I. NUMERICAL DERIVATIVES (EULER METHOD)

Physics 580, SDSU. Due 11:59 pm, Friday September 9, 2011

The drop deadline is September 12. The main purpose of this project is for you to test yourself whether you have the appropriate skills for this course. You should find this project easy; if not, you should strongly consider dropping the course.

Consider the function, $f(x) = x \sin x$.

A. Basic Project (worth 75%)

Using the symmetric three-point formula discussed in class, compute the numerical second derivative, $f''(x_0)$. Your code should ask the user for any value of x_0 as well as the step size dx, (often called h in the numerical method literature).

In addition to your code, you should plot a sample output. Specifically, plot the absolute value of the difference between your numerical result and the exact results as a function of step size dx on a log-log plot. Turn your plot into a postscript (.ps or .eps) file and include with your program.

For the value of x_0, use the first letter of your last name (A=1., B=2., etc.)

Choose a reasonable range for dx. While you do not have to use logarithmic spacing for the sampling of dx, but it is convenient.

B. Advanced Project (worth 25%)

Look up, either in a book or online, the symmetric five-point formula for the second derivative. Plot both the three-point and five-point results on your graph.

C. Extra Credit (worth 10%)

Using regression tools, find the power law dependence for the error as a function of dx. Is it what you expect?

D. Notes

For full credit on all parts, your program should be well-commented, with its input and output clear and easy to use. The ideal program will have separate functions for the three-point and five-point formulas.

To make identification easier for me, please use the convention `lastname_proj1.f` (with different extensions for different programming languages) for your program. Also, your program should print out the following at the beginning:

> This is computational project 1
> Written by *your name here*

Submit your project:

- Create a subdirectory, `lastname_project1/`
- Now create a *tar* file (tape archive),
  `tar -cvf lastname1.tar lastname_project1/`
- and then compress it
  `gzip lastname1.tar`
- This will produce a file, `lastname1.tar.gz`, attach it to an email to ckishimo@ucla.edu .