ENG 122 Fall 2016 Homework #01

Date: Wednesday, September 21, 2016

DUE: Wednesday, September 28, 2016 before class in Box A in the MAE department if a paper assignment and if digital turn in it in via Canvas.

Problem 1

A function object is a value you can assign to a variable or pass as an argument. For example, `do_twice` is a function that takes a function object as an argument and calls it twice:

```
def do_twice(f):
    f()
    f()
```

Here's an example that uses `do_twice` to call a function named `print_spam` twice.

```
def print_spam():
    print 'spam'

do_twice(print_spam)
```

1. Type this example into a Jupyter notebook and test it.

2. Modify `do_twice` so that it takes two arguments, a function object and a value, and calls the function twice, passing the value as an argument to the function.

3. Write a more general version of `print_spam`, called `print_twice`, that takes a string as a parameter and prints it twice.

4. Use the modified version of `do_twice` to call `print_twice` twice, passing 'spam' as an argument.

5. Define a new function called `do_four` that takes a function object and a value and calls the function four times, passing the value as a parameter. There should be only two statements in the body of this function, not four.

Problem 2

In a Jupyter notebook use NumPy to solve the following:

1. Create a uniform subdivision of the interval -1.3 to 2.5 with 64 subdivisions.

2. Generate an array of length $3n$ filled with the cyclic pattern 1, 2, 3.

3. Create an array of the first 10 odd integers.

4. Create a 10 x 10 arrays of zeros and then "frame" it with a border of ones.

5. Create an 8 x 8 array with a checkerboard pattern of zeros and ones using a slicing + striding approach.

6. Try using the dot function on a vector-vector, matrix-vector and matrix-matrix example. (This may seem simple but it's good to see how the results differ in each case.)

7. Create a function which creates an n×n array with (i,j)-entry equal to i+j.

8. Evaluate cos and sin on the interval [0, 1] and then stack the results into a tall array with rows being the (cos(x), sin(x)) entries.

9. Create a random 3x5 array using the `np.random.rand(3, 5)` function and compute: the sum of all the entries, the sum of the rows and the sum of the columns. (*Just like sorted had an optional key= argument, many Numpy functions have an optional axis= argument!*)

10. Create a random 5x5 array using the function `np.random.rand(5, 5)`. We want to sort the rows according to the second column. Try combining array slicing + argsort + indexing to do this.

Refer to the NumPy documentation and SciPy Lecture Notes for help.

Problem 3

In a Jupyter notebook use NumPy and Matplotlib to create a plot of the Batman equation. The outline should be should be yellow and the enclosed space should be filled with black. Remove the grid and axes (i.e. plain white background) and insert your first name into the inside the symbol as large as it can be without touching the edges of the symbol. Color your name yellow too.

Refer to the Matplotlib documentation and gallery for help.