Experiment No. 10
To explore the basics Matplotlib for data visualization.
Date of Performance: 26/03/2024
Date of Submission: 02/04/2024

Aim: To explore the basics Matplotlib for data visualization.

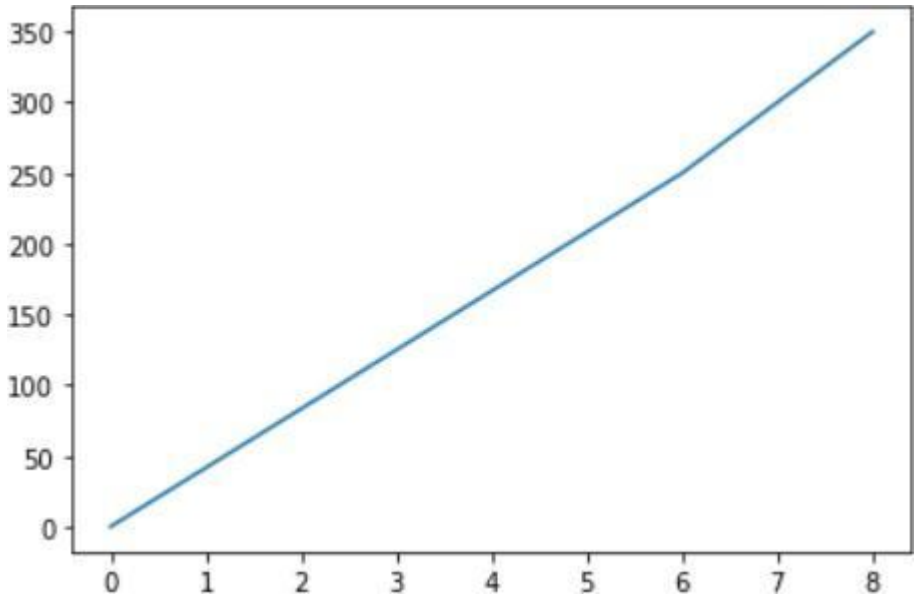
Objective:To understand how to use graphs and charts for data analysis.

Theory:

Matplotlib is a low level graph plotting library in python that serves as a visualization utility.
Matplotlib is open source and we can use it freely.
Most of the Matplotlib utilities lies under the pyplot submodule, and are usually imported under the plt alias.

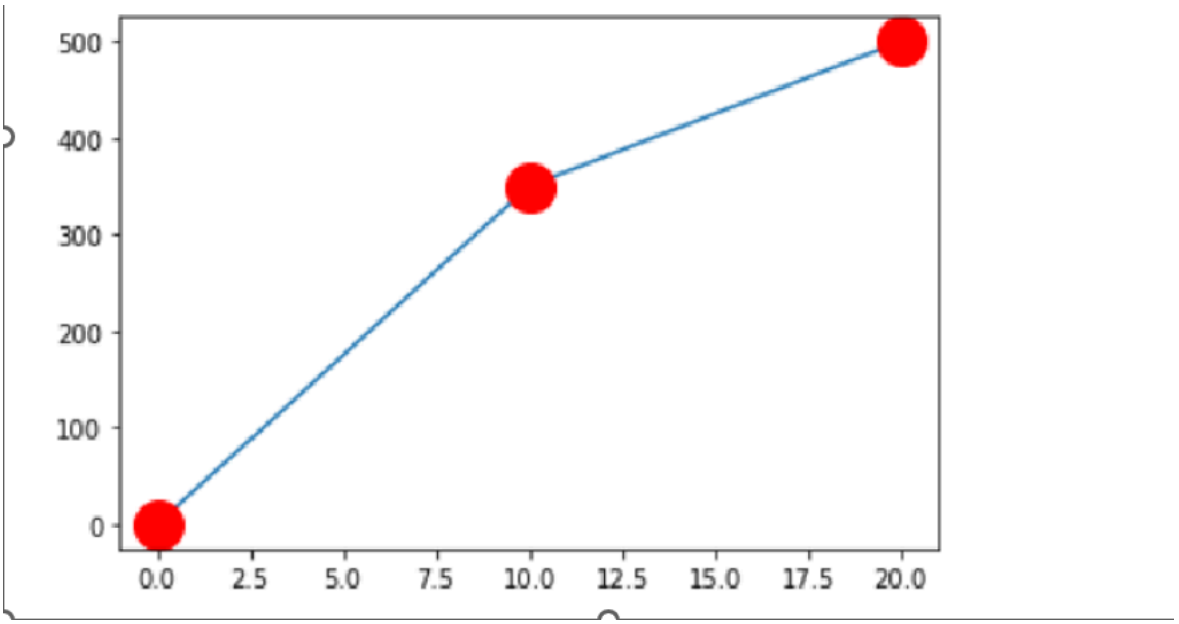
- The plot() function is used to draw points (markers) in a diagram.
- By default, the plot() function draws a line from point to point.
- The function takes parameters for specifying points in the diagram.
- Parameter 1 is an array containing the points on the x-axis.
- Parameter 2 is an array containing the points on the y-axis.Eg: (0,0), (6,250), (8,350)

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

x = np.array([0,6,8])
y = np.array([0,250,350])

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



- The keyword argument marker is to emphasize each point with a specified marker.
- The keyword argument markersize or the shorter version, ms is to set the size of the markers
- The keyword argument markeredgecolor or the shorter mec is to set the color of the edge of the markers
- The keyword argument markerfacecolor or the shorter mfc is to set the color inside the edge of the markers

