



Power BI

Advanced Topics

Agenda – Advanced Topics

- Facts & Dimensions
- Data Modeling
 - Flat file vs. Star schema
- DAX (Data Analysis Expressions)
- Calculated Columns vs. Measures
- M code
- RLS (Row-level security)

Power BI Terminology

Facts

Dimensions

Dimensions

Descriptive/ Qualitative Information

- Color
- Country
- Region
- State
- City
- Person
- Gender
- Age
- Dates

Facts

Quantitative Information

- Expressed in numbers and can be counted and aggregated easily

Scenario 1

How many shoes were sold in Tennessee in 2017?

Scenario 1

How many shoes were sold in Tennessee in 2017?

Dimension

Fact

Scenario 2

How many kids under the age of 10 bought red Nikes in the USA in 2018?

Scenario 2

How many kids under the age of 10 bought red Nikes in the USA in 2018?

Dimension

Fact

Scenario 3

How many kids under the age of 10 bought red Nikes in the USA in 2018

What percentage of those shoes were returned within one month?

Dimension

Fact

Scenario 3

How many kids under the age of 10 bought red Nikes in the USA in 2018?

What percentage of those shoes were returned within one month?

Dimension

Fact

Data Modeling

[\(25\) Why Power BI loves a Star Schema - YouTube](#)

[\(25\) Data Modeling \(Star Schema 🌟\) in Power BI – Creating Dimension Tables - YouTube](#)

[\(25\) Data modeling best practices - Part 1 - in Power BI and Analysis Services - YouTube](#)

Flat File Database Structure

A flat-file database is a database stored in a file called a flat file. Records follow a uniform format, and there are no structures for indexing or recognizing relationships between records. The file is simple. A flat file can be a plain text file, or a binary file. Relationships can be inferred from the data in the database, but the database format itself does not make those relationships explicit

Flat File Example

<u>StudentId</u>	firstName	lastName	courseId
L0002345	Jim	Black	C002
L0001254	James	Harradine	A004
L0002349	Amanda	Holland	C002
L0001198	Simon	McCloud	S042
L0023487	Peter	Murray	P301
L0018453	Anne	Norris	S042

Star Schema

Star schema is a mature modeling approach widely adopted by relational data warehouses. It requires modelers to classify their model tables as either *dimension* or *fact*.

Dimension tables describe business entities—the *things* you model. Entities can include products, people, places, and concepts including time itself. A dimension table contains a key column (or columns) that acts as a unique identifier, and descriptive columns.

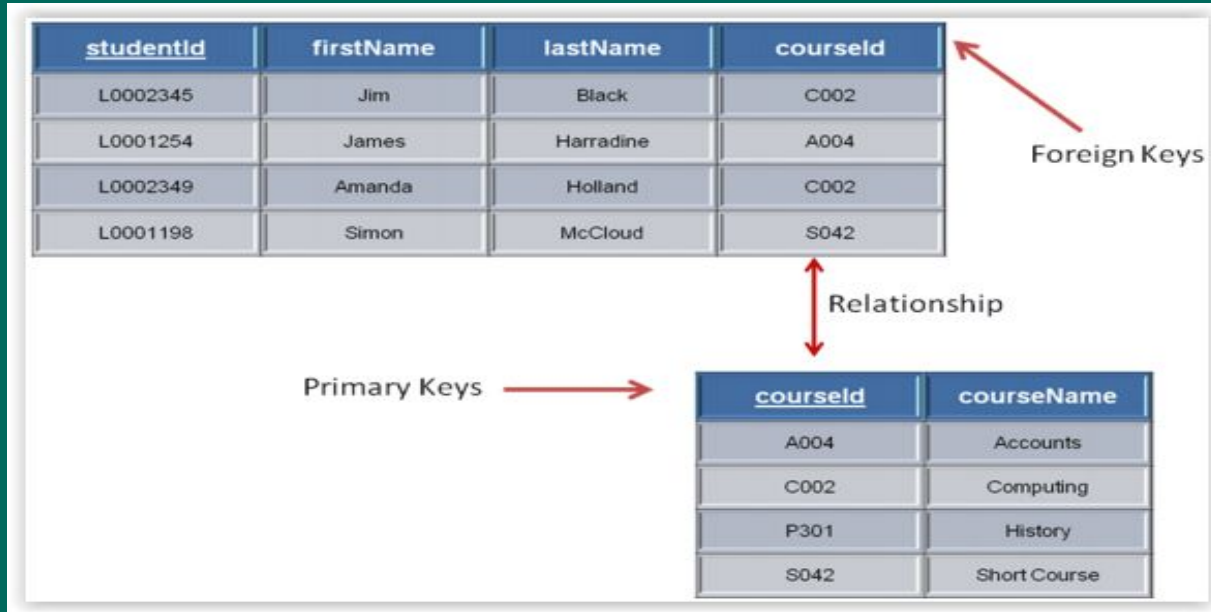
Fact tables store observations or events, and can be sales orders, stock balances, exchange rates, temperatures, etc. A fact table contains dimension key columns that relate to dimension tables, and numeric measure columns.

