Python Matplotlib

Matplotlib is a widely-used plotting library in Python that enables the creation of static, animated, and interactive visualizations. It is highly customizable and supports various types of plots.

Installation

To install Matplotlib, use pip:

```
pip install matplotlib
```

Basic Concepts

Importing Matplotlib

```
import matplotlib.pyplot as plt
```

Plotting Basics

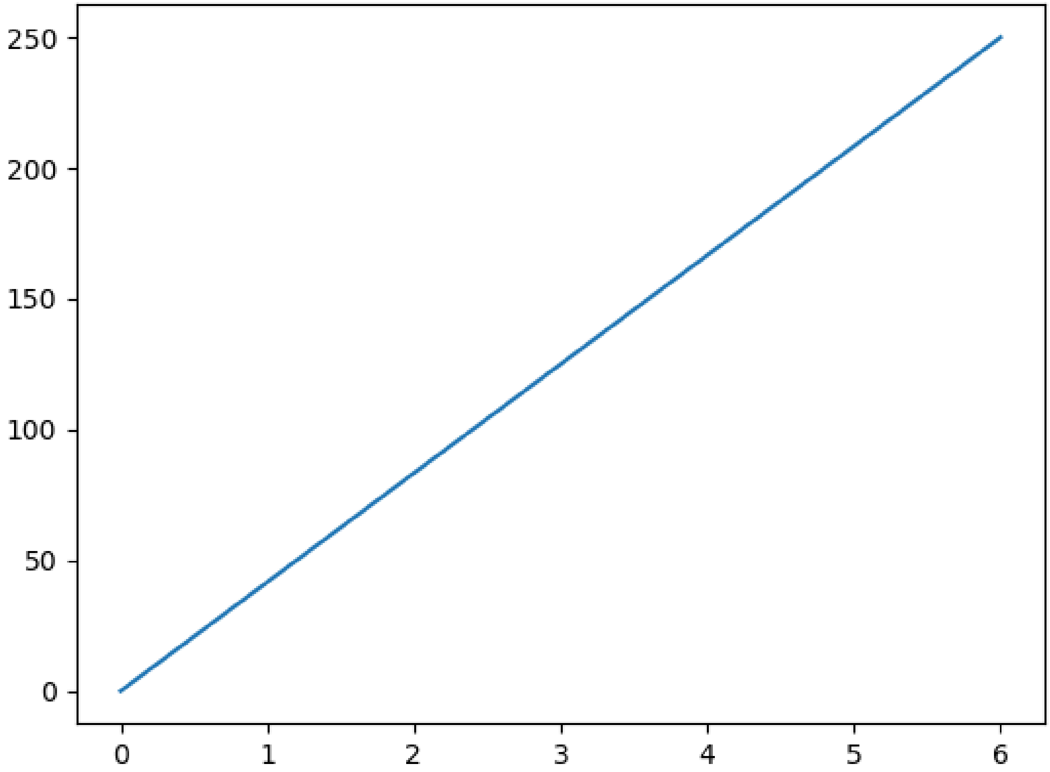
To create a simple plot:

```
import matplotlib.pyplot as plt

# Sample data
x = [1, 2, 3, 4]
y = [10, 20, 25, 30]

plt.plot(x, y)
plt.xlabel('X-axis label')
plt.ylabel('Y-axis label')
plt.title('Simple Plot')
plt.show()
```

Plot Types

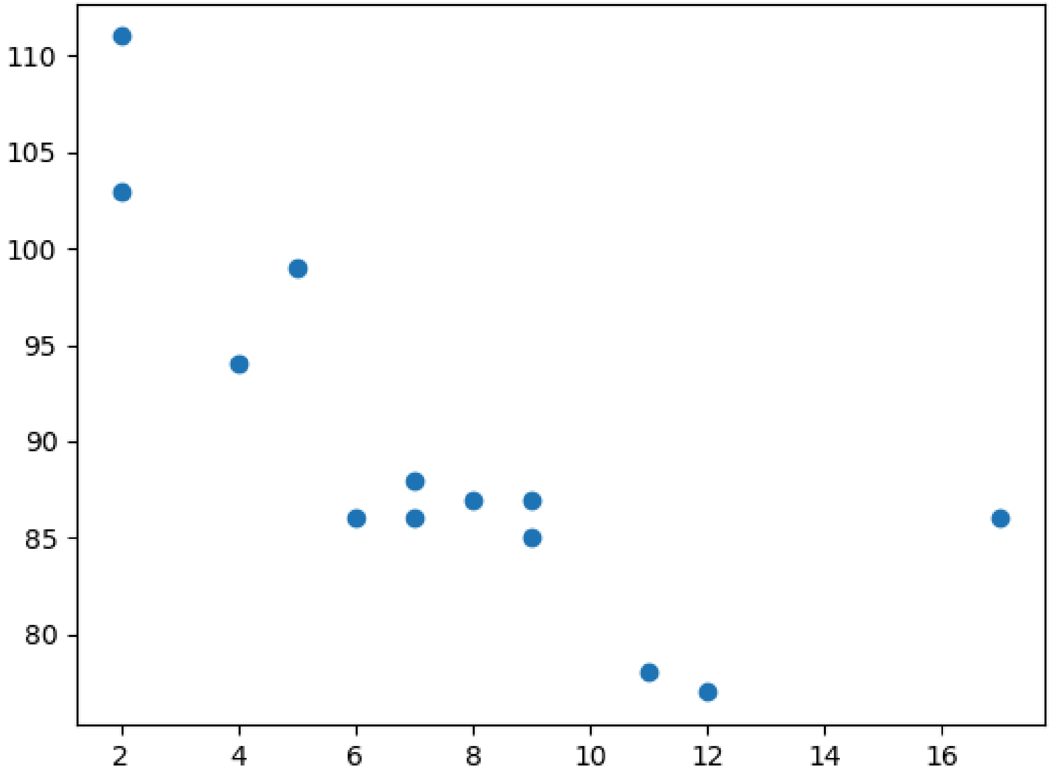
Line Plot

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

xpoints = np.array([0, 6])
ypoints = np.array([0, 250])

plt.plot(xpoints, ypoints)
plt.show()
```



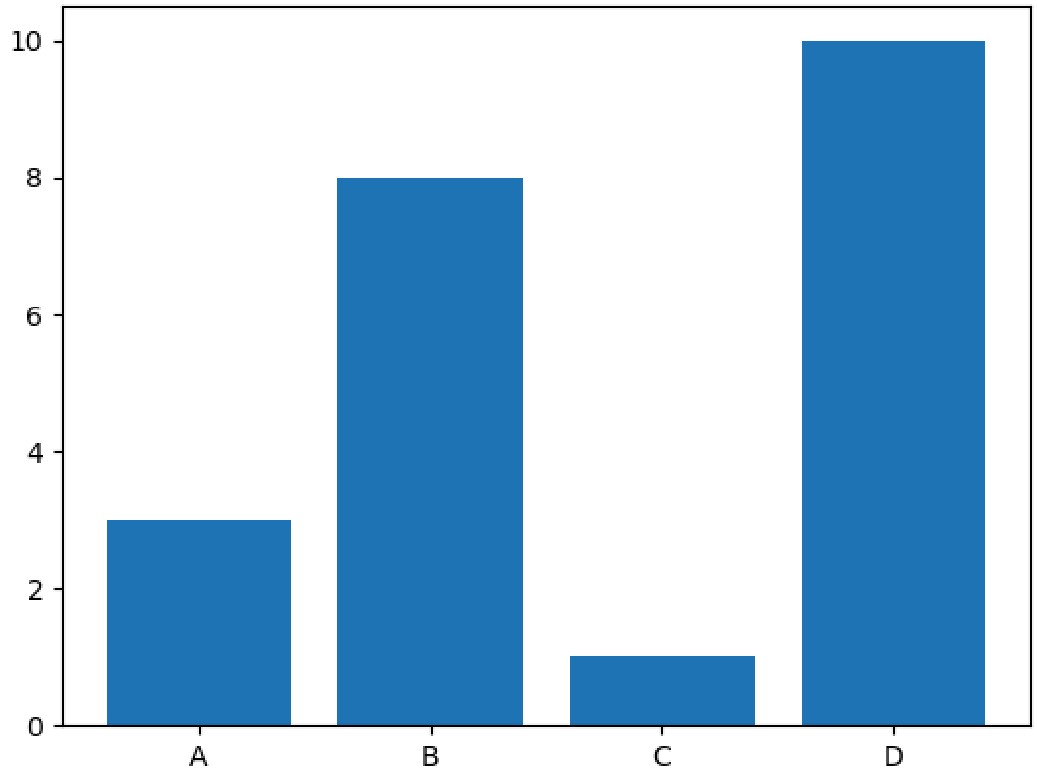
Scatter Plot

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

x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y =
np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])

plt.scatter(x, y)
plt.show()
```



