Introduction to Power BI, Charts, DAX & Creating Reports

Q.1 Define Power BI and What are the key components of the Power BI ecosystem? Briefly explain:
- **Power BI Desktop**
- **Power BI Service**
- **Power BI Mobile**
- **Power BI Gateway**

→ Power BI is a business analytics tool developed by Microsoft that helps users collect, transform, analyze, and visualize data. It allows organizations to create interactive dashboards and reports that provide meaningful insights and support data-driven decision-making.

Key Components of the Power BI Ecosystem

The Power BI ecosystem consists of several components that work together to analyze and share data effectively. The main components are:

1. Power BI Desktop

Power BI Desktop is a Windows-based application used to create reports and data models. It allows users to connect to multiple data sources, clean and transform data using Power Query, create relationships, and design interactive visualizations. Reports created in Power BI Desktop can be published to the Power BI Service.

2. Power BI Service

Power BI Service is a cloud-based platform used to publish, share, and collaborate on reports and dashboards. It enables users to access reports online, schedule data refreshes, and share insights with others across the organization. It also supports collaboration and security management.

3. Power BI Mobile

Power BI Mobile is a mobile application available for Android, iOS, and Windows devices. It allows users to view and interact with reports and dashboards anytime and anywhere. The app provides real-time data access and alerts for important updates.

4. Power BI Gateway

Power BI Gateway is a bridge between on-premises data sources and the Power BI Service. It enables secure data transfer and allows scheduled refreshes of data stored in local databases, files, or servers without moving the data to the cloud.

Conclusion

Power BI combines these components to provide a complete business intelligence solution that supports data visualization, analysis, collaboration, and secure data access.

Q.2 Compare the following Power BI visuals:
● Pie Chart vs Donut Chart
● Bar Chart vs Column Chart When would you prefer one over the other? Give one example for each pair.

→Power BI provides various visuals to represent data effectively. Below is a comparison of commonly used visuals and situations where each is preferred.
1. Pie Chart vs Donut Chart

Aspect	Pie Chart	Donut Chart
Structure	Circular chart divided into slices	Similar to pie chart but with a hollow center
Data Display	Shows part-to-whole relationship	Shows part-to-whole with space for labels
Readability	Simple but can look crowded	More visually appealing and clearer
Extra Information	Limited space for details	Center can display total or key value

When to Prefer

- Pie Chart: When there are very few categories and you want a simple representation.
- Donut Chart: When you want to display additional information such as total values in the center.

Example

- Pie Chart Example: Percentage of market share held by different smartphone brands.
- Donut Chart Example: Percentage contribution of each department to total company expenses, with total expenses shown in the center.

2. Bar Chart vs Column Chart

Aspect	Bar Chart	Column Chart

Orientation	Horizontal bars	Vertical columns
Best Used For	Comparing categories with long names	Showing trends or comparisons over time
Readability	Better for large category labels	Better for time-based data
Common Usage	Category-wise comparison	Time-series analysis

When to Prefer

- Bar Chart: When category names are long or when there are many categories.
- Column Chart: When analyzing data over time or showing trends.

Example

- Bar Chart Example: Comparison of sales across different product categories.
- Column Chart Example: Monthly sales trend of a company over one year.

Conclusion

Choosing the right visual depends on the type of data and the insight you want to communicate. Pie and Donut charts are best for part-to-whole comparisons, while Bar and Column charts are ideal for comparing values across categories and time periods.

Q.3 Explain the significance of:
● Star schema vs Snowflake schema
● Primary key vs Foreign key in relationships (Power BI)
Why is cardinality important?

→ Data modeling plays a crucial role in Power BI as it directly affects report performance, accuracy, and ease of analysis. The following concepts are important in building an effective data model.

1. Star Schema vs Snowflake Schema

Star Schema

A star schema consists of a central fact table connected directly to multiple dimension tables. The structure resembles a star.

Significance:

- Simple and easy to understand
- Faster query performance
- Fewer joins, improving report speed
- Recommended and widely used in Power BI

Example:
Sales Fact table connected to Product, Customer, Date, and Region dimension tables.

Snowflake Schema

A snowflake schema is an extension of the star schema where dimension tables are further normalized into multiple related tables.