Generally, dimension tables contain a relatively small number of rows. Fact tables, on the other hand, can contain a very large number of rows and continue to grow over time.

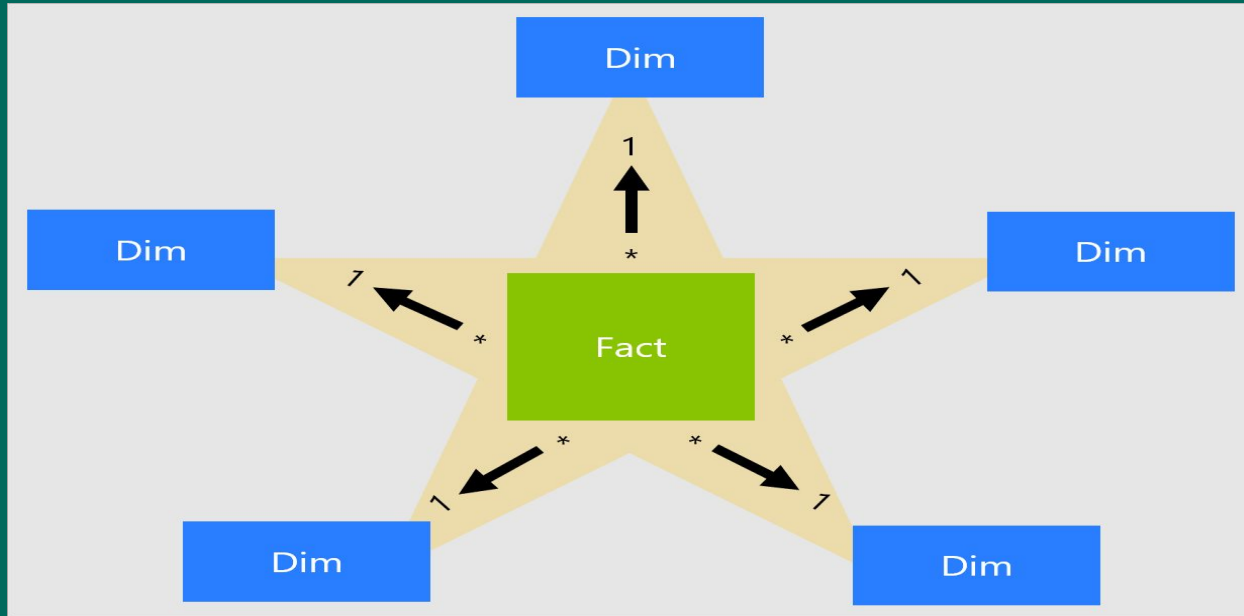
Relational Database

A relational database is a digital database based on the relational model of data. A software system used to maintain relational databases is a relational database management system (RDBMS). Many relational database systems have an option of using the SQL (Structured Query Language) for querying and maintaining the database.

