

# Introduction to Computer Programming

## Week 9.1: Matplotlib - Plotting



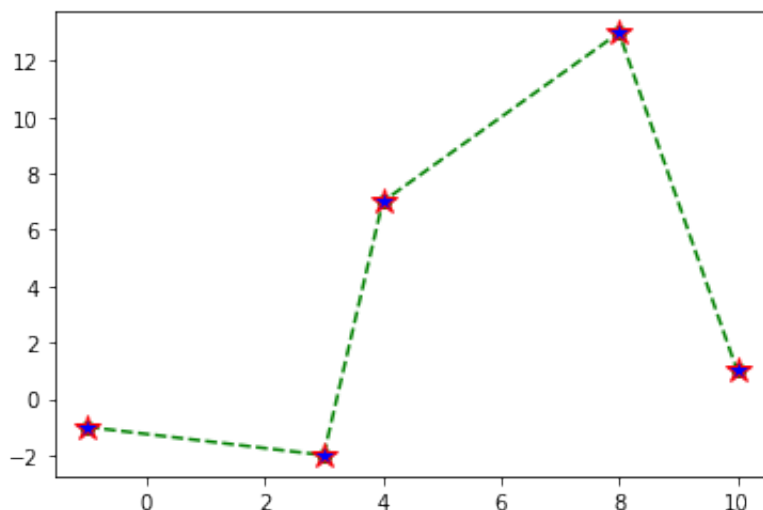
## In-class Demos

```
In [5]: 1 import matplotlib.pyplot as plt
        2 %matplotlib inline
        3 import numpy as np
        4
```

**Example 1:** Use the format string to change the appearance of the plot of f against x.

```
In [8]: 1 x = [-1, 3, 4, 8, 10]
        2 f = [-1, -2, 7, 13, 1]
```

```
In [9]: 1 plt.plot(x, f, '--og')
        2
        3 #plt.plot(x, f, 'k.')
        4
        5 #plt.plot(x, f, 'ro')
        6
        7 plt.plot(x, f, 'r*', markerfacecolor='blue', markersize=12)
        8
        9 plt.show()
```



### Example 2:

Display:

- the bar chart of the students in each group
- the histogram of the frequency distribution of z

as two subplots on the same figure.

`subplots_adjust` can be used to adjust the spacing between plots

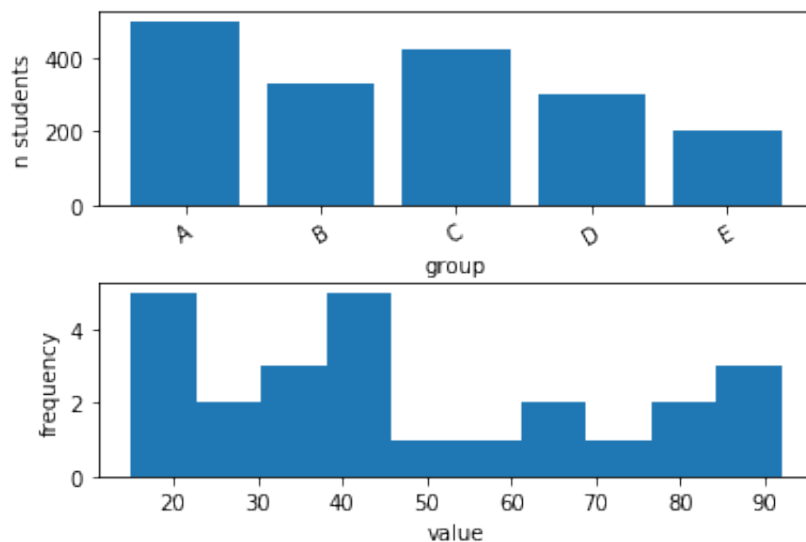
[https://matplotlib.org/stable/api/\\_as\\_gen/matplotlib.pyplot.subplots\\_adjust.html](https://matplotlib.org/stable/api/_as_gen/matplotlib.pyplot.subplots_adjust.html)  
[\(https://matplotlib.org/stable/api/\\_as\\_gen/matplotlib.pyplot.subplots\\_adjust.html\)](https://matplotlib.org/stable/api/_as_gen/matplotlib.pyplot.subplots_adjust.html)

```
In [10]: 1 #sample data
        2 groups = ('A', 'B', 'C', 'D', 'E')
        3 num_students = (500, 332, 425, 300, 200)
        4 z = np.random.randint(low=0, high=100, size=25)
```

```

In [11]: 1 plt.subplot(211)                                # 2 rows, 1 column, ind
          2 x_pos = np.arange(len(groups))                # array with element fo
          3 plt.bar(x_pos, num_students)                  # bar chart
          4 plt.xticks(x_pos, groups) # replace labels
          5 plt.xlabel('group')
          6 plt.ylabel('n students')
          7
          8 plt.subplot(212)                                # 2 rows, 1 column, ind
          9 plt.hist(z, bins=10)                          # histogram of data and
         10 plt.xlabel('value')
         11 plt.ylabel('frequency')
         12
         13
         14 plt.subplots_adjust(hspace = 0.4)              # adjust spacing
         15
         16 plt.show()