Significance:

- Reduces data redundancy
- Uses less storage space
- More complex structure
- Slower performance due to multiple joins

Example:
Sales Fact table → Product table → Product Category table.

2. Primary Key vs Foreign Key in Relationships (Power BI)

Primary Key

A primary key is a column that uniquely identifies each record in a table.

Significance:

- Ensures data uniqueness

- Used on the one side of a relationship
- Helps Power BI filter data correctly

Example:
CustomerID in Customer table.

Foreign Key

A foreign key is a column that refers to the primary key of another table.

Significance:

- Used to create relationships between tables
- Exists on the many side of a relationship
- Enables data lookup and filtering

Example:
CustomerID in Sales table referencing Customer table.

3. Importance of Cardinality in Power BI

Cardinality defines the relationship between tables, such as:

- One-to-One (1:1)
- One-to-Many (1:*)
- Many-to-Many (*:*)

Why Cardinality Is Important

- Ensures correct data aggregation
- Prevents incorrect totals and duplicate values
- Controls how filters flow between tables
- Improves report accuracy and performance

Example:
One customer can have many sales → One-to-Many relationship.

Conclusion

Using the correct schema, defining proper primary and foreign keys, and setting accurate cardinality are essential for building efficient, reliable, and high-performing Power BI data models.

Q.4 Differentiate between:
● Calculated column vs Measure
Also, define Row context and Filter context with simple examples.

→ Difference Between Calculated Column and Measure in Power BI

Calculated Column

A calculated column is a column created using DAX that is calculated row by row and stored in the data model.

Key Points:

- Calculated at data refresh time
- Uses row context
- Increases model size
- Values remain fixed unless data is refreshed
- Used for row-level calculations

Example:
TotalPrice = Quantity × UnitPrice (calculated for each row)

Measure

A measure is a calculation created using DAX that is computed at query time based on the filters applied in a report.

Key Points:

- Calculated on the fly

- Uses filter context
- Does not increase model size
- Changes dynamically with slicers and filters
- Used for aggregations and KPIs

Example:
Total Sales = SUM(Sales[TotalPrice])

Row Context

Row context means that DAX evaluates an expression one row at a time, considering values from the current row only.

Simple Example:
In a Sales table:
Quantity = 5, Price = 100
Calculated Column formula:
Total = Sales[Quantity] × Sales[Price]
Here, the calculation applies separately to each row.

Filter Context

Filter context refers to the set of filters applied to a calculation, such as slicers, filters, rows, or columns in a visual.

Simple Example:
Measure:
Total Sales = SUM(Sales[Amount])

If a slicer is applied for Year = 2025, the measure calculates sales only for that year.

Conclusion

Calculated columns are best for row-level calculations, while measures are ideal for dynamic aggregations. Understanding row context and filter context is essential for writing correct and efficient DAX formulas in Power BI.

Q.5 What is the difference between a report and a dashboard in Power BI?

→ In Power BI, reports and dashboards are used to visualize and analyze data, but they serve different purposes and have different features.

Power BI Report

A report is a collection of multiple pages containing visuals such as charts, tables, and maps. Reports are created using Power BI Desktop and are based on a single dataset.

Key Features:

- Can have multiple pages
- Built from one dataset
- Highly interactive (filters, slicers, drill-down)
- Used for detailed data analysis
- Can be edited and customized

Example:
A sales analysis report with separate pages for monthly sales, regional performance, and product-wise analysis.

Power BI Dashboard

A dashboard is a single-page view that displays key visuals called tiles. Dashboards are created in the Power BI Service by pinning visuals from one or more reports.

Key Features:

- Single page only
- Can combine visuals from multiple reports and datasets
- Limited interactivity
- Used for high-level overview
- Mainly used by decision-makers

Example:
A management dashboard showing total revenue, profit, top products, and key KPIs.

Conclusion

Reports are best suited for in-depth analysis, while dashboards are ideal for monitoring key metrics at a glance. Both play important roles in effective data-driven decision-making.

