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B.Sc. CS 5th Sem

DATA VISUALIZATION TOOL (UCS23505J)- Lab Manual

Lab 1: Shelves & Cards

- **Title:** Understanding Shelves and Cards in Data Visualization
- **Aim:** To familiarize with the basic interface elements of a data visualization tool, specifically focusing on the concept and functionality of "shelves" and "cards" for building visualizations.
- **Procedure:**
    1. Open the data visualization software (e.g., Tableau Desktop).
    2. Connect to a sample dataset (e.g., Superstore dataset).
    3. Identify the "Columns" and "Rows" shelves. Drag a dimension (e.g., `Category`) to the "Columns" shelf and a measure (e.g., `Sales`) to the "Rows" shelf. Observe the resulting chart.
    4. Explore the "Marks" card. Change the Mark Type (e.g., from Automatic to Bar, Line, or Shape).
    5. Drag different fields to the "Color," "Size," "Label," "Detail," and "Tooltip" shelves/cards on the Marks card. Observe how these additions affect the visualization.
    6. Experiment with reordering fields on the shelves and observe the changes in the visualization.
    7. Save your workbook.
- **Source Code:** (This section typically involves screenshots or detailed step-by-step instructions within the software, rather than traditional code. For example, in Tableau, it would be a series of drag-and-drop actions.)
- `// Example steps for a hypothetical data visualization tool`
- `1. Connect to 'Sample - Superstore.xls'.`
- `2. Drag 'Order Date' to Columns shelf.`
- `3. Drag 'Sales' to Rows shelf.`
- `4. Change Mark Type to 'Area'.`
- `5. Drag 'Region' to Color on the Marks card.`

- **Input:** Sample Superstore Dataset (or any similar structured dataset with dimensions and measures).
- **Expected Output:** A basic visualization (e.g., a bar chart or line chart) demonstrating the use of Columns, Rows, and various Marks card options, showing data segmented by color, size, or labels.

Lab 2: Color, Size, Shapes and Label Options- Choosing Color Options

- **Title:** Customizing Visualizations with Color, Size, Shapes, and Labels
- **Aim:** To learn how to effectively use color, size, shapes, and labels to enhance data visualization and convey insights more clearly.
- **Procedure:**
    1. Open your data visualization software and connect to a dataset.
    2. Create a basic chart (e.g., a scatter plot or bar chart).
    3. Drag a dimension to the "Color" shelf/card. Experiment with different color palettes (e.g., categorical, sequential, diverging).
    4. Drag a measure to the "Size" shelf/card. Observe how the size of marks changes based on the measure's value.
    5. For a scatter plot, drag a dimension to the "Shape" shelf/card. Observe how different categories are represented by different shapes.
    6. Drag a field to the "Label" shelf/card to display text labels on the marks. Customize label formatting (e.g., font, alignment, allowing overlap).
    7. Combine multiple options (e.g., color by one dimension, size by a measure, label by another field).
    8. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `1. Create a scatter plot with 'Profit' on Columns and 'Sales' on Rows.`
- `2. Drag 'Region' to Color.`
- `3. Drag 'Profit Ratio' to Size.`
- `4. Drag 'Customer Name' to Detail.`
- `5. Drag 'Sales' to Label.`

- **Input:** Sample Superstore Dataset or any dataset suitable for demonstrating these visual attributes.
- **Expected Output:** A visualization where data points are differentiated by color, size, shape, and have informative labels, demonstrating effective use of these visual encoding techniques.

Lab 3: Formatting Options

- **Title:** Applying Formatting Options to Enhance Readability and Aesthetics
- **Aim:** To understand and apply various formatting options (e.g., fonts, colors, borders, shading, number formats) to improve the readability and aesthetic appeal of visualizations and dashboards.
- **Procedure:**
    1. Open your data visualization software and load an existing visualization or create a new one.
    2. Explore formatting options for axes: change font, color, tick marks, and titles.
    3. Format numbers and currencies: apply appropriate number formats (e.g., currency, percentage, custom).
    4. Adjust pane and header formatting: change shading, borders, and line styles.
    5. Customize tooltips: add or remove fields, change text formatting within the tooltip.
    6. Change font styles and sizes for titles, legends, and other text elements.
    7. Experiment with different background colors and shading for worksheets and dashboards.
    8. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `1. Open 'Lab 1' workbook.`
- `2. Right-click on the 'Sales' axis and select 'Format'.`
- `3. Change 'Numbers' to 'Currency (Custom)' with 0 decimal places.`
- `4. Right-click on the sheet and select 'Format'.`
- `5. Go to 'Shading' and change 'Worksheet' background color.`
- `6. Edit the 'Title' font to 'Arial Black', size 14, bold.`

- **Input:** Any existing visualization or a new one created for this lab.
- **Expected Output:** A well-formatted visualization with clear axes, appropriate number formats, and aesthetically pleasing fonts and colors, demonstrating mastery of formatting options.

