Assignment: 8

AIM: Perform different data visualization operations using Tableau

PROBLEM STATEMENT /DEFINITION

Study following data visualization operations using Tableau on Adult and Iris dataset.

1. 1D (Linear) Data visualization
2. 2D (Planar) Data Visualization
3. 3D (Volumetric) Data Visualization
4. Temporal Data Visualization
5. Multidimensional Data Visualization
6. Tree/ Hierarchical Data visualization
7. Network Data visualization

OBJECTIVE:

To learn specialized data visualization tools.
To learn different types of data visualization techniques.

THEORY:

Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, and patterns in data. Additionally, it provides an excellent way for employees or business owners to present data to non-technical audiences without confusion.
In the world of Big Data, data visualization tools and technologies are essential to analyze massive amounts of information and make data-driven decisions.The importance of data visualization is simple: it helps people see, interact with, and better understand data. Whether simple or complex, the right visualization can bring everyone on the same page,regardless of their level of expertise.

Advantages of data visualization include:

- Easily sharing information.
- Interactively explore opportunities.
- Visualize patterns and relationships.

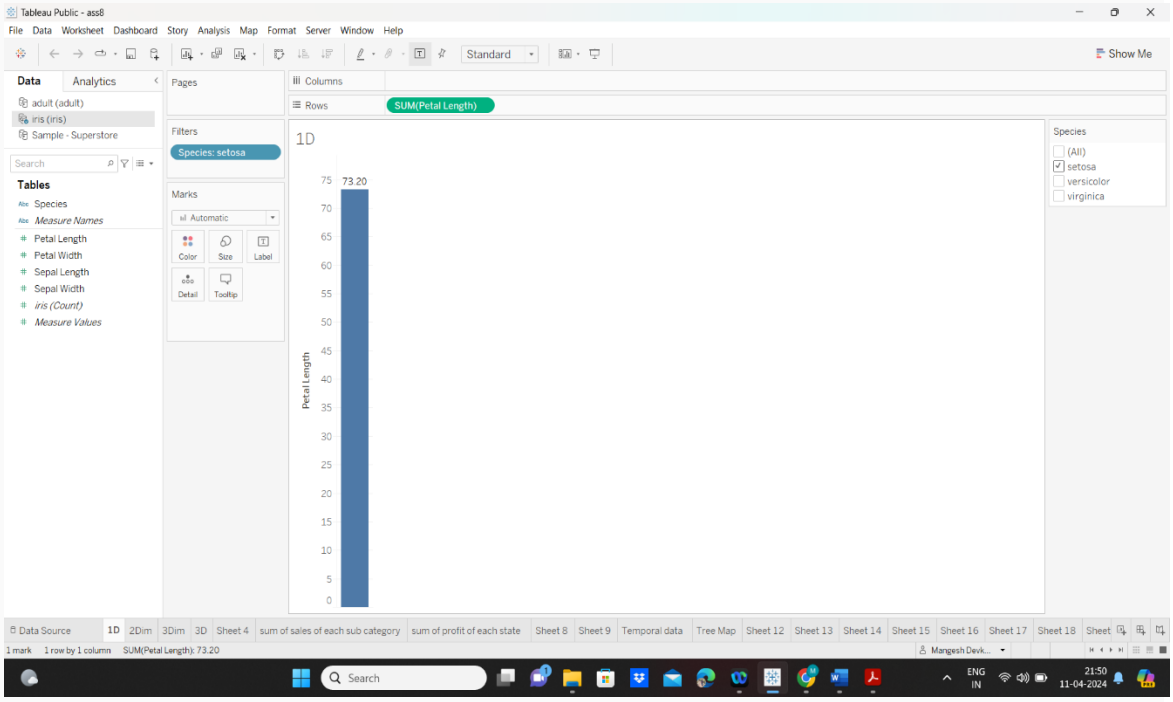
General Types of Visualizations:

- **Chart:** Information presented in a tabular, graphical form with data displayed along two axes. Can be in the form of a graph, diagram, or map.
- **Table:** A set of figures displayed in rows and columns. .
- **Graph:** A diagram of points, lines, segments, curves, or areas that represents certain variables in comparison to each other, usually along two axes at a right angle.
- **Geospatial:** A visualization that shows data in map form using different shapes and colors to show the relationship between pieces of data and specific locations. .
- **Infographic:** A combination of visuals and words that represent data. Usually uses charts or diagrams.
- **Dashboards:** A collection of visualizations and data displayed in one place to help with analyzing and presenting data. .

