Tutorial problems for Lectures 1, 2, and beginning of 3. Due April 27, 2017.

Problem 1: Make a new text file with your name, email address, what youre working on for your honours project, plus a few things youd like to learn in the course. Initialize a git repository and commit this file. (5)

Problem 2: Put your answers to the other tutorial questions into another text file. Add this to the repository also. (5)

Problem 3: Make a github account and push the repository onto github. Email Hazmatally (hazmatally@gmail.com) and me (jonathan.sievers@gmail.com) your github name so we can have a look at your file/answers. (10)

Problem 3: Write a python script to make a vector of n evenly spaced numbers between 0 and $\pi/2$. i.e. x[0]=0, x[-1]=$pi/2$ (5)

Use this vector to integrate cos(x) from 0 to $\pi/2$ for a range of number of points using the simple method. Include 10,30,100,300,1000 points between 0 and $\pi/2$. How does error scale with number of points? Your answer should look like $err \propto n^{\alpha}$, say what α is(5)

Problem 4: Python supports array slicing - x[5:10:2] will take points 5,7,9 from x. x[5::2] will take points 5,7,9 from x. How can I take all odd points from an array? How can I take all even points from an array, but skipping the first and last points? (5)

Problem 5: Write a python function to integrate this vector using Simpsons rule. How does error scale with number of points? How many points did we need to use in part 2 to get same accuracy as 11 points with Simpsons rule? (10)

Problem 6: Plot the errors as a function of number of points using Simpsons rule and standard sum. You will want to use a log scale here - look at logplot.py in the github distribution (5)

Bonus: The scipy module has built in integration functions in scipy.integrate. The quad routine will do numerical integrals. quad will try to put its effort where the function changes quickly, which can save huge amounts of computation for some problems.

B1: Look at scipy_quad_example.py, which uses scipy to integrate our Gaussian function over two different ranges. The integrals should be (almost) identical - yet they are not. Can you figure out why? (5)

B2: Can you write another function that will always give the correct answer to this integral? (5) Hint - you may want to do two integrals instead of one.