Q.6 Using the Sample Superstore dataset:

● Create a Clustered Bar Chart to display Total Sales by Sub-Category

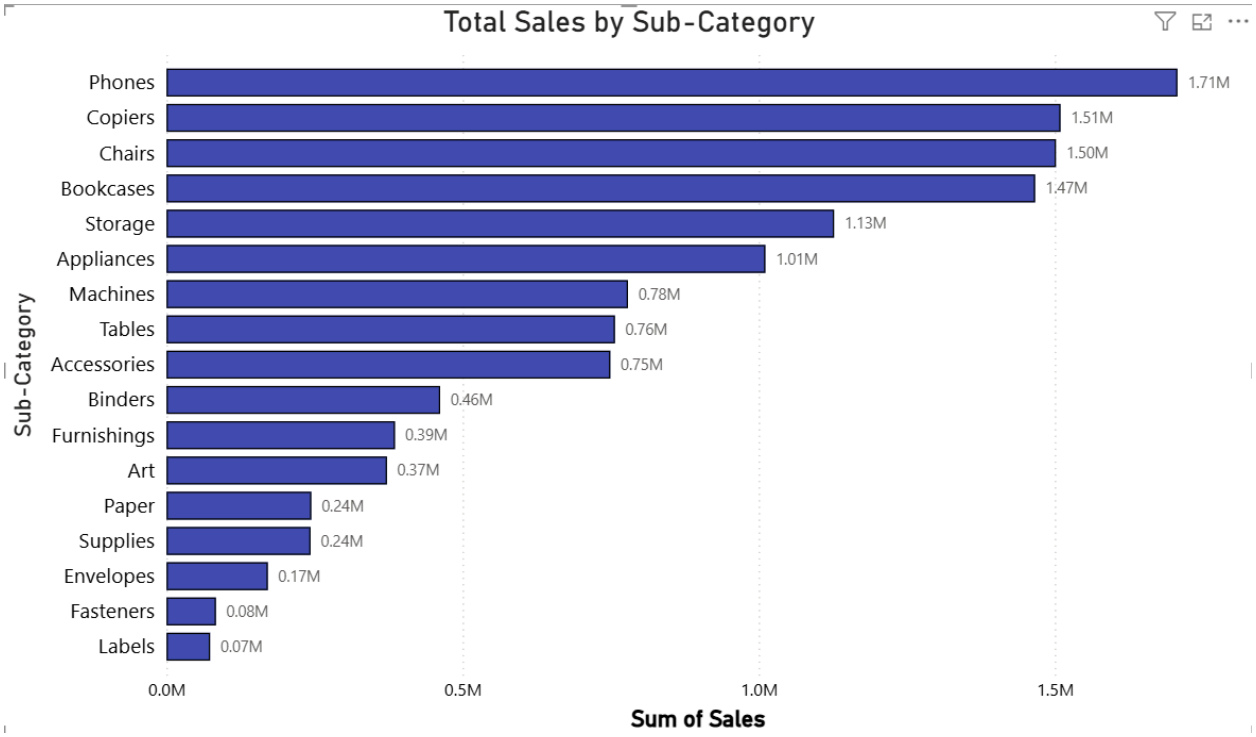
● Create a Donut Chart for Sales % by Region Provide screenshots of both visuals.

→

1. Clustered Bar Chart – Total Sales by Sub-Category

Show Total Sales for each Sub-Category

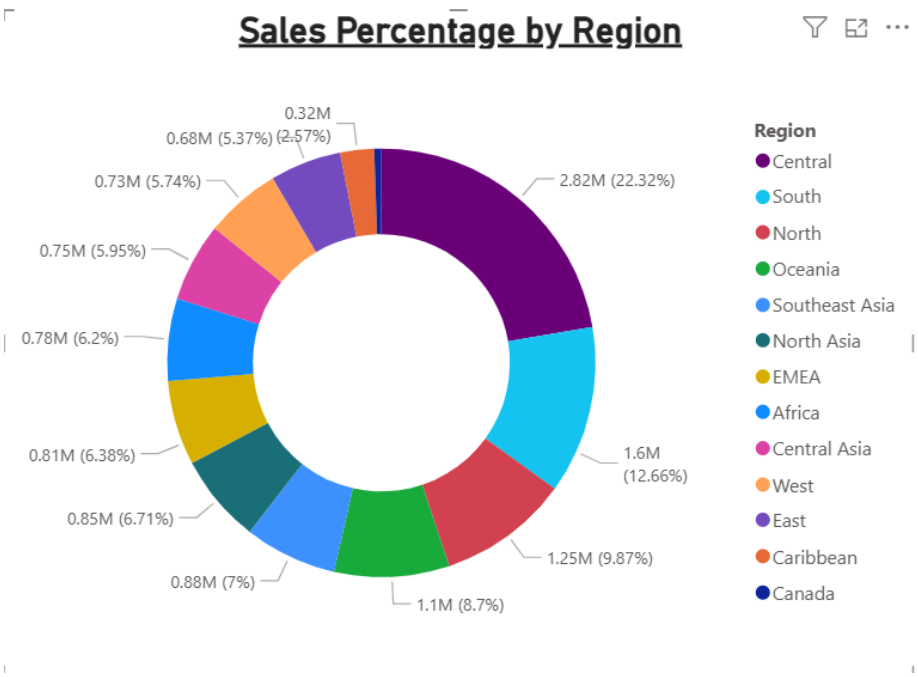
Phones contribute higher sales .



