Physics Assignment 1

PHY410: Do problems 1 and 2
PHY 505: Do all three problems.

Accept the assignment from github classroom: https://classroom.github.com/a/FIqZjTmA. You will then get a link to your own github area.
You should submit your code through github classroom. Submit your writeup, and a link to your github classroom area where your code is, on UBLearns.

Problem 1:

Calculate the "Hubble" program (either py or c++) to make a least-squares fit to the 9 groups (open circles) in Figure 1 of Hubble's 1929 article and compare the slope of the fitted straight line to Hubble's value of K. Estimate the age of the universe that this value implies.

Note: Hubble states in his article: "Two solutions have been made, one using the 24 nebulae individually, and the other combining them into 9 groups according to proximity in direction and in distance." He does not specify the 9 groups, so you need to figure how he selected them. The distances are given in Table 1, but not the directions. Presumably he had a galaxy catalog handy on his desk with the directions of each object listed. You can look them up at http://spider.seds.org/ngc/ngc.html.

Problem 2:

Modify the linear "chi_square_fit" functions (either c++ or python) to fit an exponential function to the CO2 data in the DataAnalysis/FFT directory by taking the logarithm of the concentration, and fitting that logarithm. Lecture 5 has an example of how to read and plot the data in python, but you are free to use either python or C++ in this problem.

At 50,000 ppm CO2 concentration, the atmosphere will become toxic to oxygen-breathing life. Assuming the current exponential trend, on what date will the atmosphere become toxic?

Problem 3 (PHY505 only):

Repeat problem 2, assuming a quadratic increase instead of an exponential increase. This requires you to derive the values for “chi_square_fit” with a 2nd order polynomial instead of a 1st order polynomial (so, sorry, there is a lot of algebra to do). Now on what date will the atmosphere become toxic?