

Data Modeling with Power BI Desktop



Agenda

- Creating Table Relationships
 - Creating Calculated Columns and Measure
 - Creating Tables using DAX Expressions
 - Configuring Fields for Geographic Mapping
 - Creating Dimensional Hierarchies
 - Using the DAX Calculate Function
 - Calendar Tables and Time Intelligence



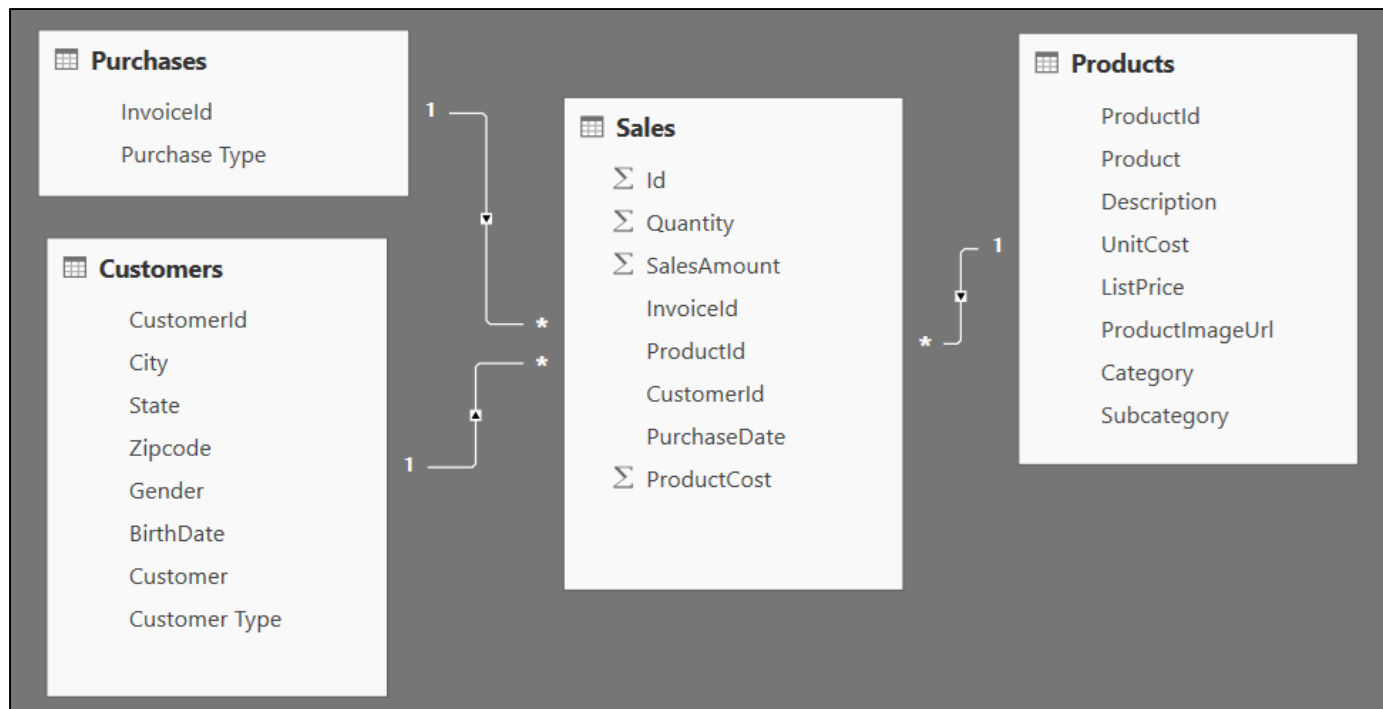
Data Modeling with Power BI Desktop

- Steps to create a data model with Power Pivot
 - Create relationships between tables
 - Modify native columns (e.g. set formatting and data category)
 - Create calculated columns
 - Create measures
 - Create dimensional hierarchies
 - Add Calendar table(s)



Table Relationships

- Tables in data model associated with relationships
 - Relationships based on single columns
 - Tabular model supports [1-to-1] and [1-to-many] relationships



Relationship Properties

- Cardinality

Cardinality

Many to One (*:1)

Many to One (*:1)

One to One (1:1)

One to Many (1:*)

- Cross filter direction

Cross filter direction

Both

Single

Both

Edit Relationship

Select tables and columns that relate to one another.

Sales

Id	Quantity	SalesAmount	InvoiceId	ProductId	CustomerId	PurchaseDate	ProductCost
2899	100	100	1457	14	888	Thursday, June 21, 2012	\$8
3824	100	100	1901	14	1137	Saturday, July 21, 2012	\$8
3968	100	100	1969	14	1173	Wednesday, July 25, 2012	\$8

Customers

CustomerId	City	State	ZipCode	Gender	BirthDate	Customer	CustomerType
55	San Jose	CA	95110	Female	Thursday, March 10, 1949	Jewell Ryan	Repeat Customer
73	San Jose	CA	95123	Male	Thursday, May 9, 1985	Granville Perry	Repeat Customer
74	San Jose	CA	95122	Female	Tuesday, June 19, 1979	Sheri Mercado	Repeat Customer

Cardinality

Many to One (*:1)

Cross filter direction

Both

☒ Make this relationship active

OK Cancel



How Do You Create a Relationship Here?

- Two tables don't have fields to create relationship
 - The solution is to create two new calculated columns



Creating Composite Key Fields

- Create composite key column in Budgets

The screenshot shows the Power BI interface with a table named 'Budgets'. The formula bar at the top displays the formula: `Budget Key = [Year] & "-" & [Quarter] & "-" & [Category]`. The table has five columns: Year, Quarter, Category, Amount, and Budget Key. The 'Budget Key' column contains values like '2017-Q1-Marketing'. On the right, the 'FIELDS' pane shows the 'Budgets' table with 'Amount', 'Budget Key', and 'Category' fields listed. 'Budget Key' is highlighted.

Year	Quarter	Category	Amount	Budget Key
2017	Q1	Marketing	\$5,000	2017-Q1-Marketing
2017	Q1	Office Supplies	\$8,000	2017-Q1-Office Supplies
2017	Q1	Operations	\$8,000	2017-Q1-Operations
2017	Q1	Research & Development	\$5,000	2017-Q1-Research & Development
2017	Q2	Marketing	\$6,000	2017-Q2-Marketing
2017	Q2	Office Supplies	\$4,000	2017-Q2-Office Supplies
2017	Q2	Operations	\$7,000	2017-Q2-Operations

