EML3041 Computational Methods Fall 2023 Week Four: Sep 11 – Sep 15

Session: Two

Answer the free-response question#1 starting on a fresh sheet of paper. Solve the problem as if you were submitting them for a test. Put your last name, first name, and your first letter of last name in bold on top of the page.

1) Given the equation $x^3 = 6.4$ and an initial guess of $x_0 = 12$ what is the second iterative value of its root, x_2 by Newton-Raphson method?

Answer: 5.37

2) The square root of a positive real number R can be found iteratively by using the formula

 $x_{i+1} = \frac{1}{2} \left(x_i + \frac{R}{x_i} \right)$. How much computational time does it take to conduct four iterations as

given in the program below? Assume you are utilizing an AMD chip that uses 4 clock cycles to conduct one multiplication, 4 clock cycles to conduct one addition, 4 clock cycles to conduct one subtraction and 16 clock cycles to conduct one division. The computer uses a 2.5 GHz processor.

n=4 R=7 for i=1:1:n xnew=0.5*(xold+R/xold) xold=xnew end

Answer: 3.84×10^{-8} seconds

3) Given is the following equation $x^2 - 16 = 0$

- a. Using bisection method, what is the estimate of the root after two iterations if the initial bracket is [1,8]. Before iterating, determine if the bracket is valid first.
- b. Use a *modified* bisection method as explained below. The initial bracket given is [1, 8] and is already given to you as a valid bracket. The root estimated at the end of first iteration would be the midpoint between 1 and 8 in case of bisection method. Instead, in the *modified* bisection method, the root estimated at the end of the first iteration would be the point where the straight line drawn from the function at x = 1 to the function at x = 8 crosses the *x*-axis. What is this estimate of the root?

Answer: a) 2.75, 2.666