Lab 3
Data Visualization and Interpretation Using Matplotlib-II

Objective

To understand and practice data visualization concepts using the **Matplotlib** library by plotting mathematical functions, time-series data, multi-line graphs, shaded regions, dual-axis plots, and basic graphical shapes.

Tasks:

1. Write code for line chart to generate 70 numbers with X- axis and Y-axis is mx+c, were m=2 and c=0.3, Draw the four different line charts using matplotlib library. (Take Y1=X, Y2=X**2, Y3=X**3 and Y4=sqrt(X)).

2. Plot the function **$y = x^2 - 4x + 3$** for **x ranging from -2 to 6**. Identify and annotate the **minimum point** of the graph. Add appropriate labels, title, and grid.

3. Plot sin(x) and cos(x) from 0 to 2π on the same graph. Use fill_between() to shade the area between the two curves where sin(x) is greater than cos(x). Add labels and a title.

4. Consider monthly temperature data for the year 2023 and plot it using a time-series line graph.

months = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']

temperature = [12, 14, 18, 24, 30, 34, 32, 31, 28, 22, 16, 13]

Label the x-axis as Months and y-axis as Temperature (°C). Format the x-axis to show month names instead of numbers.

5. Plot three mathematical functions on the same graph:

- $y = x^2$ (Red, Dashed Line)
- $y = 2x + 1$ (Blue, Solid Line)
- $y = \sqrt{x}$ (Green, Dotted Line)

Add a legend, labels, and title.

6. Create a **dual-axis plot** where:

- The **primary y-axis** represents the **monthly rainfall (in mm)** in 2023 as a **bar chart**.
- The **secondary y-axis** represents the **average temperature (in °C)** as a **line graph** on the same plot.

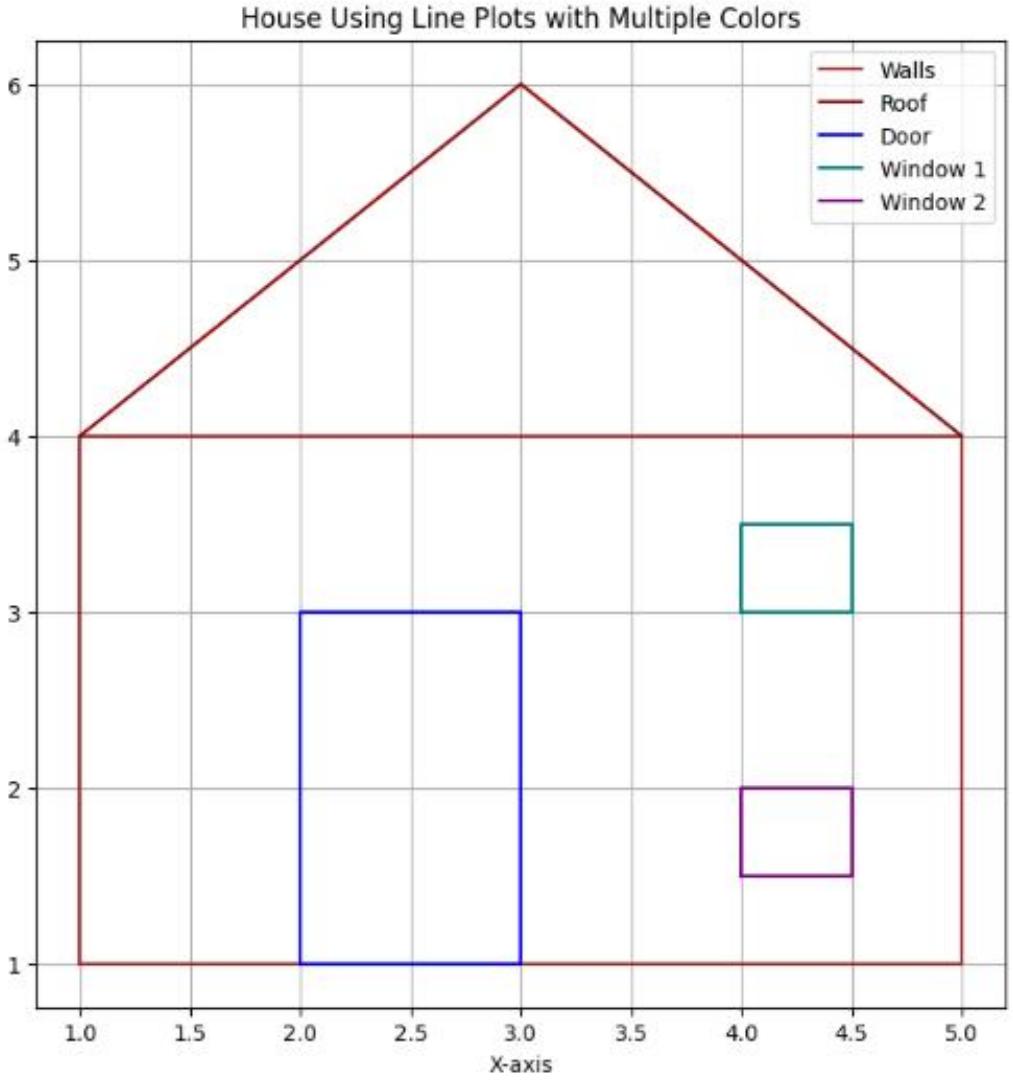
  months = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']

rainfall = [78, 62, 55, 41, 32, 140, 300, 280, 150, 90, 85, 80]

temperature = [12, 14, 18, 24, 30, 34, 32, 31, 28, 22, 16, 13]

Label both y-axes and use **different colors** for bars and the line.

7: Draw a house using matplotlib line charts:



Submission Requirements:

1. Save all the plots generated as image files (e.g., PNG, JPG).
2. Compile the images into a single Word or PDF document, including titles and brief descriptions for each graph.
3. Submit the document as per the instructor's instructions.
4. Organize exercises clearly under headers.
5. Include question, code, output, and short explanations as comments.

6. Header on each page must be

   ECSEI24303 Data Visualization

7. Footer on each page must be

   [Lab 3] [Page Number] [USN number]

Additional Notes:

- Ensure proper labeling of axes and titles for all plots.
- Use appropriate colors and styles for better visual clarity.
- Verify that all graphs are legible and accurately represent the data.