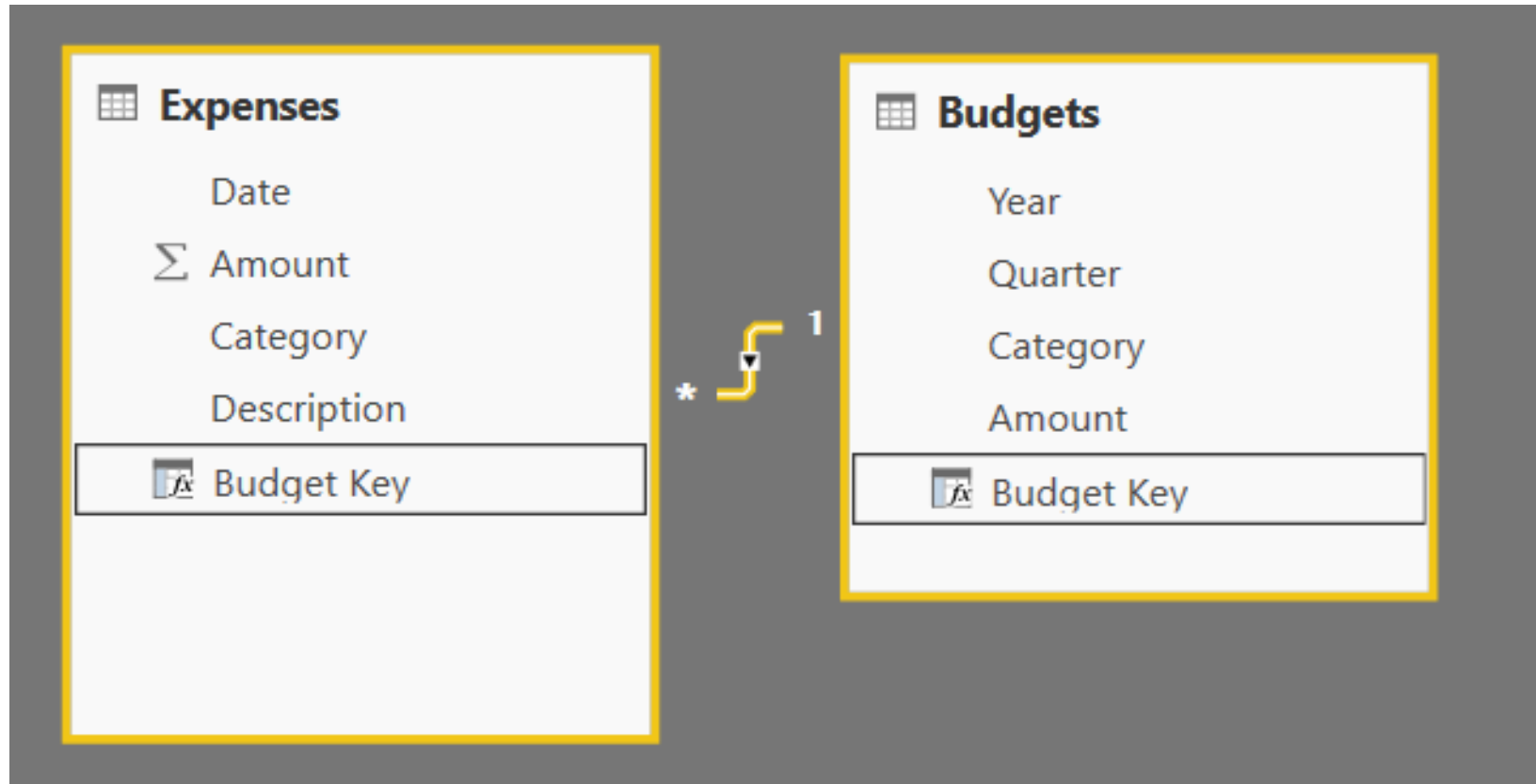
- Create composite key column in Expenses

The screenshot shows the Power BI interface with a table named 'Expenses'. The formula bar at the top displays the formula: `Budget Key = VAR BudgetYear = YEAR([Date]) VAR BudgetMonth = "Q" & FORMAT([Date], "q") RETURN BudgetYear & "-" & BudgetMonth & "-" & [Category]`. The table has five columns: Date, Amount, Category, Description, and Budget Key. The 'Budget Key' column contains values like '2017-Q2-Operations'. On the right, the 'FIELDS' pane shows the 'Expenses' table with 'Amount', 'Budget Key', and 'Category' fields listed. 'Budget Key' is highlighted.

Date	Amount	Category	Description	Budget Key
Sunday, April 2, 2017	\$925	Operations	Verizon - Telephone and Internet	2017-Q2-Operations
Monday, April 3, 2017	\$142	Office Supplies	Postage Stamps	2017-Q2-Office Supplies
Wednesday, April 5, 2017	\$294	Operations	Electricity Bill	2017-Q2-Operations
Wednesday, April 5, 2017	\$120.25	Office Supplies	Coffee Supplies	2017-Q2-Office Supplies
Thursday, April 13, 2017	\$1,200	Operations	Cleaning Service	2017-Q2-Operations



Create Relationship Using Composite Keys



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Formatting Columns

- Each column has its own formatting properties
 - Formatting propagated to reports and visuals
 - Makes it easier on data model consumers

WingtipSalesAnalytics - Power BI Desktop

File Home Modeling

Manage Relationships Relationships New Measure Calculations New Column New Table Sort Column Sort

Data Type: Fixed Decimal Number
Format: \$ English (United States)
Formatting: \$ % .00 2

Home Table: Data Category: Uncategorized Default Summarization: Sum Properties

Id	Quantity	SalesAmount	InvoiceId	ProductId	CustomerId	PurchaseDate	ProductCost
2899	100	\$100.00	1457	14	888	Thursday, June 21, 2012	\$8
3824	100	\$100.00	1901	14	1137	Saturday, July 21, 2012	\$8
3968	100	\$100.00	1969	14	1173	Wednesday, July 25, 2012	\$8
4008	100	\$100.00	1987	14	1186	Thursday, July 26, 2012	\$8
4224	100	\$100.00	2096	14	1239	Friday, August 3, 2012	\$8
4724	100	\$100.00	2352	14	1390	Sunday, August 19, 2012	\$8

Fields

- Customers
- Products
- Purchases
- Sales



Working with DAX

- DAX is the language used to create data models
 - DAX stands for "Data Analysis Expression Language"
- DAX expressions are similar to Excel formulas
 - They always start with an equal sign (=)
 - DAX provides many built-in functions similar to Excel
- DAX Expressions are unlike Excel formulas...
 - DAX expressions cannot reference cells (e.g. A1 or C4)
 - Instead DAX expressions reference columns and tables

```
=SUM('Sales' [SalesAmount])
```



Writing DAX Expressions

- Some DAX expressions are simple

```
Sales Revenue = Sum(Sales[SalesAmount])
```

- Some DAX expressions are far more complex

```
Sales Growth PM = IF(
  ( ISFILTERED(Calendar[Month]) && ISFILTERED(Calendar[Date]) = FALSE() ),
  DIVIDE(
    SUM(Sales[SalesAmount]) -
    CALCULATE(
      SUM(Sales[SalesAmount]),
      PREVIOUSMONTH(Calendar[Date])
    ),
    CALCULATE(
      SUM(Sales[SalesAmount]),
      PREVIOUSMONTH(Calendar[Date])
    )
  ),
  BLANK()
)
```



Creating Variables in DAX Expressions

- Variables can be added at start of expression
 - Use **VAR** keyword once for each variable
 - Use **RETURN** keyword to return expression value

```
Budget Key =  
    VAR BudgetYear = YEAR([Date])  
    VAR BudgetMonth = "Q" & FORMAT([Date], "q")  
RETURN  
    BudgetYear & "-" & BudgetMonth & "-" & [Category]
```



Calculated Columns vs Measures

- Calculated Columns (aka Columns)
 - Evaluated based on context of a single row
 - Evaluated when data is loaded into memory

`Column1 = <DAX expression>`

- Measures
 - Evaluated at query time based on current filter context
 - Commonly used for aggregations (e.g. SUM, AVG, etc.)
 - Used more frequently than calculated columns

`Measure1 = <DAX expression>`



When to Create Calculated Columns

- Measures often better choice than calculate columns
 - Don't create calculated column when you need a measure
 - Prefer to create calculated columns only in specific scenarios
- When should you create calculated columns?
 - To create headers for row labels or column labels
 - To place calculated results in a slicer for filtering
 - Define an expression strictly bound to current row
 - Categories text or numbers (e.g. customer age groups)



Creating Calculated Columns

- Edited in formula bar of Power Pivot data view
 - Start with name and then equals (=) sign
 - Enter a valid DAX expression
 - Clicking on column adds it into expression



PurchaseYear = YEAR(Sales[PurchaseDate])									
Id	Quantity	SalesAmount	InvoiceId	ProductId	CustomerId	PurchaseDate	ProductCost	SalesProfit	PurchaseYear
2899	100	\$100.00	1457	14	888	6/21/12	\$8.00	\$92.00	2012
3824	100	\$100.00	1901	14	1137	7/21/12	\$8.00	\$92.00	2012
3968	100	\$100.00	1969	14	1173	7/25/12	\$8.00	\$92.00	2012
4008	100	\$100.00	1987	14	1186	7/26/12	\$8.00	\$92.00	2012
4224	100	\$100.00	2096	14	1239	8/3/12	\$8.00	\$92.00	2012
4724	100	\$100.00	2352	14	1390	8/19/12	\$8.00	\$92.00	2012



