

ASEN 3502 Computational Methods

Homework 3

See Gradescope for Due Date

Question 1 (Adapted from *Applied Numerical Analysis* by Gerald & Wheatley)

The quadratic function $f(x) = (x - 0.3)(x - 0.5)$ clearly has roots at 0.3 and 0.5.

- (a) Why is the interval $[0.1, 0.6]$ not a satisfactory starting interval for bisection? Why?
- (b) What are good starting intervals for bisection towards each root? Why?
- (c) If you start bisection on $[0, 0.49]$, which root is reached with bisection?
- (d) Starting with the interval $[0.27, 0.32]$, how many iterations of bisection are required to reach a tolerance of 10^{-4} ?
- (e) Using equation 6.8, estimate the number of iterations required for the Newton Raphson method to achieve a root estimate with 10^{-4} precision starting from initial guess 0.29? Use the concept of “quadratic convergence” to explain why Newton Raphson is so much faster than bisection.

Question 2

Exercise 6.10 in the textbook.

Question 3

Exercise 6.21 in the textbook. Solve for an accuracy of 1 degree. Work this problem out mostly by hand. You may use a calculator or a computer program such as Julia or Matlab to evaluate $f(\theta_0)$ or the derivative. The reason for doing this by hand is to practice for the exam. This problem in particular would be too time consuming for the exam, but a structurally similar one may be asked.

Question 4

Work with your lab team to get a solution for Task 1.5 on Lab 2 (this does NOT need to be submitted with this homework assignment).