Lab 4: Joining Multiple Tables from the Same Database

- **Title:** Combining Data from Multiple Tables Using Joins
- **Aim:** To understand the concept of joining tables and to practically implement different types of joins (e.g., inner, left, right, full outer) to combine data from multiple tables within the same database.
- **Procedure:**
    1. Open your data visualization software and connect to a database (e.g., a local SQL database or a sample database with multiple related tables).
    2. Drag multiple tables (e.g., `Orders` and `Returns`) to the data source pane.
    3. Observe the automatic join created by the software or manually define the join condition (e.g., `Order ID` from `Orders` to `Order ID` from `Returns`).
    4. Experiment with different join types (Inner, Left, Right, Full Outer) and observe how the number of rows in the resulting dataset changes.
    5. Create a simple visualization using fields from both joined tables to verify the join.
    6. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `1. Connect to 'SQL Server' database.`
- `2. Select 'Orders' table.`
- `3. Drag 'Returns' table next to 'Orders'.`
- `4. Ensure join condition is 'Orders.OrderID = Returns.OrderID'.`
- `5. Change join type to 'Left Join'.`
- `6. Create a table showing 'Order ID' and 'Returned' status.`

- **Input:** A database with at least two related tables (e.g., `Orders` and `Order Details`, or `Customers` and `Orders`).
- **Expected Output:** A combined dataset visible in the data source pane, and a visualization that correctly displays data from both joined tables, demonstrating the effect of different join types.

Lab 5: Hiding, Renaming and Combining Fields

- **Title:** Managing Data Fields: Hiding, Renaming, and Combining
- **Aim:** To learn how to effectively manage data fields within the data visualization environment by hiding unnecessary fields, renaming fields for clarity, and combining multiple fields into a single, more useful field.
- **Procedure:**
    1. Open your data visualization software and connect to a dataset.
    2. **Hiding Fields:** Identify fields that are not relevant for analysis. Right-click on a field in the Data pane and select "Hide." Observe that it no longer appears in the list of available fields.
    3. **Renaming Fields:** Right-click on a field and select "Rename." Give it a more descriptive or user-friendly name. Observe the change in the Data pane and any existing visualizations.
    4. **Combining Fields:** Select multiple fields (e.g., `First Name` and `Last Name`). Right-click and select "Combine Fields" or "Create Combined Field." Use this new combined field in a visualization.
    5. Explore other data management options like creating folders to organize fields.
    6. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `1. Connect to 'Sample - Superstore.xls'.`
- `2. Right-click on 'Row ID' and select 'Hide'.`
- `3. Right-click on 'Customer Name' and select 'Rename' to 'Full Customer Name'.`
- `4. Select 'Category' and 'Sub-Category', right-click and choose 'Create Combined Field'.`
- `5. Drag the new combined field to Rows.`

- **Input:** Any dataset with multiple fields, including some that might be redundant or could be combined.
- **Expected Output:** A refined data pane with hidden fields, renamed fields, and a new combined field, demonstrating improved data organization and usability.