Calculated Column used in a Slicer

- Calculated column can populate slicer values



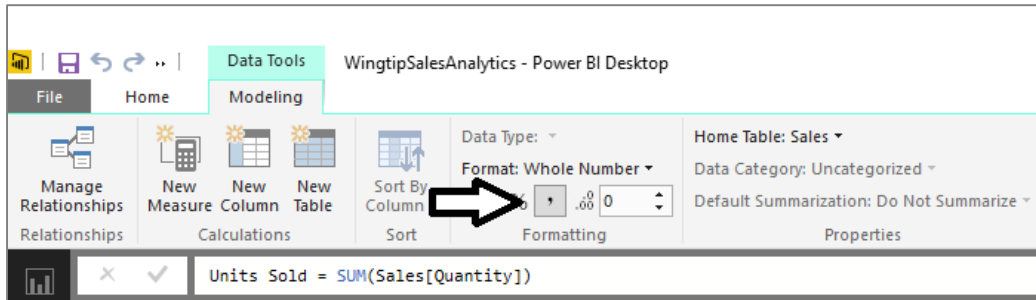
Creating Measures

- Measures have advantage over calculated columns
 - They are evaluated based on the current evaluation context
- Creating a measure with Power BI Desktop
 1. Click New Measure button
 2. Give measure a name and write DAX expressions
 3. Configure formatting



Formatting Measures

- Format as whole number



- Format as currency

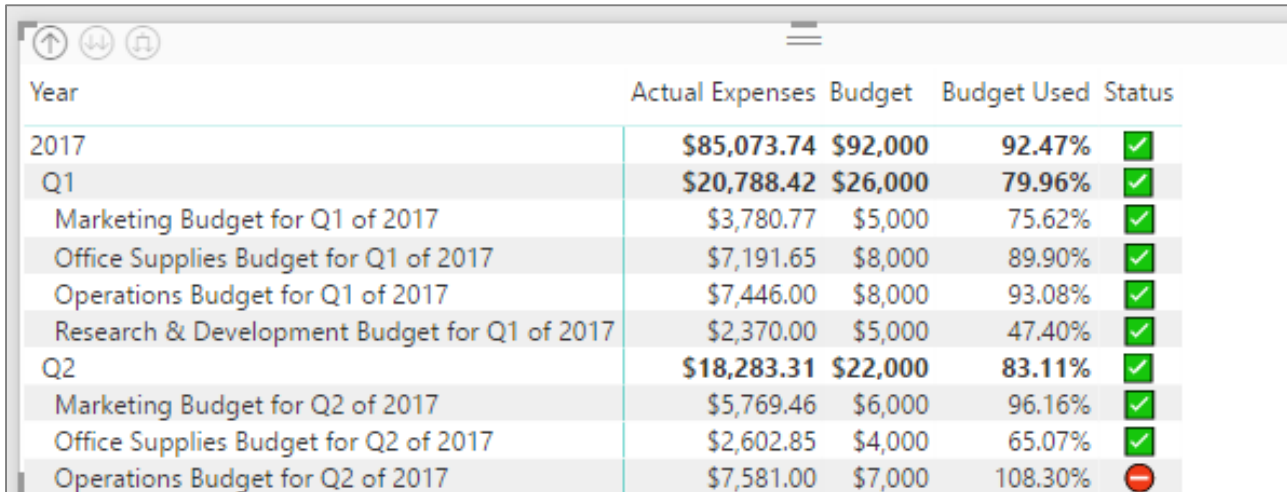


Working with UNICHAR Characters

- Create a measure to return a single UNICHAR character
 - There are many different UNICHAR characters with symbols

```
Status =  
IF(  
    [Budget Used] > 1,  
    UNICHAR(9940),  
    UNICHAR(9989)  
)
```

- UNICHAR character symbols can be displayed in table or matrix



Year	Actual Expenses	Budget	Budget Used	Status
2017	\$85,073.74	\$92,000	92.47%	✓
Q1	\$20,788.42	\$26,000	79.96%	✓
Marketing Budget for Q1 of 2017	\$3,780.77	\$5,000	75.62%	✓
Office Supplies Budget for Q1 of 2017	\$7,191.65	\$8,000	89.90%	✓
Operations Budget for Q1 of 2017	\$7,446.00	\$8,000	93.08%	✓
Research & Development Budget for Q1 of 2017	\$2,370.00	\$5,000	47.40%	✓
Q2	\$18,283.31	\$22,000	83.11%	✓
Marketing Budget for Q2 of 2017	\$5,769.46	\$6,000	96.16%	✓
Office Supplies Budget for Q2 of 2017	\$2,602.85	\$4,000	65.07%	✓
Operations Budget for Q2 of 2017	\$7,581.00	\$7,000	108.30%	✗



The UNICHAR Browser Demo

Unichar Browser - Power BI Desktop

File Home View Modeling Help

Clipboard: Paste, Cut, Copy, Format Painter

External data: Get Data, Recent Sources, Enter Data, Edit Queries, Refresh

Insert: New Page, New Visual, Ask A Question, Text box, Image, Shapes

Custom visuals: From Store, From File

Themes: Switch Theme

Relationships: Manage Relationships

Calculations: New Measure, New Column, New Quick Measure

Share: Publish

Ted Pattison

8000	8200	8400	8600	8800	9000	9200	9400	9600	9800	10000	10200	10400	10600	10800	11000	11200	11400	11600	11800
8100	8300	8500	8700	8900	9100	9300	9500	9700	9900	10100	10300	10500	10700	10900	11100	11300	11500	11700	11900

9900 9901 9902 9903 9904 9905 9906 9907 9908 9909 9910 9911 9912 9913 9914 9915

9916 9917 9918 9919 9920 9921 9922 9923 9924 9925 9926 9927 9928 9929 9930 9931

9932 9933 9934 9935 9936 9937 9938 9939 9940 9941 9942 9943 9944 9945 9946 9947

9948 9949 9950 9951 9952 9953 9954 9955 9956 9957 9958 9959 9960 9961 9962 9963

9964 9965 9966 9967 9968 9969 9970 9971 9972 9973 9974 9975 9976 9977 9978 9979

9980 9981 9982 9983 9984 9985 9986 9987 9988 9989 9990 9991 9992 9993 9994 9995

9996 9997 9998 9999

UNICHAR Browser

PAGE 1 OF 1

VISUALIZATIONS

Charts

Page

Symbol

Symbol Layout

Value

Values

Drag data fields here

FILTERS

Page level filters

Drag data fields here

Drillthrough filters

Drag drillthrough fields here

Report level filters

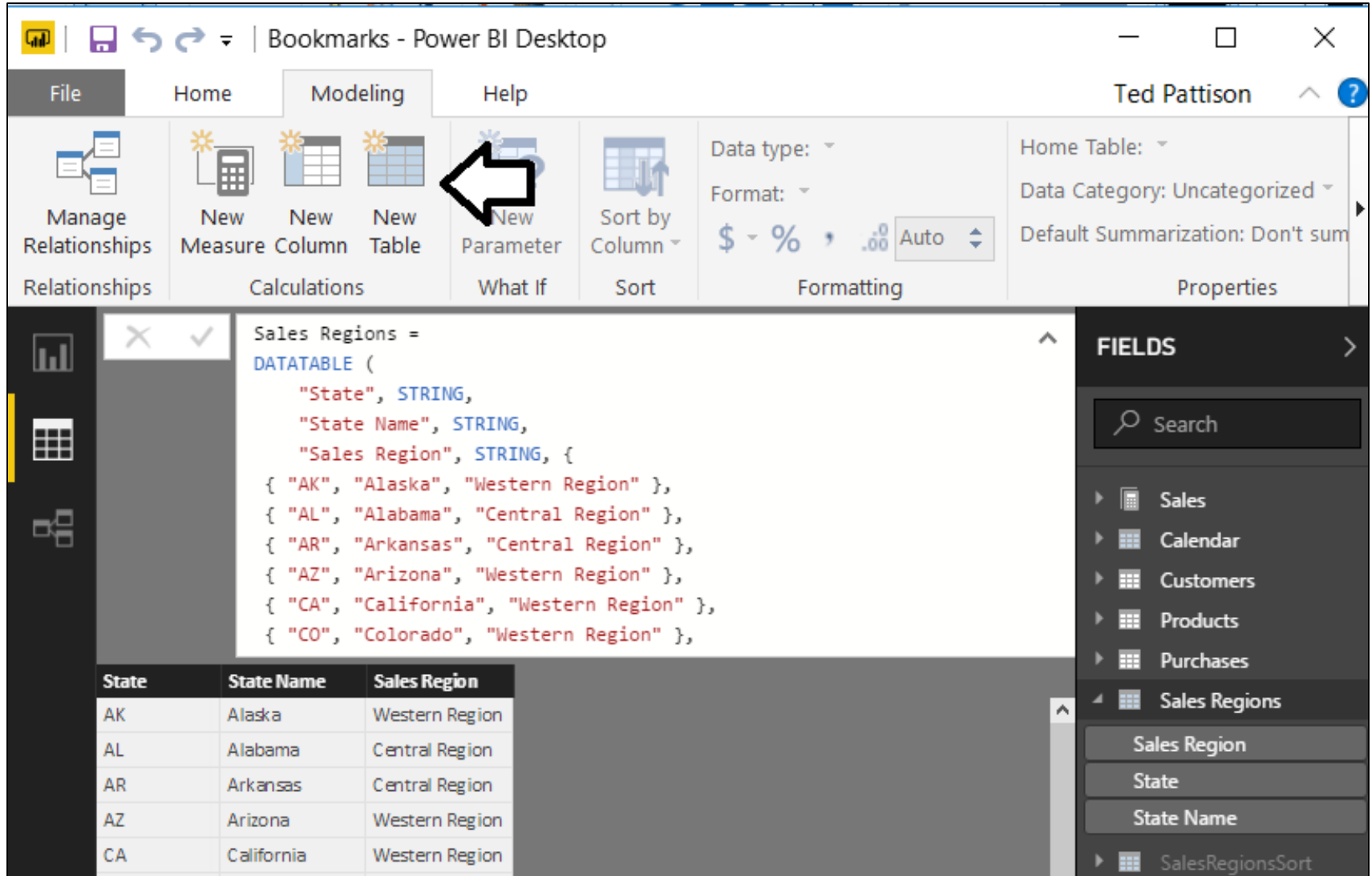
Drag data fields here

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Creating Tables Dynamically using DAX



Bookmarks - Power BI Desktop

File Home Modeling Help Ted Pattison

Manage Relationships Relationships

New Measure Calculations

New Column

New Table

New Parameter What If

Sort by Column Sort

Data type: Format: \$ % , .00 Auto

Home Table: Data Category: Uncategorized Default Summarization: Don't sum

Properties

```
Sales Regions =
DATATABLE (
    "State", STRING,
    "State Name", STRING,
    "Sales Region", STRING, {
        { "AK", "Alaska", "Western Region" },
        { "AL", "Alabama", "Central Region" },
        { "AR", "Arkansas", "Central Region" },
        { "AZ", "Arizona", "Western Region" },
        { "CA", "California", "Western Region" },
        { "CO", "Colorado", "Western Region" },
    }
)
```

State	State Name	Sales Region
AK	Alaska	Western Region
AL	Alabama	Central Region
AR	Arkansas	Central Region
AZ	Arizona	Western Region
CA	California	Western Region

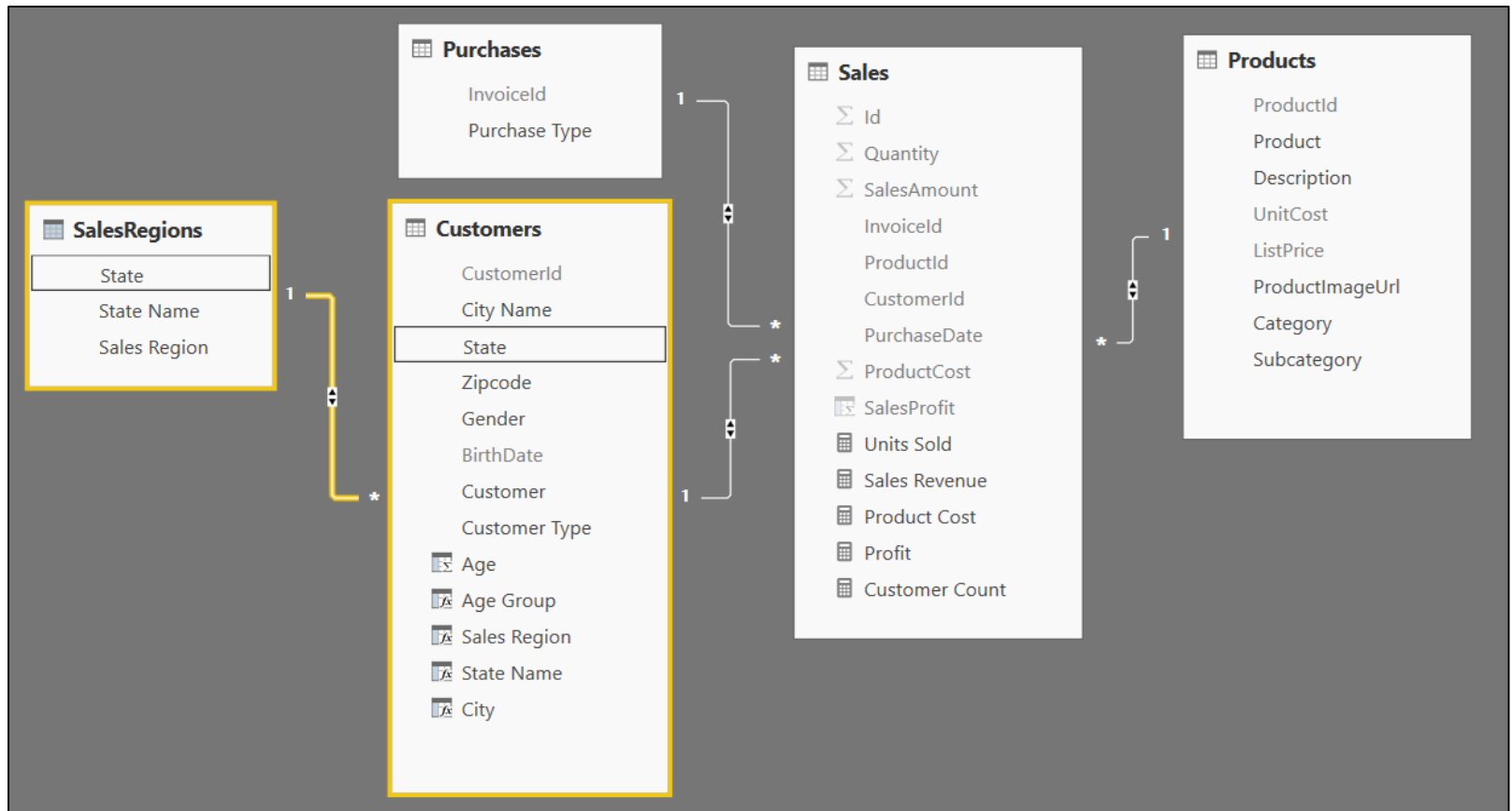
FIELDS

Search

- Sales
- Calendar
- Customers
- Products
- Purchases
- Sales Regions
 - Sales Region
 - State
 - State Name
- SalesRegionsSort