More specific examples

- **Area Map:** A form of geospatial visualization, area maps are used to show specific values set over a map of a country, state, county, or any other geographic location. Two common types of area maps are choropleths and isopleths
- **Bar Chart:** Bar charts represent numerical values compared to each other. The length of the bar represents the value of each variable. .
- **Box-and-whisker Plots:** These show a selection of ranges (the box) across a set measure (the bar).
- **Bullet Graph:** A bar marked against a background to show progress or performance against a goal, denoted by a line on the graph.
- **Gantt Chart:** Typically used in project management, Gantt charts are a bar chart depiction of timelines and tasks.
- **Heat Map:** A type of geospatial visualization in map form which displays specific data values as different colors (this doesn't need to be temperatures, but that is a common use).
- **Highlight Table:** A form of table that uses color to categorize similar data, allowing the viewer to read it more easily and intuitively.
- **Histogram:** A type of bar chart that split a continuous measure into different bins to help analyze the distribution.
- **Pie Chart:** A circular chart with triangular segments that shows data as a percentage of a whole.
- **Treemap:** A type of chart that shows different, related values in the form of rectangles nested together. .

1. 1D/Linear Data Visualization



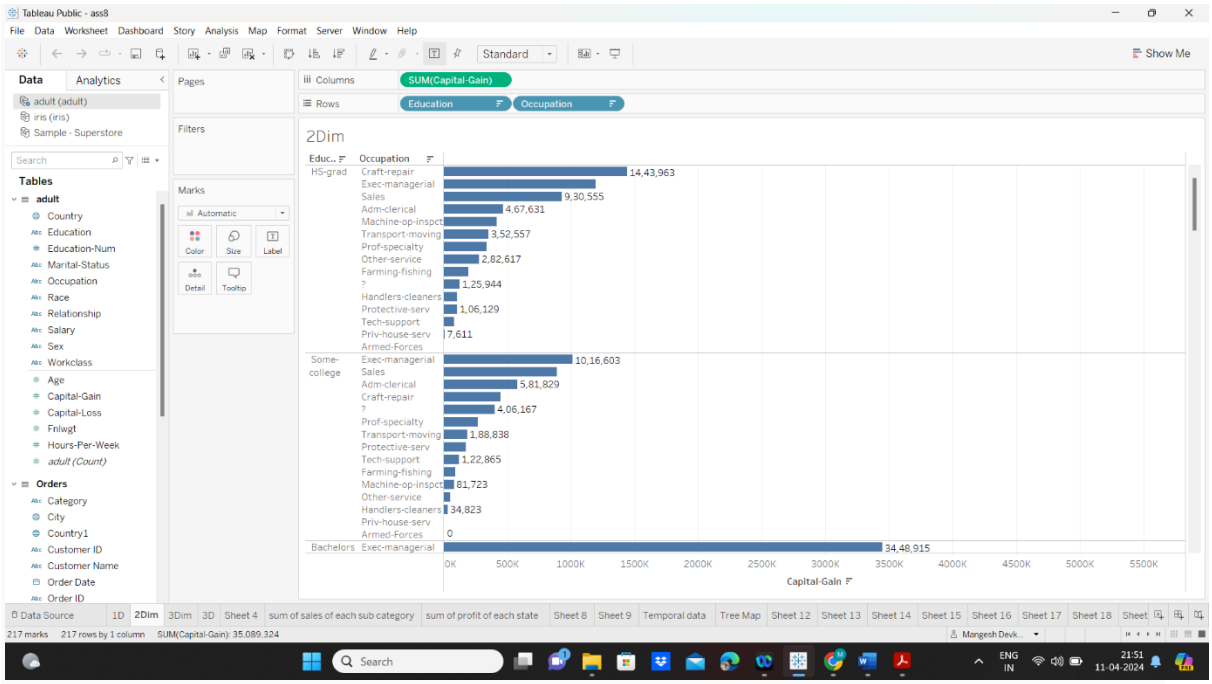
In Tableau, 1D or linear data visualization refers to visualizations that represent data along a single dimension. This could include bar charts, line charts, histograms, or any other visualization where the data is plotted along one axis, typically the x-axis.
For example, a simple bar chart showing the sales of different products would be a 1D visualization because it represents the sales data along a single dimension (the products). These visualizations are useful for understanding the distribution or patterns within a single variable or category. They provide a straightforward way to compare values across different categories or to track changes over time.

