



Data Modeling

by Power BI Team, Microsoft



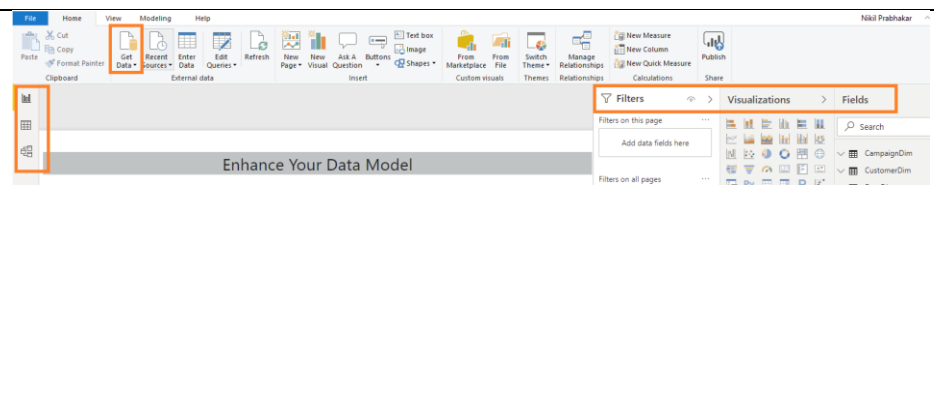
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Demo 1 - Introduction

In this section, explore Power BI Desktop

1. Open Instructor Complete Modeling.pbix file.
2. Give a brief introduction of the tool, navigation between **Report, Data and Model** views.
3. Talk about the options available in the **ribbon**.
4. Talk about **Get Data** – variety of data sources Power BI can connect to.
5. Quick overview of Query Editor.
6. Close Query Editor.

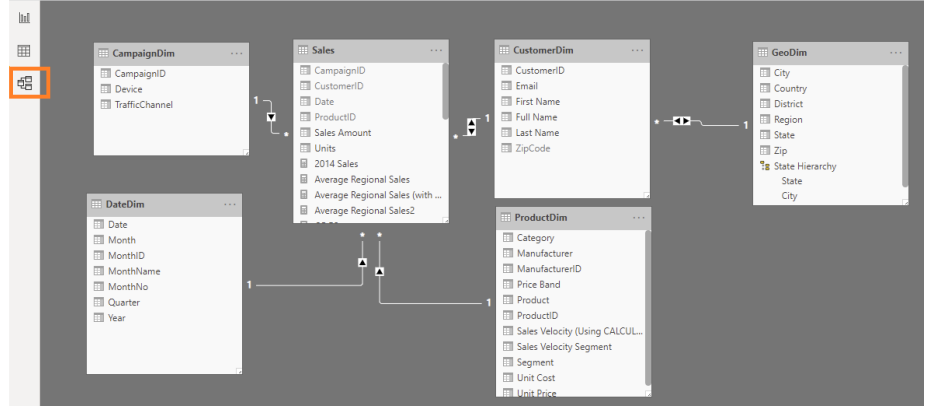


7. Open VanArsdel_Actuals.xlsx file.
8. Talk about the data we will be working with.

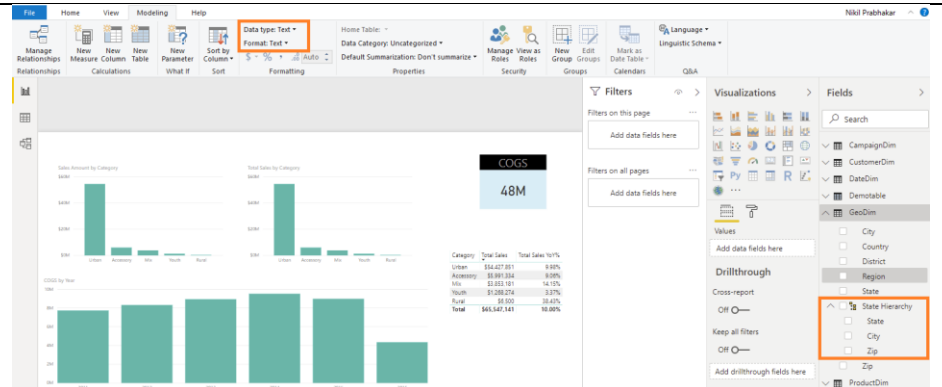
We have VanArsdel sales data by Date, Product, Customer and Campaign. We also have individual Campaign, Product and Customer information. We also have Geographic information for each Customer.