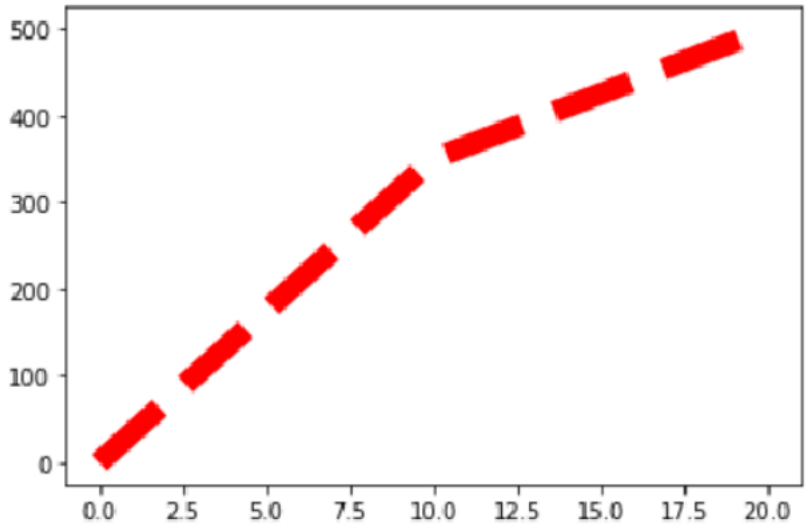
```
import matplotlib.pyplot as plt
import numpy as np

x=np.array([0,10,20])
y=np.array([0,350,500])
plt.plot(x,y,marker='o',ms=20,mec='r',mfc='r')
plt.show()
```



- The keyword argument linestyle, or shorter ls, to change the style of the plotted line.
- The line style can be written in a shorter syntax:
    - linestyle can be written as ls.
    - dotted can be written as :.
    - dashed can be written as --.
- the keyword argument color or the shorter c to set the color of the line

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

x=np.array([0,10,20])
y=np.array([0,350,500])
plt.plot(x,y,color='red',ls='--',lw=10
)
```

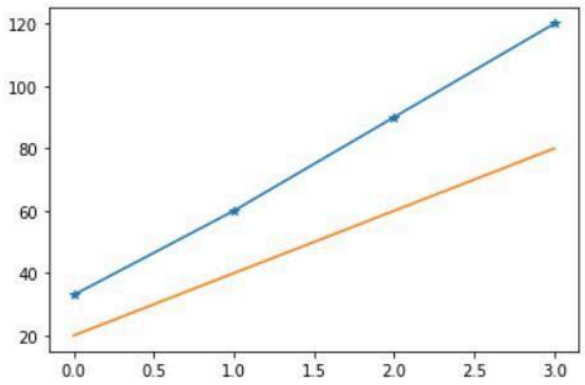
```
Out[16]: [<matplotlib.lines.Line2D at 0x24587eee970>]
```



Many plotting can be done by adding more plt.plot() functions

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

y1=np.array([33,60,90,120])
y2=np.array([20,40,60,80])
```

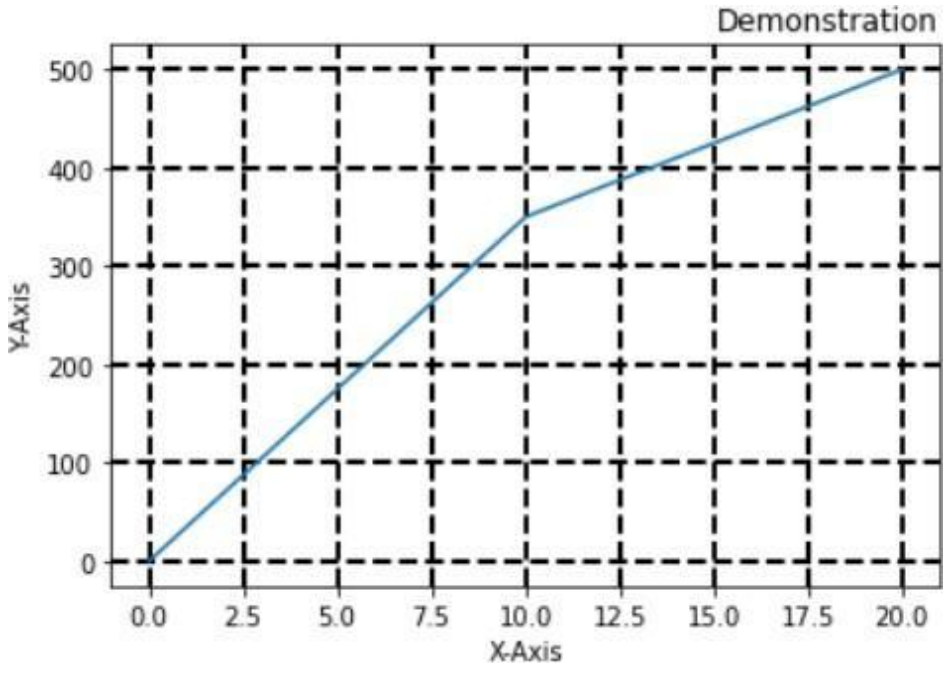
```
Out[22]: [<matplotlib.lines.Line2D at 0x2458853efa0>]
```




```
plt.plot(y1,marker='*')
plt.plot(y2)
```

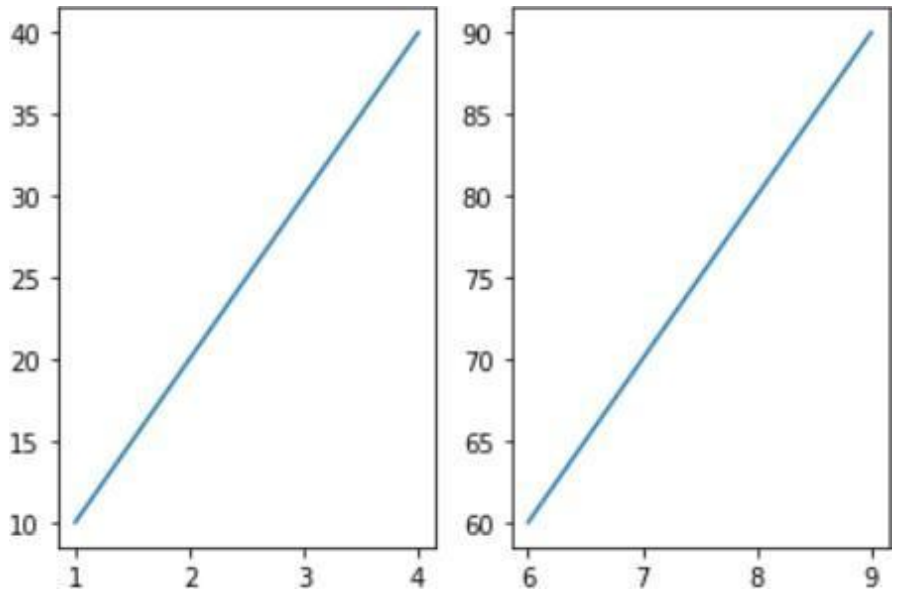
- With Pyplot, you can use the xlabel() and ylabel() functions to set a label for the x- and y-axis.
- With Pyplot, you can use the title() function to set a title for the plot.
- You can use the loc parameter in title() to position the title.
- Legal values are: 'left', 'right', and 'center'. Default value is 'center'.
- With Pyplot, you can use the grid() function to add grid lines to the plot.
- You can use the axis parameter in the grid() function to specify which grid lines to display.
- Legal values are: 'x', 'y', and 'both'. Default value is 'both'.

