**PreLab07: Matplotlib in Python**

So far you have been exposed to some of the standard features of Python. Some of these features are string and list manipulation, decision structures and some basics of graphics. In this Prelab you will learn how to plot graphs given a dataset using the *matplotlib* library. This library provides you a set of functions to plot several types of graphs such as line, bar, pie and scatter charts. Because of this, we encourage you to carefully study the definition of each function in the library and understand very well the functionality of their parameters. These parameters are used to control the appearance, shape and size of the graphs.

Through this Prelab and Lab07 you will be required to do some manipulation of the data before plotting it.

Summary of available functions: [http://matplotlib.org/api/pyplot_summary.html](http://matplotlib.org/api/pyplot_summary.html)

**Prelab policy**

We encourage you to work together on the Pre Lab. The Pre Lab is not graded but will help you prepare for your lab session. In the Pre Lab, you may find questions to answer. We do not require you to provide us the answers, but we do recommend you to try to answer these questions. If you have any questions on the material in the pre lab, first check the book and recitation slides, if you do not find your answer please email your recitation TA or the course instructors.

**Installing matplotlib on your personal machine**

**Mac OS**

Open up your terminal and type:

```
sudo pip3 install matplotlib
```

**Windows**

Here are some unofficial pre-compiled libraries:

[http://www.lfd.uci.edu/~gohlke/pythonlibs/#matplotlib](http://www.lfd.uci.edu/~gohlke/pythonlibs/#matplotlib)

You should first install numpy using one of the below links:

1. numpy-1.10.4+vanilla-cp34-none-win32.whl
2. numpy-1.10.4+vanilla-cp34-none-win_amd64.whl
according to your machine.

Then, move the file you just installed to C:/Python34/Scripts/ and open the terminal:

```bash
cd C:/Python34/Scripts/
pip3.exe install "numpy-1.10.4+mkl-cp34-cp34m-win32.whl"
```

After installing numpy, you can install matplotlib using:

```bash
cd C:/Python34/Scripts/
pip3.exe install matplotlib
```

If this throws a Fatal error in launcher, then install it with

```bash
cd C:/Python34/
python -m pip install matplotlib
```

If you have installed Python3.4 within Program Files, then you would have to run the above in command prompt with Administrator privileges.

If you have issues with installing Matplotlib on your PC, please drop by one of the office hours. It is technically hard to resolve problems remotely when it comes to installing libraries.

### Plotting a line graph

Reference: [http://matplotlib.org/api/pyplot_api.html#matplotlib.pyplot.plot](http://matplotlib.org/api/pyplot_api.html#matplotlib.pyplot.plot)

Simply, the following code will plot a line graph which is going to draw a line between (x1,y1), (x2,y2), ..., (xn,yn) points on 2d plane.

```python
plt.plot([x1, x2, ..., xn], [y1, y2, ..., yn])
```

Here are some examples to plot lines.

**Example 1:**

```python
import matplotlib.pyplot as plt

plt.plot([1,2,3],[10,10,10])

plt.show()
```

here is the output:
Example 2:

```python
import matplotlib.pyplot as plt
plt.plot([1,2,3],[1,2,3])
plt.show()
```

here is the output:
Example 3:

```python
import matplotlib.pyplot as plt
plt.plot([1,2,3],[5,30,15])
plt.show()
```

here is the output:
Example 4:

```python
import matplotlib.pyplot as plt

plt.plot( [10,20,30,40],[100,200,100,200] )
plt.title( 'Hello CS 177 students' )
plt.xlabel( 'I am x label' )
plt.ylabel( 'I am y label' )

plt.show()
```

Here is the output:

![Graph output](image)

Example 5:

```python
import matplotlib.pyplot as plt

plt.plot( [1,2,3],[5,30,15], color='blue' )
plt.plot( [1,2,3],[10,10,10], color='red' )

plt.title( 'Hello CS 177 students' )
plt.xlabel( 'I am x label' )
plt.ylabel( 'I am y label' )

plt.show()
```
here is the output:

![Bar Chart Example]

**Plotting a bar chart**

Reference: [http://matplotlib.org/api/pyplot_api.html#matplotlib.pyplot.bar](http://matplotlib.org/api/pyplot_api.html#matplotlib.pyplot.bar)

Similar to the line plot, the following code will plot a bar chart which is going to draw bars at the positions \((x_1, x_2, \ldots, x_n)\) with the heights \((y_1, y_2, \ldots, y_n)\).

```python
plt.plot([x1, x2, ... , xn], [y1, y2, ... , yn])
```

Here are some examples to bar charts:

**Example 1:**

```python
import matplotlib.pyplot as plt
plt.bar([1,2,3],[10,20,30], color='red')
plt.show()
```
Example 2:

```python
import matplotlib.pyplot as plt

plt.bar([1,4,7],[10,20,30], color='blue')
plt.bar([2,5,8],[20,30,40], color='red')
plt.show()
```

here is the output:
Example 3:

```python
import matplotlib.pyplot as plt

plt.bar([1,4,7],[10,20,30], color='blue')
plt.bar([2,5,8],[20,30,40], color='red')
plt.xticks([2,5,8], ['CS 177', 'CS 180', 'CS 190'])

plt.show()
```

here is the output:
Plotting scatter graph

Reference: http://matplotlib.org/api/pyplot_api.html#matplotlib.pyplot.scatter

The following code will plot a scatter graph which is going to draw points at the \((x_1,y_1), (x_2,y_2), \ldots, (x_n,y_n)\) points on 2d plane.

```python
plt.scatter([x1, x2, \ldots, xn], [y1, y2, \ldots, yn])
```

Here are some examples to plot lines.

```python
import matplotlib.pyplot as plt
plt.scatter([1,3,5,7], [8,10,8,10], color='blue')
plt.scatter([2,4,6,8], [5,7,5,7], color='red')
plt.show()
```

and here is the output: