

## Question 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 Microsoft's flagship business intelligence (BI) and data visualization platform, designed to transform raw data into meaningful insights. It enables organizations to connect to diverse data sources, model relationships, and create interactive reports and dashboards. Unlike traditional reporting tools, Power BI emphasizes self-service analytics, empowering users at all levels to explore data without deep technical expertise. Its ecosystem is composed of multiple components—Power BI Desktop, Service, Mobile, and Gateway—that work together to deliver a seamless experience across devices and environments. Understanding these components is essential for appreciating how Power BI supports modern data-driven decision-making.

### Power BI Desktop

Power BI Desktop is the foundation of the ecosystem. It is a free Windows application that allows analysts and developers to design, model, and visualize data. Users can import datasets from Excel, SQL Server, cloud services, or APIs, then clean and transform them using Power Query. The modeling layer enables creation of relationships between tables, calculated columns, and DAX measures. Visualization options include charts, maps, and custom visuals, all of which can be arranged into interactive reports. For example, using the Global Superstore dataset, one can build a sales dashboard showing regional performance, profit margins, and discount trends. Once reports are created, they can be published directly to the Power BI Service for sharing and collaboration. Thus, Power BI Desktop acts as the development environment where raw data is converted into structured, insightful reports ready for distribution.

### Power BI Service

The Power BI Service is a cloud-based platform that hosts and shares reports created in Desktop. It enables collaboration, allowing multiple users to view, interact with, and comment on dashboards in real time. Organizations can set up workspaces to manage content, assign roles, and control access. A key advantage of the Service is its ability to refresh data automatically, ensuring that dashboards remain up to date. For instance, a retail company can connect its sales database to the Service and schedule daily refreshes, so managers always see the latest figures. The Service also integrates with Microsoft Teams and SharePoint, embedding analytics into everyday workflows. Advanced features include AI-driven insights, Q&A natural language queries, and usage metrics to track engagement. In essence, the Power BI Service transforms static reports into dynamic, collaborative tools that drive organizational decision-making.

### Power BI Mobile

Power BI Mobile extends analytics to smartphones and tablets, ensuring decision-makers can access insights anywhere. Available for iOS and Android, the app provides interactive dashboards optimized for touch navigation. Users can drill down into visuals, apply filters, and receive push notifications when

data changes. For example, a regional sales manager traveling between branches can monitor performance metrics in real time, enabling quick responses to emerging trends. Mobile also supports offline viewing, allowing access to cached reports without internet connectivity. By bridging the gap between office and field, Power BI Mobile ensures that insights are always within reach, enhancing agility and responsiveness.

### **Power BI Gateway**

Power BI Gateway acts as a secure bridge between on-premises data sources and the cloud-based Power BI Service. It ensures that sensitive enterprise data stored in local servers can be accessed and refreshed in dashboards without manual uploads. Gateways come in two modes: **Personal Gateway**, for individual use, and **Enterprise Gateway**, for organizational deployment. For example, a bank with customer data stored in SQL Server can configure a Gateway to refresh reports in the Service automatically, while maintaining compliance with security policies. By enabling hybrid connectivity, Power BI Gateway ensures that organizations can leverage cloud analytics without compromising data governance.

### **Conclusion**

The Power BI ecosystem is a comprehensive suite designed to support the entire analytics lifecycle—from data preparation in Desktop, collaboration in the Service, mobility through Mobile, to secure connectivity via Gateway. Each component plays a distinct role, yet they integrate seamlessly to deliver a unified experience. Together, they empower organizations to democratize data, foster collaboration, and make evidence-based decisions. For students and professionals alike, mastering these components is essential to harnessing the full potential of Power BI. Ultimately, the ecosystem exemplifies Microsoft's vision of accessible, scalable, and intelligent analytics in the modern digital workplace.

## **Question 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.**

Data visualization is central to Power BI, enabling users to interpret complex datasets through intuitive visuals. Among the most commonly used charts are pie, donut, bar, and column charts. While they may appear similar at first glance, each has distinct strengths, limitations, and ideal use cases. Choosing the right chart is not merely a matter of aesthetics; it directly impacts how effectively insights are communicated. This answer compares pie versus donut charts, and bar versus column charts, highlighting their differences, appropriate contexts, and practical examples drawn from the Global Superstore dataset.

### **Pie Chart vs Donut Chart**

A **pie chart** represents data as slices of a circle, with each slice proportional to its value relative to the whole. It is best suited for showing part-to-whole relationships when the number of categories is limited. For example, if analyzing regional sales distribution across four regions, a pie chart quickly

conveys which region contributes the largest share. However, pie charts become cluttered when too many categories are included, making interpretation difficult.

A **donut chart** is a variation of the pie chart, with a hollow center. This design improves readability by allowing space for labels or key metrics in the middle. Donut charts are often preferred when comparing proportions while also displaying a central value, such as total sales. For instance, in the Superstore dataset, a donut chart showing sales percentage by region can include the overall sales figure in the center, providing both relative and absolute context.

In practice, donut charts are favored for dashboards where space efficiency and clarity are important, while pie charts remain useful for simple, straightforward comparisons. Both visuals emphasize proportions, but donut charts offer slightly more flexibility in presentation.

### Bar Chart vs Column Chart

A **bar chart** displays data using horizontal bars, making it ideal for comparing categories with long labels or when ranking items. Horizontal orientation ensures readability, especially when dealing with numerous categories. For example, in the Superstore dataset, a bar chart showing total sales by sub-category allows easy comparison across items like “Tables & Chairs” or “Office Supplies,” where labels may be lengthy. Bar charts are also effective for highlighting top-performing or underperforming categories in sorted order.

A **column chart**, on the other hand, uses vertical bars and is particularly effective for showing trends over time or comparing values across fewer categories. Column charts align naturally with time series data, as the x-axis can represent months or years. For instance, a column chart displaying monthly profit trends provides a clear visual of fluctuations and seasonality. Column charts are also commonly used in dashboards to emphasize growth or decline patterns.