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

x=np.array([0,10,20])
y=np.array([0,350,500]
) plt.plot(x,y)
plt.xlabel("X-Axis")
plt.ylabel("Y-Axis")
plt.title('Demonstration',loc='right')
plt.grid(color='black',linestyle='--',linewidth=2
)
```



SubPlots:
With the subplots() function you can draw multiple plots in one figure.
The subplots() function takes three arguments that describes the layout of the figure.
The layout is organized in rows and columns, which are represented by the first and second argument.
The third argument represents the index of the current plot.

```
x=np.array([1,2,3,4])
y=np.array([10,20,30,40])

plt.subplot(1,2,1)
plt.plot(x,y)


x=np.array([6,7,8,9])
y=np.array([60,70,80,90])

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

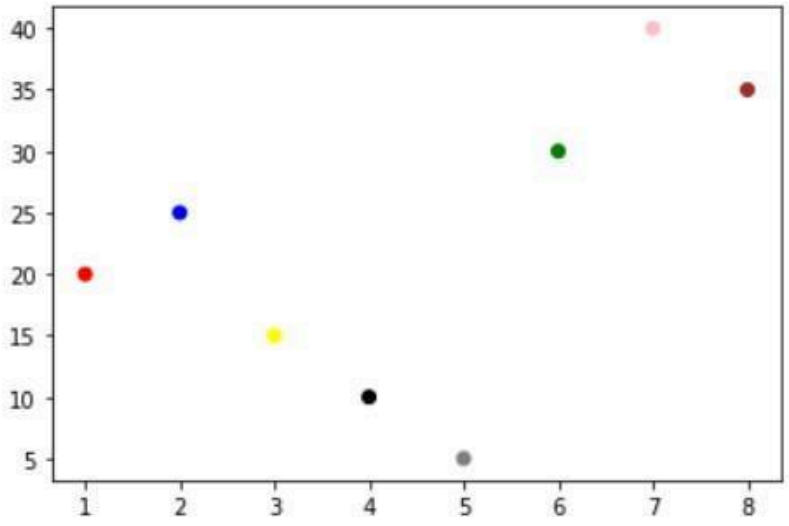


Scatter Plots:

- With Pyplot, you can use the scatter() function to draw a scatter plot.
- The scatter() function plots one dot for each observation. It needs two arrays of the same length, one for the values of the x-axis, and one for values on the y-axis.
- You can set your own color for each scatter plot with the color or the c argument.

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

x=np.array([1,2,3,4,5,6,7,8])
y=np.array([20,25,15,10,5,30,40,35])
c=np.array(['red','blue','yellow','black','grey','green','pink','brown'])
plt.scatter(x,y,color=c)
```

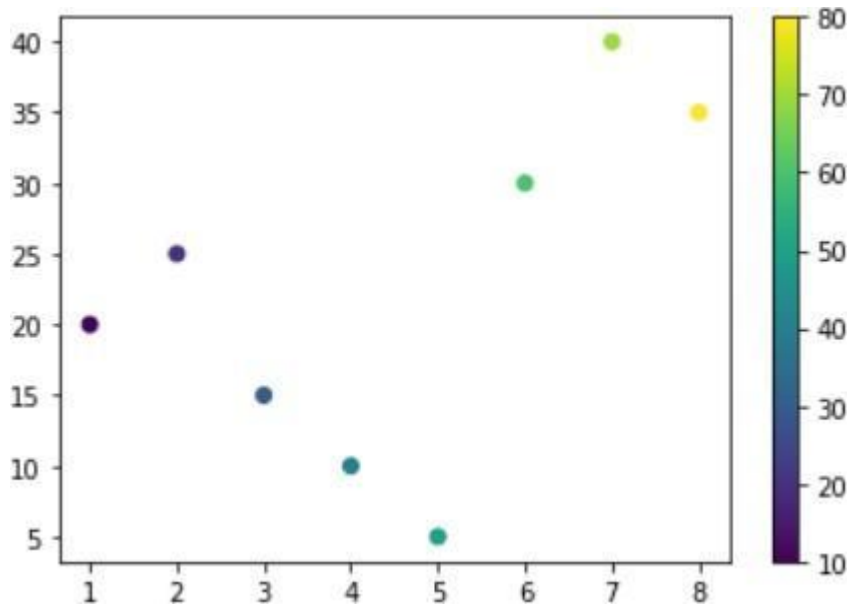
```
Out[53]: <matplotlib.collections.PathCollection at 0x24588442040>
```



ColorMaps

The Matplotlib module has a number of available colormaps.
A colormap is like a list of colors, where each color has a value that ranges from 0 to 100.

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


x=np.array([1,2,3,4,5,6,7,8])
y=np.array([20,25,15,10,5,30,40,35])
col=np.array([10,20,30,40,50,60,70,80])
plt.scatter(x,y,c=col,cmap='viridis')
plt.colorbar()
plt.show()
```