Integrating the Lookup Table into the Data Model

- Lookup table must be integrated into data model
 - Accomplished by creating relationship to one or more tables



The RELATED Function

- RELATED function performs cross-table lookup
 - Effectively replaces older VLOOKUP function
 - Used in many-side table to look up value from one-side
 - Used to pull data from lookup table into primary table

Sales Region = RELATED(SalesRegions[SalesRegion])										
CustomerId	City	State	ZipCode	Gender	BirthDate	Customer	CustomerType	Age	Age Group	Sales Region
55	San Jose	CA	95110	Female	3/10/49	Jewell Ryan	Repeat Customer	66	Ages 65 and over	Western Region
73	San Jose	CA	95123	Male	5/9/85	Granville Perry	Repeat Customer	30	Ages 30 TO 39	Western Region
74	San Jose	CA	95122	Female	6/19/79	Sheri Mercado	Repeat Customer	36	Ages 30 TO 39	Western Region
78	San Jose	CA	95110	Male	6/16/78	Raleigh Olson	Repeat Customer	37	Ages 30 TO 39	Western Region
136	San Jose	CA	95124	Female	1/2/45	Carrie Foreman	Repeat Customer	70	Ages 65 and over	Western Region
150	San Jose	CA	95134	Female	8/11/84	Renee McMillan	Repeat Customer	31	Ages 30 TO 39	Western Region

State Name = RELATED(SalesRegions[StateFullName])

State	ZipCode	Gender	BirthDate	Customer	CustomerType	Age	Age Group	Sales Region	State Name
CA	95110	Female	3/10/49	Jewell Ryan	Repeat Customer	66	Ages 65 and over	Western Region	California
CA	95123	Male	5/9/85	Granville Perry	Repeat Customer	30	Ages 30 TO 39	Western Region	California
CA	95122	Female	6/19/79	Sheri Mercado	Repeat Customer	36	Ages 30 TO 39	Western Region	California
CA	95110	Male	6/16/78	Raleigh Olson	Repeat Customer	37	Ages 30 TO 39	Western Region	California
CA	95124	Female	1/2/45	Carrie Foreman	Repeat Customer	70	Ages 65 and over	Western Region	California
CA	95134	Female	8/11/84	Renee McMillan	Repeat Customer	31	Ages 30 TO 39	Western Region	California

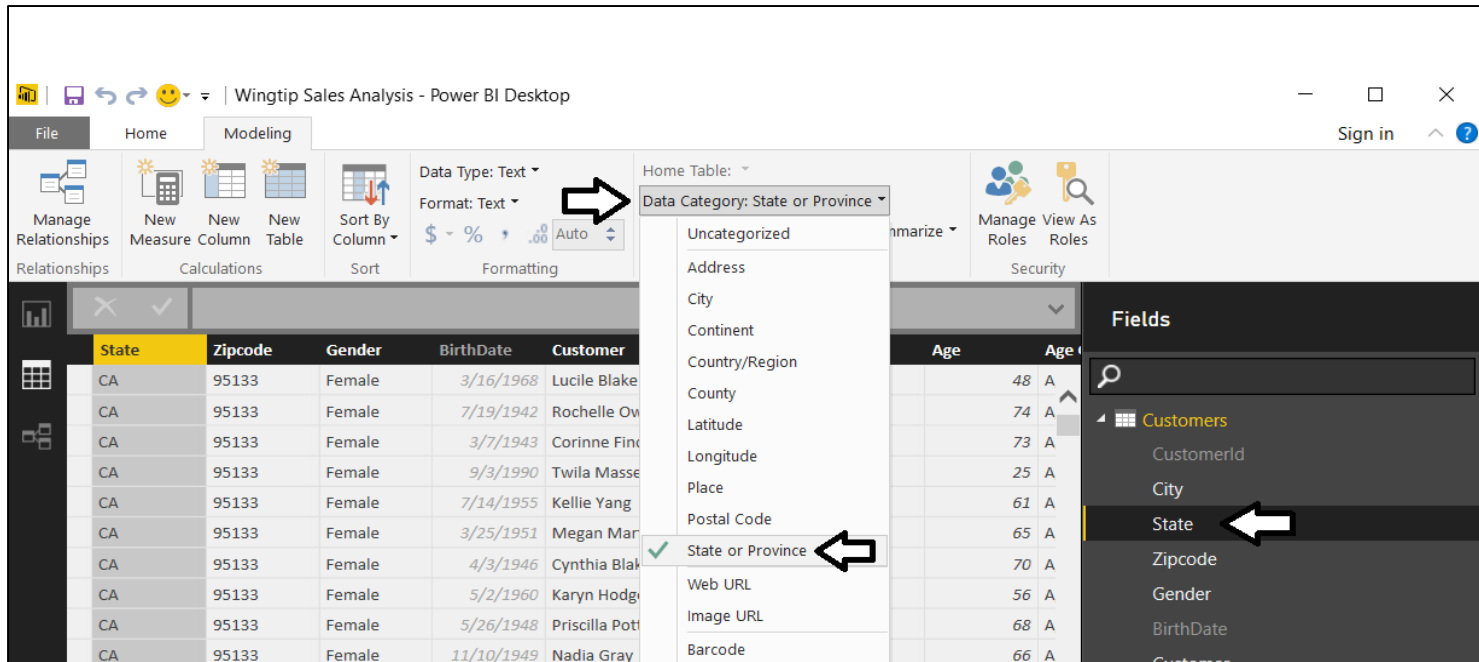
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Geographic Field Metadata

- Fields in data model have metadata properties
 - Metadata used by visuals and reporting tools
 - Used as hints to Bing Mapping service



Eliminate Geographic Ambiguity

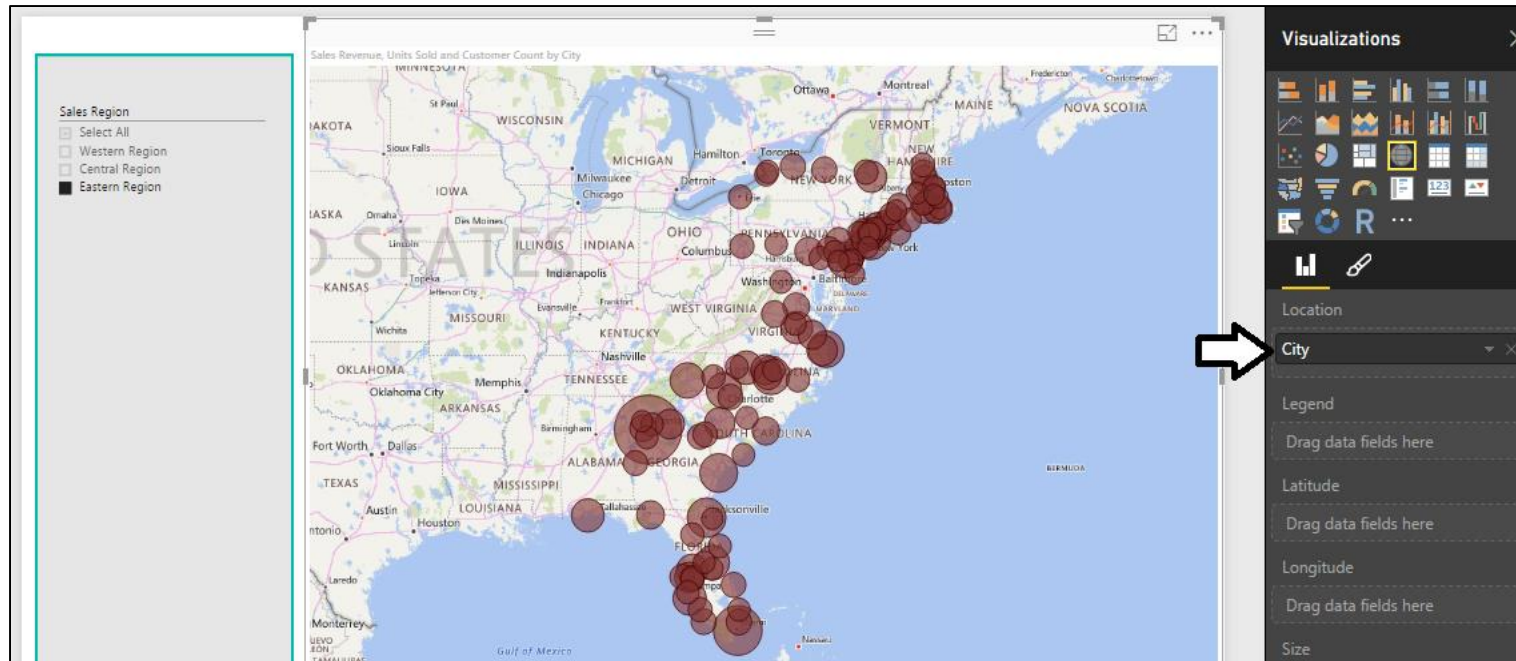
- City name alone is ambiguous
 - "Athens" defaults to Greece not Georgia
 - Concatenate city name with state to disambiguate

