Project #1 – Math 3368-01 – Spring 2009 Due day: Feb. 13

1. Write and test a subprogram or Matlab M-file implementation of the bisection algorithm. Use it to find the indicated solution to the following nonlinear equations to within an absolute error of 10^{-3}. Turn in your program and results.

(a) $x^{-1} - 2^x = 0$. Find a root in $[0, 1]$.

(b) $2^{-x} + e^x + 2\cos(x) - 6 = 0$. Find a root in $[1, 3]$.

2. Write and test a subprogram or Matlab M-file implementation of the Newton's method. Use it to find the root of $f(x) = x^3 - 3x - 2$ with tol$= 10^{-6}$.

(a) Plot the graph of $f(x)$ and estimate the roots of $f(x)$.

(b) using the starting value $x_0 = -2.4$, to find the root of $f(x)$.

(c) using the starting value $x_0 = 1.2$, to find the root of $f(x)$.

(d) Among (a) and (b), which converges to the root faster? Please try yo give some comments.

3. For a cubic polynomial $f(x) = 4x^3 - 16x^2 + 17x - 4$,

(a) Plot the graph of $f(x)$, and estimates three roots of the $f(x)$.

(b) Use the secant method to find the three roots of the cubic polynomial $f(x)$. Print out the result of every step.

(c) Use the method of False Position to find three roots of the cubic polynomial $f(x)$. Print out the result of every step.

4. The following is a variable transformation $X - > x$ defined as

$$X = 2cx + \log\left(\frac{(c+p) + (c-p)e^{2px}}{(c-p) + (c+p)e^{2px}}\right) \tag{1}$$

Fixing $c = 10.0$, $p = 9.5$, and having the domain of $X \in [-10, 10]$ being divided into 100 equi-distance subinterval with $\Delta x = 0.2$, that is, $X_i = -10 + i\Delta x$, $i = 0, 1, \cdots, 99$.

(a) For each X_i, use the Newton's method to find x_i which satisfies (1).

(b) Plot a graph with X_i being the x-axis and x_i being the y-axis.

(c) An implicit function of X can be defined as $u(x) = 1/\cosh^2(x)$ with variable transformation (1). Plot two graphs of u with x and X being the x-axis and x_i being the x-axis, respectively.