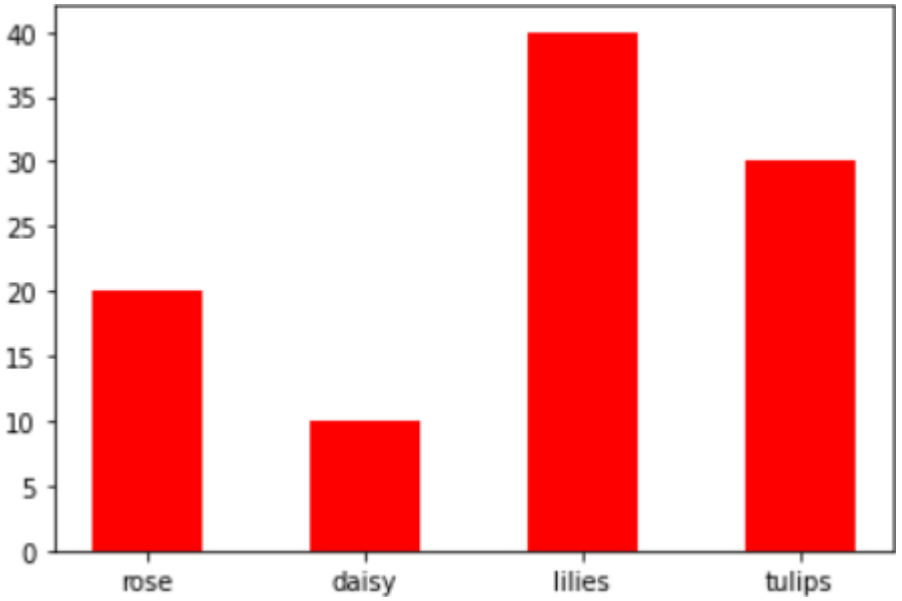


Bar Graph

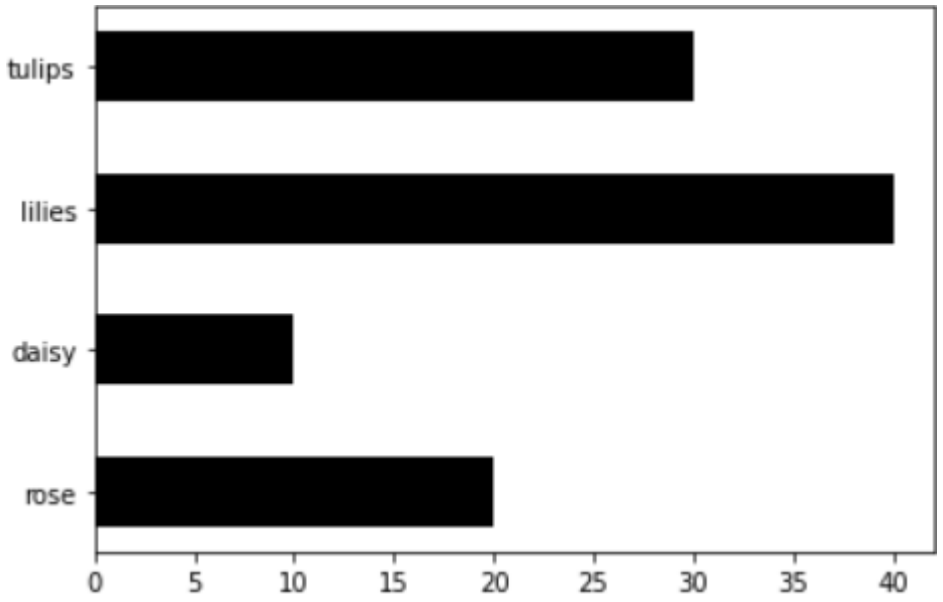
- With Pyplot, you can use the bar() function to draw bar graphs.
- The bar() function takes arguments that describes the layout of the bars.
- The categories and their values represented by the first and second argument as arrays.
- If you want the bars to be displayed horizontally instead of vertically, use the barh() function.
- The bar() and barh() takes the keyword argument color to set the color of the bars.
- The bar() takes the keyword argument width to set the width of the bars.

- The barh() takes the keyword argument height to set the height of the bars.

```
import matplotlib.pyplot as plt
import numpy as np
x=np.array(['rose','daisy','lilies','tulips'])
y=np.array([20,10,40,30])
plt.bar(x,y,color='red',width=0.5)
```




```
import matplotlib.pyplot as plt
import numpy as np
x=np.array(['rose','daisy','lilies','tulips'])
y=np.array([20,10,40,30])
plt.barh(x,y,color='black',height=0.5)
```

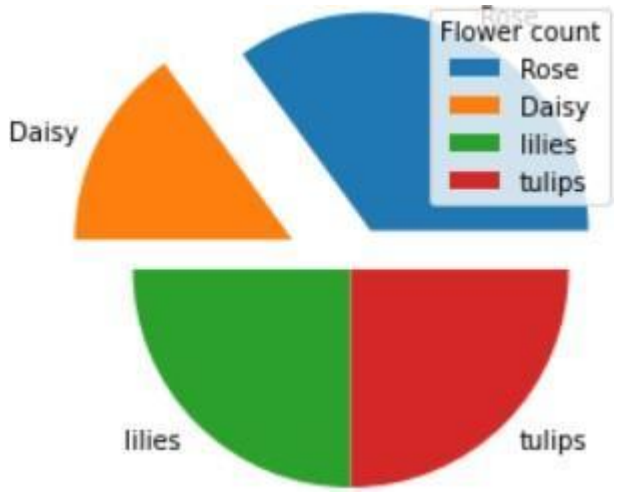


Pie Charts

- With Pyplot, you can use the pie() function to draw pie charts.
- The pie chart draws one piece (called a wedge) for each value in the array .
- By default the plotting of the first wedge starts from the x-axis and move counterclockwise.
- Add labels to the pie chart with the label parameter.
- The label parameter must be an array with one label for each wedge.
- The default start angle is at the x-axis, but you can change the start angle by specifying a startangle parameter.
- The startangle parameter is defined with an angle in degrees, default angle is 0.
- The explode parameter allows you to do that.
- The explode parameter, if specified, and not None, must be an array with one value for each wedge.
- Each value represents how far from the center each wedge is displayed

```
import matplotlib.pyplot as plt
import numpy as np
y=np.array([35,15,25,25])
l=np.array(['Rose','Daisy','lilies','tulips'])
e=np.array([0.2,0.3,0,0])
```

```
plt.pie(y,labels=l,explode=e)
plt.legend(title="Flower count")
plt.show()
```



