

Introduction to Computer Programming

Week 9.1: Matplotlib - Plotting



University of
BRISTOL

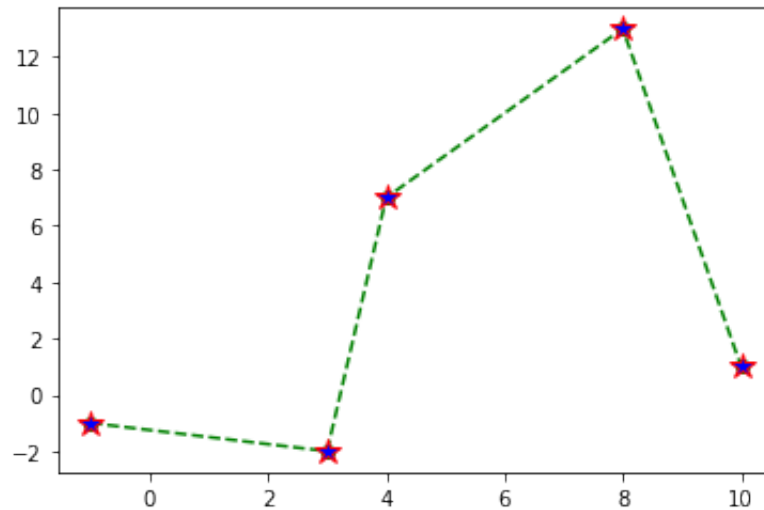
In-class Demos

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

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

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

```
In [9]: plt.plot(x, f, '--og')
#plt.plot(x, f, 'k.')
#plt.plot(x, f, 'ro')
plt.plot(x, f, 'r*', markerfacecolor='blue', markersize=12)
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)

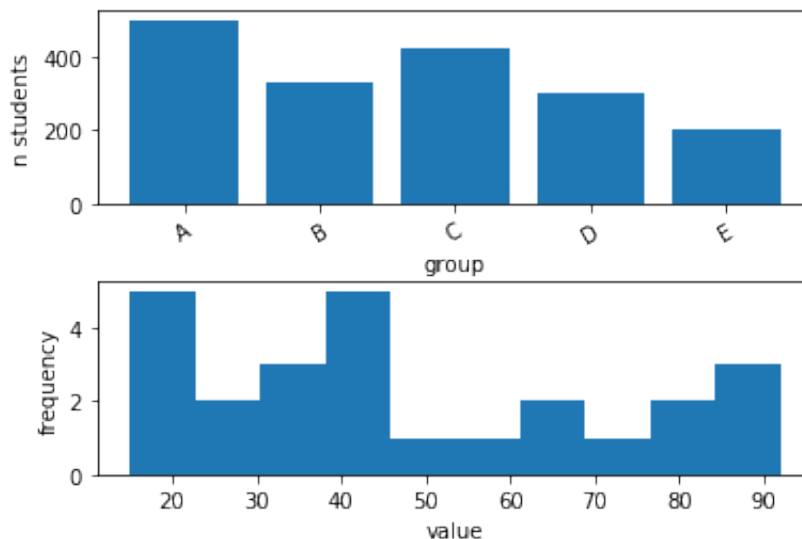
```
In [10]: #sample data
groups = ('A', 'B', 'C', 'D', 'E')
num_students = (500, 332, 425, 300, 200)
z = np.random.randint(low=0, high=100, size=25)
```

```
In [11]: plt.subplot(211)                                # 2 rows, 1 column, index 1
x_pos = np.arange(len(groups))                          # array with element for each
plt.bar(x_pos, num_students)                            # bar chart
plt.xticks(x_pos, groups, rotation=30)                  # replace labels
plt.xlabel('group')
plt.ylabel('n students')

plt.subplot(212)                                        # 2 rows, 1 column, index 2
plt.hist(z, bins=10)                                    # histogram of data and bins
plt.xlabel('value')
plt.ylabel('frequency')

plt.subplots_adjust(hspace = 0.4)                       # adjust spacing

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]: import matplotlib.pyplot as plt
import numpy as np

students = np.loadtxt('sample_data/sample_student_data.txt',
                      skiprows=2,
                      usecols=(3,4))

print(students[:2,:]) # have a look at the data
```

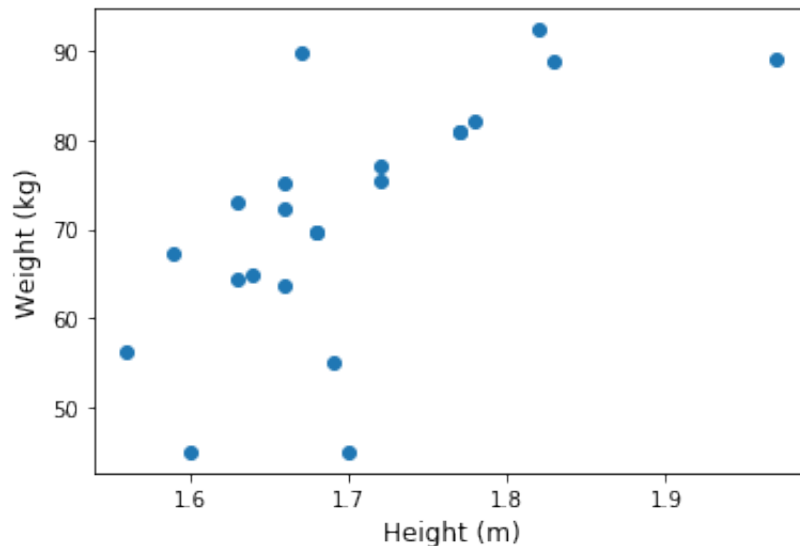
```
[[ 1.82 92.4 ]
 [ 1.77 80.9 ]]
```