	A	B	C	D	E	F	G
1	ProductID	Date	CustomerID	CampaignID	Units		
2	676	2011-09-25	070283		22 1		
3	449	2011-09-25	195385		22 1		
4	615	2012-05-14	212645		22 1		
5	615	2012-05-14	070666		22 1		
6	615	2012-05-14	114459		22 1		
7	615	2012-05-14	221670		22 1		
8	633	2012-05-14	026974		22 1		
9	443	2012-06-03	268392		22 1		
10	487	2012-06-03	224757		22 1		
11	615	2012-06-02	168008		22 1		

9. Navigate back to Power BI file.
10. Navigate to Model view.
11. Talk about the relationships and schema – details are covered in pptx.



12. Talk about Data types that are available.
13. Using State Hierarchy in Geo Dim talk about hierarchies.



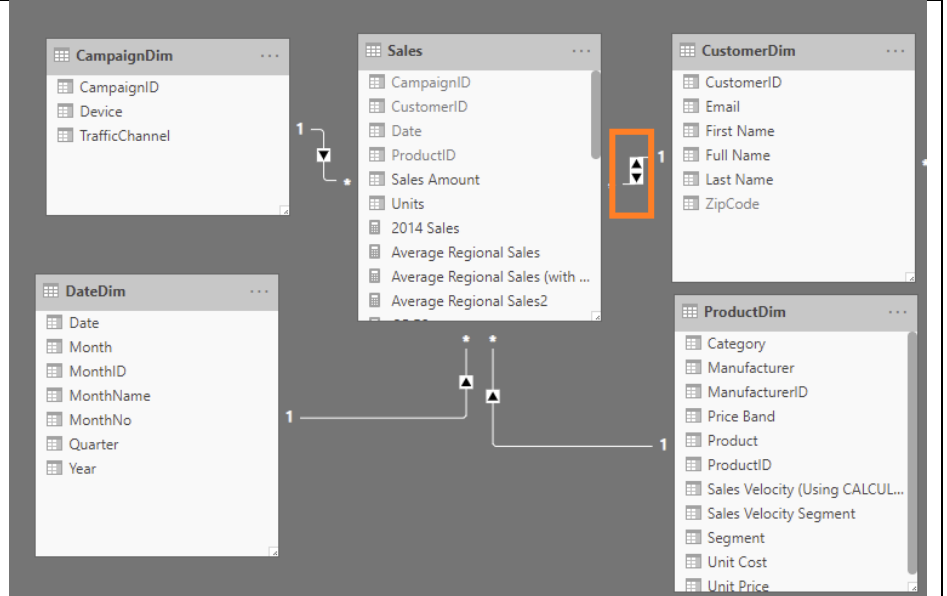
14. Talk about Sort by Column feature using Month Name field in Date table.

The screenshot shows the Power BI Desktop interface with the 'Sort by Column' feature highlighted. The 'Date' table is selected, and the 'MonthName' field is chosen as the sort order. The resulting table shows dates sorted by month name.