Code :

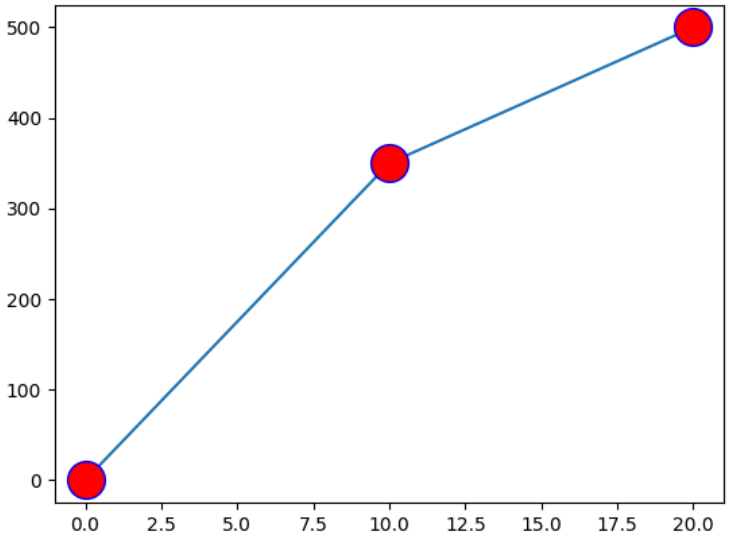
```
import matplotlib.pyplot as plt
import numpy as np
# 1.
x= np.array([0,6,8])
y=np.array([0,250,350])
plt.plot(x,y)


# 2.
x= np.array([0,10,20])
y=np.array([0,350,500])
plt.plot(x,y,marker='o',ms=20,mec='blue',mfc='b')


# 3.
x=np.array([0,10,20])
y=np.array([0,350,500])
plt.plot(x,y,color='purple',ls='--',lw=10)

# 4.
y1=np.array([33,90,90,120])
y2=np.array([20,70,60,80])
plt.plot(y1,marker='*')
plt.plot(y2)

# 5.
x=np.array([0,10,20])
y=np.array([0,350,500])
```

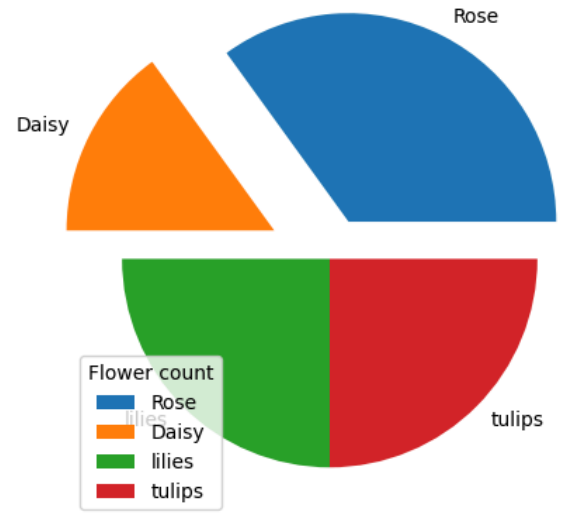
```
plt.plot(x,y)
plt.xlabel("X-Axis")
plt.ylabel("Y-Axis")
plt.title('Demonstration',loc='right')
plt.grid(color='orange',linestyle='--',linewidth=2)


# 6.
x=np.array([1,2,3,4])
y=np.array([10,20,30,40])
plt.subplot(1,2,1)
plt.plot(x,y)
x=np.array([6,7,8,9])
y=np.array([60,70,80,90])
plt.subplot(1,2,2)
plt.plot(x,y)


# 7.

x=np.array([1,2,3,4,5,6,7,8])
y=np.array([20,25,15,10,5,30,40,35])
c=np.array(['red','blue','yellow','black','grey','green','pink','brown'])
plt.scatter(x,y,color=c)

# 8.
x=np.array([1,2,3,4,5,6,7,8])
y=np.array([20,25,15,10,5,30,40,35])
col=np.array([10,20,30,40,50,60,70,80])
plt.scatter(x,y,c=col,cmap='viridis')
plt.colorbar()
plt.show()

# 9.
x=np.array(['rose','daisy','lilies','tulips'])
y=np.array([20,10,40,30])
plt.bar(x,y,color='pink',width=0.5)

# 10.
y=np.array([35,15,25,25])
l=np.array(['Rose','Daisy','lilies','tulips'])
e=np.array([0.2,0.3,0,0])
plt.pie(y,labels=l,explode=e)
plt.legend(title="Flower count")
plt.show()

import matplotlib.pyplot as plt
import numpy as np
# 1.
x= np.array([0,6,8])
y=np.array([0,250,350])
plt.plot(x,y)
```