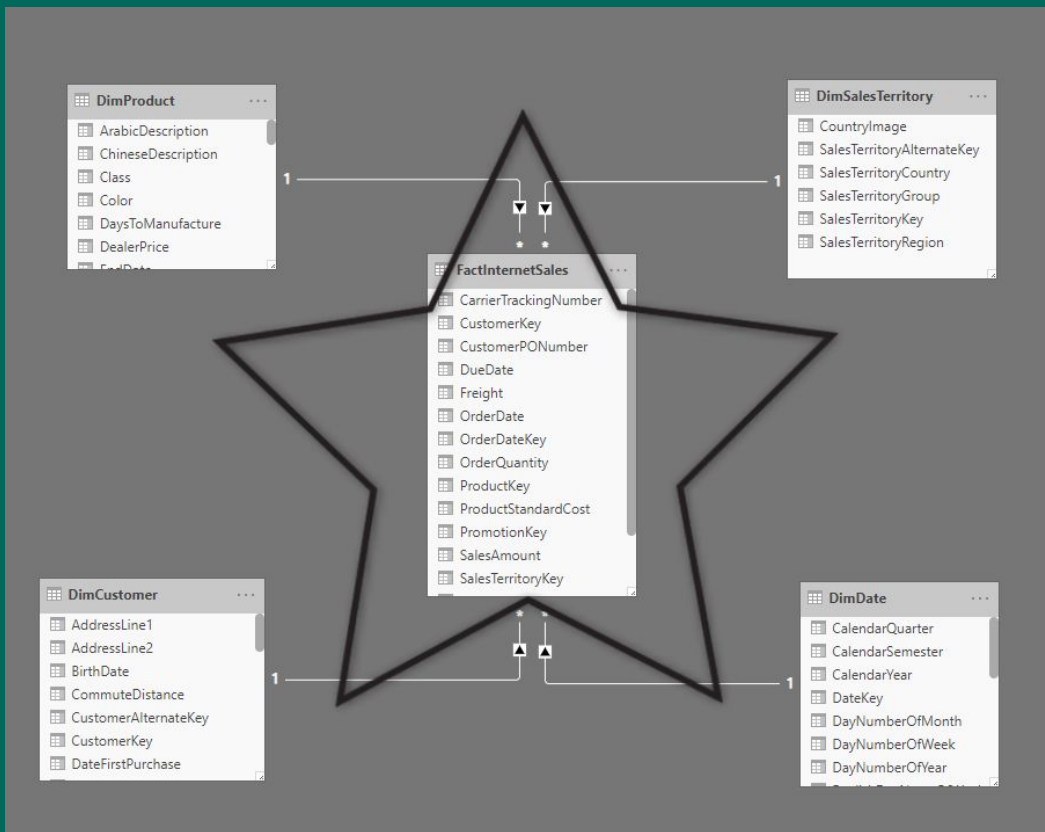
Relational Database Example



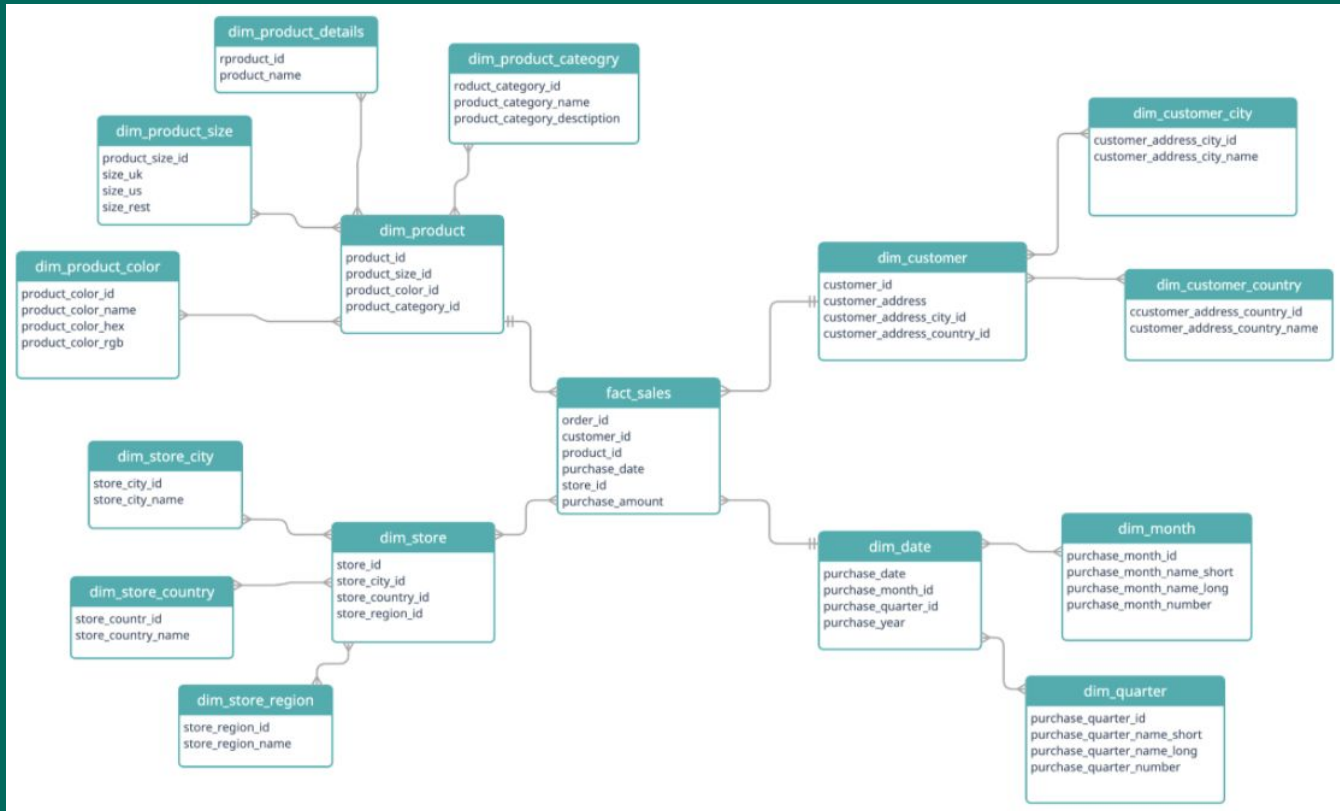
Star Schema Example



Star Schema Example



Snowflake Schema Example



Advanced Power BI Terminology

DAX

Measures VS Calculated Columns

M code

Row-Level Security

DAX – Data Analysis Expressions

[\(25\) DAX! Uggg - Where do you start? | Power BI - YouTube](#)