2. Donut Chart – Sales % by Region

Purpose

Show percentage contribution of sales by region



The Central region contributes the highest percentage of total sales, followed by the south region.

Q.7 Write and apply the following measures:

● Total Profit = SUM([Profit])

● Average Discount = AVERAGE([Discount]) Display both in a KPI Card, and use a Line Chart to show profit trend over months.

Add visuals and DAX formulas.

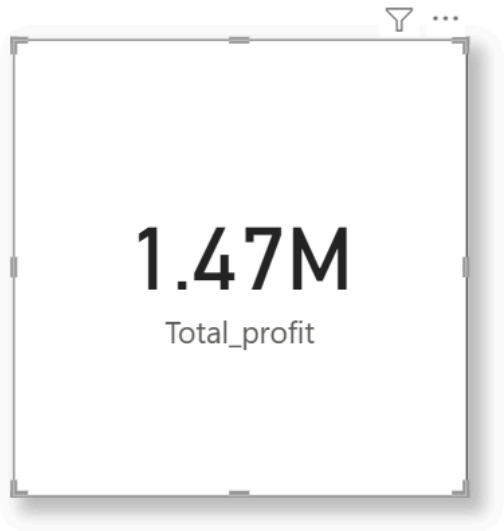
→ DAX formulas:

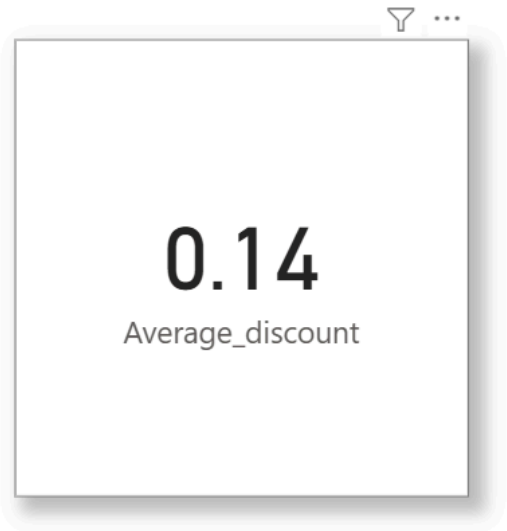
```
1. Total_profit = SUM(Global_Superstore2[Profit])

2. Average_discount = AVERAGE(Global_Superstore2[Discount])
```

Measures in KPI Card(s)