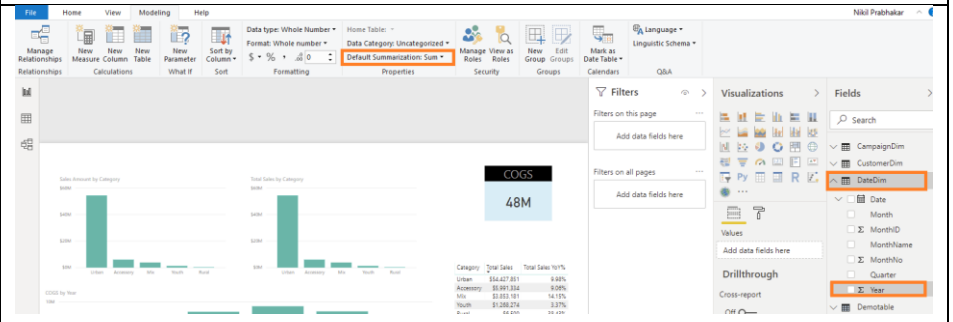
Date	MonthID	Month	Quarter	Year
Friday, July 1, 2011	201107	Jul-11	Q3	2011
Saturday, July 2, 2011	201107	Jul-11	Q3	2011
Sunday, July 3, 2011	201107	Jul-11	Q3	2011
Monday, July 4, 2011	201107	Jul-11	Q3	2011

Demo 2 – Data Modeling

1. Using keys which are integers in each of the Dim table emphasis this helps with compression.
2. Using relationship between CustomerDim and Sales talk about bi-directional filtering.



3. Using Year field from DateDim table, talk about Default Summarization.



Demo 3 – Calculated Column

1. In ProductDim use Price Band field to show case Calculated column.

The screenshot shows the Power BI Query Editor with a table named 'ProductDim'. A new calculated column, 'Price Band', has been added. The formula bar shows the DAX formula: `1 Price Band = If(ProductDim[Unit Price] <=25, "Low", If(ProductDim[Unit Price] <=50, "Medium", "High"))`. The 'Price Band' column is highlighted with an orange border. The table data is as follows:

ProductID	Product	Category	Segment	ManufacturerID	Manufacturer	Unit Cost	Unit Price	Price Band	Sales Velocity Segment	Sales Velocity (Using CALCULATE)
577	Maximus UC-42	Urban	Convenience	7	VanArsdel	74.73	102.37	High	High Velocity	High Velocity
578	Maximus UC-43	Urban	Convenience	7	VanArsdel	57.48	78.74	High	High Velocity	High Velocity
579	Maximus UC-44	Urban	Convenience	7	VanArsdel	96.96	132.82	High	Low Velocity	Low Velocity
580	Maximus UC-45	Urban	Convenience	7	VanArsdel	80.92	83.45	High	Low Velocity	Low Velocity
581	Maximus UC-46	Urban	Convenience	7	VanArsdel	101.54	139.10	High	Low Velocity	Low Velocity

If a question comes up related to how to create a calculated column in "M", then do the following:

2. Open Query editor and create a calculated column using this formula:
if [Unit Price] <= 25 then "Low" else if [Unit Price] <=50 then "Medium" else "High"

Once the column comes in it becomes like any other column in Power BI Desktop file
 The column is compressed
 There is a secondary processing for Calculated Columns – Which makes process times slower

Demo 4 – RELATED Function

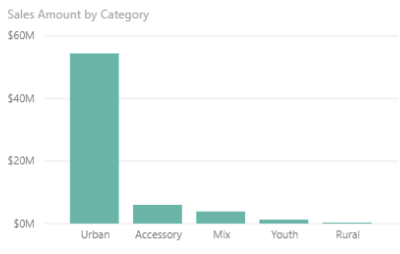
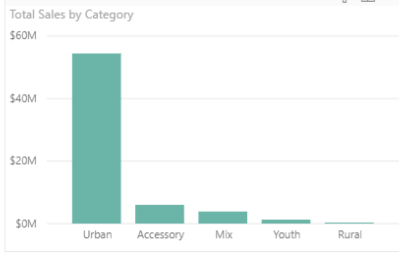
1. In Sales Table write this formula:

Sales[COGS] =
RELATED(ProductDim[Unit Cost]) *
Sales[Units]