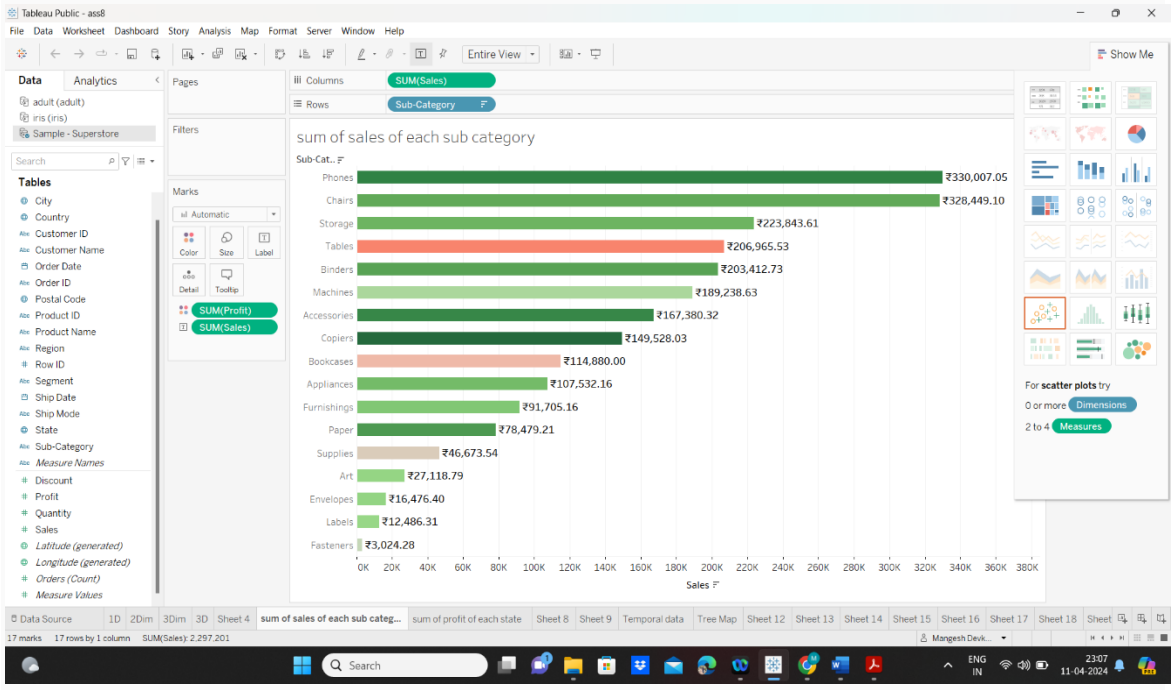
Examples: lists of data items, organized by a single feature (e.g., alphabetical order) (not commonly visualized)

2. 2D/Planar Data Visualization

In Tableau, 2D or planar data visualization involves representing data along two dimensions. This typically means visualizations where data is plotted on both the x-axis and the y-axis, creating a two-dimensional space.