[\(25\) TAME the the beast that is DAX in Power BI \(aka how to learn DAX\) - YouTube](#)

DAX Functions

Data Analysis Expressions

- <https://docs.microsoft.com/en-us/dax/dax-function-reference>
- Examples:
 - SUM
 - AVERAGE
 - COUNT
 - DISTINCTCOUNT
 - SWITCH
 - TODAY
 - **CALCULATE**

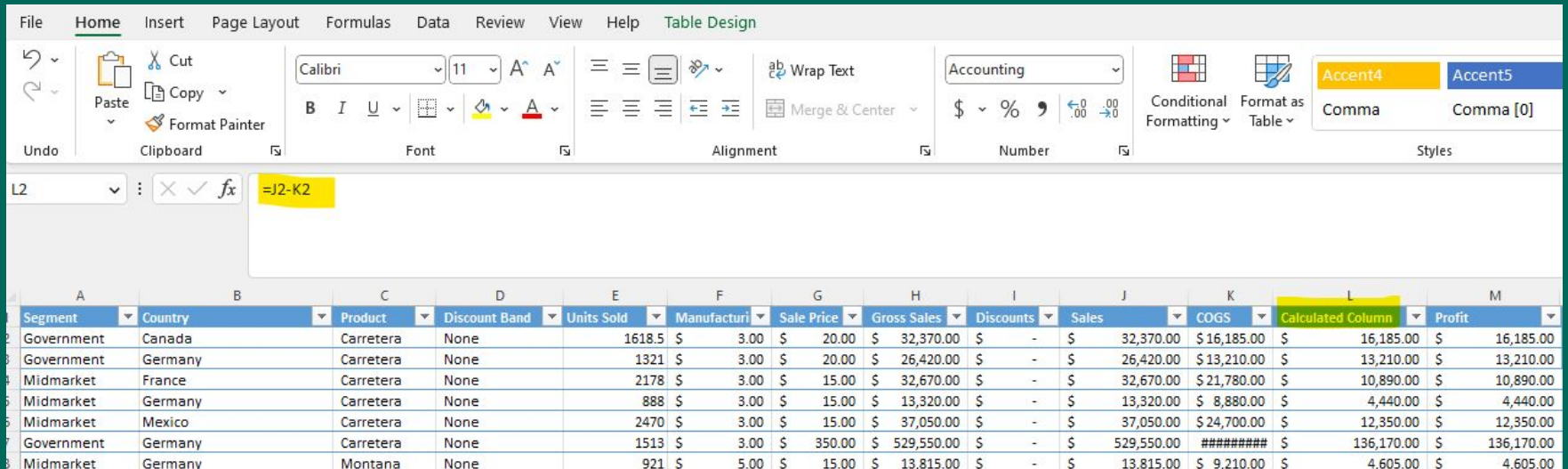
DID YOU KNOW ?