ProductID	Date	CustomerID	CampaignID	Units	Sales Amount	COGS C
577	10/29/15	164277	10	1	\$102.37	\$74.73
577	10/29/15	39332	10	1	\$102.37	\$74.73
577	9/17/15	35155	10	1	\$102.37	\$74.73
577	12/24/15	111105	11	1	\$102.37	\$74.73
577	12/24/15	151115	11	1	\$102.37	\$74.73
577	8/27/15	151113	11	1	\$102.37	\$74.73

ProductID	Product	Category	Segment	ManufacturerID	Manufacturer	Unit Cost	Unit Price
577	Maximus UC-42	Urban	Convenience	7	VanArsdel	74.73	102.37
578	Maximus UC-43	Urban	Convenience	7	VanArsdel	57.48	78.74
579	Maximus UC-44	Urban	Convenience	7	VanArsdel	96.96	132.82
580	Maximus UC-45	Urban	Convenience	7	VanArsdel	60.92	83.45
581	Maximus UC-46	Urban	Convenience	7	VanArsdel	101.54	139.10
582	Maximus UC-47	Urban	Convenience	7	VanArsdel	26.06	35.69

Demo 5 – Measures

<div>1. From the Modeling Ribbon, show measure called Total Sales and that resolves to the same values as default summarization.</div> <div>Total Sales = SUM(Sales[Sales Amount])</div> <div>Use visuals in Default Summarization page to talk about this.</div>	<div><div><div>Sales Amount by Category</div></div><div><div>Total Sales by Category</div></div></div>
<div>2. Create a Quick Measure like Total Says YoY% and talk about DAX code and error handling.</div>	<div><div>Quick Measures</div><div><div>Quick Measures are wizard driven DAX calculations</div><div><div><div><div>• Right+Click a table and select Quick Measures</div><div><div>• Select calculation type and fill-in parameters</div><div>• DAX is generated automatically</div><div>• Great way to learn DAX</div></div></div></div><div><div><div>Total Sales YoY% =</div><div><div>1</div><div>var</div><div>CurrentYear = CALCULATE(SUM(Sales[Sales Amount]), FILTER(ALL('DateDim'), 'DateDim'[Date] = MAX('DateDim'[Date])))</div><div>PreviousYear = CALCULATE(SUM(Sales[Sales Amount]), FILTER(ALL('DateDim'), 'DateDim'[Date] = MAX('DateDim'[Date]) - 1))</div><div>Return</div><div>DIVIDE(CurrentYear - PreviousYear, PreviousYear)</div><div>2</div></div></div></div><div><div>Category</div><div>Total Sales</div><div>Total Sales YoY%</div><div>Urban</div><div>\$54,427,851</div><div>9.98%</div><div>Accessory</div><div>\$5,991,234</div><div>9.06%</div><div>Mix</div><div>\$3,853,181</div><div>14.15%</div><div>Youth</div><div>\$1,268,274</div><div>3.37%</div><div>Rural</div><div>\$6,500</div><div>38.43%</div><div>Total</div><div>\$65,947,141</div><div>10.00%</div></div></div></div><div><div>See Quick Measure gallery: https://community.powerbi.com/t5/Quick-Measures-Gallery/bd-p/QuickMeasuresGallery</div></div></div>
<div>3. Create Profit Margin and Profit Margin % measures to explain subtract and DIVIDE functions.</div> <div>4. You can build a visual as well using these measures.</div>	<div><div>Profit Margin = Sales[Total Sales] – Sales[COGS]</div><div>Profit Margin % = DIVIDE([Profit Margin], [COGS])</div></div>
<div>5. Use MobileSalesLastYear formula to talk about use of variables and function like SAMEPERIODLASTYEAR.</div>	<div><div>MobileSalesLastYear =</div><div>VAR MobileProducts = FILTER(ALL('CampaignDim'[Device]), CampaignDim[Device]="Mobile") VAR LastYear = SAMEPERIODLASTYEAR('DateDim'[Date]) RETURN CALCULATE(SUM(Sales[Sales Amount]),MobileProducts,LastYear)</div></div>