 		City = [City Name] & ", " & [State]			
	Age Group	Sales Region	State Name	SalesRegionSort	City
48	Ages 40 TO 49	Western Region	California	1	San Jose, CA
74	Ages 65 and over	Western Region	California	1	San Jose, CA
73	Ages 65 and over	Western Region	California	1	San Jose, CA
25	Ages 18 TO 23	Western Region	California	1	San Jose, CA
61	Ages 50 TO 65	Western Region	California	1	San Jose, CA
65	Ages 65 and over	Western Region	California	1	San Jose, CA



Using Map Visual with a Geographic Field

- Map Visual shows distribution over geographic area
 - Visual automatically updates when filtered



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Dimensional Hierarchies

- Hierarchy created from two or more columns
 - All columns in hierarchy must be from the same table
 - Defines parent-child relationship between columns
 - Provides path to navigate through data
 - Provides path to drill down into greater level of detail



Pulling Columns for Hierarchy into Single Table

- Sometimes hierarchy columns are spread across tables
 - Use RELATED function from DAX to pull columns into single table

Sales Region = RELATED(SalesRegions[SalesRegion])					
Customer	Customer Type	Age	Age Group	Sales Region	State Name
Lucile Blake	One-time Customer	48	Ages 40 TO 49	Western Region	California
Rochelle Owen	One-time Customer	74	Ages 65 and over	Western Region	California
Corinne Finch	One-time Customer	73	Ages 65 and over	Western Region	California
Twila Massey	One-time Customer	25	Ages 18 TO 23	Western Region	California

- Then create hierarchy in the table with all the columns

Customer Geography
Sales Region
State
City
Zipcode



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A Tale of Two Evaluation Contexts

- Row Context
 - Context includes all columns in iteration of current row
 - Used to evaluate DAX expression in calculated column
 - Only available in measures with iterator function (e.g. SUMX)
- Filter Context
 - Context includes filter(s) defining current set of rows
 - Used by default to evaluate DAX expressions in measures
 - Can be fully ignored or partially ignored using DAX code
 - Not used to evaluate DAX in calculated columns



Understanding Row Context

- Row context used to evaluate calculated columns

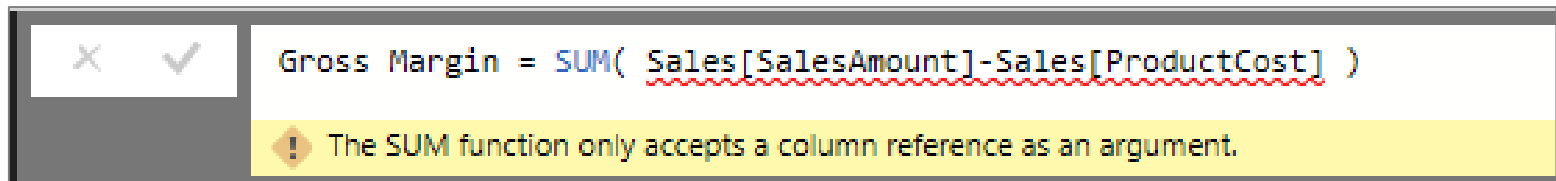
✕	✓	City = [City Name] & ", " & [State]			
	Age Group	Sales Region	State Name	SalesRegionSort	City
48	Ages 40 TO 49	Western Region	California	1	San Jose, CA
74	Ages 65 and over	Western Region	California	1	San Jose, CA
73	Ages 65 and over	Western Region	California	1	San Jose, CA
25	Ages 18 TO 23	Western Region	California	1	San Jose, CA
61	Ages 50 TO 65	Western Region	California	1	San Jose, CA
65	Ages 65 and over	Western Region	California	1	San Jose, CA

✕	✓	Age = Floor((TODAY()-Customers[BirthDate])/365, 1)			
Customer	Customer Type	Age	Age Group	Sales Region	State Name
Lucile Blake	One-time Customer	48	Ages 40 TO 49	Western Region	California
Rochelle Owen	One-time Customer	74	Ages 65 and over	Western Region	California
Corinne Finch	One-time Customer	73	Ages 65 and over	Western Region	California

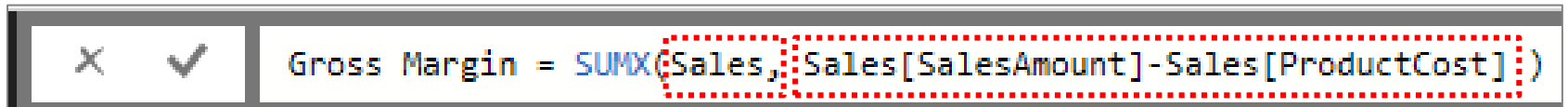


Understanding Iterators Like SUMX

- Standard aggregation functions (e.g. SUM) have no row context
 - You can use SUM to sum values of a single column
 - You cannot use SUM to sum results of an expressions



- Iterator functions (e.g. SUMX) iterate through rows in target table



- First argument accepts expressions that evaluates to table of rows
- Second argument accepts expression that is evaluated for each row



Understanding Filter Context

- Visuals apply various filters in different evaluation contexts

Month in Year	2012	2013	2014	2015	Total
January	\$6,306	\$164,334	\$385,275	\$512,822	\$1,068,737
February	\$48,815	\$126,501	\$358,244	\$597,684	\$1,131,244
March	\$53,958	\$243,676	\$381,309	\$532,123	\$1,211,067
April	\$52,601	\$300,872	\$381,157	\$602,751	\$1,337,381
May	\$61,756	\$334,948	\$438,261	\$647,276	\$1,482,241
June	\$76,756	\$321,715	\$378,749	\$608,448	\$1,385,668
July	\$104,408	\$287,800	\$359,744	\$620,316	\$1,372,268
August	\$111,167	\$298,483	\$457,312	\$678,499	\$1,545,461
September	\$110,716	\$376,207	\$505,332	\$613,971	\$1,606,229
October	\$145,999	\$362,943	\$602,448	\$620,735	\$1,732,125
November	\$156,751	\$340,228	\$545,572	\$590,220	\$1,632,770
December	\$147,593	\$331,526	\$581,977	\$686,814	\$1,747,910
Total	\$1,076,826	\$3,489,234	\$5,375,379	\$7,311,660	\$17,253,100

Filters on this evaluation

[Year] = 2015

[Month in Year] = "October"