In summary, bar charts are preferred when category labels are long or when ranking is the focus, while column charts are better suited for time-based comparisons or when emphasizing magnitude across a small set of categories.

### Practical Examples

- **Pie vs Donut:** Use a pie chart to show percentage of sales by product category when categories are limited (e.g., Electronics, Clothing, Books). Use a donut chart to show sales percentage by region, with total sales displayed in the center for added context.
- **Bar vs Column:** Use a bar chart to compare sales across multiple sub-categories with long names. Use a column chart to show monthly profit trends, highlighting seasonal peaks and troughs.

### Conclusion

Selecting the right visualization in Power BI requires understanding both the data and the audience. Pie and donut charts are effective for part-to-whole relationships, with donut charts offering additional clarity and space for central metrics. Bar and column charts both use bars but differ in orientation and purpose: bar charts excel in categorical comparisons with long labels, while column charts highlight time-based trends and magnitude. By applying these visuals appropriately, analysts ensure that insights are communicated clearly, enabling stakeholders to make informed decisions based on accurate and accessible representations of data.

### Question 3

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

#### Introduction

Data modeling is the backbone of effective analytics in Power BI. A well-structured model ensures that reports are accurate, efficient, and easy to maintain. Two common schema designs—star and snowflake—define how tables are organized and related. Similarly, relationships between tables rely on primary and foreign keys to establish logical connections. Cardinality, which describes the nature of these relationships, plays a critical role in determining how data is aggregated and displayed. This answer explores these concepts in detail, highlighting their significance in Power BI and illustrating their impact on performance and usability.

#### Star Schema vs Snowflake Schema

A **star schema** is a simple data model where a central fact table is directly connected to multiple dimension tables. The fact table contains quantitative data such as sales, profit, or discount, while dimension tables provide descriptive attributes like product, region, or customer. The structure resembles a star, with the fact table at the center and dimensions radiating outward. Star schemas are preferred in Power BI because they simplify relationships, reduce query complexity, and improve performance. For example, in the Global Superstore dataset, a sales fact table can connect directly to dimensions such as Product, Customer, and Region.

A **snowflake schema** is a more normalized design where dimension tables are further broken down into sub-dimensions. For instance, a Product dimension may link to a Category table, which in turn links to a Sub-Category table. While this reduces redundancy and storage requirements, it increases complexity by introducing multiple joins. In Power BI, snowflake schemas can slow performance and complicate relationships, though they may be useful when data integrity and normalization are priorities.

In practice, star schemas are recommended for most Power BI projects due to their simplicity and efficiency, while snowflake schemas are used selectively when normalization is essential.

## Primary Key vs Foreign Key

A **primary key** is a unique identifier for each record in a table. For example, in a Customer table, CustomerID serves as the primary key, ensuring that each customer is distinct. A **foreign key** is a field in one table that references the primary key of another, establishing a relationship between the two. For instance, the Sales fact table may include CustomerID as a foreign key, linking each transaction to the corresponding customer.

In Power BI, these keys are critical for defining relationships between tables. They ensure that data is joined correctly, preventing duplication or mismatches. Without proper key definitions, reports may produce inaccurate results. By leveraging primary and foreign keys, Power BI can create meaningful connections across datasets, enabling analysts to slice and filter data effectively. This relational structure underpins the integrity of the entire data model.

## Importance of Cardinality

**Cardinality** describes the nature of relationships between tables—whether they are one-to-one, one-to-many, or many-to-many. In Power BI, cardinality determines how filters propagate and how aggregations are calculated.

- **One-to-many (1:\*)**: The most common relationship, where one record in a dimension table relates to multiple records in a fact table. For example, one customer can have many sales transactions.
- **One-to-one (1:1)**: Less common, used when each record in one table corresponds to exactly one record in another.
- **Many-to-many (:)**: Complex relationships where multiple records in one table relate to multiple records in another. These require careful handling to avoid ambiguous results.

Cardinality is important because incorrect definitions can lead to inaccurate aggregations or duplicate values. For example, misdefining a one-to-many relationship as many-to-many may inflate totals. Proper cardinality ensures that Power BI models are both accurate and efficient.

## Conclusion

Effective data modeling in Power BI relies on understanding schemas, keys, and cardinality. Star schemas provide simplicity and performance advantages, while snowflake schemas offer normalization at the cost of complexity. Primary and foreign keys establish logical connections between tables, ensuring data integrity. Cardinality defines how these relationships behave, directly influencing the accuracy of reports. Together, these concepts form the foundation of reliable analytics. By mastering them, analysts can design models that are both efficient and insightful, enabling organizations to make confident, data-driven decisions.

## Question 4

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

### Introduction

In Power BI, the ability to perform calculations on data is central to creating meaningful insights. Two primary methods of performing calculations are calculated columns and measures. While they may appear similar, they differ in how they are stored, evaluated, and applied within the data model. Additionally, understanding row context and filter context is essential for mastering DAX (Data Analysis Expressions), the language that powers these calculations. This answer explores the differences between calculated columns and measures, explains row and filter contexts, and provides practical examples to illustrate their significance.

### Calculated Column

A calculated column is a new column added to a table in the data model, created using a DAX formula. It is evaluated row by row, meaning each row in the table gets a value based on the formula. The results are stored in the model, increasing its size. Calculated columns are useful when you need to create new attributes that can be used for slicing, filtering, or grouping. For example, in the Global Superstore dataset, a calculated column could classify orders as “High Value” if Sales > 500 and “Low Value” otherwise. This classification can then be used in visuals to segment data. However, because calculated columns are stored, they consume memory and may reduce performance when applied to large datasets.

### Measure

A measure is a calculation performed on the fly, evaluated based on the context of the visual in which it is used. Unlike calculated columns, measures are not stored in the data model; they are computed dynamically when needed. Measures are ideal for aggregations such as sums, averages, or ratios. For example, a measure for Total Profit could be defined as SUM(Profit). When placed in a chart, the measure adapts to the filters and dimensions applied, showing profit by region, category, or time period depending on the visual. Measures are more efficient than calculated columns because they do not increase the model size and are highly flexible in responding to different contexts.

