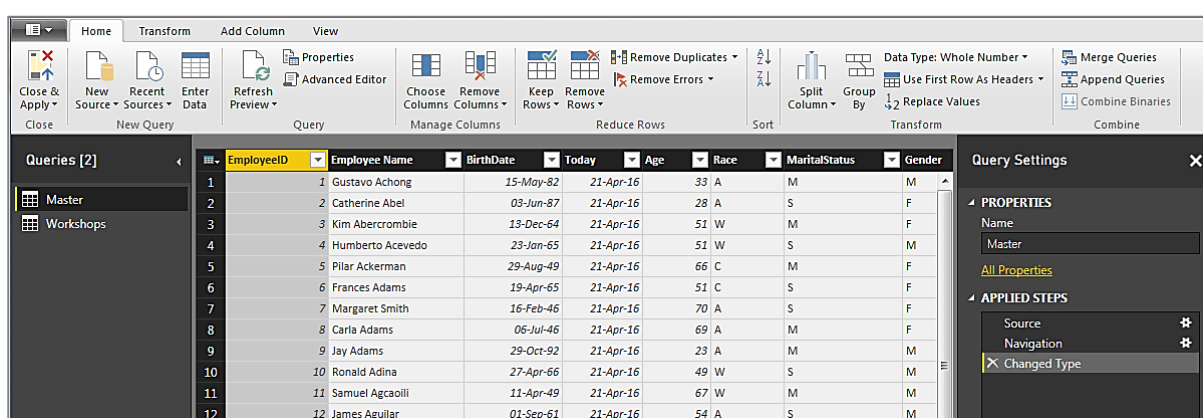
1. Select **Get Date** – Select **Employee Data.csv** – Select **Edit**
2. Convert **Employee ID** to **Text** data type
3. Remove Columns – **NationalIDNumber**, **ContactID** and **LoginID**
4. Rename the **Title** field to **Job Position**
5. Change the **Birth Date** to data type **Date** and **locale** – **English United Kingdom**
6. Change **Marital Status** to **M – Married** and **S – Single**
7. Change **Gender** to **M – Male** and **F – Female**
8. Change the **Hire Date** to data type **Date** and **locale** – **English United Kingdom**
9. Remove the **Modified Date** field
10. Change the *Job Position* field to be in **Upper Case** and to also use the **Trim** formula

Aggregating Data into New Tables

A common requirement when you are working with data is to produce a work with summarised data tables. For example, in our current Employee Master example we may want to create a table that stores the total training cost, highest training cost and lowest training and no of courses attended for each Employee.

1. Select the **Edit Queries** icon
2. The **Query Editor** interface is opened

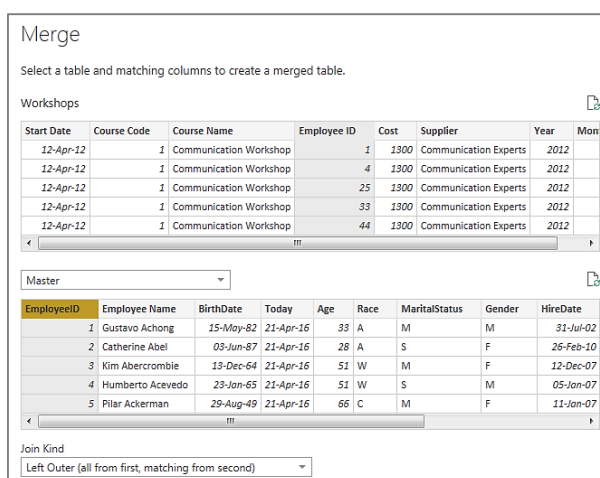
The Query Editor uses the same ribbon and menu structure that the rest of Power BI Desktop uses.



The first requirement is that we require the Employee Name to be in the Workshops table. We are going to use a Merge Query option to access the Employee Name.

1. Select the **Workshops** table
2. Select **Merge Queries**

The Merge Queries dialog box opens.



3. Make sure that **Employee ID** in the **Workshops** table is selected and the **Employee ID** in the **Master** Table
4. Click **Ok**

Supplier	Year	Month	NewColumn
300	Communication Experts	2012	4 Table
300	Communication Experts	2012	4 Table
300	Communication Experts	2012	4 Table
300	Communication Experts	2012	4 Table
300	Communication Experts	2012	4 Table
300	Communication Experts	2012	4 Table

A New Column is created in the Workshops table. Select the NewColumn icon to select the fields to add to the table.

Search Columns to Expand

Expand Aggregate

- (Select All Columns)
- EmployeeID
- Employee Name
- BirthDate
- Today
- Age
- Race
- MaritalStatus
- Gender
- HireDate

5. Select **Employee Name** and remove the Use original name as prefix option

The Employee Name is added to the Workshops table.

6. Select the **Group By** icon

The **Group By** dialog box opens.

Group By

Specify the columns to group by.

