**Matplotlib Notes**

**1. What is Matplotlib?**

* **Matplotlib** is a Python library used for **data visualization**.
* It allows you to create a wide range of **plots and graphs**: line plots, bar charts, scatter plots, histograms, pie charts, etc.
* Mostly used along with **NumPy** and **Pandas** for scientific & data analysis tasks.
* The most commonly used module is **pyplot** (like matplotlib.pyplot).

**2. Installation**

pip install matplotlib

**3. Importing**

import matplotlib.pyplot as plt

**4. Basic Syntax (General Flow)**

import matplotlib.pyplot as plt

# 1. Create data

x = [1, 2, 3, 4, 5]

y = [2, 4, 6, 8, 10]

# 2. Plot data

plt.plot(x, y)

# 3. Add labels/title

plt.xlabel("X-axis")

plt.ylabel("Y-axis")

plt.title("Basic Line Graph")

# 4. Show plot

plt.show()

**5. Important Functions in pyplot**

**(A) Line Plot**

plt.plot(x, y, color='r', linestyle='--', marker='o')

plt.show()

* color → 'r', 'g', 'b' etc.
* linestyle → '-' (solid), '--' (dashed), ':' (dotted).
* marker → 'o', 's', '\*', '+' etc.

**(B) Multiple Lines in One Graph**

x = [1, 2, 3, 4, 5]

y1 = [1, 4, 9, 16, 25]

y2 = [1, 2, 3, 4, 5]

plt.plot(x, y1, label="Squares")

plt.plot(x, y2, label="Linear")

plt.legend() # Show labels

plt.show()

**(C) Bar Chart**

x = ["A", "B", "C", "D"]

y = [5, 7, 3, 8]

plt.bar(x, y, color='skyblue')

plt.xlabel("Categories")

plt.ylabel("Values")

plt.title("Bar Chart Example")

plt.show()

**(D) Horizontal Bar Chart**

plt.barh(x, y, color='orange')

plt.show()

**(E) Scatter Plot**

x = [5,7,8,7,2,17,2,9,4,11]

y = [99,86,87,88,100,86,103,87,94,78]

plt.scatter(x, y, color='red')

plt.title("Scatter Plot Example")

plt.show()

**(F) Histogram**

data = [22,87,5,43,56,73,55,54,11,20,51,5]

plt.hist(data, bins=5, color='purple', edgecolor='black')

plt.title("Histogram Example")

plt.show()

* bins → number of intervals.

**(G) Pie Chart**

labels = ['Apples', 'Bananas', 'Cherries', 'Dates']

sizes = [20, 30, 25, 25]

colors = ['red', 'yellow', 'pink', 'brown']

explode = (0, 0.1, 0, 0) # “explode” 2nd slice

plt.pie(sizes, labels=labels, colors=colors, explode=explode,

autopct='%1.1f%%', shadow=True, startangle=90)

plt.title("Fruit Pie Chart")

plt.show()

**(H) Subplots (Multiple Graphs in One Figure)**

x = [1,2,3,4,5]

y1 = [1,4,9,16,25]

y2 = [1,2,3,4,5]

plt.subplot(1,2,1) # (rows, cols, index)

plt.plot(x, y1)

plt.title("Squares")

plt.subplot(1,2,2)

plt.plot(x, y2)

plt.title("Linear")

plt.tight\_layout() # Adjust layout

plt.show()

**6. Customization Options**

✅ **Axis Limits**

plt.xlim(0, 10)

plt.ylim(0, 30)

✅ **Grid**

plt.grid(True)

✅ **Figure Size**

plt.figure(figsize=(6,4))

✅ **Saving Figures**

plt.savefig("myplot.png")

**7. Theory Summary for Notes**

* **Matplotlib**: Python library for creating static, animated, and interactive visualizations.
* **pyplot**: A module that provides MATLAB-like interface for plotting.
* **Types of plots**:
  + Line Plot → plt.plot()
  + Bar Chart → plt.bar()
  + Scatter Plot → plt.scatter()
  + Histogram → plt.hist()
  + Pie Chart → plt.pie()
  + Subplots → plt.subplot()
* **Customization**: title, labels, legend, grid, color, linestyle, markers, axis limits.
* **Practical Use**: Data science, machine learning, reports, dashboards, statistics visualization.