Numerical Computation
Assignment 3

1.
(i) Use the Intermediate Value Theorem to find an interval of length one that contains a root of the equation. (a) $x^5 + x = 1$ (b) $\sin x = 6x + 5$ (c) $\ln x + x^2 = 3$

(ii)Consider three equations. Apply two steps of the Bisection Method to find an approximate root within 1/8 of the true root.

2. Apply two steps of Newton's Method with initial guess $x_0 = 1$ on the equation $x^3 + x^2 - 1 = 0$.

3. Considering the equation $32x^3 - 32x^2 - 6x + 9 = 0$; with roots $r = -\frac{1}{2}, r = \frac{3}{4}$. Estimate the error e_{i+1} in terms of the pervious error e_i as Newton's Method converges to the given roots. Is the convergence linear or quadratic?

4. Apply two steps of the Secant Method on the interval with initial guesses $x_0 = 1$ and $x_1 = 2$ to find the approximate root of $x^3 = 2x + 2$.

Computer Problem

5. Implement the bisection method in Matlab. Your m-file should have header line like: **function v = bisection(f, a, b, N, tol, esp)** where f is the function, a and b is the initial interval, N is the maximum number of iterations, tol is for terminal condition $f(x_k) < tol$, and esp is for terminal condition $\frac{|a-b|}{|b|} < esp$.

6. Implement the Newton's method in Matlab. Your m-file should have header line like: **function w = Newton(f, fp, x0, N, tol)** where f is the function, fp is the derivative of the function, x0 is the initial point, N is the maximum number of iterations, tol is for terminal condition $f(x_k) < tol$.

7. Implement the Secant method in Matlab. Your m-file should have header line like: **function u = Secant(f, x0, x1, N, tol)** where f is the function,

x0 and x1 are the initial points, N is the maximum number of iterations, tol is for terminal condition $f(x_k) < tol$.

8. Run your bisection code and Newton code on the function $f(x) = x^3 - 2x - 1$, with a=1, b=2, x0=3. Compare your results.

9. Run your Newton code and secant code to find $\sqrt{2}$, with x0=0, x1=1. Compare your results.

Please submit all you answers (including Computer problem) in a Pdf file on iSpace.