

Q1: What is Matplotlib? Why is it used? Name five plots.

Matplotlib is a **Python library for data visualization**. It is used to **create static, animated, and interactive plots** in Python. The **pyplot** module in Matplotlib provides functions similar to MATLAB to make plotting easy.

Common plots using **pyplot**:

1. Line plot (`plt.plot()`)
 2. Scatter plot (`plt.scatter()`)
 3. Bar plot (`plt.bar()`)
 4. Histogram (`plt.hist()`)
 5. Pie chart (`plt.pie()`)
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Q2: Scatter plot with generated data

A **scatter plot** is used to visualize the relationship between two variables using points on a 2D plane.

Code:

```
import numpy as np
import matplotlib.pyplot as plt

# Generate data
np.random.seed(3)
x = 3 + np.random.normal(0, 2, 50)
y = 3 + np.random.normal(0, 2, len(x))

# Plot scatter plot
plt.scatter(x, y, color='blue', marker='o')
plt.title("Scatter Plot of X vs Y")
plt.xlabel("X-axis")
plt.ylabel("Y-axis")
```

```
plt.grid(True)
plt.show()
```

✓ This will display a scatter plot with **title**, **x-label**, and **y-label**.

Q3: `subplot()` function and four line plots

- `subplot()` is used to display **multiple plots in a single figure** by defining a grid of rows and columns.
- Syntax: `plt.subplot(nrows, ncols, plot_number)`

Code for four line plots:

```
import numpy as np
import matplotlib.pyplot as plt

# Data
x = np.array([0, 1, 2, 3, 4, 5])
y1 = np.array([0, 100, 200, 300, 400, 500])
y2 = np.array([50, 20, 40, 20, 60, 70])
y3 = np.array([10, 20, 30, 40, 50, 60])
y4 = np.array([200, 350, 250, 550, 450, 150])

# Plotting 4 subplots
plt.figure(figsize=(10,8))

plt.subplot(2, 2, 1)
plt.plot(x, y1, 'r-o')
plt.title("Line 1")

plt.subplot(2, 2, 2)
plt.plot(x, y2, 'g-s')
plt.title("Line 2")

plt.subplot(2, 2, 3)
plt.plot(x, y3, 'b-^')
```

```
plt.title("Line 3")

plt.subplot(2, 2, 4)
plt.plot(x, y4, 'm-d')
plt.title("Line 4")

plt.tight_layout()
plt.show()
```

✓ This will create a **2x2 grid of line plots**.

Q4: Bar plot

- A **bar plot** is used to **compare quantities** for different categories.
- Vertical bar: `plt.bar()`
- Horizontal bar: `plt.barh()`

Code:

```
import numpy as np
import matplotlib.pyplot as plt

# Data
company = np.array(["Apple", "Microsoft", "Google", "AMD"])
profit = np.array([3000, 8000, 1000, 10000])

# Vertical bar plot
plt.bar(company, profit, color='orange')
plt.title("Company Profits (Vertical)")
plt.xlabel("Company")
plt.ylabel("Profit")
plt.show()

# Horizontal bar plot
plt.barh(company, profit, color='green')
```

```
plt.title("Company Profits (Horizontal)")
plt.xlabel("Profit")
plt.ylabel("Company")
plt.show()
```

✓ Two bar plots: **vertical and horizontal**.

Q5: Box plot

- A **box plot** (or whisker plot) is used to **visualize distribution, median, quartiles, and outliers** of a dataset.

Code:

```
import numpy as np
import matplotlib.pyplot as plt

# Generate data
box1 = np.random.normal(100, 10, 200)
box2 = np.random.normal(90, 20, 200)

# Plot box plot
plt.boxplot([box1, box2], labels=['Box1', 'Box2'])
plt.title("Box Plot of Two Datasets")
plt.ylabel("Values")
plt.grid(True)
plt.show()
```

✓ The box plot will show **median, quartiles, and potential outliers**.