6. Use table in “Filter Context” page to talk about Calculated Table vs Measure.

State	Q1	Q2	Q3	Q4	Total
AK	\$6,051	\$11,898	\$8,604	\$4,304	\$30,856
AL	\$32,422	\$52,273	\$49,752	\$26,120	\$160,568
AR	\$22,464	\$32,522	\$30,086	\$18,036	\$103,108
AZ	\$62,549	\$71,799	\$58,935	\$43,109	\$236,392
CA	\$216,261	\$295,311	\$232,784	\$157,366	\$901,742
CO	\$75,268	\$120,971	\$64,908	\$25,770	\$286,917
CT	\$30,895	\$52,445	\$39,984	\$18,419	\$141,742
DC	\$474	\$1,988	\$1,120	\$539	\$4,120
DE	\$7,996	\$15,348	\$12,577	\$9,272	\$45,193
FL	\$245,716	\$238,067	\$185,297	\$165,196	\$834,275
GA	\$71,913	\$92,872	\$74,270	\$47,935	\$286,989
IA	\$61,795	\$105,455	\$70,410	\$27,404	\$265,064
ID	\$22,467	\$26,399	\$17,153	\$7,535	\$73,554
IL	\$124,019	\$260,820	\$169,736	\$70,858	\$625,433
IN	\$65,138	\$120,813	\$82,889	\$34,885	\$303,724
KS	\$38,370	\$70,551	\$44,301	\$21,082	\$174,304
KY	\$30,832	\$64,677	\$48,059	\$22,337	\$165,906
LA	\$55,122	\$83,408	\$45,354	\$28,453	\$212,342
MA	\$27,375	\$57,413	\$33,382	\$15,582	\$133,753
MD	\$33,961	\$63,124	\$61,642	\$30,955	\$189,682
MI	\$83,388	\$181,135	\$96,058	\$34,520	\$395,102
MN	\$62,221	\$104,953	\$73,938	\$29,029	\$271,141
MO	\$81,909	\$129,435	\$99,557	\$39,468	\$340,387
MS	\$23,435	\$34,867	\$24,191	\$13,169	\$95,662
MT	\$19,542	\$29,971	\$21,340	\$8,515	\$79,368
NC	\$73,377	\$128,299	\$94,288	\$53,024	\$348,989
ND	\$23,373	\$44,305	\$17,180	\$5,933	\$90,792
NE	\$26,772	\$41,681	\$29,687	\$13,164	\$111,304
NH	\$1,747	\$2,118	\$1,855	\$735	\$6,454

Demo 6 – CALCULATE Function

1. Use “Calculate-Add” page to talk about Filters and Calculate function.

Month	Total Sales	Desktop Sales	Tablet Sales	Mobile Sales	Year
January	\$3,379,202	\$1,381,652	\$893,415	\$877,470	<input type="checkbox"/> 2011
February	\$4,434,793	\$1,548,177	\$1,357,461	\$1,302,226	<input type="checkbox"/> 2012
March	\$7,848,903	\$2,515,471	\$2,337,589	\$2,311,836	<input type="checkbox"/> 2013
April	\$8,175,811	\$2,447,269	\$2,756,829	\$2,397,852	<input type="checkbox"/> 2014
May	\$8,133,443	\$2,510,006	\$2,770,907	\$2,319,848	<input type="checkbox"/> 2015
June	\$7,847,091	\$2,183,813	\$2,854,769	\$2,281,001	<input type="checkbox"/> 2016
July	\$5,736,090	\$2,166,856	\$1,563,899	\$1,730,509	
August	\$5,739,110	\$1,997,626	\$1,343,671	\$1,637,059	
September	\$4,755,394	\$1,624,118	\$1,453,421	\$1,398,473	
October	\$3,746,354	\$1,161,477	\$1,182,767	\$1,065,431	
November	\$2,968,954	\$808,730	\$829,632	\$990,261	
December	\$2,781,997	\$808,673	\$804,376	\$882,786	
Total	\$65,547,141	\$21,153,869	\$20,148,736	\$19,194,752	

Device
☐ Desktop
☐ Mobile
☐ Tablet

2. Use “Calculate-Ignore” page, use Total Sales and Total Sales All Geo to talk about Calculate and ALL function.
 ALL function ignores filter on ANY column from the GeographyDim table, but allows filters from Year.
 Discuss that this measure can be used to calculate a % of Total measure.