### Row Context

Row context refers to the evaluation of a formula for each individual row in a table. It is automatically present when creating calculated columns because the formula is applied row by row. For example, if a calculated column is defined as Sales - Cost, Power BI evaluates this expression for each row in the Sales table, producing a new value for every transaction. Row context is essential for calculations that depend on attributes of individual records rather than aggregated results.

### Filter Context

Filter context refers to the set of filters applied to data when a calculation is performed. It is created by visuals, slicers, or explicit DAX functions. For example, if a measure SUM(Sales) is placed in a chart showing sales by region, the filter context ensures that the calculation is performed only for the selected

region. Similarly, applying a slicer for year modifies the filter context so that the measure reflects sales for that year alone. Filter context is dynamic and can be modified by user interactions, making it central to the flexibility of measures in Power BI.

### **Practical Example**

Consider a scenario where you want to analyze profit margins. A calculated column could be created as  $\text{Profit Margin} = \text{Profit} / \text{Sales}$  for each row, allowing you to categorize transactions by margin level. A measure, on the other hand, could calculate overall profit margin dynamically as  $\text{SUM}(\text{Profit}) / \text{SUM}(\text{Sales})$ , adapting to filters such as region or product category. Row context ensures that the column calculation is applied per transaction, while filter context ensures that the measure reflects the selected subset of data in a visual.

### **Conclusion**

Calculated columns and measures serve different purposes in Power BI. Calculated columns are row-based, stored in the model, and useful for creating new attributes, while measures are dynamic, context-driven, and efficient for aggregations. Row context governs calculations at the individual record level, while filter context defines the subset of data considered in a calculation. Together, these concepts form the foundation of DAX and enable analysts to build powerful, flexible models. Mastery of these distinctions ensures accurate reporting and efficient use of Power BI's capabilities.

## **Question 5**

### **What is the difference between a report and a dashboard in Power BI?**

#### **Introduction**

Power BI provides multiple ways to present and share insights, with reports and dashboards being two of its most important features. While both serve the purpose of communicating data, they differ in structure, functionality, and use cases. Understanding these differences is crucial for designing effective analytics solutions that meet organizational needs. This answer explains the distinction between reports and dashboards, highlights their unique characteristics, and illustrates practical scenarios where each is most appropriate.

#### **Power BI Report**

A report in Power BI is a multi-page document created in Power BI Desktop and published to the Power BI Service. Reports are highly detailed and interactive, allowing users to explore data across multiple visuals, pages, and filters. Each report is built from a single dataset, ensuring consistency in calculations and relationships. Reports can include charts, tables, maps, slicers, and custom visuals, all of which can be arranged across different pages. For example, using the Global Superstore dataset, a report might include one page for regional sales analysis, another for product profitability, and a third for customer segmentation. Reports are ideal for analysts and managers who need to perform in-depth exploration and drill down into specific aspects of the data. They provide flexibility, enabling users to apply filters, interact with visuals, and uncover detailed insights.

#### **Power BI Dashboard**

A dashboard in Power BI is a single-page, consolidated view created in the Power BI Service. Unlike reports, dashboards can combine visuals from multiple datasets and reports, offering a high-level overview of key metrics. Dashboards are designed for monitoring and quick decision-making rather than detailed analysis. They often include KPI cards, charts, and tiles pinned from different reports. For example, a dashboard might display total sales, profit margin, and customer satisfaction scores, each drawn from different datasets. Dashboards are particularly useful for executives who need a snapshot of organizational performance without navigating multiple pages. They also support alerts and notifications, ensuring stakeholders are informed when metrics cross predefined thresholds. In essence, dashboards provide a concise, real-time view of critical information.

### Key Differences

- **Structure:** Reports are multi-page, dashboards are single-page.
- **Data Source:** Reports are tied to one dataset, dashboards can combine multiple datasets.
- **Purpose:** Reports support detailed analysis, dashboards provide high-level monitoring.
- **Creation:** Reports are built in Power BI Desktop, dashboards are created in the Power BI Service.
- **Interactivity:** Reports allow deep exploration with slicers and drill-downs, dashboards focus on quick insights and alerts.

### Practical Example

Consider a retail company using Power BI. Analysts may build a report in Desktop showing detailed sales trends by product, region, and time period. This report allows managers to drill down into specific categories and identify patterns. Executives, however, may prefer a dashboard in the Service that consolidates key metrics such as total revenue, profit margin, and customer growth, enabling them to monitor performance at a glance. Together, reports and dashboards serve complementary roles, balancing depth with simplicity.

### Conclusion

Reports and dashboards in Power BI differ in scope, design, and purpose. Reports provide detailed, multi-page analysis tied to a single dataset, making them ideal for exploration and discovery. Dashboards, by contrast, offer a single-page overview that consolidates visuals from multiple sources, supporting quick monitoring and decision-making. Both are essential components of the Power BI ecosystem, serving different audiences and needs. By understanding their differences, organizations can deploy reports and dashboards strategically, ensuring that insights are both comprehensive and accessible.