```
In [18]: # Plot column 1 against column 0
plt.plot(students[:, 0], students[:, 1], 'o')

# change colour
# plt.plot(students[:, 0], students[:, 1], 'ko', markerfacecolor='red')

# Axes labels
plt.xlabel('Height (m)')
plt.ylabel('Weight (kg)')
```

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 lables(s).

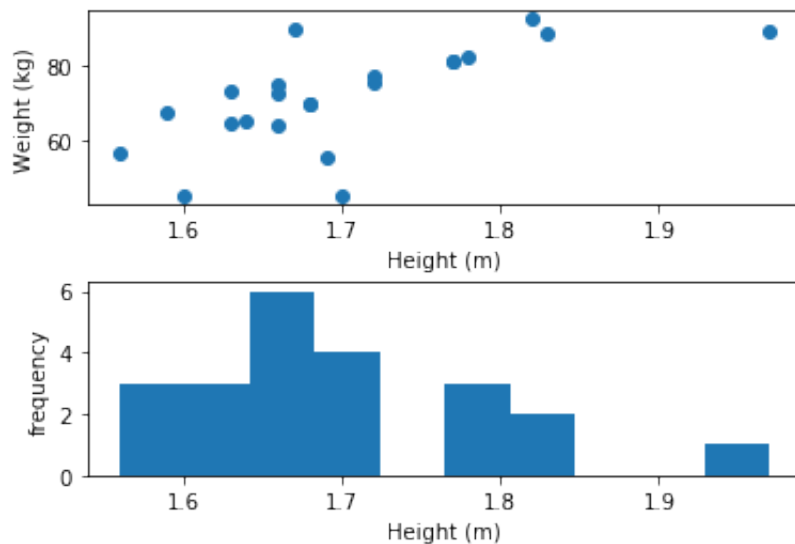
```
In [19]: students = np.loadtxt('sample_data/sample_student_data.txt',
                                skiprows=2,
                                dtype=str)

height = students[:, 3].astype(float)
weight = students[:, 4].astype(float)

plt.subplot(211)
plt.plot(height, weight, 'o')
plt.xlabel('Height (m)')
plt.ylabel('Weight (kg)')

plt.subplot(212)
plt.hist(height, bins=10);
plt.xlabel('Height (m)')
plt.ylabel('frequency')

plt.subplots_adjust(hspace = 0.4)
```



```
In [20]: fig, ax = plt.subplots(nrows=2) # 2 rows, 1 column
#fig, ax = plt.subplots(nrows=2, sharex=True) # 2 rows, 1 column
#fig, ax = plt.subplots(2,1) # 2 rows, 1 column

height = students[:, 3].astype(float)
weight = students[:, 4].astype(float)

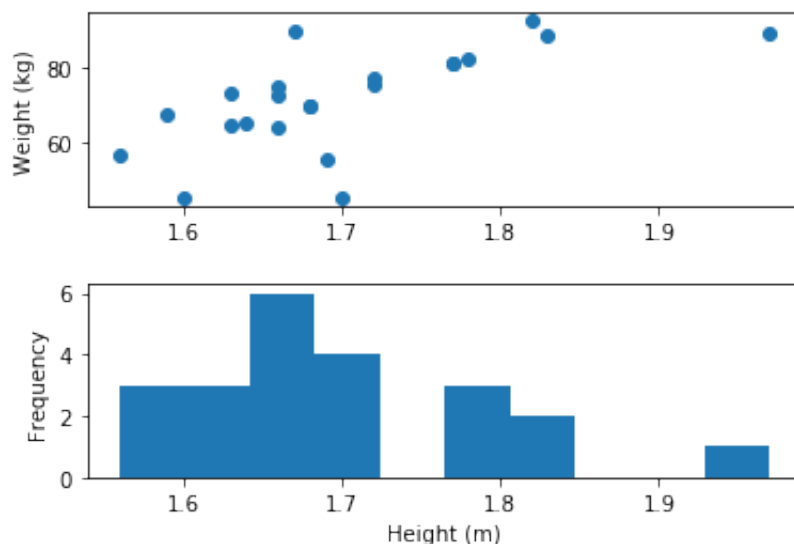
ax[0].plot(height, weight, 'o') # 1st row
ax[0].set(ylabel="Weight (kg)")

ax[1].hist(height, bins=10)
ax[1].set(xlabel="Height (m)",ylabel="Frequency")

plt.subplots_adjust(hspace = 0.4) # the amount of height reserved for

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)

In []:

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