Lab 6: Extracting Data, Data Blending

- **Title:** Optimizing Performance with Data Extracts and Integrating Diverse Data Sources with Data Blending
- **Aim:** To understand the benefits of data extracts for performance and to learn how to create and manage them. Also, to learn how to use data blending to combine data from different data sources when a direct join is not feasible.
- **Procedure:**
    1. **Data Extraction:**
        - Connect to a large dataset (e.g., a database table with many rows).
        - Go to the Data Source tab and select the option to "Extract" the data.
        - Configure the extract options (e.g., number of rows, filters).
        - Create a visualization and observe the performance difference compared to a live connection.
        - Refresh the extract.
    2. **Data Blending:**
        - Connect to two different data sources (e.g., one Excel file and one CSV file) that share a common dimension (e.g., `Region`).
        - Create a visualization using fields from the primary data source.
        - Drag a field from the secondary data source to the visualization. Observe how the blend is established (indicated by a chain link icon).
        - Edit the blend relationships if necessary.
        - Create a visualization that combines data from both blended sources.
    3. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `// Data Extraction`
- `1. Connect to 'Sales_Database.db'.`
- `2. In Data Source tab, select 'Extract' instead of 'Live'.`
- `3. Click 'Edit' and set 'Filter' to 'Year(Order Date) = 2023'.`
- `4. Save the extract.`
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- `// Data Blending`
- `1. Connect to 'Sales_2022.xlsx' (Primary).`
- `2. Connect to 'Marketing_Spend_2022.csv' (Secondary).`
- `3. Drag 'Region' from 'Sales_2022.xlsx' to Rows.`
- `4. Drag 'Ad Spend' from 'Marketing_Spend_2022.csv' to Columns.`
- `5. Ensure the blend is active on 'Region'.`

- **Input:**
    1. For Extraction: A large dataset (e.g., a database table).
    2. For Blending: Two different data sources with at least one common linking field (e.g., `Region`, `Date`, `Product ID`).
- **Expected Output:**
    1. For Extraction: A faster-loading visualization, confirming the extract was created and used.
    2. For Blending: A visualization that successfully combines data from two distinct sources, demonstrating the blended relationship.

Lab 7: Pie Chart, Text Table/Crosstab

- **Title:** Creating and Customizing Pie Charts and Text Tables (Crosstabs)
- **Aim:** To learn how to create and effectively use pie charts for part-to-whole relationships and text tables (crosstabs) for detailed, tabular data display.
- **Procedure:**
    1. **Pie Chart:**
        - Connect to a dataset.
        - Drag a dimension (e.g., `Segment`) to the "Color" shelf/card.
        - Drag a measure (e.g., `Sales`) to the "Angle" shelf/card.
        - Change the Mark Type to "Pie."
        - Add labels (e.g., `Segment` and `Sales` or `Percentage of Total`) to the pie slices.
        - Adjust size and position.
    2. **Text Table/Crosstab:**
        - Drag multiple dimensions (e.g., `Category`, `Sub-Category`) to the "Rows" shelf.
        - Drag multiple measures (e.g., `Sales`, `Profit`, `Quantity`) to the "Columns" shelf.
        - Ensure the Mark Type is "Automatic" or "Text."
        - Apply formatting to the table (e.g., column headers, row banding).
        - Export the crosstab to Excel.
    3. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `// Pie Chart`
- `1. Drag 'Category' to Color.`
- `2. Drag 'Sales' to Angle.`
- `3. Set Mark Type to 'Pie'.`
- `4. Drag 'Category' and 'Sales' to Label.`
-
- `// Text Table`
- `1. Drag 'Region' to Rows.`
- `2. Drag 'Category' to Rows (nested under Region).`
- `3. Drag 'Sales', 'Profit', 'Quantity' to Columns.`

- **Input:** Any dataset suitable for categorical analysis and tabular display.
- **Expected Output:** A clear pie chart showing proportions of a measure across categories, and a well-formatted text table (crosstab) displaying multiple dimensions and measures in a tabular format.

Lab 8: Wordcloud

- **Title:** Generating Word Clouds for Text Data Visualization
- **Aim:** To learn how to create a word cloud to visualize the frequency or importance of text data, where the size of each word indicates its prominence.
- **Procedure:**
    1. Connect to a dataset that contains a text field (e.g., `Product Name`, `Customer Comments`, `Description`).
    2. Drag the text field to the "Text" shelf/card.
    3. Drag a measure (e.g., `Number of Records` or a calculated field representing frequency) to the "Size" shelf/card.
    4. Change the Mark Type to "Text" if not already.
    5. Adjust font, color, and layout options for the word cloud.
    6. Consider filtering out common words (stop words) or performing text cleaning if necessary (though this might involve calculated fields beyond the scope of a basic word cloud).
    7. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `1. Connect to a dataset with a 'Product Name' field.`
- `2. Drag 'Product Name' to Text.`
- `3. Drag 'Number of Records' to Size.`
- `4. Ensure Mark Type is 'Text'.`
- `5. Adjust font and color as desired.`

- **Input:** A dataset containing a text field (e.g., `Product Name`, `Review Text`).
- **Expected Output:** A visually appealing word cloud where the size of each word corresponds to its frequency or a related measure, providing a quick overview of prominent terms.