1. KPI Card – Total Profit

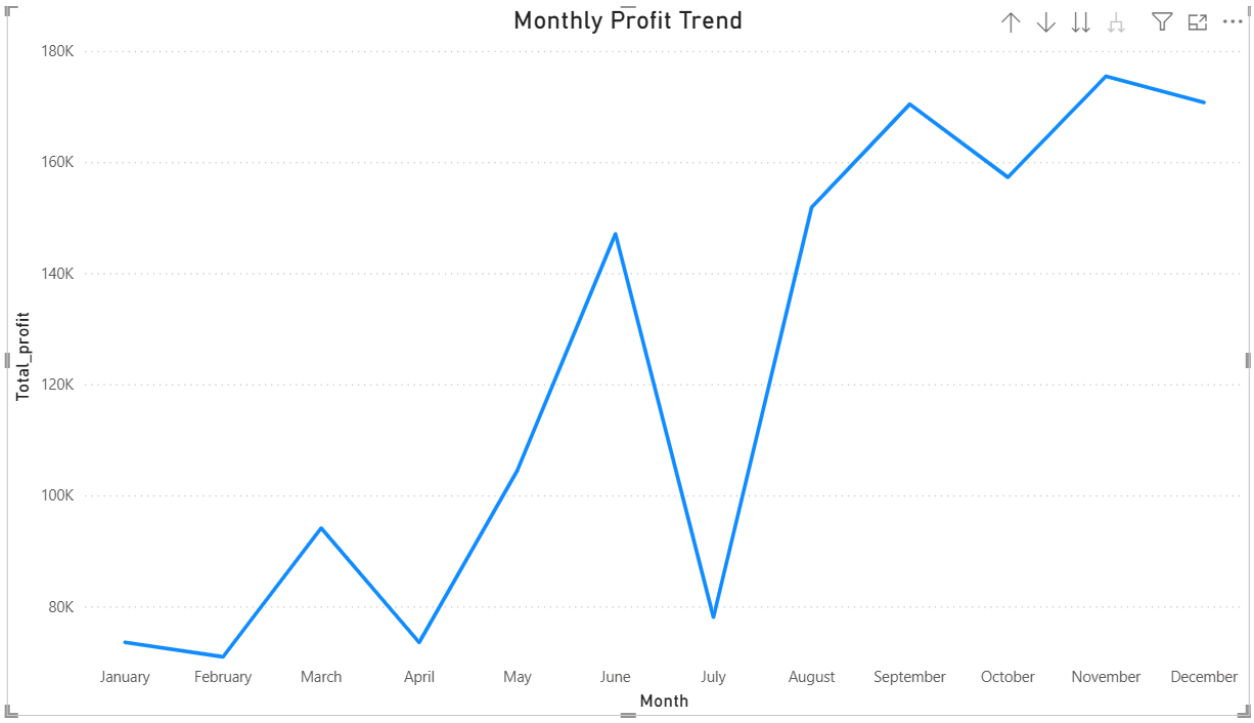
2. KPI Card – Average Discount





The Total Profit KPI shows overall profitability, while the Average Discount KPI indicates the average discount offered across all orders.

Line Chart – Profit Trend Over Months



The monthly profit trend highlights fluctuations in profit over time, helping identify high-performing and low-performing months.

Q.8 Implement a DAX measure that calculates the percentage of total sales by product category.

Product_category	Sales_Amount
Electronics	5000
Clothing	3000
Home Appliances	7000
Books	2000
Tables & Chairs	8000
Toy	1500
Sports Equipment	1200
Office Supplies	1000
Beauty Products	4400

Garden Supplies	1000
Jewelry	1800
Automotive	2600

→ The percentage of total sales by product category is calculated using a DAX measure. First, a total sales measure is created using the SUM function. Then, the percentage is calculated by dividing category sales by total sales using CALCULATE and ALL functions to remove category filters.

DAX measure formula:

Base Measure:

```
Total_sales = SUM(Sheet1[Sales_Amount])
```

Percentage of Total Sales Measure

```
Sales_%_by_category = DIVIDE([Total_sales],
CALCULATE([Total_sales],ALL(Sheet1[Product_category])))
```

Q.9 Create a DAX Measure for Total Profit

● Use it in a Waterfall Chart to analyze how different Sub-Categories contribute to overall profit

● Add a Slicer for Region to filter the visual

● Write brief business insights (4–5 lines) from the chart and provide 2–3 data-driven recommendations to improve profit. Provide a steps, screenshot of the Waterfall chart and the DAX formula

→ Steps to Create Total Profit Waterfall Chart with Region Slicer

Step 1: Load the Dataset

1. Open Power BI Desktop

2. Click Get Data → Excel / CSV
3. Select the Sample Superstore dataset
4. Click Load

Step 2: Create DAX Measure for Total Profit

1. Go to Report View
2. In the Fields pane, right-click the dataset table
3. Select New Measure
4. Enter the following DAX formula:

DAX formula for total profit

```
Total_profit = SUM(Global_Superstore2[Profit])
```

5. Press Enter

Step 3: Insert Waterfall Chart

1. From the Visualizations pane, select Waterfall Chart
2. Add fields:
    - Category → `Sub-Category`
    - Y-axis (Values) → `Total Profit`
3. Sort the chart by Total Profit (Descending)

