

Physics 325 — Scientific Computing — Fall 2016 — Lab 03

September 9, 2016

Exercise 1. Simpson Rule

Write a program to that calculates $\int_0^\pi \sin(x)e^{-x}dx$ using the both the Trapezoidal and Simpson Rules. Make the program write out a delimited file where the first column is the number of bins, the second the Trapezoidal rule value, and the third the Simpson's rule value. Write out the data file for the number of bins ranging from 1 to 20. **(10 points)**

Exercise 2. Array Operation with CO₂ Data

Using the "co2_mm_mlo.txt" data, write a script that uses the Numpy where() function and the min() and max() functions to find and print the largest and smallest CO₂ fractions using the interpolated column for the month of December only! **(10 points)**

Note: the where() function creates a more complicated datatype than one might assume. It is called a tuple. To ensure a useable array of indices, run the results of np.where() through np.squeeze() which reduces the dimensionality. When in doubt, use the type() function manually to see what kind of variable you are dealing with.

Exercise 3. Initial Differentiation

Using the CO₂ data, use the central difference method to calculate the derivative of the "seasonally adjusted trend" data. You can skip the derivative of the first and last points for now (but note you would use forward and backwards formulas for those two points). Have the script make and save a plot of the derivative. **(10 points)**

Extra Credit: By exploring Pyplot options, have your plot include two separate plots, with the trend data plotted above and the derivative plotted below. **(3 points)**