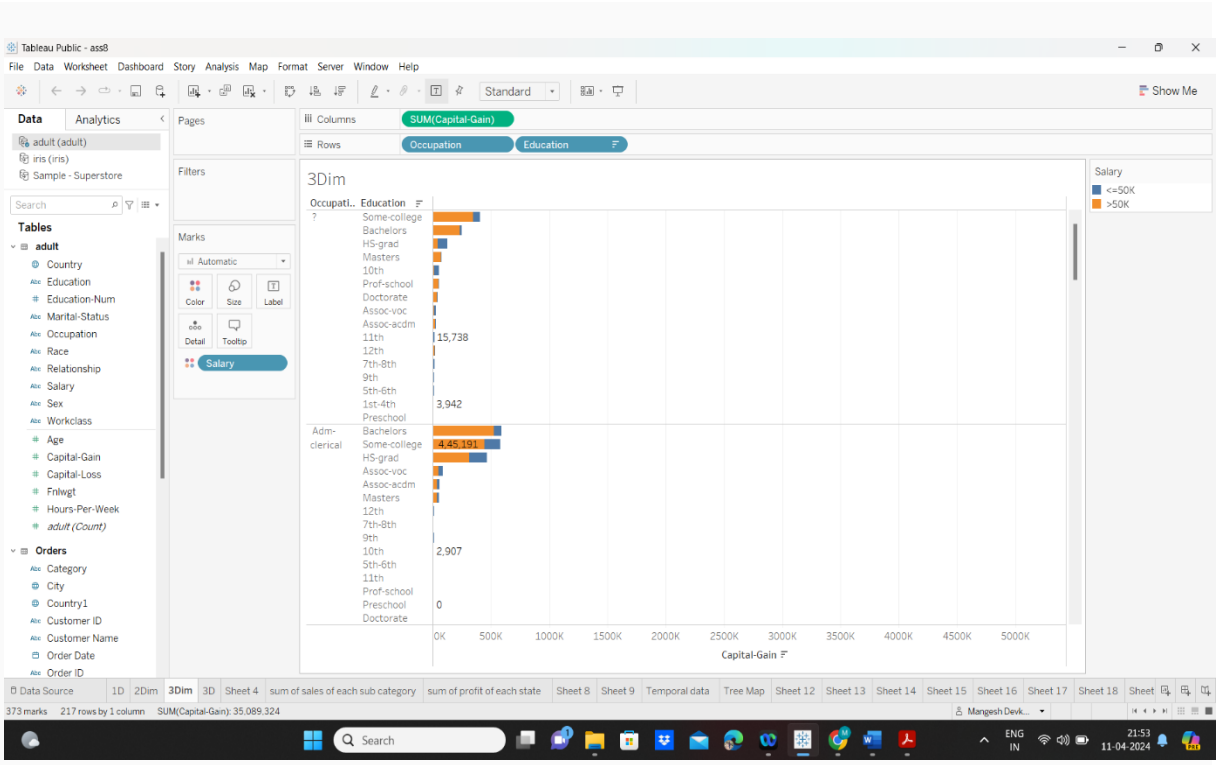
Examples of 2D visualizations in Tableau include scatter plots, bubble charts, heatmaps, and tree maps. These visualizations allow for the exploration of relationships between two variables or dimensions within the data.