Lab 9: Worksheet Actions- Filter Actions

- **Title:** Implementing Interactive Filter Actions in Worksheets and Dashboards
- **Aim:** To understand and apply filter actions to create interactive dashboards, allowing users to filter data in one worksheet by selecting marks in another.
- **Procedure:**
    1. Create two or more worksheets that share a common dimension (e.g., one showing `Sales by Category` and another showing `Sales by Sub-Category`).
    2. Create a new dashboard and drag both worksheets onto it.
    3. Go to the Dashboard menu and select "Actions..."
    4. Add a new "Filter" action.
    5. Configure the action:
        - **Source Sheets:** Select the worksheet that will initiate the filter (e.g., `Sales by Category`).
        - **Target Sheets:** Select the worksheet(s) that will be filtered (e.g., `Sales by Sub-Category`).
        - **Run action on:** Select "Select" (or "Hover" or "Menu").
        - **Clearing the selection will:** Choose "Show all values" or "Exclude all values."
        - **Target Filters:** Ensure the common dimension is selected.
    6. Test the filter action by clicking on different categories in the source worksheet and observing the filtering in the target worksheet.
    7. Save your workbook.
- **Source Code:** (This involves configuring actions within the dashboard interface.)
- `// Example steps for a hypothetical data visualization tool`
- `1. Create 'Sheet1' (Bar Chart: Category vs Sales).`
- `2. Create 'Sheet2' (Table: Sub-Category vs Sales).`
- `3. Create a new Dashboard.`
- `4. Drag 'Sheet1' and 'Sheet2' to the Dashboard.`
- `5. Go to Dashboard -> Actions -> Add Action -> Filter.`
- `6. Source Sheet: Sheet1.`
- `7. Target Sheet: Sheet2.`
- `8. Run action on: Select.`
- `9. Clearing the selection will: Show all values.`
- `10. Test by clicking on bars in Sheet1.`

- **Input:** Two or more related worksheets within the same workbook.
- **Expected Output:** An interactive dashboard where clicking on a data point in one visualization filters the data displayed in another linked visualization, demonstrating a working filter action.

Lab 10: Background Maps and Layers: Maps Options

- **Title:** Visualizing Geospatial Data with Background Maps and Layers
- **Aim:** To learn how to create map-based visualizations, utilize background maps, and work with different map layers and options to display geographic data.
- **Procedure:**
    1. Connect to a dataset containing geographic information (e.g., `Country`, `State`, `City`, `Latitude`, `Longitude`).
    2. Drag geographic fields (e.g., `State`) to the visualization area. The software should automatically generate a map.
    3. Explore different map styles (e.g., normal, street, satellite, dark).
    4. Add additional layers to the map (e.g., `City` as a detail, `Sales` as size on the marks card).
    5. Customize map options:
        - Show/hide map layers (e.g., country borders, place names).
        - Add custom background images or WMS servers if applicable.
        - Enable pan and zoom.
    6. Create a filled map (choropleth) by dragging a measure to the "Color" shelf/card.
    7. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `1. Connect to 'Sample - Superstore.xls'.`
- `2. Double-click 'State'.`
- `3. Drag 'Sales' to Color.`
- `4. Go to Map -> Map Layers.`
- `5. Change 'Style' to 'Dark'.`
- `6. Uncheck 'Country/Region Names'.`

- **Input:** A dataset with geographical data (e.g., `State`, `City`, `Country` fields).
- **Expected Output:** An interactive map visualization displaying data points or filled regions based on geographic data, with customized background maps and layers.

