Phys601: Problem set 1

Due date : 25 Feb 2012.

Topic : Round off and truncation errors

1. Find the machine precesion of your machine in single and double precision.
2. What is the smallest and largest real number that can be represented in single and double precision for your machine.
3. A Riemann integral is approximated by

$$\int_a^b f(x)dx = \lim_{\Delta x \to 0} \sum_a^b f(x_i)\Delta x \tag{1}$$

   where $\Delta x = (b-a)/N$. Using this algorithm, compute the integral of functions $f(x) = x^3, x^5$ for $a = 0$ and $b = 5$. Check the dependence on value of N. Calculate the fractional percentage error (use $N = 1000$) by comparing with exact answer. Fix the value of N and discuss which function gives large errors.

4. Find the derivative of the function $f(x) = x^4 + 3x^2 + 1$ using the algorithm

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} \tag{2}$$

   at $x = 10$. Estimate the round off and truncation errors.