Bar Plot

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

x = np.array(["A", "B", "C", "D"])
y = np.array([3, 8, 1, 10])

plt.bar(x,y)
plt.show()
```

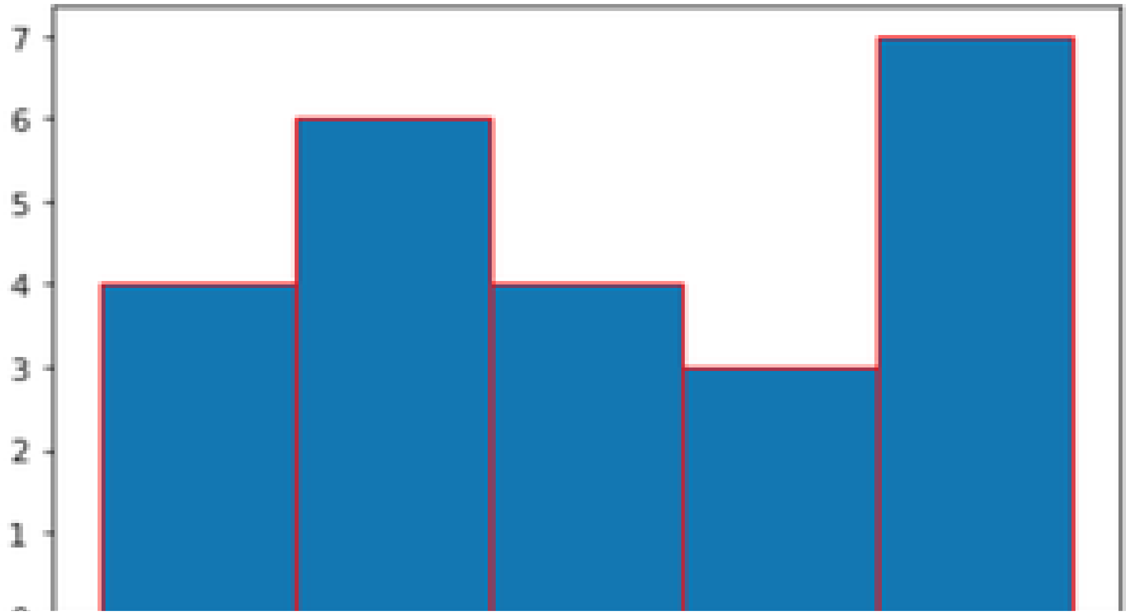


```
# Horizontal bar plot
plt.barh(x, y)
```

Histogram

```
import matplotlib.pyplot as plt

height = [189, 185, 195, 149, 189, 147, 154,
         174, 169, 195, 159, 192, 155, 191,
         153, 157, 140, 144, 172, 157, 181,
         182, 166, 167]

