Graph Plotting in Python | Set 1

This series will introduce you to graphing in python with Matplotlib, which is arguably the most popular graphing and data visualization library for Python.

Installation

Easiest way to install matplotlib is to use pip. Type following command in terminal:

```
pip install matplotlib
```

OR, you can download it from here and install it manually.

Getting started (Plotting a line)

```
# importing the required module
import matplotlib.pyplot as plt

# x axis values
x = [1,2,3]
# corresponding y axis values
y = [2,4,1]

# plotting the points
plt.plot(x, y)

# naming the x axis
plt.xlabel('x - axis')
# naming the y axis
plt.ylabel('y - axis')

# giving a title to my graph
plt.title('My first graph!')

# function to show the plot
plt.show()
```

Output:

The code seems self explanatory. Following steps were followed:

- Define the x-axis and corresponding y-axis values as lists.
- Plot them on canvas using **.plot()** function.
- Give a name to x-axis and y-axis using **.xlabel()** and **.ylabel()** functions.
- Give a title to your plot using **.title()** function.
- Finally, to view your plot, we use **.show()** function.

Plotting two or more lines on same plot

```
import matplotlib.pyplot as plt

# line 1 points
x1 = [1,2,3]
y1 = [2,4,1]
# plotting the line 1 points
plt.plot(x1, y1, label = "line 1")

# line 2 points
x2 = [1,2,3]
y2 = [4,1,3]
# plotting the line 2 points
plt.plot(x2, y2, label = "line 2")

# naming the x axis
plt.xlabel('x - axis')
# naming the y axis
plt.ylabel('y - axis')
# giving a title to my graph
plt.title('Two lines on same graph!')

# show a legend on the plot
plt.legend()

# function to show the plot
plt.show()
```

Output:

- Here, we plot two lines on same graph. We differentiate between them by giving them a name(**label**) which is passed as an argument of .plot() function.
- The small rectangular box giving information about type of line and its color is called legend. We can add a legend to our plot using **.legend()** function.

Customization of Plots

Here, we discuss some elementary customizations applicable on almost any plot.

```
import matplotlib.pyplot as plt

# x axis values
x = [1,2,3,4,5,6]
```

```
x = [1,2,3,4,5,6]
# corresponding y axis values
y = [2,4,1,5,2,6]

# plotting the points
plt.plot(x, y, color='green', linestyle='dashed', linewidth = 3,
         marker='o', markerfacecolor='blue', markersize=12)

# setting x and y axis range
plt.ylim(1,8)
plt.xlim(1,8)

# naming the x axis
plt.xlabel('x - axis')
# naming the y axis
plt.ylabel('y - axis')

# giving a title to my graph
plt.title('Some cool customizations!')



# function to show the plot
plt.show()
```

Output:

As you can see, we have done several customizations like

- setting the line-width, line-style, line-color.
- setting the marker, marker's face color, marker's size.
- overriding the x and y axis range. If overriding is not done, pyplot module uses auto-scale feature to set the axis range and scale.

Bar Chart

```
import matplotlib.pyplot as plt

# x-coordinates of left sides of bars
left = [1, 2, 3, 4, 5]

# heights of bars
height = [10, 24, 36, 40, 5]

# labels for bars
tick_label = ['one', 'two', 'three', 'four', 'five']

# plotting a bar chart
plt.bar(left, height, tick_label = tick_label,
        width = 0.8, color = ['red', 'green'])

# naming the x-axis
```

```
plt.xlabel('x - axis')
# naming the y-axis
plt.ylabel('y - axis')
# plot title
plt.title('My bar chart!')

# function to show the plot
plt.show()
```

Output :

- Here, we use **plt.bar()** function to plot a bar chart.
- x-coordinates of left side of bars are passed along with heights of bars.
- you can also give some name to x-axis coordinates by defining **tick_labels**

Histogram

```
import matplotlib.pyplot as plt

# frequencies
ages = [2,5,70,40,30,45,50,45,43,40,44,
        60,7,13,57,18,90,77,32,21,20,40]

# setting the ranges and no. of intervals
range = (0, 100)
bins = 10

# plotting a histogram
plt.hist(ages, bins, range, color = 'green',
        histtype = 'bar', rwidth = 0.8)

# x-axis label
plt.xlabel('age')
# frequency label
plt.ylabel('No. of people')
# plot title
plt.title('My histogram')

# function to show the plot
plt.show()
```

Output:

- Here, we use **plt.hist()** function to plot a histogram.
- frequencies are passed as the **ages** list.
- Range could be set by defining a tuple containing min and max value.
- Next step is to “**bin**” the range of values—that is, divide the entire range of values into a series of intervals—and then count how many values fall into each interval. Here we have defined **bins** = 10. So, there are a total of 100/10 = 10 intervals.

Scatter plot

```
import matplotlib.pyplot as plt

# x-axis values
x = [1,2,3,4,5,6,7,8,9,10]
# y-axis values
y = [2,4,5,7,6,8,9,11,12,12]

# plotting points as a scatter plot
plt.scatter(x, y, label= "stars", color= "green",
            marker= "*", s=30)

# x-axis label
plt.xlabel('x - axis')
# frequency label
plt.ylabel('y - axis')
# plot title
plt.title('My scatter plot!')
# showing legend
plt.legend()

# function to show the plot
plt.show()
```

Output:

- Here, we use **plt.scatter()** function to plot a scatter plot.
- Like a line, we define x and corresponding y – axis values here as well.
- **marker** argument is used to set the character to use as marker. Its size can be defined using **s** parameter.

Pie-chart

```
import matplotlib.pyplot as plt

# defining labels
activities = ['eat', 'sleep', 'work', 'play']

# portion covered by each label
slices = [3, 7, 8, 6]

# color for each label
colors = ['r', 'y', 'g', 'b']

# plotting the pie chart
plt.pie(slices, labels = activities, colors=colors,
        startangle=90, shadow = True, explode = (0, 0, 0.1, 0),
        radius = 1.2, autopct = '%1.1f%%')

# plotting legend
plt.legend()
```

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

Output of above program looks like this:

- Here, we plot a pie chart by using **plt.pie()** method.
- First of all, we define the **labels** using a list called **activities**.
- Then, portion of each label can be defined using another list called **slices**.
- Color for each label is defined using a list called **colors**.
- **shadow = True** will show a shadow beneath each label in pie-chart.
- **startangle** rotates the start of the pie chart by given degrees counterclockwise from the x-axis.
- **explode** is used to set the fraction of radius with which we offset each wedge.
- **autopct** is used to format the value of each label. Here, we have set it to show the percentage value only upto 1 decimal place.

Plotting curves of given equation

```
# importing the required modules
import matplotlib.pyplot as plt
import numpy as np

# setting the x - coordinates
x = np.arange(0, 2*(np.pi), 0.1)
# setting the corresponding y - coordinates
y = np.sin(x)

# potting the points
plt.plot(x, y)

# function to show the plot
plt.show()
```

Output of above program looks like this:

Here, we use **NumPy** which is a general-purpose array-processing package in python.

- To set the x – axis values, we use **np.arange()** method in which first two arguments are for range and third one for step-wise increment. The result is a numpy array.
- To get corresponding y-axis values, we simply use predefined **np.sin()** method on the numpy array.
- Finally, we plot the points by passing x and y arrays to the **plt.plot()** function.

So, in this part, we discussed various types of plots we can create in matplotlib. There are more plots which haven't been covered but the most significant ones are discussed here –

- Graph Plotting in Python | Set 2
- Graph Plotting in Python | Set 3

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