Step 4: Format the Waterfall Chart

1. Turn Title → ON

- Title text: Profit Contribution by Sub-Category

2. Turn Data labels → ON
3. Set sentiment colors:
    - Increase → Green
    - Decrease → Red
    - Total → Blue
4. Ensure the Total bar is displayed at the end

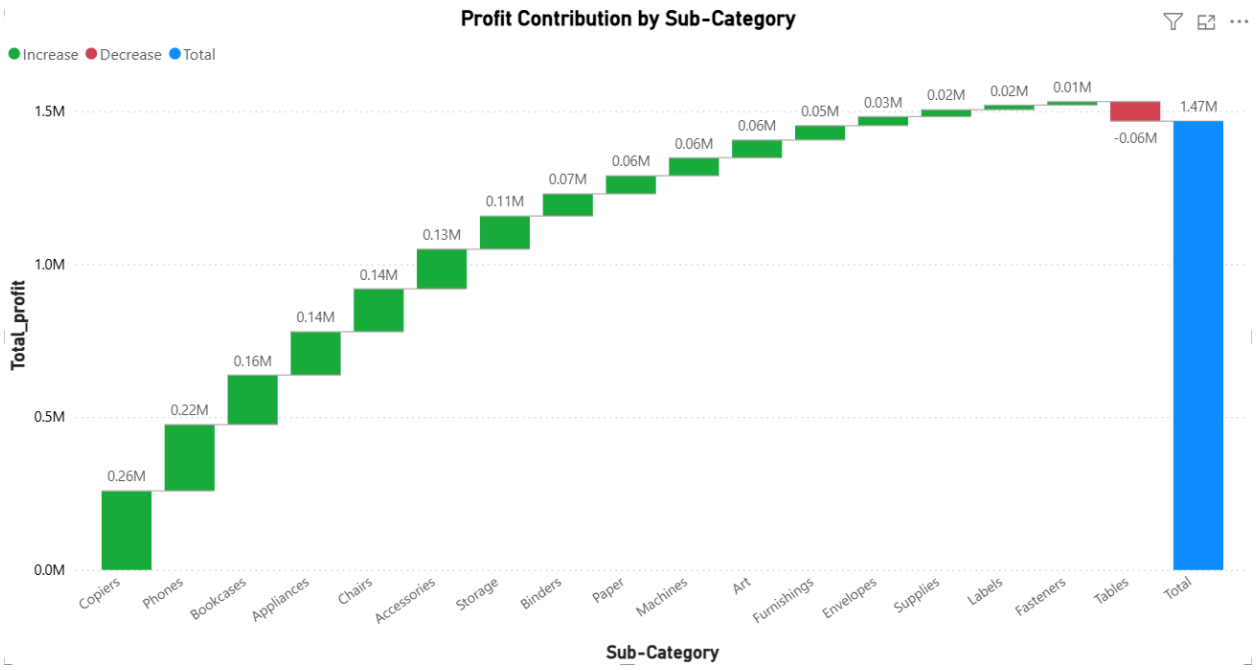
Step 5: Add Region Slicer

1. Select Slicer visual from Visualizations
2. Drag Region into the slicer field
3. Format the slicer:
    - Title → Region Filter

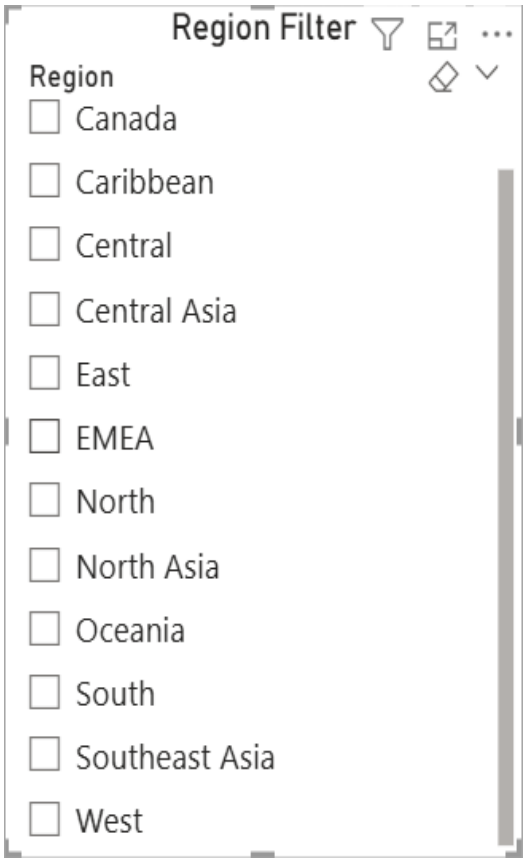
Step 6: Analyze the Visual

1. Use the Region slicer to filter profit by region
2. Observe how each Sub-Category increases or decreases total profit
3. Identify high-profit and loss-making sub-categories