```

**Example 3:**

Import height and weight data from `sample_data/sample_student_data.txt` and plot a scatter plot of the data.

How can we change the colour of the markers in the plot?

```

In [17]: 1 import matplotlib.pyplot as plt
          2 import numpy as np
          3
          4 students = np.loadtxt('sample_data/sample_student_data.txt',
          5                      skiprows=2,
          6                      usecols=(3,4))
          7
          8
          9 print(students[:2,:]) # have a look at the data

```

```

[[ 1.82  92.4 ]
 [ 1.77  80.9 ]]

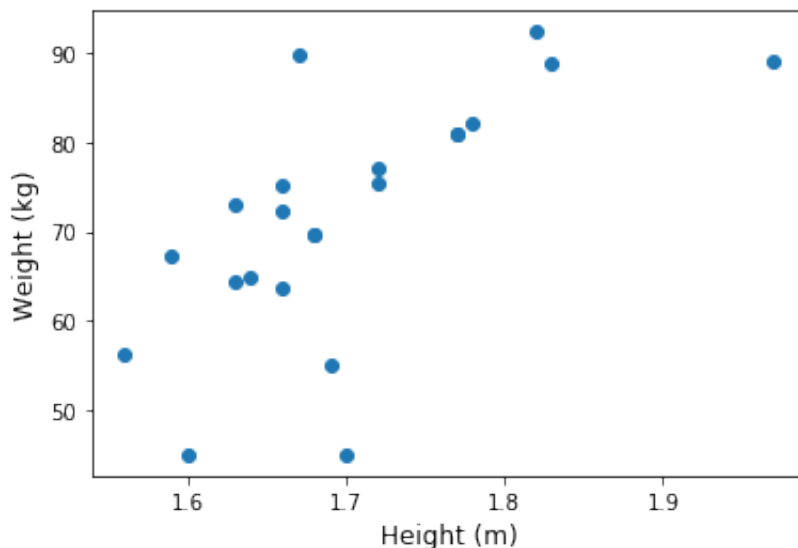
```

```

In [18]: 1 # Plot column 1 against column 0
          2 plt.plot(students[:, 0], students[:, 1], 'o')
          3
          4 # change colour
          5 # plt.plot(students[:, 0], students[:, 1], 'ko', markerfacecoloro
          6
          7 # Axes labels
          8 plt.xlabel('height')
          9 plt.ylabel('weight')

```

Out[18]: Text(0, 0.5, 'Weight (kg)')



#### Example 4: (Extra)

Import height and weight data from `sample_data/sample_student_data.txt`.

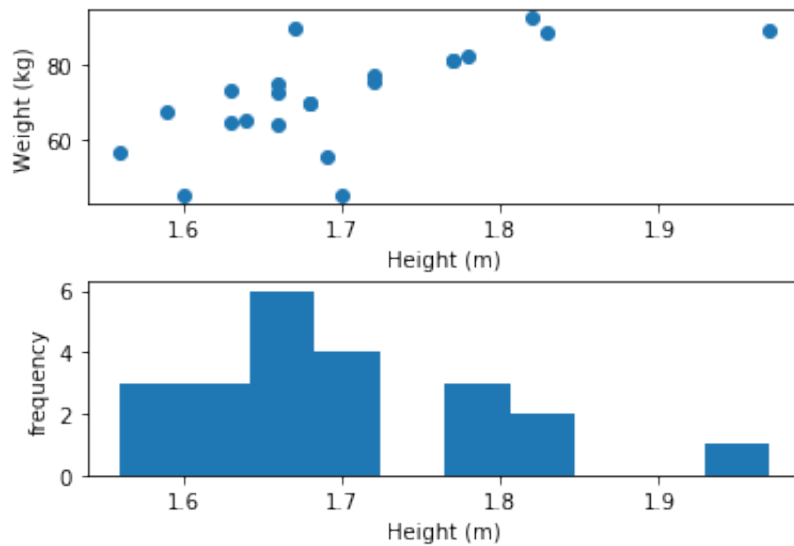
Display the plots:

- scatter graph of height(horizontal axis) vs weight (vertical axis)
- frequency distribution of the height of each student

as two subplots of the same figure.

