Lab 3: Roundoff and Numerical Errors
Assigned on 10/15/2015 (Thursday) and due on 10/22/2015 (Thursday)

Lab Practice:

Use the code of Listing 5.9 of the textbook to answer the following questions:

(1) You were told in the class that the relative error decreases because decrease of truncation error and then increases because of roundoff error. How can you test it?

(2) We derived in last class that the accuracy of forward difference is $O(h)$. How to verify it numerically?

Lab Assignment:

Use backward difference approximation

$$f'(x) = \frac{f(x) - f(x - \Delta x)}{\Delta x}$$

to numerically differentiate $sin(x)$. Complete the following assignments:

(1) Use the Taylor series to analytically derive the order of truncation error of the backward difference. (5 points)

(2) Write a MATLAB function to evaluate the backward difference for $x = 1$. Use Listing 5.9 of the textbook as the starting point.

(3) Determine the error by comparing with built-in function $cos(x)$. Plot the magnitude of the error as a function of h, for $h = 1/2, 1/4, 1/8, \ldots$. Is your derived order of truncation error is correct. Refer to Listing 5.8 of the textbook for the verification. (10 points)