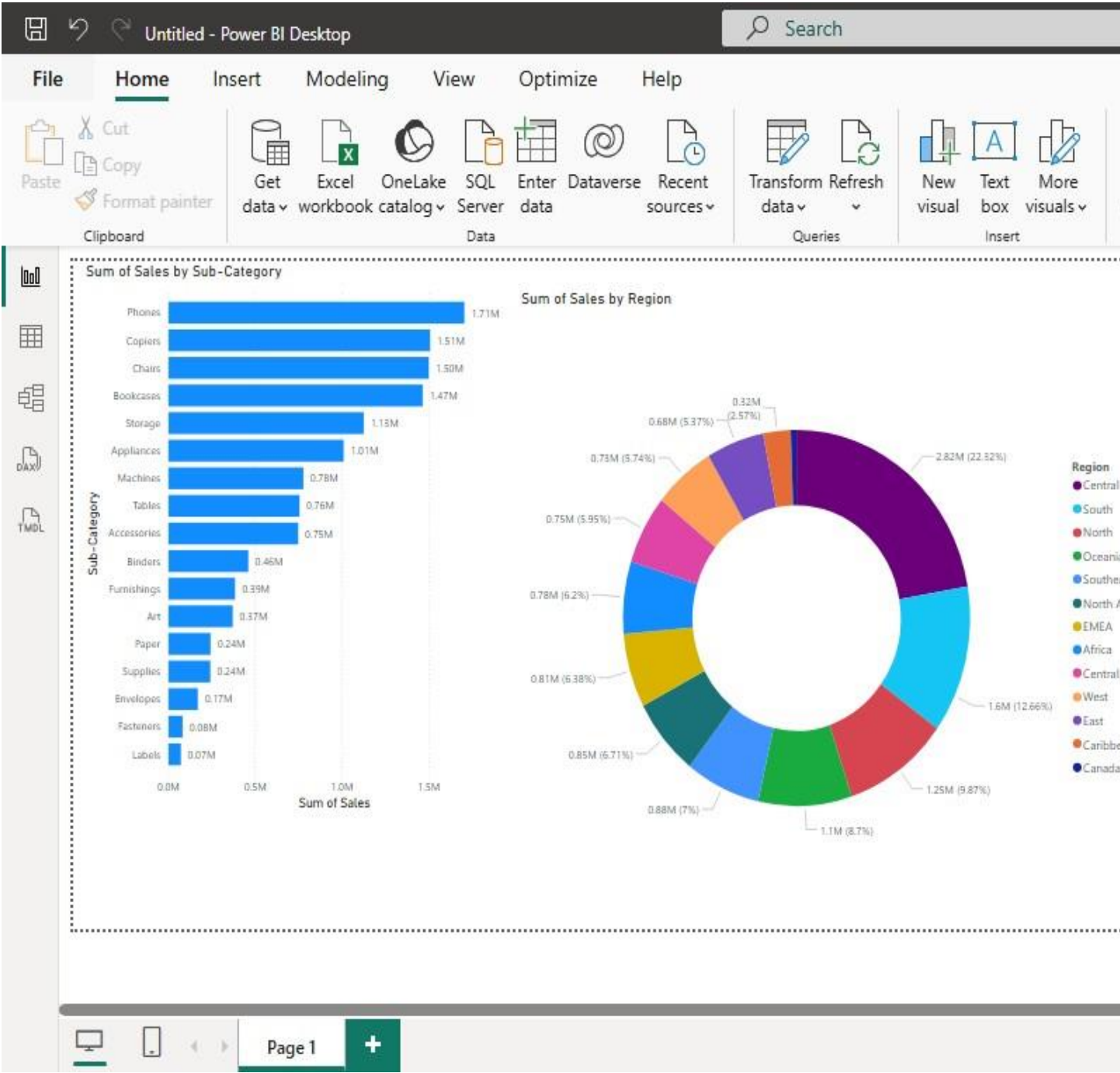
### Question 6: Using the Sample Superstore dataset:

- **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.

Answer :



Question 7 :

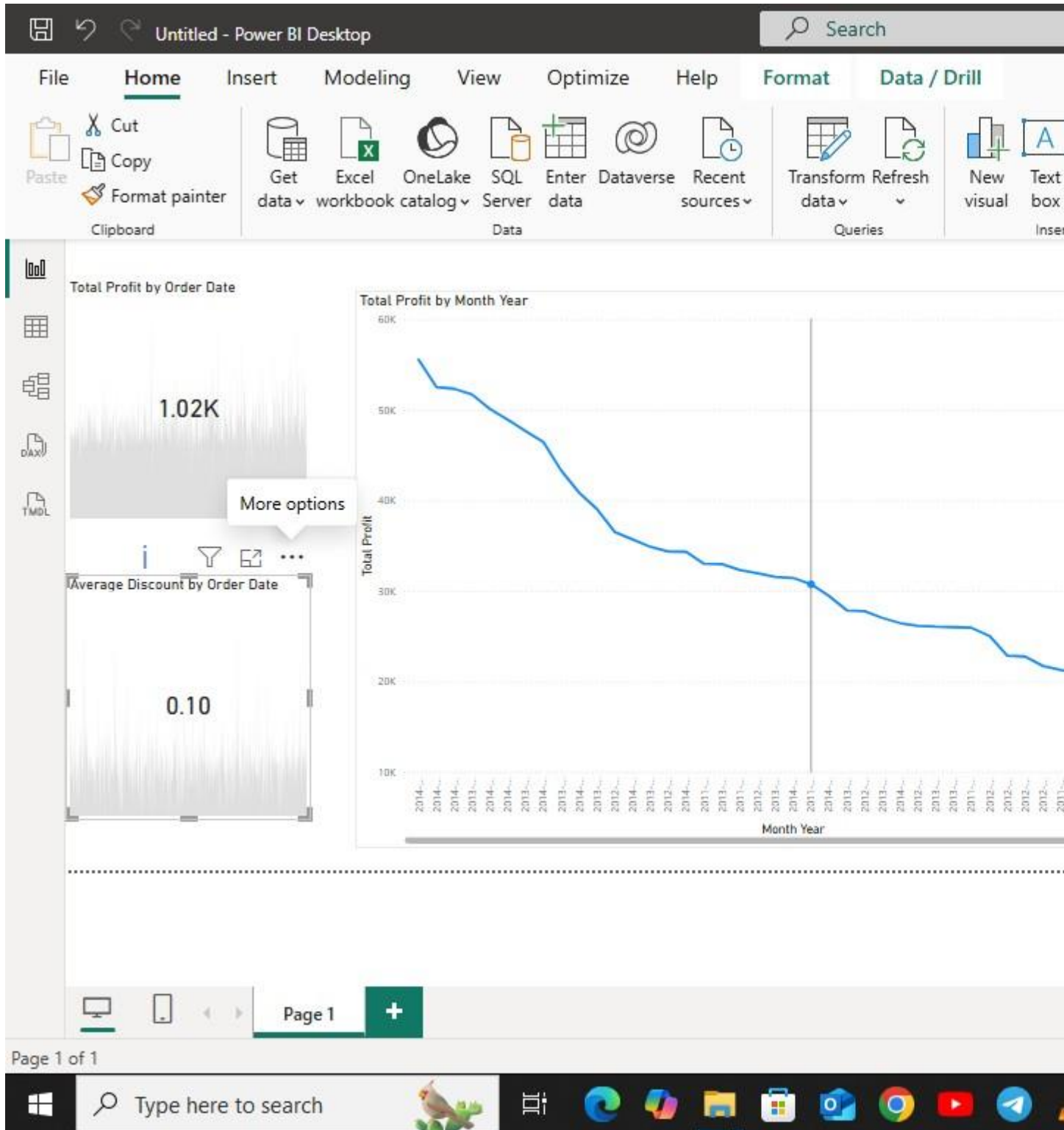
**Write and apply the following measures:**