Format the subplots so that they share the same x axis labels(s).

```
In [19]: 1 students = np.loadtxt('sample_data/sample_student_data.txt',
2                       skiprows=2,
3                       dtype=str)
4
5 height = students[:, 3].astype(float)
6 weight = students[:, 4].astype(float)
7
8 plt.subplot(211)
9 plt.plot(height, weight, 'o')
10 plt.xlabel('Height (m)')
11 plt.ylabel('Weight (kg)')
12
13 plt.subplot(212)
14 plt.hist(height, bins=10);
15 plt.xlabel('Height (m)')
16 plt.ylabel('frequency')
17
18 plt.subplots_adjust(hspace = 0.4)
```

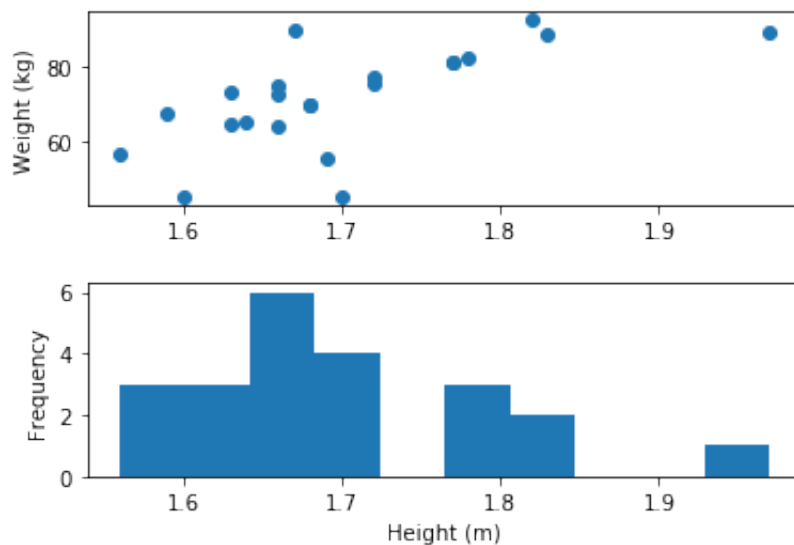


```

In [20]: 1 fig, ax = plt.subplots(nrows=2) # 2 rows, 1 column
          2 #fig, ax = plt.subplots(nrows=2, sharex=True) # 2 rows, 1 column
          3 #fig, ax = plt.subplots(2,1) # 2 rows, 1 column
          4
          5 height = students[:, 3].astype(float)
          6 weight = students[:, 4].astype(float)
          7
          8 ax[0].plot(height, weight, 'o') # 1st row
          9 ax[0].set(ylabel="Weight (kg)")
         10
         11
         12 ax[1].hist(height, bins=10)
         13 ax[1].set(xlabel="Height (m)", ylabel="Frequency")
         14
         15
         16 plt.subplots_adjust(hspace = 0.4) # the amount of height between subplots
         17
         18
         19 fig.show()

```

/Users/hp12384/opt/anaconda3/lib/python3.7/site-packages/ipykernel\_launcher.py:19: UserWarning: Matplotlib is currently using module ://ipykernel pylab.backend\_inline, which is a non-GUI backend, so cannot show the figure.



[https://matplotlib.org/3.1.1/gallery/subplots\\_axes\\_and\\_figures/subplots\\_demo.html](https://matplotlib.org/3.1.1/gallery/subplots_axes_and_figures/subplots_demo.html)  
[\(https://matplotlib.org/3.1.1/gallery/subplots\\_axes\\_and\\_figures/subplots\\_demo.html\)](https://matplotlib.org/3.1.1/gallery/subplots_axes_and_figures/subplots_demo.html)

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1