DAX (Data Analytics Expression)

DAX is a powerful formula language, because it specifically designed for creating formulas and expressions that operates the data.

You can perform wide range of analysis and reporting with the DAX.

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DAX Data types

- Numeric
- Text
- Date and Time
- Boolean
- Currency
- Percentage
- Duration
- Binary
- Variant
- Table type
- Other

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What type of calculations can you perform with DAX

1. Calculated Columns
2. Calculated Tables
3. Measures

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Calculated Columns

- By writing DAX Formula, you can add a new column to the table.
- Your formula determines whether it duplicates the exiting column from a table or generating a new series of values.
- Formula should return a single column with list of values
- You can create this in report view, model view and table view

```
Sales_Amount = Sales[Unit Price] * Sales[Order Quantity]
```

DAX formula creating a simple sales calculations and returns a series of sales values

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Calculated Columns

- Calculated columns create additional data in the data model, so this increases the model size if there are many calculated columns.
- Calculations are performed on row-by-row basis.
- Calculated column values are refreshed during the entire model’s refreshed time if the model uses import mode.
- If the model uses direct query, the formula is not calculated within the model. Instead, the formula pushed to data source and the calculation performed at query time in the database.

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Calculated Columns

- Few Interview Questions.
  - How does calculated column differ from other columns ?
  - When and how calculated columns are refreshed ?
  - When would you choose calculated columns instead of measures ?
  - Pros and cons of calculated columns ?

Calculated Tables

- By writing DAX Formula, you can add a new table to your model.
- Your formula determines whether it duplicates the exiting table or generating a new series of values for calculated table.
- Your formula should return a table instead of returning a single value.
- You can create this in report view, model view and table view
- Calculated tables are recalculated, if any of the tables are refreshed or updated.

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Calculated Tables

```
fact_summarize_date = SUMMARIZE(
                    'fact_premiums', fact_premiums[date],
                    fact_premiums[final_premium_amt(INR)])
```

- DAX formula was created to summarize the ‘fact_premiums’ table by date. This returns a table of summarized values
- This always imported into your model, so this increases your model size and can prolong your data refresh time.
- Just like other tables, calculated tables have a relationship with other tables.

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Calculated Tables

- Few Interview Questions.
  - How does calculated table differ from other physical tables ?
  - How do you create calculated tables?
  - In which scenarios would you choose calculated tables?
  - Pros and cons of calculated tables ?

MEASURES

- Measure is a calculated value based on the data in your model
- Measures are evaluated at query time and it takes memory for DAX formula and not the results.
- There are two types of measures
  - Implicit Measure
  - Explicit Measure

MEASURES

- Implicit Measures
    - This is automatically created by power bi when you drag and drop your numerical values into visual area such as metrics, tables.
    - You can have flexibility to change the summarization method of applied implicit measures.

MEASURES

- Explicit Measures
  - These are created by the developers to perform specific calculation as per the need.
  - By writing DAX Formula, to create a measure to your model and must return single value.
  - You can organize all your measures in display folders for better readability.

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Measures

- Few Interview Questions.
  - How does measure differ from calculated column ?
  - How do you create implicit/explicit measures ?
  - What type of calculations can you perform with measures ?
  - How do you handle errors in DAX measures ?
  - What strategies can you use to optimize the performance of measures ?

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CALCULATE

- CALCULATE is primarily used function to modify the context in which a calculation is performed and this will allow you to apply filters on the calculations.

```
Weekday_Sale =
var revenue = CALCULATE(
            SUM[Revenue],                          ←  Evaluating sum of revenue
            dim_date[month]= ‘Febrarury’,          ←  Filter 1
            dim_date[week_type] = "Weekday")       ←  Filter 2
return revenue                                     ←  Return statement
```

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CALCULATE

- The code creates a measure to our model
- Code calculates the revenue amount for current month and weekday
- for e.g.: now we are in February, formula returns the revenue for weekday's in February's and excludes weekend.
- Used VARIABLES for better readability and debugging.
- SUM is an aggregate function used in the code, which is default function exists in DAX

CALCULATE

- Do comment if you know any other ways to achieve the sales that occurred on weekdays within the current month.

In Day 6, I will share mine.

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CALCULATE

Here is other way to achieve the same weekday sales with CALCULATE function.

- Total_Revenue = SUM(fact_premiums[final_premium_amt(INR)])
- Above code creates a measure by aggregating ‘final_premium_amount’
- One can use this measure in multiple places, reducing the need duplicate the same calculation

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CALCULATE

```
 Weekday_Sale =
 var revenue = CALCULATE(
               [Total_Revenue], ←── Measure
Filter 1 ───→  FILTER(dim_date, dim_date[month]= 'Febrarury' &&
Filter 2 ───→  dim_date[week_type] = "Weekday"))
 return revenue
```

- Used FILTER functions to achieve the revenue of current month’s weekday sale

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CALCULATE

- Here is one more way to achieve the same weekday sales with CALCULATE function

```
Weekday_Sale =
var revenue = CALCULATE(
              [Total_Revenue],        ← Explicit Measure
Filter 1 →    dim_date[week_type] = "Weekday“,
Filter 2 →    VALUES(dim_date[month]))
return revenue
```

VALUES

- Formula used new function which is VALUES.
- Instead of using a variable to set the current month, we apply context of current month using VALUES function.
- This calculation ensures, it is performed for weekdays with in the current month

CALCULATETABLE

- It is used to change the filter context of an entire table rather then single expression.
- If there is a need to generate a table instead of scalar value, choose this CALCULATETABLE
- Syntax is similar to CALCULATE.
- This function is not supported for direct query mode when used in calculated columns or row-level-security.

