2018 Numerical Analysis Midterm

Closed book and notes. Answer in English. Show the intermediate processes for the partial credits. You can use a calculator. Compute up to 3 decimal digits after the decimal point.

1. Write a Fortran function that returns the maximum of the diagonal entries of a real N by N matrix A. The type is real*8. The input parameters are N, A. You can assume that the row dimension in main routine is same as N. (Diagonal means a(i,j), I = j, e.g, a(2,2), a(3,3))

2. $f(x) = x^3 - 3x - 1 = 0$
   x = [0, 2]

$\epsilon = 5 * 10^{-2}$.

a) Perform the bisection method for the root in [0, 2] until your root is closer to the real root within ϵ.

Let $x_0 = 1.0$, $x_1 = 1.2$

b) Perform the secant method until your root is closer to the real root within ϵ.

c) Do as in b) with the Newton's method, with $x_0 = 1.1$

3. $e^x - y = 0$
   $xy - e^x = 0$

Let $x_0 = 0.95$, $y_0 = 2.7$

Perform 2 steps of Newton's method for the above system of equations.