plt.hist(height, edgecolor="red", bins=5)
plt.show()
```

Output :

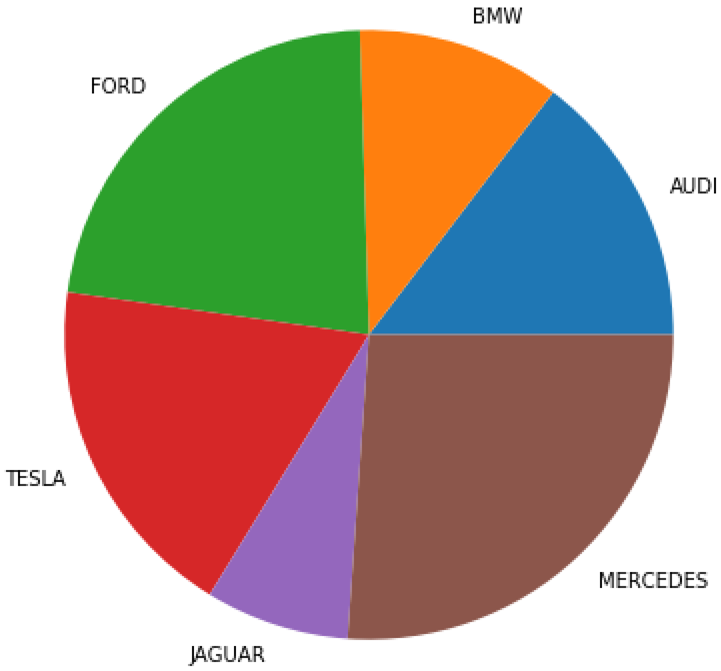


Pie Chart

```
# Import libraries
from matplotlib import pyplot as plt
import numpy as np

# Creating dataset
cars = ['AUDI', 'BMW', 'FORD',
        'TESLA', 'JAGUAR', 'MERCEDES']

data = [23, 17, 35, 29, 12, 41]

# Creating plot
fig = plt.figure(figsize=(10, 7))
plt.pie(data, labels=cars)
```

```
# show plot
plt.show()
```

Output:



Box Plot

```
# Import libraries
import matplotlib.pyplot as plt
import numpy as np


# Creating dataset
np.random.seed(10)
data = np.random.normal(100, 20, 200)
```

```
fig = plt.figure(figsize =(10, 7))

# Creating plot
plt.boxplot(data)

# show plot
plt.show()
```

Customizing Plots

Titles and Labels

```
plt.title('Plot Title')
plt.xlabel('X-axis Label')
plt.ylabel('Y-axis Label')
```

Legends

```
plt.plot(x, y, label='Line 1')
plt.legend()
```

Grid

```
pythonplt.grid(True)
```

Axis Limits

```
plt.xlim(0, 5)
plt.ylim(0, 35)
```

Colors and Styles

```
plt.plot(x, y, color='green', linestyle='dashed',
marker='o')
```

Subplots

Creating Multiple Plots

```
# Using subplot() function
plt.subplot(1, 2, 1) # 1 row, 2 columns, plot 1
plt.plot(x, y)

plt.subplot(1, 2, 2) # 1 row, 2 columns, plot 2
plt.plot(y, x)
```

Using `plt.subplots()`

```
fig, axs = plt.subplots(2, 2) # 2x2 grid of plots

axs[0, 0].plot(x, y)
axs[0, 1].plot(y, x)
axs[1, 0].plot(x, x)
axs[1, 1].plot(y, y)
```

Advanced Topics

Logarithmic Scale

```
plt.yscale('log')
plt.xscale('log')
```

Saving Plots

```
plt.savefig('plot.png')
plt.savefig('plot.pdf')
```

Simple Line Plot with Customization

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

# Sample data
x = np.linspace(0, 10, 100)
y = np.sin(x)

plt.plot(x, y, label='Sine Wave', color='blue',
linestyle='--')
plt.title('Sine Wave Example')
plt.xlabel('X values')
plt.ylabel('Sine of X')
plt.legend()
plt.grid(True)
plt.show()
```

Multiple Subplots Example

```
fig, axs = plt.subplots(3, 1, figsize=(5, 10))

x = np.linspace(0, 10, 100)
y1 = np.sin(x)
```

```
y2 = np.cos(x)
y3 = np.tan(x)

axs[0].plot(x, y1)
axs[0].set_title('Sine')

axs[1].plot(x, y2)
axs[1].set_title('Cosine')

axs[2].plot(x, y3)
axs[2].set_title('Tangent')

for ax in axs:
 ax.set_xlabel('X-axis')
 ax.set_ylabel('Y-axis')
 ax.grid(True)

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