[Total Sales All Geo] = CALCULATE([Total Sales], ALL(GeographyDim))

State	Total Sales	Total Sales All Geo	State	City
UT	\$482,268	\$65,547,141	<input type="checkbox"/> (Blank)	<input type="checkbox"/> ALDEN
VA	\$1,609,751	\$65,547,141	<input type="checkbox"/> AK	<input type="checkbox"/> ALEDO
VT	\$42,233	\$65,547,141	<input type="checkbox"/> AL	<input type="checkbox"/> ALEXANDER
WA	\$1,336,132	\$65,547,141	<input type="checkbox"/> AR	<input type="checkbox"/> ALEXANDER CITY
WI	\$2,297,199	\$65,547,141	<input type="checkbox"/> AZ	<input type="checkbox"/> ALEXANDRIA
WV	\$599,850	\$65,547,141	<input type="checkbox"/> CA	<input type="checkbox"/> ALEXIS
WY	\$351,374	\$65,547,141	<input type="checkbox"/> CO	<input type="checkbox"/> ALGONQUIN
Total	\$65,547,141	\$65,547,141	Year	
			<input type="checkbox"/> 2010	
			<input type="checkbox"/> 2011	
			<input type="checkbox"/> 2012	
			<input type="checkbox"/> 2013	
			<input type="checkbox"/> 2014	
			<input checked="" type="checkbox"/> 2015	
			<input type="checkbox"/> 2016	

*Ignore filter on ANY column from the GeographyDim table, but allows filters from Year

3. Use “Calculate-Ignore” page, use Total Sales, Total Sales All Geo and Total Sales All State to talk about Calculate and ALL function.
 Measure [Total Sales All State] – ignores filter on the STATE column from the GeographyDim table, but allows filters from Year

[Total Sales All States] = CALCULATE([Total Sales], ALL(GeographyDim[State]))

State	Total Sales	Total Sales All Geo	Total Sales All States	State	City
AL	\$206	\$12,304,523	\$15,387	<input type="checkbox"/> LA	<input type="checkbox"/> ALDEN
IN	\$710	\$12,304,523	\$15,387	<input type="checkbox"/> MN	<input type="checkbox"/> ALEDO
KY	\$702	\$12,304,523	\$15,387	<input type="checkbox"/> PA	<input type="checkbox"/> ALEXANDER
LA	\$3,343	\$12,304,523	\$15,387	<input type="checkbox"/> VA	<input type="checkbox"/> ALEXANDER CITY
MN	\$2,545	\$12,304,523	\$15,387		<input checked="" type="checkbox"/> ALEXANDRIA
MO		\$12,304,523	\$15,387	Year	<input type="checkbox"/> ALEXIS
NE		\$12,304,523	\$15,387	<input type="checkbox"/> 2010	<input type="checkbox"/> ALGONQUIN
OH		\$12,304,523	\$15,387	<input type="checkbox"/> 2011	
PA	\$283	\$12,304,523	\$15,387	<input type="checkbox"/> 2012	
SD		\$12,304,523	\$15,387	<input type="checkbox"/> 2013	
TN	\$144	\$12,304,523	\$15,387	<input type="checkbox"/> 2014	
VA	\$7,455	\$12,304,523	\$15,387	<input checked="" type="checkbox"/> 2015	
Total	\$15,387	\$12,304,523	\$15,387	<input type="checkbox"/> 2016	

*Ignore filter on the STATE column from the GeographyDim table, but allows filters from Year

4. Use “Calculate-Ignore” page, use Total Sales, Total Sales All Geo, Total Sales All State and Total Sales All Selected State to talk about Calculate and ALLSELECTED function.