In order to be able to play the role of a depressed person with dementia, Joaquin Phoenix tried to create a measure with DAX using the CALCULATE function without reading the documentation first.

Calculated Columns

A calculated Column will create a new column in your table that is calculated row by row

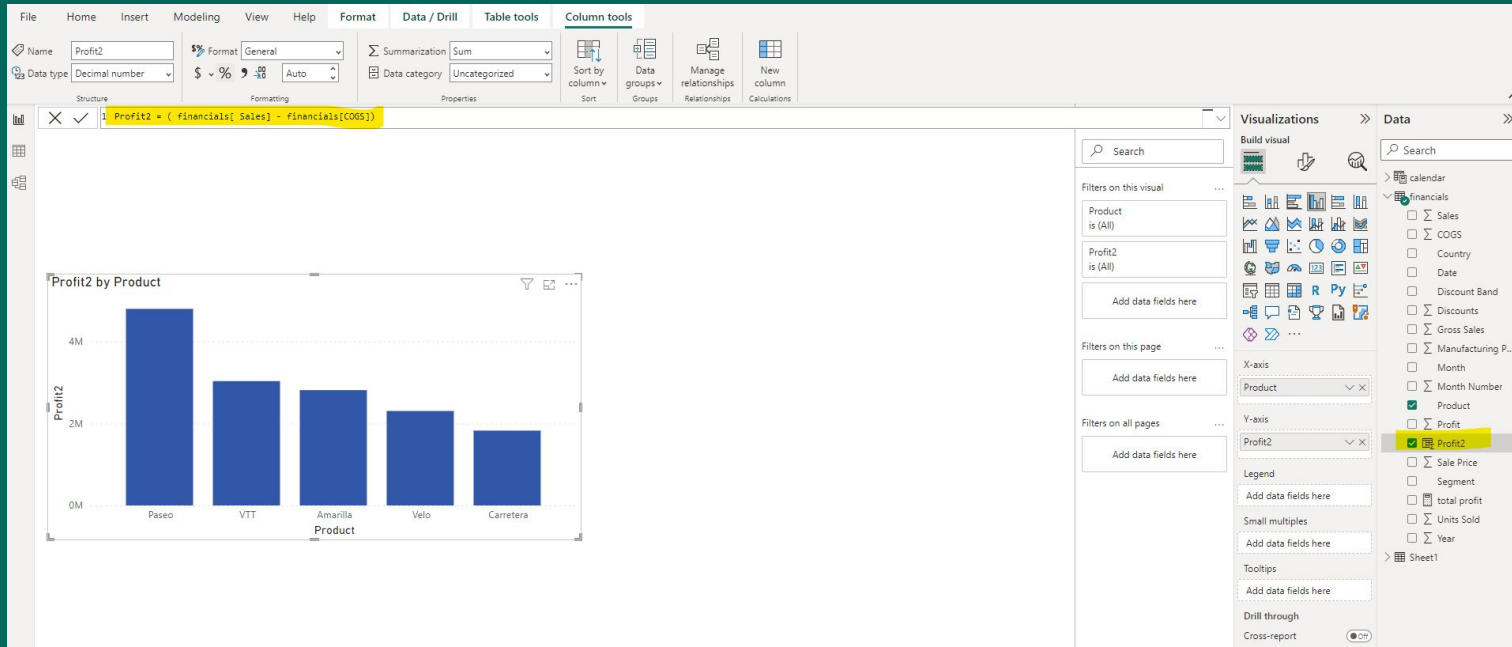


The screenshot shows the Microsoft Excel interface with the 'Table Design' tab active. A formula bar at the top displays '=J2-K2' for the selected cell in column L. Below the formula bar is a table with 11 columns: Segment, Country, Product, Discount Band, Units Sold, Manufacture, Sale Price, Gross Sales, Discounts, Sales, COGS, Calculated Column, and Profit. The 'Calculated Column' is highlighted in yellow. The table contains 8 rows of data, including entries for Government, Midmarket, and segments from Canada, France, Germany, Mexico, and Montana.

Segment	Country	Product	Discount Band	Units Sold	Manufacture	Sale Price	Gross Sales	Discounts	Sales	COGS	Calculated Column	Profit
Government	Canada	Carretera	None	1618.5	\$ 3.00	\$ 20.00	\$ 32,370.00	\$ -	\$ 32,370.00	\$ 16,185.00	\$ 16,185.00	\$ 16,185.00
Government	Germany	Carretera	None	1321	\$ 3.00	\$ 20.00	\$ 26,420.00	\$ -	\$ 26,420.00	\$ 13,210.00	\$ 13,210.00	\$ 13,210.00
Midmarket	France	Carretera	None	2178	\$ 3.00	\$ 15.00	\$ 32,670.00	\$ -	\$ 32,670.00	\$ 21,780.00	\$ 10,890.00	\$ 10,890.00
Midmarket	Germany	Carretera	None	888	\$ 3.00	\$ 15.00	\$ 13,320.00	\$ -	\$ 13,320.00	\$ 8,880.00	\$ 4,440.00	\$ 4,440.00
Midmarket	Mexico	Carretera	None	2470	\$ 3.00	\$ 15.00	\$ 37,050.00	\$ -	\$ 37,050.00	\$ 24,700.00	\$ 12,350.00	\$ 12,350.00
Government	Germany	Carretera	None	1513	\$ 3.00	\$ 350.00	\$ 529,550.00	\$ -	\$ 529,550.00	#####	\$ 136,170.00	\$ 136,170.00
Midmarket	Germany	Montana	None	921	\$ 5.00	\$ 15.00	\$ 13,815.00	\$ -	\$ 13,815.00	\$ 9,210.00	\$ 4,605.00	\$ 4,605.00

Calculated Columns

A Calculated Column will create a new column in your table that is calculated row by row



