AMATH 581 Autumn Quarter 2019

Homework 0: Basics with Scorelator

Due Monday September 30, 11:59 pm

1. Consider the function

$$f(x) = x\sin(3x) - \exp(x)$$

and find the root for the x-value near $x \approx -0.5$ that satisfies $f(x) = 0$ In the first part, use the Newton-Raphson method

$$x^{k+1} = x^k - \frac{f(x^k)}{f'(x^k)}$$

with the initial guess $x^1 = -1.6$ to converge (in absolute value) to the solution to 10^{-6}. Keep track of the number of iterations until convergence is achieved (NOTE: please check convergence using $f(x^k)$, not $f(x^k + 1)$).

In the second part, use bisection with the initial end points $x = -0.7$ and $x = -0.4$. Keep track of the mid point values and number of iterations until an accuracy of 10^{-6} is achieved.

Answer format: Save your output as `A1.dat`, `A2.dat`, and `A3.dat`. Specifically, `A1.dat` is the vector of x-values in the Newton method starting with the initial guess $x(1) = -1.6$, and `A2.dat` is the mid point (xmid) values in the bisection method for successive iterations. `A3.dat` is a 1×2 vector with the number of iterations for the Newton and bisection respectively as the two components.

2. Define the following:

$$A = \begin{bmatrix} 1 & 2 \\ -1 & 1 \end{bmatrix}, B = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}, C = \begin{bmatrix} 2 & 0 & -3 \\ 0 & 0 & -1 \end{bmatrix}, D = \begin{bmatrix} 1 & 2 \\ 2 & 3 \\ -1 & 0 \end{bmatrix}, x = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, y = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, z = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}.$$

Calculate the following:

(a) $A + B$
(b) $3x - 4y$
(c) Ax
(d) $B(x - y)$
(e) Dx
(f) $Dy + z$
(g) AB
(h) BC
(i) CD

ANSWERS: Should be written out as A4.dat–A12.dat