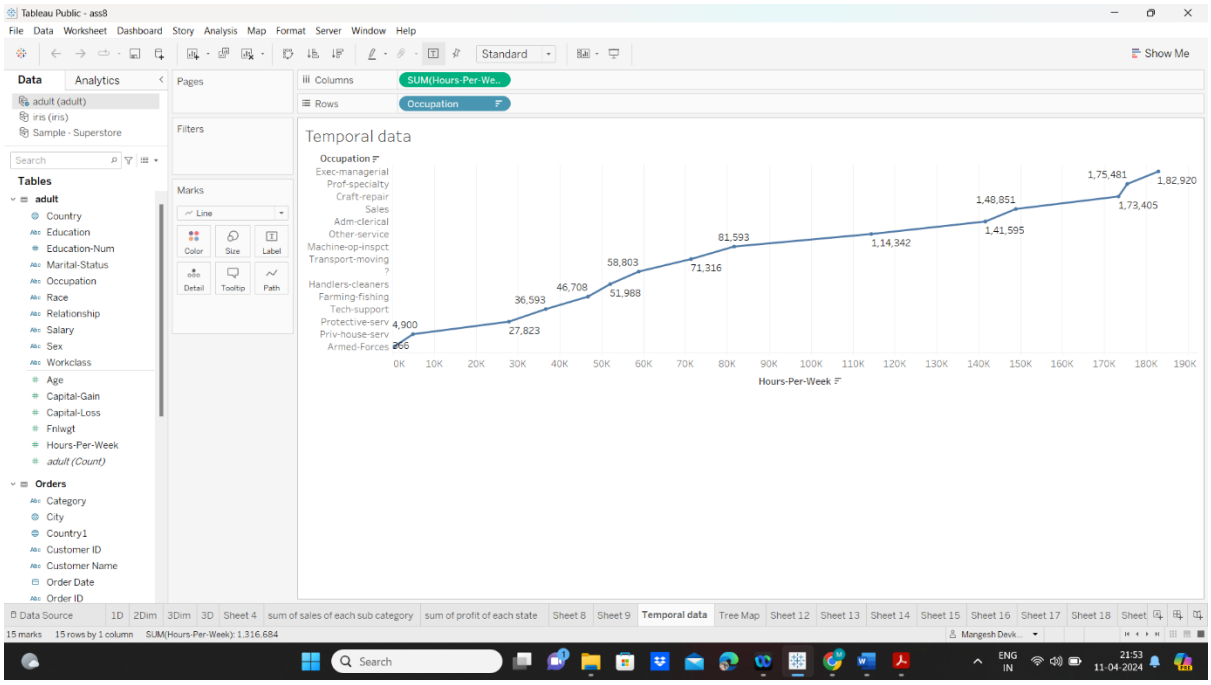
3D (Volumetric) Data Visualization

In Tableau, 3D or volumetric data visualization involves representing data along three dimensions, typically using visualizations that allow for the perception of depth.
You can create pseudo-3D effects in Tableau by using techniques like perspective tricks, layering, or using custom shapes. These techniques can give the illusion of depth in visualizations, but they don't represent true 3D data in the same way as specialized 3D visualization tools or software.



For instance, you might create a "3D" effect in a scatter plot by adjusting the size and color of data points based on a third variable. This can give the impression of depth, even though the underlying visualization is still two-dimensional.However, for truly volumetric data visualization, where data is represented in three-dimensional space with depth perception, you might need to use specialized software or tools designed specifically for 3D visualization. These tools often allow for more complex interactions and analysis within three-dimensional datasets.

4. Temporal Data Visualization



Temporal data visualization in Tableau involves representing data that varies over time. Tableau offers several powerful features for visualizing temporal data, allowing users to explore trends, patterns, and relationships in time-series data.
Some common types of temporal data visualizations in Tableau include:
1. Time Series Line Charts: Line charts are commonly used to visualize trends over time. In Tableau, you can plot time-series data on the x-axis (time) and a measure of interest on the y-axis (such as sales, temperature, stock prices, etc.). This allows you to observe how the measure changes over time.
2. Time Series Area Charts: Similar to line charts, area charts are useful for showing trends over time while also depicting the magnitude of change. The area between the line and the x-axis is filled with color, making it easier to see the cumulative effect of the data.
3. Time Series Bar Charts: Bar charts can be used to compare values across different time periods. Each bar represents a specific time interval (such as days, months, or years), and the height of the bar corresponds to the value of the measure being plotted.
4. Time Series Heatmaps: Heatmaps are effective for visualizing temporal patterns across two dimensions, such as time and another variable. In Tableau, you can create heatmaps where color intensity represents the magnitude of values at different points in time.