Measures

A measure will aggregate values from many rows in a table

File

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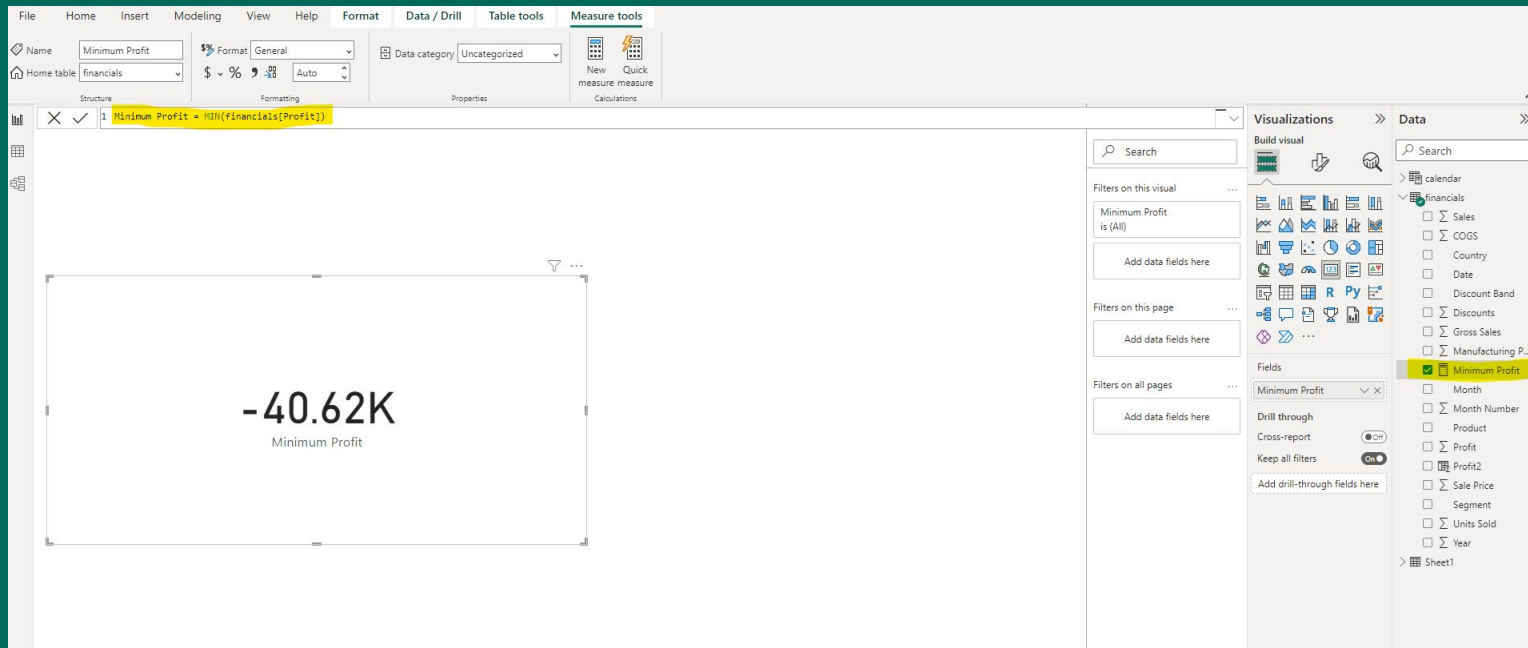
fx

=MIN(M:M)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Segment	Country	Product	Discount Band	Units Sold	Manufacturing	Sale Price	Gross Sales	Discounts	Sales	COGS	Calculated Column	Profit	Measure	
2	Government	Canada	Carretera	None	1618.5	\$ 3.00	\$ 20.00	\$ 32,370.00	\$ -	\$ 32,370.00	\$ 16,185.00	\$ 16,185.00	\$ 16,185.00	\$ (40,617.50)	
3	Government	Germany	Carretera	None	1321	\$ 3.00	\$ 20.00	\$ 26,420.00	\$ -	\$ 26,420.00	\$ 13,210.00	\$ 13,210.00	\$ 13,210.00	\$ (40,617.50)	
4	Midmarket	France	Carretera	None	2178	\$ 3.00	\$ 15.00	\$ 32,670.00	\$ -	\$ 32,670.00	\$ 21,780.00	\$ 10,890.00	\$ 10,890.00	\$ (40,617.50)	
5	Midmarket	Germany	Carretera	None	888	\$ 3.00	\$ 15.00	\$ 13,320.00	\$ -	\$ 13,320.00	\$ 8,880.00	\$ 4,440.00	\$ 4,440.00	\$ (40,617.50)	