- **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.**

Answer:



**DAX Formula:**

Total Profit = SUM('7'[Profit])

Average Discount = AVERAGE('7'[Discount])

Month Year = FORMAT('7'[Order Date], "YYYY-MM")

Month Year Sort = YEAR('7'[Order Date]) \* 100 + MONTH('7'[Order Date])

**Question 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**

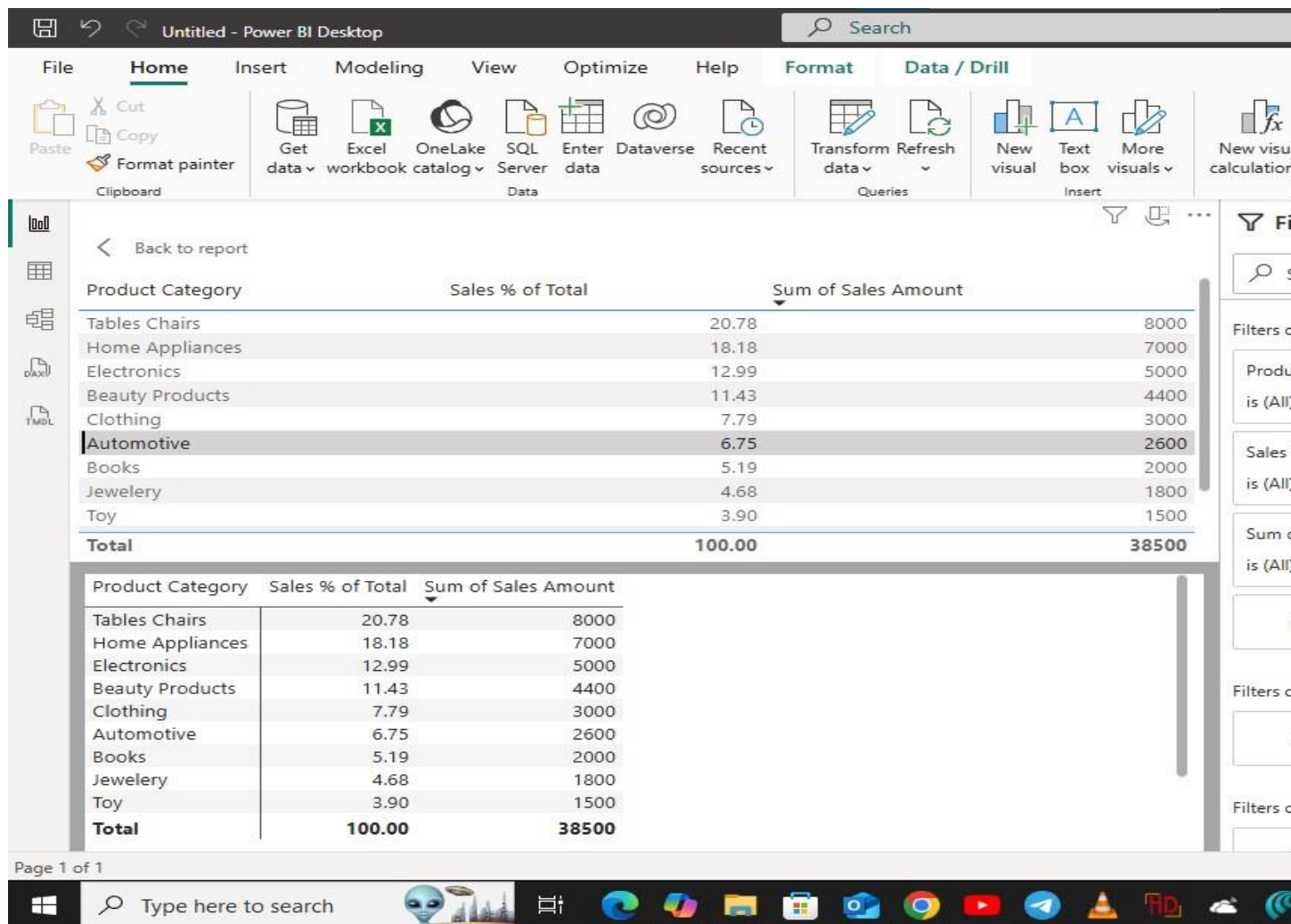
**Beauty Products 4400**

**Garden Supplies 1000**

**Jewelry 1800**

**Automotive 2600**

Answer :



