CISC106 Honors - Fall 2017
Lab 6, due Sunday 10/22

On your machine, try:
`import matplotlib.pyplot`
If that fails, you need to install the matplotlib library. You can get it at
matplotlib.org
for any operating system.
Alternatively, you can get a different python distribution (Canopy) that already includes matplotlib and many other libraries at:
https://store.enthought.com/downloads/

Problems for submission:

1. Type each of the following into the interpreter, one at a time:

```
import matplotlib.pyplot as plt

plt.figure(1)

plt.plot(range(30),range(30))

plt.show()

plt.savefig('tmp.png')
```

   For the plot command, what are the two sequences you are passing in? What did show() do?

   Now look at tmp.png on your machine, and it should look like a simple linear graph - the graph of each (x,y) pair, where x is drawn from the first range, and y is drawn from the second range. It is really important to understand this piece (where the points come from), so if it isn't clear, please ask your TA or prof.

   Start with intro to pyplot:
   http://matplotlib.org/tutorials/index.html#introductory

   How to save your plot as an image file:
   https://chartio.com/resources/tutorials/how-to-save-a-plot-to-a-file-using-matplotlib/

   Add labels to the x and y axes, and give your graph a title, then generate the image again and then add and upload the image to your cisc106 web page. Make sure to update permissions!

2. Compare the run time performance of three makeCombo functions - yours, and the two provided. Use the timing code from the last lab to generate three lists of run times. Your largest run time of all should be over one minute. Graph the run times with the three data sets shown as different colors, a key, axis labels, and title. Save as an image, which you will upload to canvas and add to your cisc106 web page.

3. Code non-mutating insertion sort (**isortNonMut(unsorted)**) (neither function changes the original unsorted list) and a series of good tests[1]

[1] What are all the boundary cases?

4. Code mutating insertion sort (**isortMut(unsorted)**) (no values or lists are returned - lists are only mutated, and all functions always returns None) and a series of good tests[2]

5. See https://www.mathsisfun.com/algebra/matrix-introduction.html
   Write a function (**transpose(m)**) to transpose a rectangular matrix of arbitrary dimensions (represented as nested lists) using nested for loops. Do not use a built-in function. [3] Write five good assertEqual tests.

6. See https://www.mathsisfun.com/algebra/matrix-multiplying.html
   Write a function (**matrix_mult(m1, m2)**)to multiply rectangular matrices of arbitrary dimensions. Do not use a built-in function. Be sure to perform the process by hand several times to make sure you understand what you will be coding. Write five good assertEqual tests.

[2] What are all the boundary cases?
[3] If you could use a Python library function, what would you use?