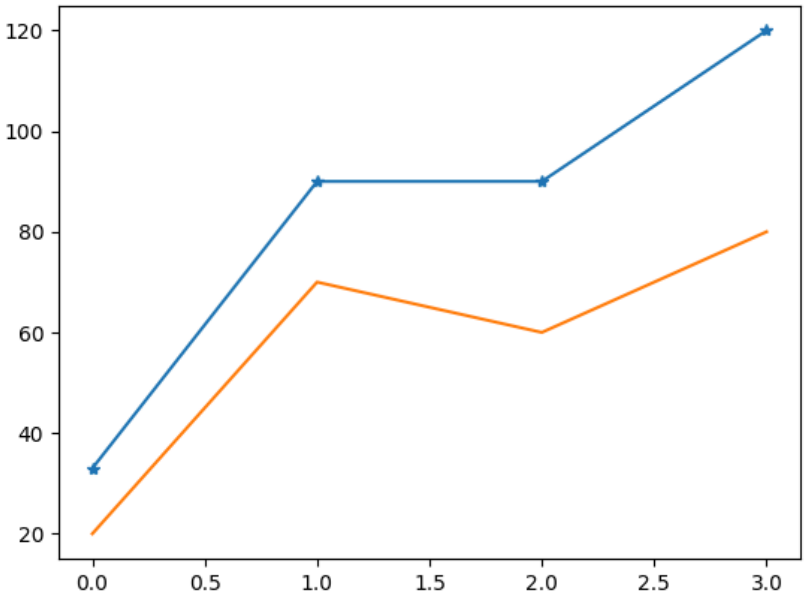
```
# 2.
x= np.array([0,10,20])
y=np.array([0,350,500])
plt.plot(x,y,marker='o',ms=20,mec='blue',mfc='b')


# 3.
x=np.array([0,10,20])
y=np.array([0,350,500])
plt.plot(x,y,color='purple',ls='--',lw=10)

# 4.
y1=np.array([33,90,90,120])
y2=np.array([20,70,60,80])
plt.plot(y1,marker='*')
plt.plot(y2)

# 5.
x=np.array([0,10,20])
y=np.array([0,350,500])
plt.plot(x,y)
plt.xlabel("X-Axis")
plt.ylabel("Y-Axis")
plt.title('Demonstration',loc='right')
plt.grid(color='orange',linestyle='--',linewidth=2)


# 6.
x=np.array([1,2,3,4])
y=np.array([10,20,30,40])
plt.subplot(1,2,1)
plt.plot(x,y)
x=np.array([6,7,8,9])
y=np.array([60,70,80,90])
plt.subplot(1,2,2)
plt.plot(x,y)


# 7.

x=np.array([1,2,3,4,5,6,7,8])
y=np.array([20,25,15,10,5,30,40,35])
c=np.array(['red','blue','yellow','black','grey','green','pink','brown'])
plt.scatter(x,y,color=c)

# 8.
x=np.array([1,2,3,4,5,6,7,8])
y=np.array([20,25,15,10,5,30,40,35])
col=np.array([10,20,30,40,50,60,70,80])
plt.scatter(x,y,c=col,cmap='viridis')
```

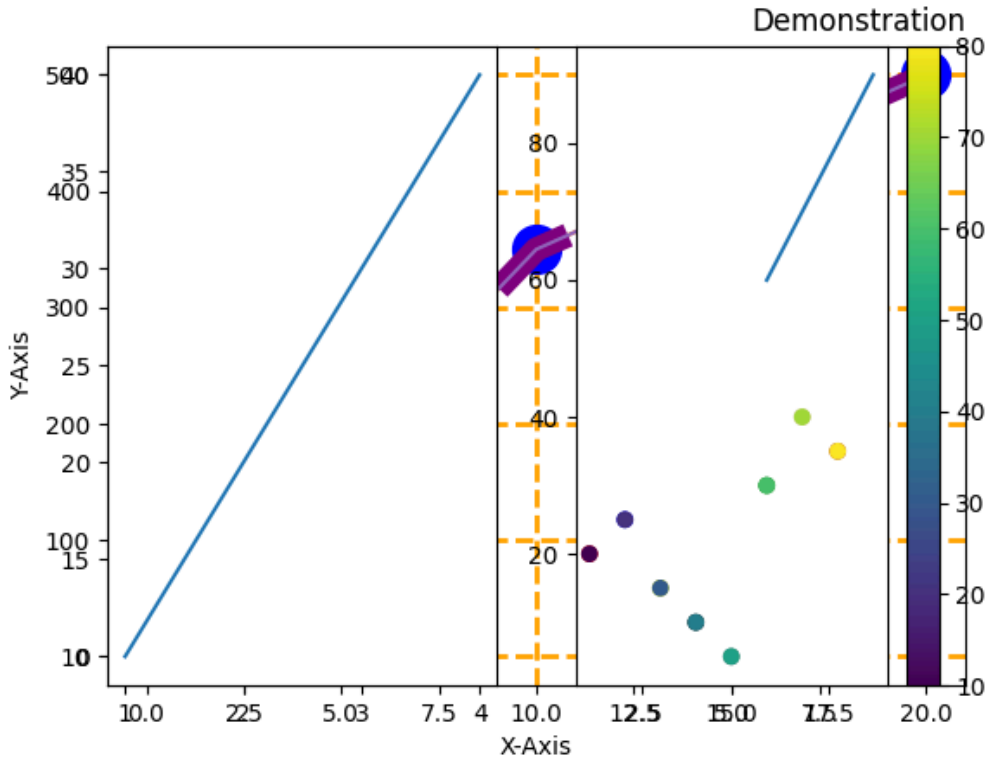
```
plt.colorbar()
plt.show()

# 9.
x=np.array(['rose','daisy','lilies','tulips'])
y=np.array([20,10,40,30])
plt.bar(x,y,color='pink',width=0.5)

# 10.
y=np.array([35,15,25,25])
l=np.array(['Rose','Daisy','lilies','tulips'])
e=np.array([0.2,0.3,0,0])
plt.pie(y,labels=l,explode=e)
plt.legend(title="Flower count")
plt.show()
```