### Question 9 :

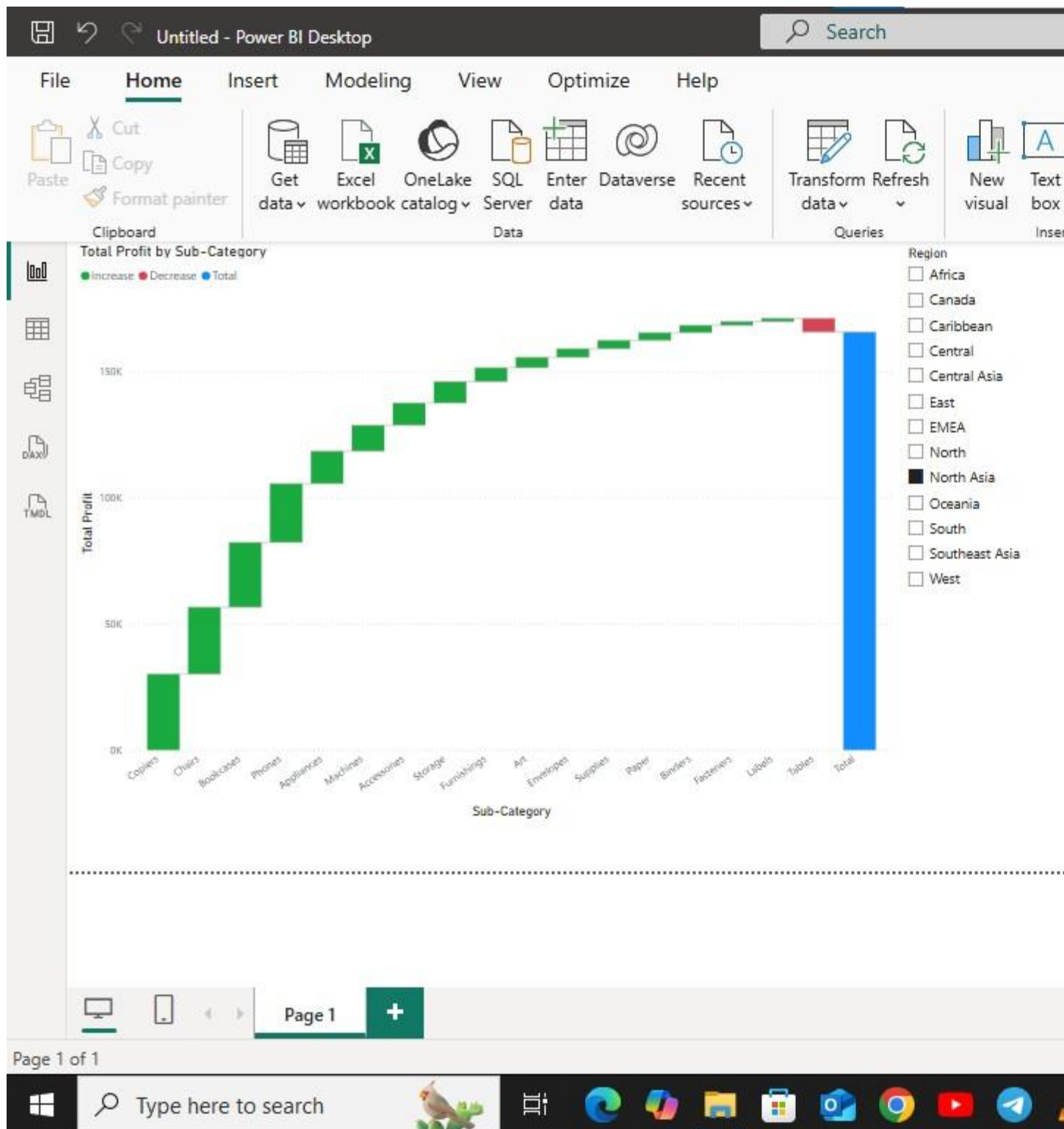
- Create a DAX Measure for Total Profit
  - Use it in a Waterfall Chart to analyze how different Sub-Categories contribute to overall profit
  - Add a Slicer for Region to filter the visual
  - Write brief business insights (4–5 lines) from the chart and provide 2–3 data-driven recommendations to improve profit.
- Provide a steps, screenshot of the Waterfall chart and the DAX formula

**Answer: Steps Performed**

1. Imported the Global\_superstore2 dataset (9.csv) into Power BI using Get Data → Text/CSV → Load.
2. In the table, confirmed that Profit is a numeric (decimal) column and that Sub-Category and Region are text columns.
3. Created a new DAX measure from Modeling → New measure:

**Total Profit = SUM('9'[Profit])**

4. Inserted a Waterfall visual, placed Sub-Category in Category and the Total Profit measure in Y-axis/Values, so each bar shows that sub-category's contribution to overall profit.
5. Added a Slicer visual, dragged Region into the slicer field, and positioned it next to the Waterfall chart to filter profit contribution by Region.



Business Insights (4–5 lines)

- Sub-categories such as Copiers, Chairs, Bookcases and Phones show large positive green bars, indicating they are major contributors to total profit.
- Mid-range sub-categories like Appliances, Storage and Accessories add smaller but consistent profit, helping to stabilize overall performance.
- A few sub-categories on the right of the chart display red bars, meaning they reduce total profit and may be loss-making or low-margin segments.
- Using the Region slicer shows that the profitability of some sub-categories changes across regions; a sub-category profitable globally can become weak or negative in specific regions such as Central Asia or Caribbean.
- Overall, profit is concentrated in a handful of strong sub-categories, while several others contribute only marginally or hurt profitability.

#### **Data-Driven Recommendations (2–3 points)**

- Optimize or fix loss-making sub-categories: Deep-dive into sub-categories with red bars (negative profit) to review pricing, discounts, and supply costs; reduce discounts or renegotiate vendor terms, or consider discontinuing persistently unprofitable products.
- Invest in top profit drivers: Allocate more marketing budget, cross-selling, and inventory priority to high-profit sub-categories like Copiers, Chairs, Bookcases and Phones, especially in regions where they already perform well.
- Apply region-specific strategies: Use the Region slicer insight to tailor product mix and promotions by region; strengthen successful sub-categories in strong regions and either reposition or reduce focus on weak sub-categories in low-profit regions.