- Filter context also affected by slicers and other filters

	Month in Year	2012	2013	2014	2015	Total
Sales Region	January	\$425	\$50,169	\$61,295	\$76,614	\$188,503
<input type="checkbox"/> Select All	February	\$13,891	\$40,133	\$63,670	\$101,542	\$219,236
<input type="checkbox"/> Central Region	March	\$19,121	\$58,411	\$73,839	\$84,180	\$235,551
<input type="checkbox"/> Eastern Region	April	\$19,128	\$53,711	\$67,919	\$91,762	\$232,520
<input checked="" type="checkbox"/> Western Region	May	\$22,939	\$64,259	\$78,668	\$109,689	\$275,555
	June	\$29,082	\$50,564	\$73,504	\$88,047	\$241,197
	July	\$34,809	\$62,971	\$69,053	\$80,749	\$247,582
	August	\$36,096	\$61,217	\$76,009	\$94,719	\$268,041
Customer Type	September	\$39,415	\$68,653	\$82,697	\$94,805	\$285,570
<input type="checkbox"/> One-time customer	October	\$51,994	\$69,122	\$99,344	\$84,177	\$304,637
<input checked="" type="checkbox"/> Repeat Customer	November	\$47,020	\$52,548	\$85,924	\$74,611	\$260,102
	December	\$50,580	\$66,260	\$102,088	\$94,877	\$313,804
	Total	\$364,500	\$698,018	\$934,009	\$1,075,771	\$3,072,298

Filters on this evaluation

[Year] = 2015

[Month in Year] = "October"

[Sales Region] = "Western Region"

[Customer Type] = "Repeat Customer"



Using the CALCULATE Function

- CALCULATE function provides greatest amount of control
 - First argument defines expression to evaluate
 - Second argument defines table on which to evaluate expression
 - You can evaluate expressions with or without current filter context

```
Pct of All Products =  
DIVIDE(  
    SUM( Sales[SalesAmount] ),  
    CALCULATE(  
        Sum (Sales[SalesAmount] ),  
        ALL(Products[Category], Products[Subcategory], Products[Product])  
    )  
)
```

```
Pct of Product Category =  
DIVIDE(  
    SUM( Sales[SalesAmount] ),  
    CALCULATE(  
        Sum (Sales[SalesAmount] ),  
        ALL( Products[Subcategory], Products[Product] )  
    )  
)
```



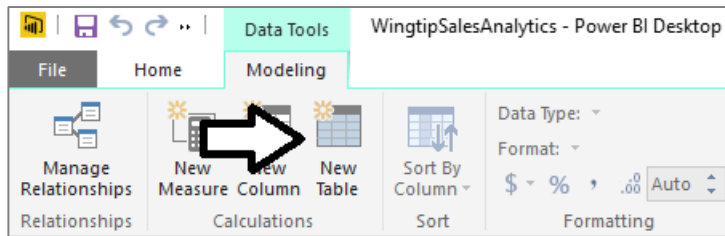
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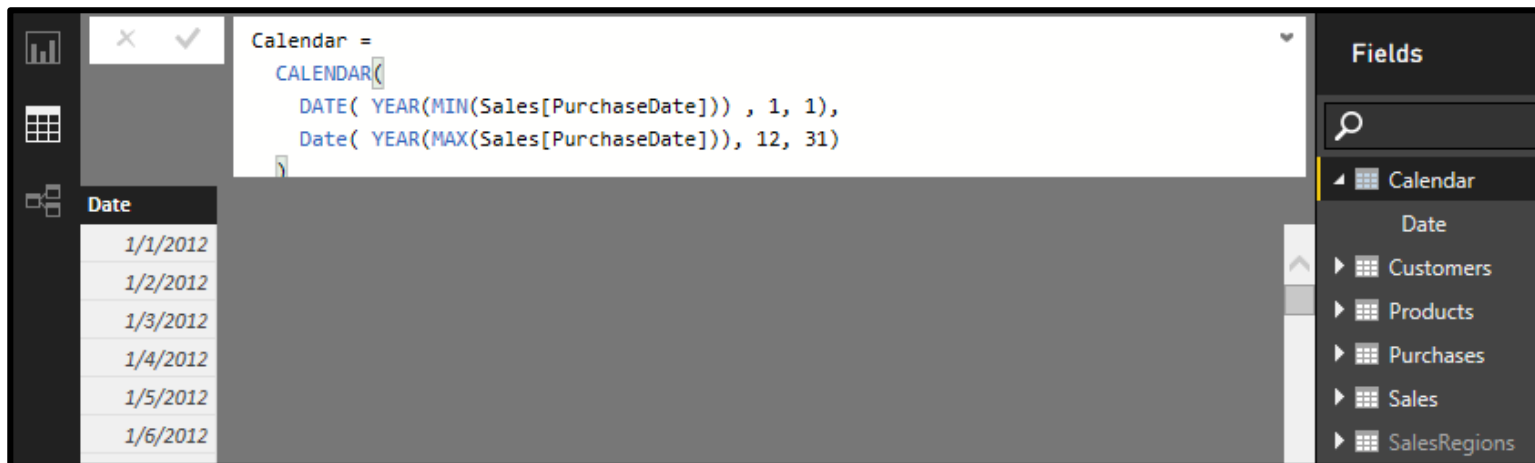


Creating Calendar Table as Calculated Table

- Use **New Table** command in ribbon



- Create calendar table using DAX **CALENDAR** function



Adding Columns to Calendar Table

- Creating the **Year** column

X ✓ Year = YEAR('Calendar'[Date])	
Date	Year
1/1/2012	2012
1/2/2012	2012
1/3/2012	2012

- Creating the **Quarter** column

X ✓ Quarter = YEAR('Calendar'[Date]) & "-Q" & FORMAT('Calendar'[Date], "q")			
Date	Year	Quarter	
01/01/2012	2012	2012-Q1	
01/02/2012	2012	2012-Q1	
01/03/2012	2012	2012-Q1	
01/04/2012	2012	2012-Q1	
01/05/2012	2012	2012-Q1	

- Creating the **Month** column

X ✓ Month = FORMAT('Calendar'[Date], "MMM yyyy")				
Date	Year	Quarter	Month	
1/1/2012	2012	2012-Q1	Jan 2012	
1/2/2012	2012	2012-Q1	Jan 2012	
1/3/2012	2012	2012-Q1	Jan 2012	



Configuring Sort Columns

- Month column will not sort in desired fashion by default
 - For example, April will sort before January, February and March
- Creating a sort column for the **Month** column
 - MonthSort** sorts alphabetically & chronologically at same time

MonthSort = FORMAT('Calendar'[Date], "yyyy-MM")				
Date	Year	Quarter	Month	MonthSort
1/1/2012	2012	2012-Q1	Jan 2012	2012-01
1/2/2012	2012	2012-Q1	Jan 2012	2012-01

- Configure **Month** column with **MonthSort** as sort column

The screenshot shows the Power BI Desktop interface. In the 'Table' view, the 'Month' column is selected. The 'Sort By Column' dropdown menu is open, showing 'Month (Default)' and 'MonthSort'. 'MonthSort' is selected, indicated by a green checkmark. A red arrow points from the 'Sort By Column' dropdown to the 'MonthSort' column in the table. Another red arrow points from the 'Month' column header to the 'Sort By Column' dropdown. The table below shows the data for the 'Month' column, with 'MonthSort' values.

