

Filter Context and Row Context

In DAX, **Filter Context** and **Row Context** are essential concepts that help determine how calculations are made within a report or visualization. Understanding these contexts allows data analysts to perform accurate and relevant analyses across various datasets and scenarios. Let's dive deeper into each context and illustrate them with examples from different industries.

1. Filter Context

Definition: Filter Context refers to any filters that are applied to a DAX calculation, either through visuals, slicers, filters, or DAX functions like CALCULATE. It defines a "subset" of data, based on conditions that are in place at the time of calculation.

How Filter Context Works: Whenever a calculation is made, Power BI applies the active filters (such as selections made on a dashboard) before computing the result. This lets users see results based on specific selections, like certain years, regions, or product categories.

Examples of Filter Context Across Industries:

- **Retail:** A retailer wants to calculate total sales for specific product categories and regions. If a filter is applied to show only sales from the "Electronics" category in "North America," then only the relevant subset of data will be included in the calculation. Any measure like SUM(Sales[Amount]) would apply only to this filtered set.
- **Finance:** An analyst at a bank calculates the total interest income for a particular type of loan. By applying a filter context for "Home Loans" and "Year 2024," DAX will only consider records that match these criteria, providing a precise figure for the filtered loan type and year.
- **Healthcare:** A hospital might use DAX to analyze patient admissions by specific departments. By setting filters on "Department = Cardiology" and "Quarter = Q1," Power BI will limit the calculation to admissions for cardiology patients in the first quarter, helping managers review department-specific data.
- **Manufacturing:** A plant manager might want to view the defect rate of products for a specific month. By applying a filter on "Month = March" and "Product Type = A," Power BI calculates defect rates only for the given month and product type, aiding in targeted quality control.

Key DAX Function for Filter Context:

- **CALCULATE:** This is used to modify the filter context of a calculation. For example:

```
Total Sales Electronics = CALCULATE(SUM(Sales[Amount]), Sales[Category] = "Electronics")
```

This formula only sums the sales amount for products in the "Electronics" category, applying a filter on category.

2. Row Context

Definition: Row Context is the context under which DAX evaluates a formula for each row in a table, allowing calculations to consider each row's specific data. It's like applying a calculation separately to each row, as in a calculated column or when using functions that iterate (e.g., SUMX, AVERAGEX).

How Row Context Works: Whenever a DAX formula is applied to a row, DAX considers each row independently. For example, if you're calculating a "Total Profit" column as [Sales] - [Cost] in each row, DAX evaluates this on a row-by-row basis, referencing the specific sales and cost values in each row.

Examples of Row Context Across Industries:

- **E-commerce:** An e-commerce company might calculate profit per order by creating a calculated column in a table with $\text{Profit} = \text{Sales}[\text{Amount}] - \text{Sales}[\text{Cost}]$. Row context ensures that each row in the "Sales" table has its own profit calculation, allowing the company to analyze individual order profits.
- **Logistics:** In a logistics firm, each shipment has different weights and costs. A calculated column might be used to calculate Cost per Weight in each row as $\text{Total Cost} / \text{Weight}$, considering each shipment's unique data. This row-based calculation helps the company understand cost efficiency on a shipment-by-shipment basis.
- **Education:** A university wants to track the GPA for each student based on individual courses taken. A DAX formula using row context can calculate the grade points per course, then sum these for each student to derive their GPA. Each student-course combination is evaluated in its own row.
- **Insurance:** An insurance company could calculate the premium rate per policyholder based on specific risk factors in each policy. If " $\text{Premium} = \text{Base Rate} * \text{Risk Factor}$ " is applied as a calculated column, each policy's row context ensures the premium calculation is unique, considering the policyholder's risk factors.

Key DAX Functions for Row Context:

- SUMX, AVERAGEX, MINX, MAXX, etc.: These functions iterate over a table, applying row context to each row.

`Total Profit = SUMX(Sales, Sales[Amount] - Sales[Cost])`

Here, SUMX iterates over each row in the Sales table, calculating Amount - Cost per row, then summing these values.

Combining Filter and Row Contexts

DAX calculations often involve both filter and row contexts working together. For example, when a measure uses CALCULATE inside an iterative function like SUMX, DAX evaluates each row based on row context and also applies any filter conditions.

Example: A company might calculate **Total Sales for Electronics in North America** by iterating through each sale in the "Electronics" category and applying a filter on "North America." Here, CALCULATE provides the filter context, while SUMX applies row context to each sale.

```
Total Sales Electronics NA =  
CALCULATE(  
    SUMX(Sales, Sales[Amount]),  
    Sales[Category] = "Electronics",  
    Sales[Region] = "North America"  
)
```

Summary of Differences and Applications

Context Type	Definition	Real-Life Applications	DAX Functions
Filter Context	Applies specific filters for calculation, limiting data subset	Viewing sales by region, tracking patient admissions by department, monitoring defect rate by product type	CALCULATE, ALL, FILTER
Row Context	Applies calculations on a row-by-row basis	Calculating profit per order, determining GPA per student, calculating premium per policyholder	SUMX, AVERAGEX, MINX, MAXX

Understanding **Filter Context** and **Row Context** is essential for writing powerful and efficient DAX expressions. Filter context helps in specifying “what subset of data,” while row context helps in specifying “how each row should be calculated.” Together, they enable data analysts to perform in-depth and targeted analyses in Power BI across various industries.