Lab 11: Calculating Fields, Table Calculations and Statistics- Creating Calculated Fields

- **Title:** Performing Data Analysis with Calculated Fields and Table Calculations
- **Aim:** To learn how to create new measures and dimensions using calculated fields for custom calculations, and to understand and apply table calculations for advanced analytical computations within the visualization.
- **Procedure:**
    1. **Creating Calculated Fields:**
        - Connect to a dataset.
        - Create a new calculated field (e.g., `Profit Ratio = SUM([Profit]) / SUM([Sales])`).
        - Create another calculated field using string functions (e.g., `Region Code = LEFT([Region], 3)`).
        - Use these calculated fields in visualizations.
    2. **Table Calculations:**
        - Create a simple chart (e.g., `Sales` over `Order Date` by `Category`).
        - Add a quick table calculation to a measure (e.g., "Running Total," "Percent of Total," "Difference From").
        - Edit the table calculation to change its computation direction (e.g., "Table (Across)," "Pane (Down)," "Specific Dimensions").
        - Add reference lines or trend lines based on statistical functions.
    3. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `// Calculated Field`
- `1. Right-click in Data pane -> Create Calculated Field.`
- `2. Name: 'Profit Ratio'. Formula: 'SUM([Profit]) / SUM([Sales])'.`
- `3. Drag 'Profit Ratio' to Columns.`
-
- `// Table Calculation`
- `1. Create a Line Chart: 'Order Date' (Year) on Columns, 'Sales' on Rows.`
- `2. Drag 'Category' to Color.`
- `3. Right-click on 'SUM(Sales)' on Rows -> Quick Table Calculation -> Running Total.`
- `4. Right-click on 'SUM(Sales)' again -> Edit Table Calculation -> Compute Using -> Table (Across).`

- **Input:** Any dataset with numerical and categorical fields suitable for calculations.
- **Expected Output:** Visualizations displaying results from custom calculated fields and demonstrating various table calculations (e.g., running totals, percentages, differences), along with basic statistical insights.

Lab 12: Reference Lines, Bands & Distributions

- **Title:** Enhancing Visualizations with Reference Lines, Bands, and Distribution Plots
- **Aim:** To learn how to add analytical context to visualizations by incorporating reference lines (e.g., average, constant, total), reference bands (e.g., confidence intervals), and distribution plots.
- **Procedure:**
    1. Create a visualization (e.g., a bar chart of `Sales by Sub-Category` or a scatter plot).
    2. **Reference Lines:**
        - Drag a "Reference Line" from the Analytics pane (or equivalent) onto an axis or pane.
        - Configure it to show an average, sum, constant value, or total for the entire table or specific panes.
        - Add labels and formatting.
    3. **Reference Bands:**
        - Drag a "Reference Band" onto an axis or pane.
        - Configure it to show a range (e.g., min-max, 60-80% of total, or based on a calculated field).
    4. **Distribution Plots:**
        - Drag a "Distribution Band" onto an axis or pane.
        - Configure it to show a distribution (e.g., percentiles, standard deviation).
    5. Observe how these additions provide additional context and insights to the data.
    6. Save your workbook.
- **Source Code:**
- `// Example steps for a hypothetical data visualization tool`
- `1. Create a Bar Chart: 'Sub-Category' on Rows, 'Sales' on Columns.`
- `2. Go to Analytics pane.`
- `3. Drag 'Average Line' to the 'Sales' axis.`
- `4. Drag 'Reference Band' to the 'Sales' axis. Set 'Value' to 'SUM(Sales)' and 'Band From' to '60%', 'Band To' to '80%'.`
- `5. Drag 'Distribution Band' to the 'Sales' axis. Set 'Computation' to 'Percentiles' (25, 75).`

- **Input:** Any visualization that can benefit from analytical context (e.g., bar charts, line charts, scatter plots).
- **Expected Output:** A visualization with clearly visible reference lines, bands, or distribution plots that add statistical or comparative context to the data, aiding in analysis.

Lab 13: Advanced Dashboard Elements- Layout Container, Blank

- **Title:** Designing Advanced Dashboards with Layout Containers and Blank Objects
- **Aim:** To learn how to use layout containers (horizontal and vertical) to precisely arrange and organize multiple worksheets and objects on a dashboard, and to use blank objects for spacing and visual separation.
- **Procedure:**
    1. Create several simple worksheets (e.g., a bar chart, a line chart, a text table).
    2. Create a new dashboard.
    3. Drag a "Horizontal" layout container onto the dashboard. Drag two worksheets into this container. Observe how they arrange themselves side-by-side.
    4. Drag a "Vertical" layout container onto the dashboard. Drag two worksheets into this container. Observe how they arrange themselves one above the other.
    5. Nest layout containers within each other to create complex layouts.
    6. Drag "Blank" objects onto the dashboard to create precise spacing between elements or to push elements into desired positions.
    7. Experiment with distributing contents evenly within containers.
    8. Save your workbook.
- **Source Code:** (This involves drag-and-drop actions within the dashboard interface.)
- `// Example steps for a hypothetical data visualization tool`
- `1. Create 'Sheet A', 'Sheet B', 'Sheet C'.`
- `2. Create a new Dashboard.`
- `3. Drag 'Horizontal' layout container to the dashboard.`
- `4. Drag 'Sheet A' into the horizontal container.`
- `5. Drag 'Sheet B' into the horizontal container (next to Sheet A).`
- `6. Drag 'Vertical' layout container below the horizontal container.`
- `7. Drag 'Sheet C' into the vertical container.`
- `8. Drag a 'Blank' object between the horizontal and vertical containers for spacing.`