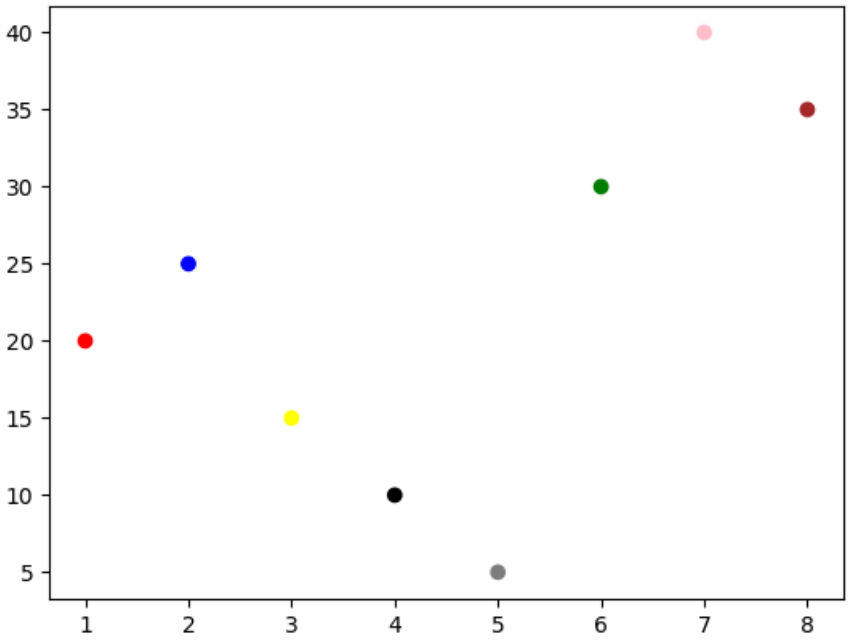
Results:

