PHYC 2050

Assignment #2

Due: 10 February 2010, at the beginning of class

Your assignment should be printed out. Show and fully explain all of your work.

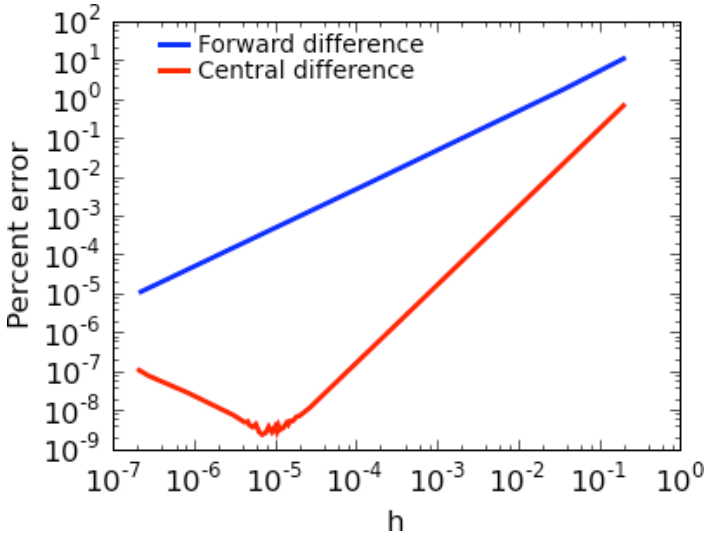
1) a) Modify the linear least-squares fit function given in class so that it also returns the fit parameter uncertainties. Get the updated notes from the class Web site for the equations.

   b) Historical temperature data from the global network of weather stations can be obtained from http://data.giss.nasa.gov/gistemp/. Download the data file for Sable Island, and write a program that plots the annual average (in the metANN column) versus year. Plot a line for the linear least-squares fit on the graph. Print the mean warming rate and uncertainty on the plot using the appropriate pylab command.

   Data can be read from a file using the numpy.loadtxt() command, which returns a 2D array of values. You can use the usual index notation to retrieve a row of values from the 2D array. To retrieve a column of values, you will need to transpose the array first. Note that the value 999.90 in the data file indicates missing data.

   c) Is the warming trend in the Sable Island data statistically significant?

2) a) In class we calculated the relative error for the first derivative of the exponential function using both the forward and central difference formulas. Reproduce the following plot, which shows the relative uncertainties against a range of choices for h.



Hint: To finish the computation in finite time, you will want to space your choices for h logarithmically.

b) Show that the maximum relative error due to roundoff in the central difference formula for the first derivative of the exponential function is ϵ/h, where ϵ is the "machine epsilon".

c) Can the portion of the plot in part (a) that has increasing error with decreasing h be attributed to roundoff error? Explain your reasoning using the result from part (b).