- **Input:** Multiple prepared worksheets to be arranged on a dashboard.
- **Expected Output:** A well-organized and visually balanced dashboard using horizontal and vertical layout containers to group and position elements, with blank objects used for effective spacing.

Lab 14: Distributing and Sharing Your Visualization- Exporting Worksheets and Dashboards- Printing to PDF Format

- **Title:** Exporting and Sharing Data Visualizations
- **Aim:** To learn various methods for distributing and sharing visualizations, including exporting individual worksheets and entire dashboards to different formats (e.g., image, PDF, data), and preparing them for printing.
- **Procedure:**
    1. Open an existing worksheet or dashboard.
    2. **Exporting Worksheets:**
        - Go to a worksheet.
        - Export the worksheet as an image (e.g., PNG).
        - Export the underlying data to a CSV or Excel file.
    3. **Exporting Dashboards:**
        - Go to a dashboard.
        - Export the dashboard as an image.
        - Export the dashboard as a PDF:
            - Configure PDF options (e.g., paper size, orientation, scaling).
            - Include specific sheets or the entire dashboard.
    4. Explore options for publishing to a server (if applicable) or saving as a packaged workbook for sharing with others who have the software.
    5. Save your workbook.
- **Source Code:** (This involves menu navigation and selection within the software.)
- `// Example steps for a hypothetical data visualization tool`
- `// Exporting Worksheet`
- `1. Go to 'Sheet 1'.`
- `2. Go to Worksheet -> Export -> Image.`
- `3. Go to Worksheet -> Export -> Data.`
-
- `// Exporting Dashboard`
- `1. Go to 'Dashboard 1'.`
- `2. Go to Dashboard -> Export -> Image.`
- `3. Go to Dashboard -> Export -> PDF.`
- `4. In PDF settings, set 'Paper Size' to 'Letter', 'Orientation' to 'Landscape'.`

- **Input:** Any completed worksheet or dashboard.
- **Expected Output:** Successfully exported image files, PDF documents, and data files of the visualizations, demonstrating proficiency in sharing and distribution methods.

Lab 15: Using Tableau Reader

- **Title:** Viewing and Interacting with Visualizations Using Tableau Reader
- **Aim:** To understand the purpose of Tableau Reader and to learn how to open and interact with packaged workbooks (`.twbx` files) using this free application.
- **Procedure:**
    1. Ensure you have Tableau Reader installed on your system. If not, download and install it.
    2. Obtain a `.twbx` (Tableau Packaged Workbook) file from a peer or create one yourself by saving a workbook as a packaged workbook in Tableau Desktop.
    3. Open the `.twbx` file using Tableau Reader.
    4. Navigate between different worksheets and dashboards within the packaged workbook.
    5. Interact with any filters, parameters, or actions that were set up in the original workbook.
    6. Observe the limitations of Tableau Reader (e.g., cannot edit or connect to live data).
    7. Close Tableau Reader.
- **Source Code:** (This involves using an external application, not code within the visualization tool itself.)
- `// Example steps for using Tableau Reader`
- `1. Download and install Tableau Reader from the official website.`
- `2. Obtain a sample '.twbx' file (e.g., from Lab 14 export).`
- `3. Double-click the '.twbx' file or open Tableau Reader and navigate to the file.`
- `4. Interact with the dashboard elements (filters, actions).`

- **Input:** A `.twbx` (Tableau Packaged Workbook) file.
- **Expected Output:** Successful opening and interaction with a packaged workbook in Tableau Reader, demonstrating an understanding of its functionality and limitations for viewing shared visualizations.