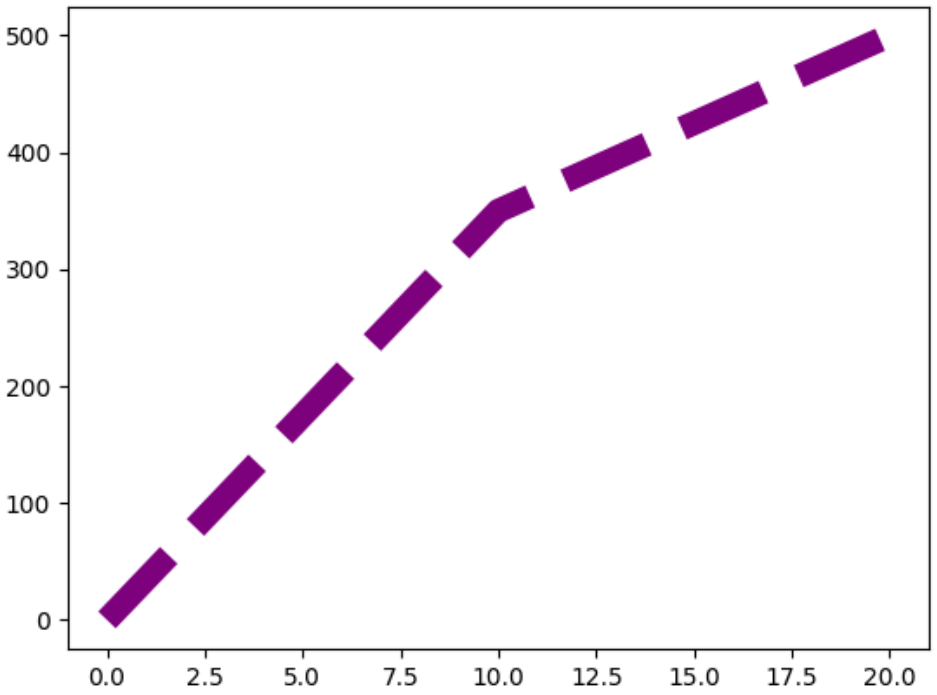


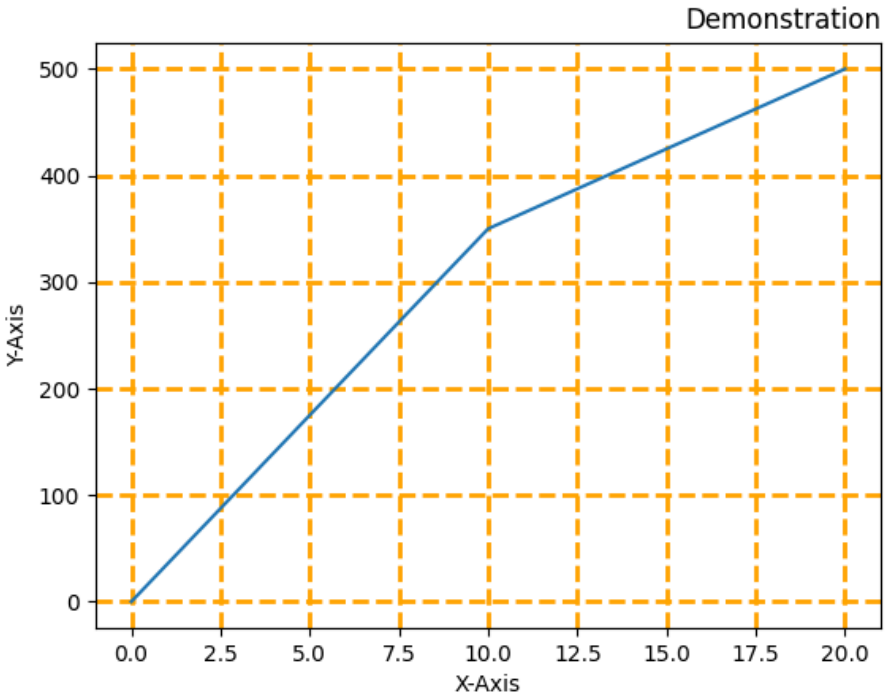

Rose
Daisy
tulips
Flower count
Rose
Daisy
lilies
tulips

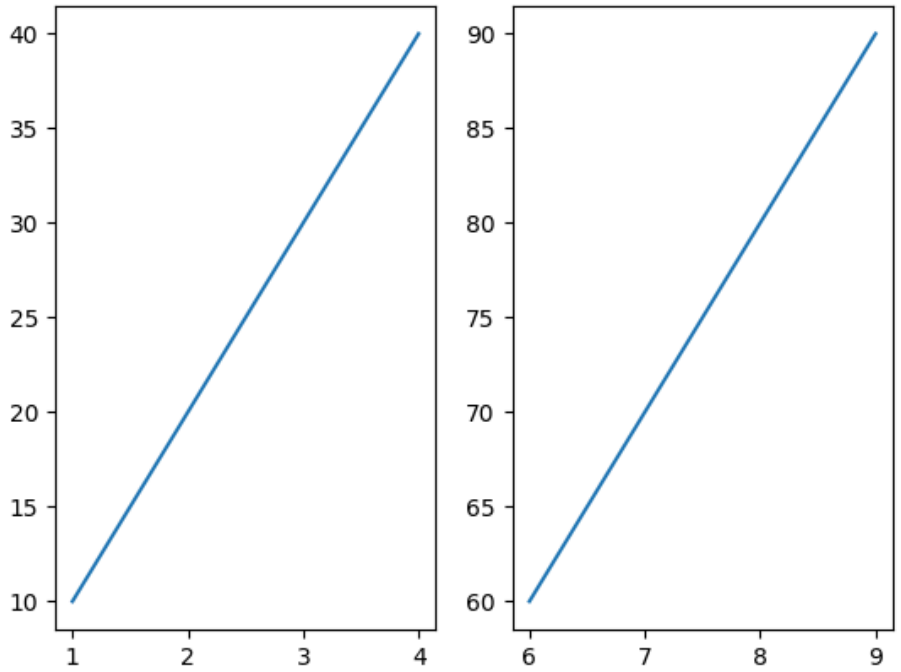

120
100
80
60
40
20
0.0
0.5
1.0
1.5
2.0
2.5
3.0

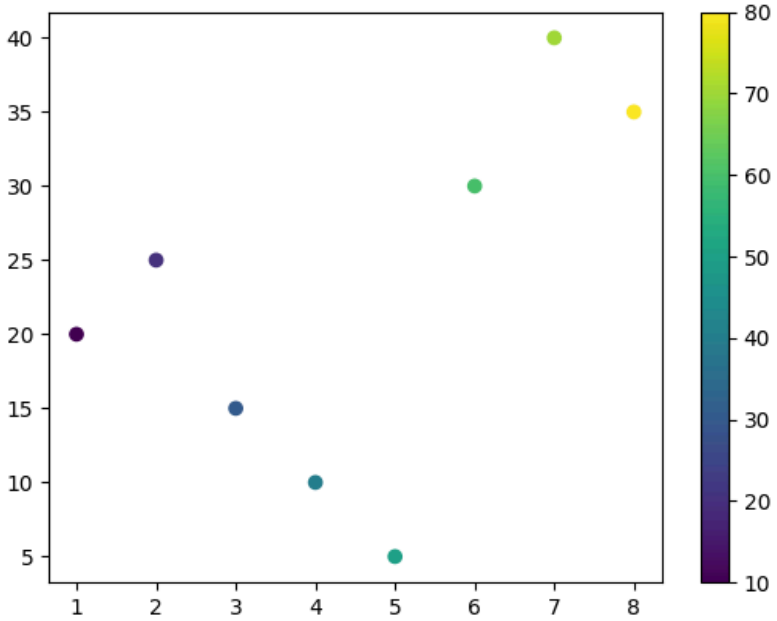

Demonstration
Y-Axis
X-Axis

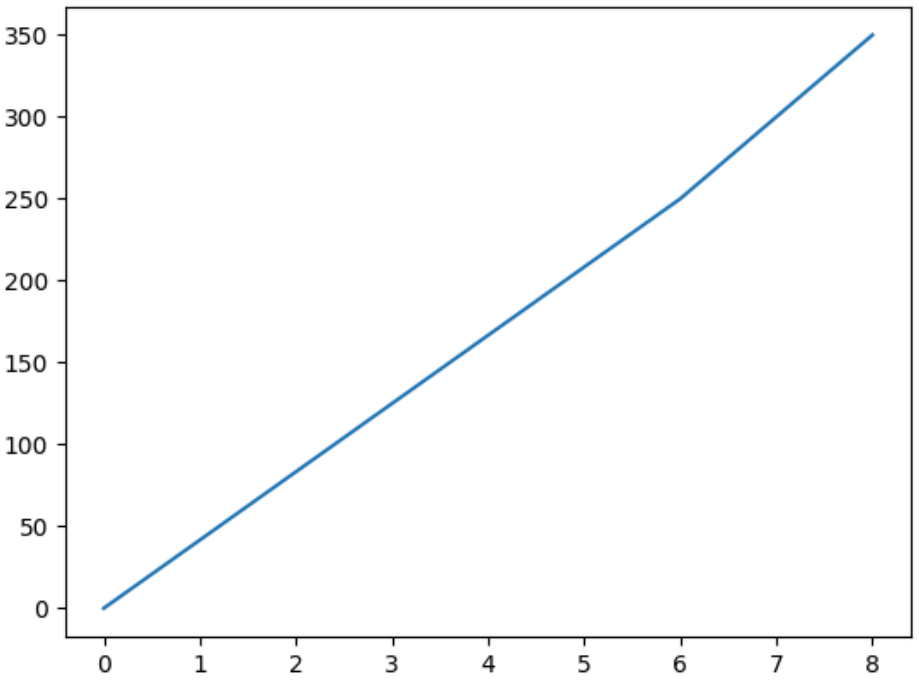



500
400
300
200
100
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0


Demonstration
500
400
300
200
100
0
Y-Axis
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
X-Axis


40
35
30
25
20
15
10
1
2
3
4
90
85
80
75
70
65
60
6
7
8
9


40
35
30
25
20
15
10
5
1
2
3
4
5
6
7
8
80
70
60
50
40
30
20
10



Conclusion:

Studying various plotting techniques with Matplotlib provides a comprehensive understanding of data visualization. Matplotlib's versatility allows for the creation of diverse plots such as line plots, scatter plots, bar plots, and histograms, catering to different data types and analysis needs. Exploring these techniques enables users to effectively communicate insights, trends, and relationships within their datasets, facilitating better understanding and decision-making. By mastering Matplotlib, data scientists and analysts gain a powerful tool for creating informative and visually appealing visuals that enhance data exploration and presentation.