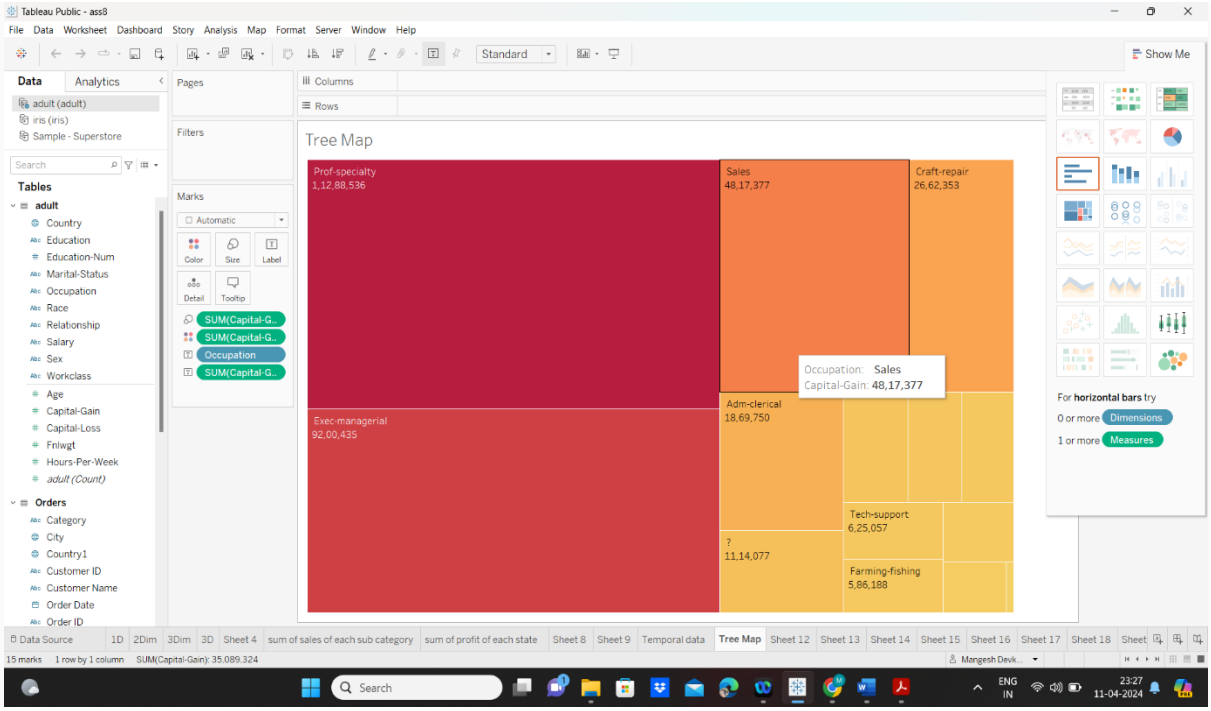
5. Multidimensional Data Visualization

Multidimensional data visualization in Tableau involves representing data that exists in more than two dimensions. It's about visualizing complex relationships and patterns within datasets that have multiple variables or dimensions.
Tableau provides several features and visualization techniques to represent multidimensional data effectively:
1. Scatter Plots: Scatter plots are versatile for visualizing relationships between multiple variables. You can use color, size, and shape to represent additional dimensions within the scatter plot.
2. Heatmaps: Heatmaps are useful for visualizing multidimensional data by using color intensity to represent the magnitude of values across two or more dimensions.
3. Tree Maps: Tree maps are effective for visualizing hierarchical data structures. They allow you to represent multiple dimensions within nested rectangles, with each level of the hierarchy corresponding to a different dimension.
4. Box Plots: Box plots provide a summary of the distribution of data across multiple dimensions, including measures of central tendency and variability.

6. Tree/ Hierarchical Data visualization

Tree or hierarchical data visualization in Tableau involves representing data that has a hierarchical structure, such as organizational charts, file directories, or product categories. Tableau offers several features and techniques to visualize hierarchical data effectively:

