Project 1: Programming with Python

Due: Friday, October 31st at beginning of class

Notes: You can use module of Python from Numpy, SciPy and Matplotlib. Do not include anything from modules that are not already found in the mpi-main node. Your code should be able to be recompiled and demonstrated from the mpi-main node directly. Save all output into a ~/project/ directory under your home directory. You can run and test your code anywhere you like (school, laptop etc.) but please verify it runs properly on mpi-main under your login. You will turn in a project report with all graphical output required in each part. This does NOT need to be in a formal report stylized output. Just note the Section area and attach the output generated. Leave all textual output in your project directory on mpi-main. I will run a test program against it from root that will compare your formatted results to my answer files (mainly for Part 3).

Part 1:

Convolve two given signals (sin(ωt)) and plot.

Signal 1:	Amplitude = 10 Frequency = 5Hz
Signal 2:	Amplitude = 200 Frequency = 50Hz
Time:	t = 0:0.001:1

Plot Directions: In one figure, use subplots to plot the following 3 signals, Signal 1, Signal 2 and the signal resulting from convolution of Signals 1 & 2. Be sure to extract the middle of the resulting convolution to force the final plot to be of the same length as Signals 1 & 2. Save resulting plot as a PDF file.

Part 2:

Use a prediction method of your choosing (Kalman Filter, Weiner Filter, Fuzzy Logic, Neural Networks, etc) to generate a prediction signal from an input signal given as a file found on BlackBoard as ‘project1_part2.txt’. Calculate the mean squared error (MSE).

Output should be 1) a pdf file showing with single figure showing the overlay of the original signal and the predicted signal. Include the MSE as an annotation within the figure, 2) a text file named ‘project1_part2final.txt’ with the original signal as column 1, the predicted signal as column 2 and the error signal as column 3.

Part 3:

Read in data from 2 input files named ‘project1_part3a.txt’ & ‘project1_part3b.txt’ found in the project section on Blackboard. Column 1 contains the required data in both files.

Read the data from both files into matrices, ***A*** & ***B***.

****** Note the change to the row and col from the original post **********
A should be a 1,000 x 10,000 matrix, ***B*** should be a 10,000 x 1,000 matrix.

Generate the resulting matrix multiplication of ***A*** & ***B*** in parallel as follows:

Using mpi4py, break the row-column multiply & sum operations into 10 iterations by using all the rows in ***A*** times the first 1000 columns of ***B***, then the rows of ***A*** times the next 1000 columns of ***B***, etc. until all the columns of ***B*** have been used. Distribute each iteration to a separate process for calculation in a slave node (you should be using 10 total processes). Return the resulting sub-matrix of each process back to the master node for reassembly into the final matrix answer. Write the final matrix to a text file in the home directory as a file named ‘project1_part3final.txt’.