Objective:

- Understand the importance of data visualization in engineering.
- Learn to create basic visualization plots in R.
- Apply visualization techniques to analyze datasets effectively.

A picture is worth a thousand words. A good data scientist is able to communicate findings and persuade stakeholders through effective data visualisations.

Following built-in functions are available in R:

- **Scatter plot or line plot:** plot( )
- **Add graph on top of existing plot:** points( )
- **Draw straight lines on existing plot:** abline( )
- **Box plot:** boxplot( )
- **Histogram:** hist( )
- **Column graph:** barplot( )
- **Pie chart:** pie( )

1. **Scatter Plot:** Used to visualize the relationship between two variables.

```
plot(x, y, main="Scatter Plot", xlab="X-axis Label", ylab="Y-axis Label", col="blue", pch=19)
```

2. **Line Plot:** Represents trends over a continuous range.

```
plot(x, y, type="l", main="Line Plot", xlab="X-axis Label", ylab="Y-axis Label", col="red")
```

3. **Bar Plot:** Displays categorical data.

```
barplot(height, names.arg=categories, main="Bar Plot", col="green")
```

4. **Histogram:** Shows the distribution of a single variable.

```
hist(data, main="Histogram", xlab="X-axis Label", col="purple")
```

5. **Box Plot:** Summarizes the distribution of a variable.

```
boxplot(data, main="Box Plot", xlab="X-axis Label", col="orange")
```

6. **Pie Chart:** Displays proportions within a dataset.

```
pie(values, labels=labels, main="Pie Chart",
col=rainbow(length(values)))
```

7. **Heatmap:** Represents data intensity through color gradients.

```
heatmap(matrix_data, main="Heatmap", col=heat.colors(256))
```

8. **Scatter Plot Matrix:** Shows pairwise relationships in a dataset.

```
pairs(dataset, main="Scatter Plot Matrix")
```

Practical 3 (Data Visualization in R)

Practical Questions:

1. **Scatter Plot:** Create a scatter plot to display the relationship between the speed and distance of a car using the `cars` dataset in R.
2. **Line Plot:** Plot the monthly average temperature of a city using a time-series dataset. Add appropriate labels and title.
3. **Bar Plot:** Use the `mtcars` dataset to create a bar plot showing the number of cars in each cylinder category.
4. **Histogram:** Generate a histogram to display the distribution of sepal lengths in the `iris` dataset. Use different colors for the bars.
5. **Box Plot:** Create a box plot to compare the weights of cars grouped by the number of cylinders in the `mtcars` dataset.
6. **Pie Chart:** Create a pie chart to display the proportion of different species in the `iris` dataset. Add labels for each species.
7. **Heatmap:** Use a random 5x5 matrix and generate a heatmap with a color gradient. Label the rows and columns.
8. **Scatter Plot Matrix:** Use the `iris` dataset to create a scatter plot matrix for all numerical columns.
9. **Customizing Plots:** Generate a customized scatter plot for the `mtcars` dataset with engine displacement (`disp`) on the x-axis and horsepower (`hp`) on the y-axis. Change the color and shape of the points.
10. **Multiple Plots:** Use the `par()` function to create a 2x2 grid layout and display a histogram, box plot, scatter plot, and line plot for any dataset of your choice.

Submission Guidelines:

- Submit the pdf file containing the code and the visualization for all the questions.
- Include a brief report with screenshots of the visualizations and a short explanation of each plot.
- Ensure proper labeling, titles, and legends in all visualizations.

Conclusion:

This practical helps students gain hands-on experience in visualizing data using R. Visualization techniques learned here will assist in analyzing engineering data and presenting results effectively.