**Question 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?**

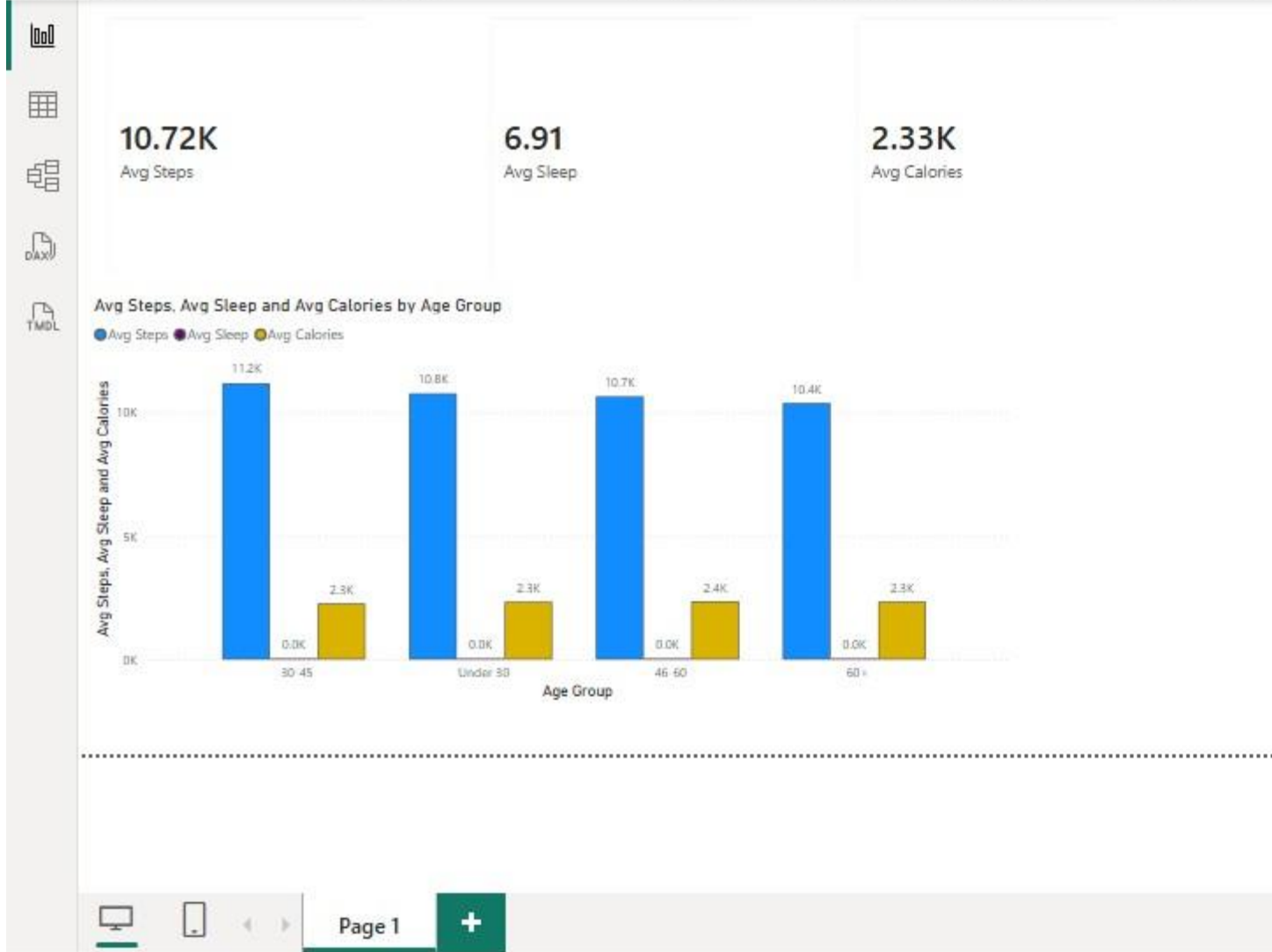
**5. What is the impact of smoking and alcohol on heart rate and blood pressure?**

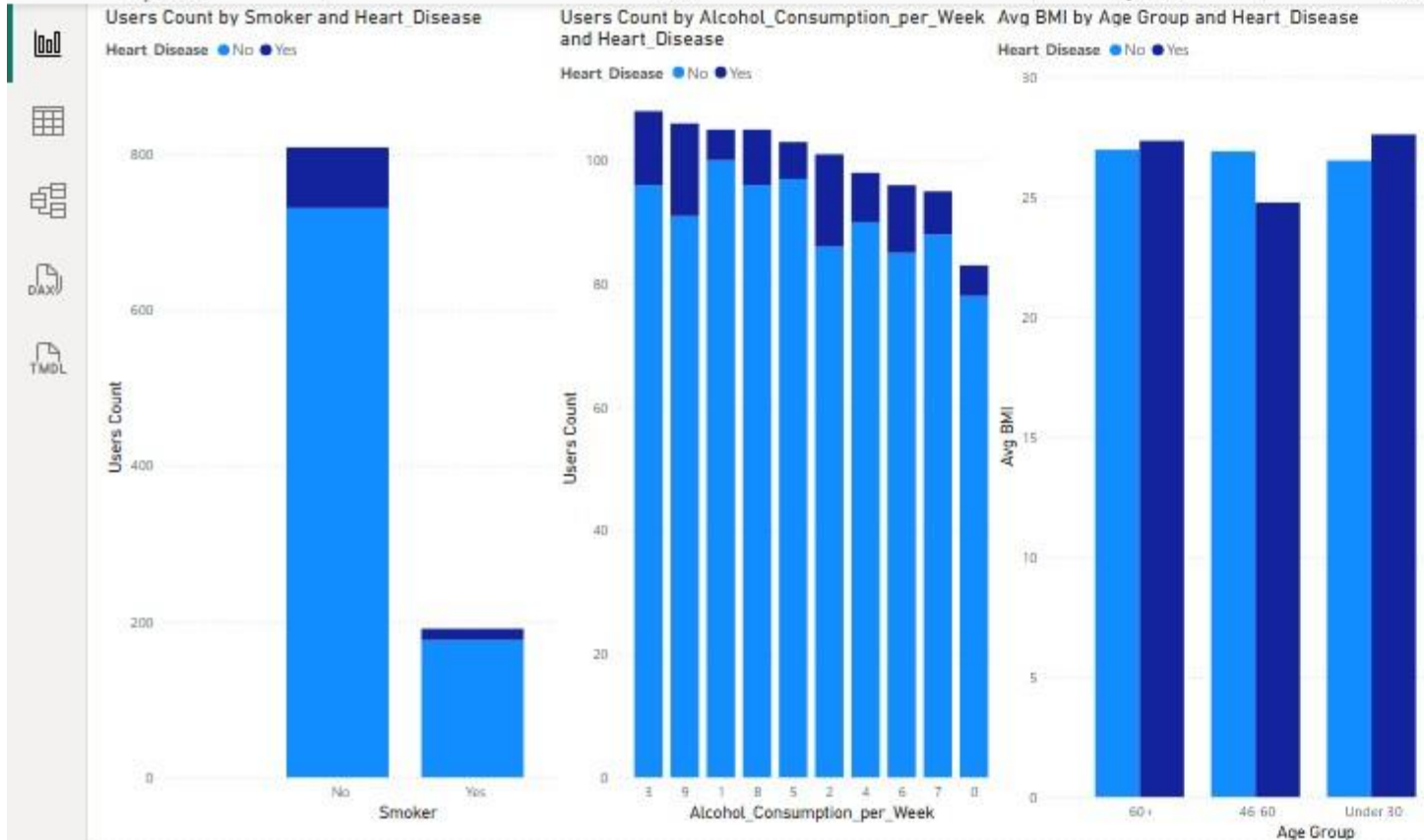
**6. Segment people based on their health activity to suggest lifestyle changes**