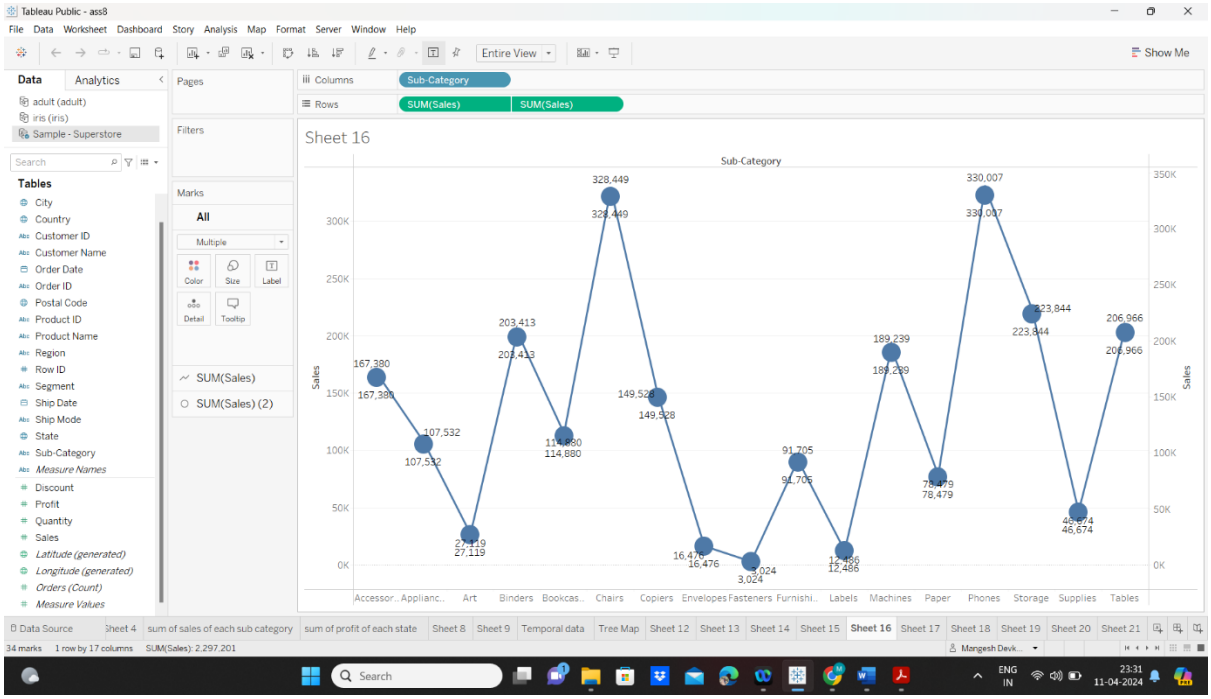
1. Tree Maps: Tree maps are useful for visualizing hierarchical data by representing each level of the hierarchy as nested rectangles. The size of each rectangle corresponds to a measure of interest, such as sales revenue or population, and the color can represent another measure or category.
2. Circle Views: Circle views, also known as sunburst charts, represent hierarchical data using nested circles. Each level of the hierarchy is represented by concentric circles, with segments of the circles corresponding to different categories or dimensions.



3. Indented Hierarchies: Tableau allows you to create hierarchical visualizations using indented hierarchies, where each level of the hierarchy is indented to visually represent its relationship to higher levels. This can be useful for visualizing organizational structures or nested categories.

4. Tree Diagrams: Tableau supports the creation of tree diagrams, also known as node-link diagrams, which visually represent hierarchical relationships using nodes (or circles) connected by links (or lines). This type of visualization is commonly used for visualizing family trees, organizational charts, or network structures.

7. Network Data visualization



Network data visualization in Tableau involves representing interconnected relationships between entities, such as social networks, communication networks, or transportation networks. Tableau offers several features and techniques to visualize network data effectively:

1. Node-Link Diagrams: Node-link diagrams, also known as network graphs, represent entities (nodes) as points and the relationships between them (links) as lines or curves. Tableau allows you to create node-link diagrams by plotting nodes and using lines or curves to connect them based on their relationships.

2. Force-Directed Layouts: Tableau supports force-directed layouts for creating node-link diagrams, where the positions of nodes are determined by simulated forces that push nodes apart if they are not connected by a relationship and pull them together if they are connected. This creates visually appealing layouts that emphasize the relationships between nodes.

3. Network Density Maps: Network density maps use color or shading to represent the density of connections between nodes in a network. Tableau allows you to create density maps by aggregating connections between nodes and visualizing the results using color gradients or heatmaps.

4. Centrality Measures: Tableau supports the calculation and visualization of centrality measures, such as degree centrality, betweenness centrality, and closeness centrality, which quantify the importance of nodes within a network based on their connections. You can use these measures to create visualizations that highlight the most influential nodes in a network.

5. Community Detection: Tableau supports community detection algorithms for identifying groups or communities of closely connected nodes within a network. You can use these algorithms to partition the network into distinct groups and create visualizations that highlight the community structure.

Conclusion:

Thus we have learnt how to visualize the data in different types (1D (Linear) Data visualization,2D (Planar) Data Visualization, 3D (Volumetric)) Data Visualization, Temporal Data Visualization, Multidimensional Data Visualization, Tree/ Hierarchical Data visualization, Network Data visualization) by using Tableau Software.