CALCULATETABLE

```
Online_Sale=
var Sales = CALCULATETABLE(
        fact_premiums, ←—— Table name
        fact_premiums[sales_mode] = "Online-App" ←—— Filter 1
        )
return Sales
```

- Above code filters the table “fact_premiums” with the sales_mode is Online_App. The result of the above code stores in a new table “Online_Sales”.
- Structure of the new table(online_sale) is same like original table(fact_premiums)

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CALCULATETABLE

Considerable facts when use CALCULATETABLE

- Cannot be applied in measures like filter functions
- You need enough memory to use calculate tables.
- Calculated tables increase the processing time in DAX.
- Calculated tables are static and cannot modified dynamically based on user interactions.
- There is risk of data redundancy or duplication of data based on how calculated tables are implemented.

CALCULATETABLE

Here will see an other scenario in CALCULATETABLE.

- Create a table that combines data from two related tables

```
weekend_table = CALCULATETABLE(
                    fact_premiums,                    ← Table 1
                    RELATEDTABLE(dim_date),           ← Table 2
                    dim_date[week_type] = "Weekend")  ← Filter 1
```

- Above code filters the fact_premiums table for payments made on week ends.
- dim_date and fact_premiumns are having single directional relationship (one-to-many)

CALCULATE VS CALCULATETABLE

CALCULATE	CALCULATETABLE
Evaluates an expression in a context modified by filter	Evaluates an table expression in a context modified by filters.
	If you use this function within the DAX measure, it is going to return virtual table
This allocates less space in mode	This allocates more memory in your model
It operates at row-level, allowing you to modify the filter context for each individual calculation	This works at table level and can be more efficient when applying filters to entire table

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RELATED

- RELATED, which is used to retrieve a related value from another table and it returns a scalar value.
- This requires establishing a relationship between current table and the table with related information that you need.
- Syntax is simple with single parameter, that specifies the column that contains the value you want to retrieve.
- It is used in measures, calculated columns to get the related value of current context.
- This won’t work between the tables which is not having any relationship.

RELATED

- Here, we have two tables Product (dimension)and Sales(fact)
- They have established one-to-many relationship.
- Calculate the sales by each product.

Column name

Table 1

Related Table

```
Sales_by_Product = SUMX(
                   Sales,
                   RELATED('Product'[List Price]) *
                   Sales[Order Quantity])
```

RELATEDTABLE

- RELATEDTABLE is a function used to retrieve a table that related to current row in the data model
- It doesn’t retrieve individual values directly, instead of return the entire related table
- When data source is Direct Query, It doesn’t work in creating calculated columns or row-level security.

RELATEDTABLE

Here is a scenario to calculate total number of sales for top products by revenue.

- Here, we have two tables Product (dimension)and Sales(fact)
- ‘Revenue’ is a column in Sales table
- In code, First calculating the top products by their sales from the sales table.
- Then, we are counting number of sales occurred for top products.

RELATEDTABLE

Finding top 3 products by the revenue

```
Top_Products_Sale =
var Top_Products = TOPN(3, 'Product', Sales[Revenue])
return
SUMX(
        Top_Products,
        COUNTROWS(RELATEDTABLE(Sales)))
```

Related Table

- RELATEDTABLE(Sales) retrieves the sales data related to the Top_Products.
- COUNTROWS, count the number of rows

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RELATED VS RELATEDTABLE

RELATED	RELATEDTABLE
RELATED() is a function, used to retrieve a related value from another table	RELATEDTABLE() function used to get table of related rows from another table
It works with in the context of established relationship between the tables	It works with in the context of established relationship between the tables
Typically used in calculated columns and measures to fetch a single related value	Typically used in calculated columns and measures to retrieve a table of related rows
Can fetch scalar value for aggregation or comparision	Often used for aggregations of filtering operations

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RELATED VS RELATEDTABLE

Few Interview Questions.

1. Purpose of RELATED() and RELATEDTABLE() ?
2. Return type of RELATED() ?
3. When would you be use RELATEDTABLE() function ?
4. Explain the differences between RELATED() and RELATEDTABLE()
5. In which scenario would you prefer to use RELATED() over RELATEDTABLE()

FILTER

- FILTER() is a function used to filter the rows or columns from a table based on specific conditions.
- It returns a table of rows instead of scalar values
- Filter can be used in various scenarios such as calculating columns, performing a conditional aggregation, measures.
- Filter() is commonly used with other DAX functions such as CALCULATE, SUMMARIZE and more
- This function not supported to use in Direct Query when used in calculated columns or RLS rules.

FILTER

```
Revenue_by_Terrirory = CALCULATE(
                        [Revenue],
                        FILTER('Sales Territory',
                        'Sales Territory'[Country] = "United States"))
```

Filtering table

Filter condition

- Above measure returns the ‘Revenue’ for the country United States.
- The measure applies the filter condition to the ‘Sales Territory’ table

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