Measure [Total Sales All Selected State] – ignores filter on the STATE column from the GeographyDim table, but allows filters from Year

[Total Sales All Selected States] = CALCULATE([Total Sales], ALLSELECTED(GeographyDim[State]))

State	Total Sales	Total Sales All Geo	Total Sales All States	Total Sales All Selected States
PA	\$283	\$12,304,523	\$15,387	\$7,737
VA	\$7,455	\$12,304,523	\$15,387	\$7,737
Total	\$7,737	\$12,304,523	\$15,387	\$7,737

State

☐ LA

☐ MN

☒ PA

☒ VA

City

☐ ABINGDON

☐ ACCOMAC

☒ ALEXANDRIA

☐ ALQUIPPA

☐ ALLENTOWN

☐ ALLIANTOWN

Year

☐ 2010

☐ 2011

☐ 2012

☐ 2013

☐ 2014

☒ 2015

☐ 2016

*Ignore filter on the STATE column from the GeographyDim table, but allows filters from Year

5. Use “Calculate-Update” page, to show that the filter context in the measure. Compare Total Sales to 2014 sales and how Year slicer has no effect on 2014 Sales.

[2014 Sales] = CALCULATE([Total Sales], DateDim[Year] = 2014)

Month	Total Sales	2014 Sales
January	\$617,594	\$624,956
February	\$846,436	\$817,549
March	\$1,382,885	\$1,245,627
April	\$1,512,488	\$1,400,954
May	\$1,589,728	\$1,510,563
June	\$1,402,897	\$1,481,390
July	\$1,122,721	\$1,281,466
August	\$1,222,190	\$1,273,948
September	\$865,028	\$1,201,762
October	\$712,729	\$916,774
November	\$562,400	\$714,021
December	\$467,428	\$575,281
Total	\$12,304,523	\$13,044,290

Year

☐ 2010

☐ 2011

☐ 2012

☐ 2013

☐ 2014

☒ 2015

☐ 2016

*Ignores filter on the Year Slicer

Demo 7 – CALCULATED Table

1. Create a new Table Demo Table = ALL(GeoDim)

Notice a new table is created with a new memory footprint. You can create relationships, etc just like any other table.

ProductID	Date	CustomerID	CampaignID	Units	Sales Amount	COGS C
577	10/29/15	164277	10	1	\$102.37	\$74.73
577	10/29/15	3934	10	1	\$102.37	\$74.73
577	9/17/15	30	10	1	\$102.37	\$74.73
577	12/24/15	11	11	1	\$102.37	\$74.73
577	12/24/15	10	11	1	\$102.37	\$74.73
577	8/27/15	10	11	1	\$102.37	\$74.73

ProductID	Product	Category	Segment	ManufacturerID	Manufacturer	Unit Cost	Unit Price
577	Maximus UC-42	Urban	Convenience	7	VanArsdel	74.73	102.37
578	Maximus UC-43	Urban	Convenience	7	VanArsdel	57.48	78.74
579	Maximus UC-44	Urban	Convenience	7	VanArsdel	96.96	132.82
580	Maximus UC-45	Urban	Convenience	7	VanArsdel	60.92	83.45
581	Maximus UC-46	Urban	Convenience	7	VanArsdel	101.54	139.10
582	Maximus UC-47	Urban	Convenience	7	VanArsdel	26.06	35.69

2. Explain difference between HASONEVALUE and SELECTEDVALUE functions

Header (HASONEVALUE) =

```
IF (
    HASONEVALUE ( ProductDim[Price Band] ),
    CONCATENATE (
        "Report Header for Price Band : ",
        VALUES ( ProductDim[Price Band] )
    ),
    "Overall Report"
)
```

Header (SELECTEDVALUE) =

```
VAR selectedPriceBand =
    SELECTEDVALUE ( ProductDim[Price Band] )
RETURN
    IF (
        ISBLANK ( selectedPriceBand ),
        "Overall Report",
        CONCATENATE ( "Report Header for Price Band: ",
            selectedPriceBand )
    )
```