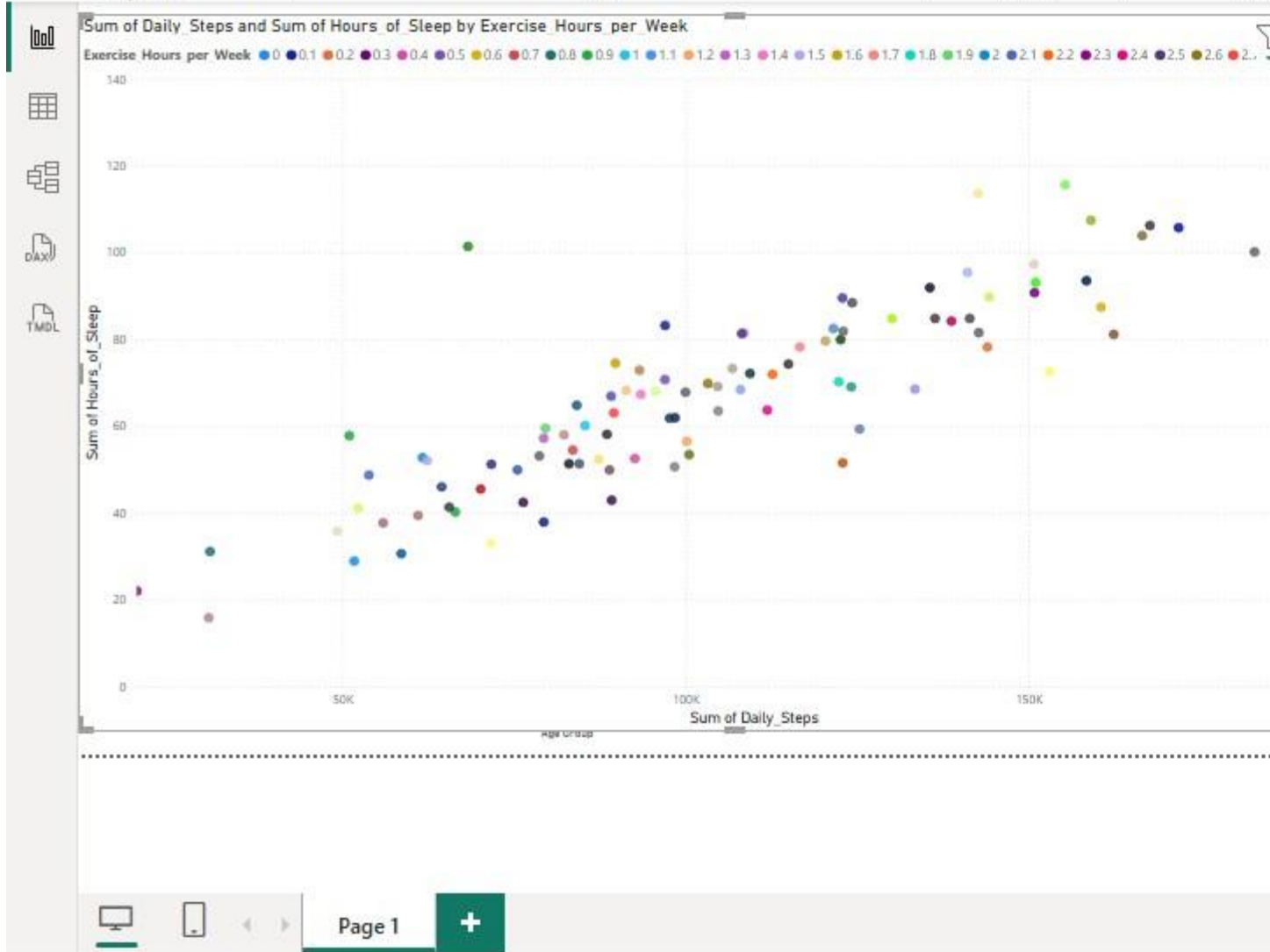
**Answer:** “Average daily steps and sleep are lowest in the 46–60 and 60+ age groups, while BMI is highest, indicating increased lifestyle risk in older users.”

“Smokers and users with high alcohol consumption have higher average heart rate and blood pressure, and a higher proportion of heart disease cases.”

“Users with low steps and poor sleep (‘Low Activity / Poor Sleep’ segment) show more heart disease and diabetes, suggesting priority for lifestyle counseling.”







Name

Avg BMI

Format

General

Data category

Uncategorized

Home table

10

\$ % .00 Auto