Date	Year	Month	MonthSort
1/1/2012	2012	Jan 2012	2012-01
1/2/2012	2012	Jan 2012	2012-01



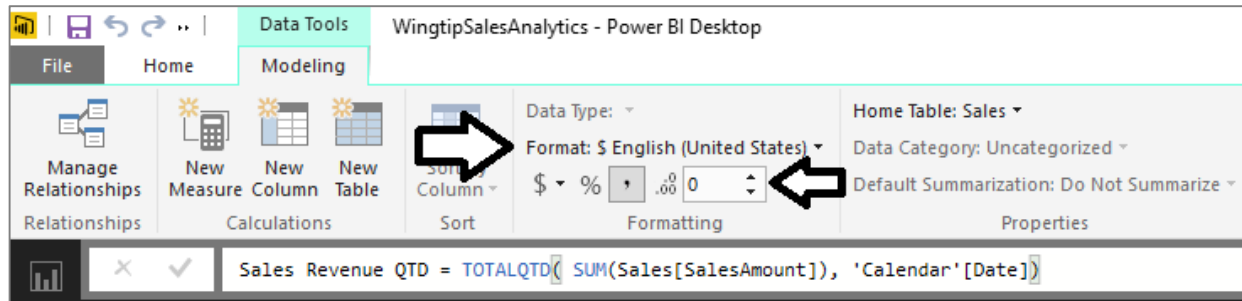
Integrating Calendar Table into Data Model

- Calendar table needs relationship to one or more tables

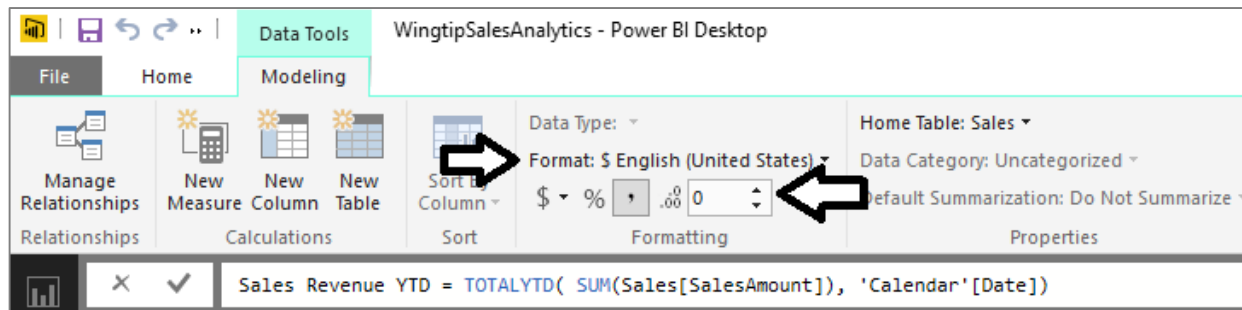


Calculated Fields for QTD and YTD Sales

- TOTALQTD function calculates quarter-to-date totals

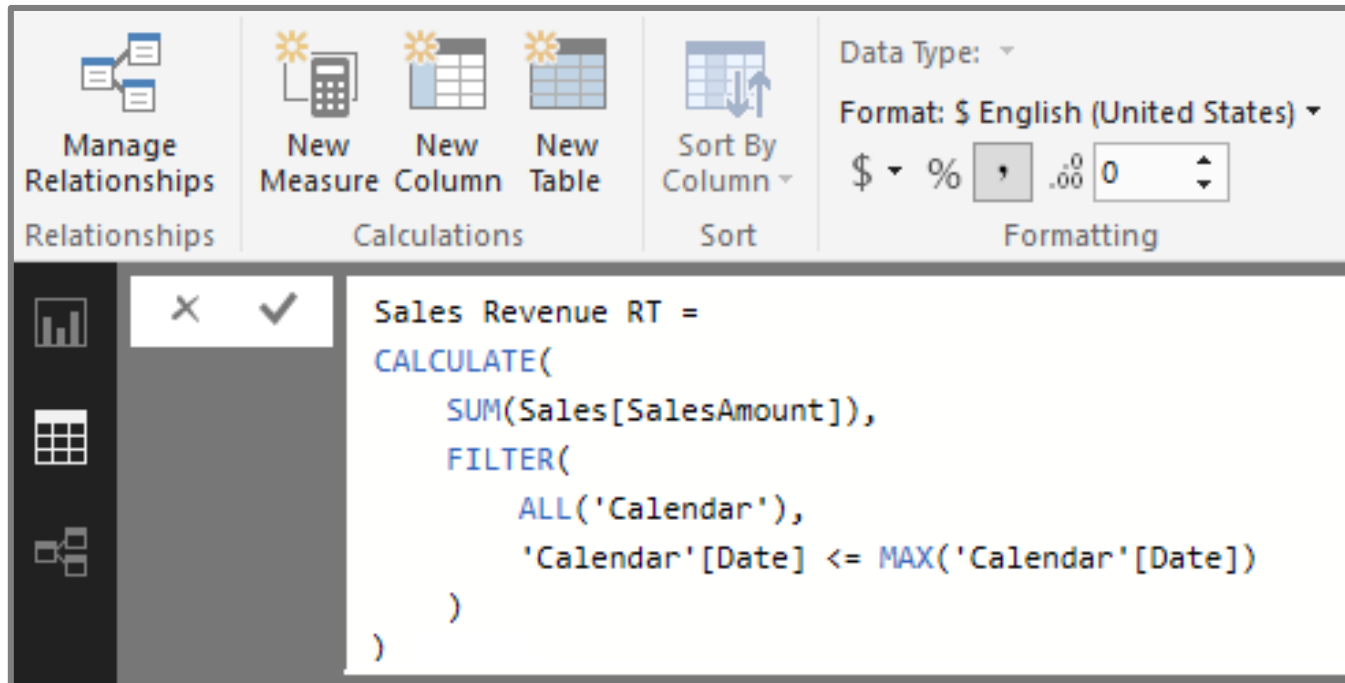


- TOTALYTD function calculates year-to-date totals



Creating Running Total using CALCULATE

- Calculate a running total of sales revenue across years
 - This must be done using **CALCULATE** function



Sales Growth PM Measure - First Attempt

- Create a measure named Sales Growth PM

```
Sales Growth PM =  
DIVIDE(  
    SUM(Sales[SalesAmount]) -  
    CALCULATE(  
        SUM(Sales[SalesAmount]),  
        PREVIOUSMONTH(Calendar[Date])  
    ),  
    CALCULATE(  
        SUM(Sales[SalesAmount]),  
        PREVIOUSMONTH(Calendar[Date])  
    )  
)
```

- Use measure in matrix evaluating month and quarter
 - Measure returns correct value when filtered by Month
 - Measure returns large, erroneous value when filtered by Quarter

Year	Quarter	Month	Sales Revenue	Sales Growth PM
2014	2014-Q1	Jan 2014	\$629,969	-18.13 %
		Feb 2014	\$609,637	-3.23 %
		Mar 2014	\$628,618	3.11 %
		Total	\$1,868,225	142.79 %
	2014-Q2	Apr 2014	\$661,588	5.24 %
		May 2014	\$748,193	13.09 %
		Jun 2014	\$814,333	8.84 %
2014	2014-Q3	Total	\$2,224,114	253.81 %
		Jul 2014	\$788,469	-3.18 %



Using the ISFILTERED Function

- ISFILTERED function used to determine when perform evaluation

```
Sales Growth PM =  
IF(  
  ( ISFILTERED(Calendar[Month]) && NOT(ISFILTERED(Calendar[Date])) ),  
  DIVIDE(  
    SUM(Sales[SalesAmount]) -  
    CALCULATE(  
      SUM(Sales[SalesAmount]),  
      PREVIOUSMONTH(Calendar[Date])  
    ),  
    CALCULATE(  
      SUM(Sales[SalesAmount]),  
      PREVIOUSMONTH(Calendar[Date])  
    )  
  ),  
  BLANK()  
)
```

- Expression returns Blank value when evaluation context is invalid

Year	Quarter	Month	Sales Revenue	Sales Growth PM
2014	2014-Q1	Jan 2014	\$629,969	-18.13 %
		Feb 2014	\$609,637	-3.23 %
		Mar 2014	\$628,618	3.11 %
		Total	\$1,868,225	
	2014-Q2	Apr 2014	\$661,588	5.24 %
		May 2014	\$748,193	13.09 %
		Jun 2014	\$814,333	8.84 %
		Total	\$2,224,114	
	2014-Q3	Jul 2014	\$788,469	-3.18 %
		Aug 2014	\$869,143	10.23 %



Summary

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