Waterfall Chart showing Profit Contribution by Sub-Category



Slicer for Region



Business Insights

1. The Waterfall chart shows that Copiers and Phones are the largest contributors to total profit, together accounting for a significant portion of overall profitability.

2. Several sub-categories such as Bookcases, Appliances, Chairs, and Accessories consistently add positive profit, indicating strong and stable performance.

3. Tables is the only sub-category with a negative profit contribution, which reduces the overall total profit.

4. Most Office Supplies sub-categories (Paper, Binders, Labels, Fasteners) contribute smaller but steady profits, supporting overall performance.

5. The final total profit of approximately 1.47 million highlights that profits are driven by a few high-performing sub-categories rather than evenly distributed across all products.

Data-Driven Recommendation for Profit

1. Increase focus on high-profit sub-categories like Copiers and Phones by prioritizing inventory, promotions, and sales strategies around these products.

2. Investigate loss-making sub-categories such as Tables to review pricing, discounts, and supply costs to reduce negative profit impact.

3. Optimize smaller profit contributors by bundling low-margin items with high-margin products to improve overall profitability.

Q.10 Scenario: VitaTrack Wellness, a digital health company in FitZone, has collected data on users' daily habits and health vitals. The analytics team is tasked with drawing actionable insights from this data to improve lifestyle suggestions and prevent heart-related risks. Your Task: Using the provided dataset (includes Age, Gender, BMI, Steps, Calories, Sleep, Heart Rate, Blood Pressure, Smoking, Alcohol, Exercise, Diabetic & Heart Disease status):
Build a one-page Power BI dashboard that answers:
1. Are users maintaining a balanced lifestyle (Steps, Sleep, Calories)
2. What lifestyle patterns (Smoking, Alcohol, BMI, etc.) indicate heart disease risk?
3. Is there any visible relationship between Sleep and Physical Activity?
4. How does BMI vary across Age Groups and Genders?
5. What is the impact of smoking and alcohol on heart rate and blood pressure?
6. Segment people based on their health activity to suggest lifestyle changes.

→ New Column Formula

```
Age Group =
SWITCH(
    TRUE(),
    'health_activity_data'[Age] < 25, "18–24",
    'health_activity_data'[Age] < 35, "25–34",
    'health_activity_data'[Age] < 45, "35–44",
    'health_activity_data'[Age] < 55, "45–54",
    "55+"
)

Health Score =
IF('health_activity_data'[Daily_Steps] > 8000, 1, 0) +
IF('health_activity_data'[Hours_of_Sleep] >= 7, 1, 0) +
IF('health_activity_data'[BMI] < 25, 1, 0)


Health Segment =
SWITCH(
    'health_activity_data'[Health Score],
    3, "Healthy",
    2, "Moderate Risk",
    "High Risk"
)
```

Key Measures

```
Avg Steps = AVERAGE('Health_activity_data'[Daily_Steps])
Avg Sleep = AVERAGE('Health_activity_data'[Hours_of_Sleep])
Avg Calories = AVERAGE('Health_activity_data'[Calories_Intake])
Avg BMI = AVERAGE('Health_activity_data'[BMI])
Avg Heart Rate = AVERAGE('Health_activity_data'[Heart_Rate])
```

Heart Disease Count

```
Heart Disease Count =
CALCULATE(
    COUNT('health_activity_data'[ID]),
    'health_activity_data'[Heart_Disease] = "Yes"
)
```

The dashboard reveals that users with higher physical activity and adequate sleep maintain healthier BMI levels. Smoking, alcohol consumption, and obesity significantly increase heart disease risk. User segmentation enables VitaTrack to provide personalized lifestyle recommendations.