Group by +

Employee Name -

New column name	Operation	Column	+
Training Cost	Sum	Cost	-
Number of Courses	Count Rows		-
Avg Training Cost	Average	Cost	-

7. **Group by – Employee Name**
8. **Training Cost – Sum – Cost**
9. **Number of Courses – Count Rows**

10. Avg Training Cost – Average –Cost

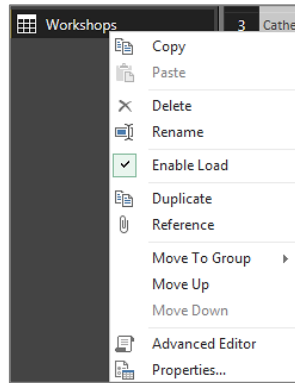
11. Click Ok

	Employee Name	Training Cost	Number of Courses	Avg Training Cost
1	Gustavo Achong	9300	5	1860
2	Humberto Acevedo	7700	5	1540
3	Catherine Abel	4600	2	2300
4	Phyllis Allen	2650	2	1325
5	Kim Abercrombie	12250	6	2041.666667
6	Maxwell Amland	12950	7	1850
7	John Ault	10900	6	1816.666667
8	Pilar Ackerman	4950	3	1650
9	Michelle Alexander	1300	1	1300
10	Frances Adams	14400	6	2400
11	Margaret Smith	14500	7	2071.428571
12	Carla Adams	10100	6	1683.333333
13	Kim Akers	11650	5	2330

Working with Queries and Applied Steps

If you want to keep the original Workshops table, it can be duplicated.

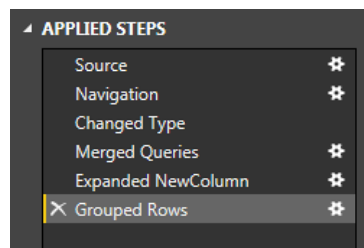
1. Right Click on the **Workshops** table



A list of options is displayed. Select the duplicate option. The table is duplicated.

2. Select the original Workshops table

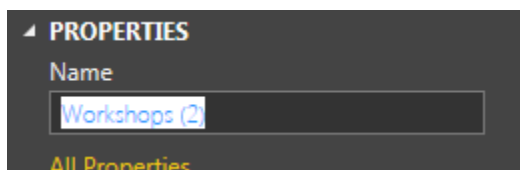
A list of all the steps that have been applied to the data is displayed.



3. Delete the last step – **Grouped Rows**

The Workshops table is returned to the state that it was at before the grouping.

4. Select the **Workshops(2)** query
5. Change the Properties name to **Train Cost by Employee**

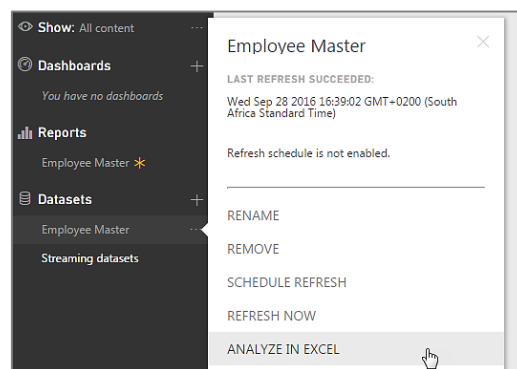


Analysis with Excel

In this lesson we are going to learn how to analyse data in Excel. Power BI provides us with the capability to create powerful online data models using the tools that we have covered in the course so far. These data models actually create a SQL Analysis Services database in the background. These data models can therefore be extremely powerful in developing and creating custom Excel analysis.

In this example we are going to use the Employee Master data that we have been using in previous exercises.

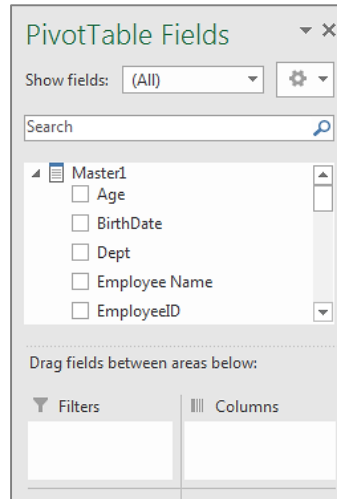
1. Start a new version of **Power BI Desktop**
2. Load the **Employee Master** data – Select the **Master1** and **Workshops2** tables
3. Publish the data to the cloud
4. On the cloud data set select **Analyze with Excel**



The system will prompt you to download the SQL_AS_OLEDB software. Please download and install the software. The software creates the capability for Excel to read the data from the Power BI data set.

Once the software has been download the system will prompt you to download the Microsoft Office Data Connection file. Download this file

1. Start Excel
2. Open the data connection file that was downloaded
3. Excel will provide a warning that there is a security concern. Enable the file
4. An Excel spreadsheet will open with a Pivot Table



The table from the Employee Master file will be opened.

1. Try to create a report displaying the **Cost** (workshops table) by **Department** (Master table)

The Pivot Table does not allow the **Cost** field to be placed in the **Values** box. This is due to the fact that the **Cost** field has to be created as a Measure in the Power BI data model.

Creating Measures in the Data Model

Earlier in the course we reviewed how to create Measures in the Power BI Desktop.

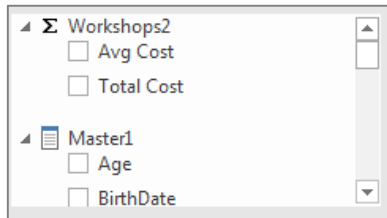
1. Go to the **Power BI Desktop**
2. Select the **Modelling tools**
3. Select **New Measure**



Enter the following Measures into the Workshop Table

1. **Total Cost=Sum(Workshops2[Cost])**
2. **Avg Cost = AVERAGE(Workshops2[Cost])**
3. Publish the data set

Go back to Excel and refresh the data set. To refresh the data set, select Pivot Table Tools and the Analyze menu option. Select the Refresh icon. The new Measures will now be added to the list of fields under the Measures icon.



Create the following Pivot Tables:

- Total Cost for each Department
- Total Cost and Avg Cost for Department
- Total Cost by Course Name
- Total Cost by Department and Gender