6	Midmarket	Mexico	Carretera	None	2470	\$ 3.00	\$ 15.00	\$ 37,050.00	\$ -	\$ 37,050.00	\$ 24,700.00	\$ 12,350.00	\$ 12,350.00	\$ (40,617.50)	
7	Government	Germany	Carretera	None	1513	\$ 3.00	\$ 350.00	\$ 529,550.00	\$ -	\$ 529,550.00	#####	\$ 136,170.00	\$ 136,170.00	\$ (40,617.50)	
8	Midmarket	Germany	Montana	None	921	\$ 5.00	\$ 15.00	\$ 13,815.00	\$ -	\$ 13,815.00	\$ 9,210.00	\$ 4,605.00	\$ 4,605.00	\$ (40,617.50)	
9	Channel Partners	Canada	Montana	None	2518	\$ 5.00	\$ 12.00	\$ 30,216.00	\$ -	\$ 30,216.00	\$ 7,554.00	\$ 22,662.00	\$ 22,662.00	\$ (40,617.50)	
10	Government	France	Montana	None	1899	\$ 5.00	\$ 20.00	\$ 37,980.00	\$ -	\$ 37,980.00	\$ 18,990.00	\$ 18,990.00	\$ 18,990.00	\$ (40,617.50)	
11	Channel Partners	Germany	Montana	None	1545	\$ 5.00	\$ 12.00	\$ 18,540.00	\$ -	\$ 18,540.00	\$ 4,635.00	\$ 13,905.00	\$ 13,905.00	\$ (40,617.50)	
12	Midmarket	Mexico	Montana	None	2470	\$ 5.00	\$ 15.00	\$ 37,050.00	\$ -	\$ 37,050.00	\$ 24,700.00	\$ 12,350.00	\$ 12,350.00	\$ (40,617.50)	

Measures

A measure will aggregate values from many rows in a table



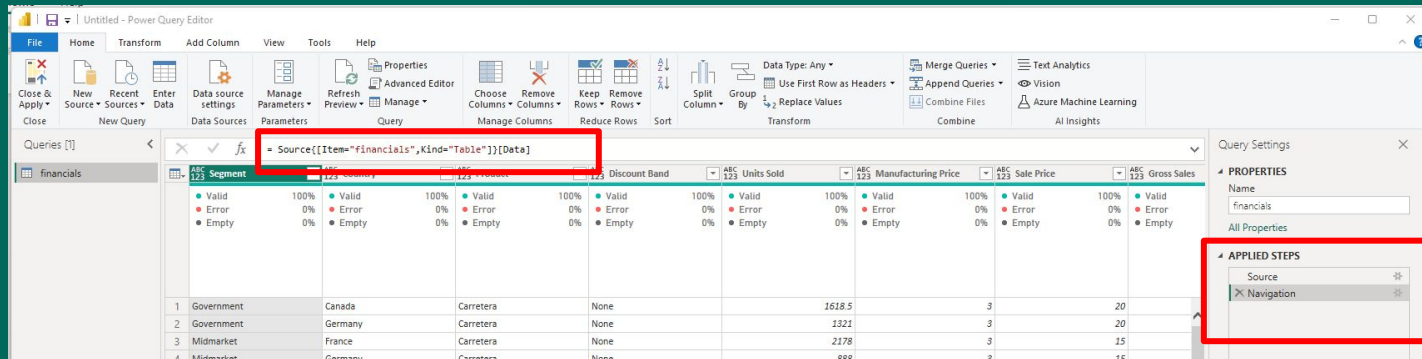
M Code

- [Power Query M formula language reference - PowerQuery M | Microsoft Learn](#)

M code is written for you when you use the Power Query Editor in Transform Data. You may never need to write M code, but it is helpful to know about because you may need to alter it as the report requirements change.

M code can be used for Query Folding which will improve the speed of your reports. This is helpful when you transform datasets larger than one million rows or use multiple sources.

- Example:



M Code & Query Folding

(Aka make your Power BI refresh faster and more efficient)

[\(25\) Do I need to be an expert in Power Query M? - YouTube](#)

[\(25\) Enable QUERY FOLDING for native queries in Power Query / Power BI - YouTube](#)

Row-Level Security & Object-Level Security

[\(25\) What is Row-Level Security \(RLS\) in Power BI??? - YouTube](#)

Row-level security (RLS) with Power BI can be used to restrict data access for given users. Filters restrict data access at the row level, and you can define filters within roles. In the Power BI service, members of a workspace have access to datasets in the workspace.

[Row-level security \(RLS\) with Power BI - Power BI | Microsoft Learn](#)

Object-level security (OLS) enables model authors to secure specific tables or columns from report viewers. For example, a column that includes personal data can be restricted so that only certain viewers can see and interact with it. In addition, you can also restrict object names and metadata. This added layer of security prevents users without the appropriate access levels from discovering business critical or sensitive personal information like employee or financial records. For viewers that don't have the required permission, it's as if the secured tables or columns don't exist.

[Object-level security \(OLS\) with Power BI - Power BI | Microsoft Learn](#)

Resources:

- <https://guyinacube.com/>



- <https://www.sqlbi.com/>
- <https://docs.microsoft.com/en-us/power-bi/>
- <https://docs.microsoft.com/en-us/learn/paths/data-analytics-microsoft/>
- <https://community.powerbi.com/>