AMATH 481 / 581 Fall 2018
CompSoftBook Practice

Submission open until 11:59:59pm Monday October 8, 2018

This assignment is for **practice** and **will not be included in your grade calculation**. Make sure to upload to CompSoftbook your main homework **m-file** as well as any **auxiliary** files (function files or data files). Your main m-file should generate all of the .dat files. Do not put any unnecessary marks, e.g. "!","$", in your code (even if you are extremely excited about the assignment).

Exercise 1 Building a Matrix

Define the following matrix:

$$\mathbf{A} = \begin{bmatrix} 34 & 45 \\ 17 & 6 \end{bmatrix}$$

Answers: Save the matrix **A** as A1.dat using the command: "`save A1.dat A -ascii`"

Exercise 2 Matrix Operations

Let the following be defined:

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

Calculate the following:
(a) $\mathbf{A} + \mathbf{B}$, (b) $3\mathbf{x} - 4\mathbf{y}$, (c) $\mathbf{A}\mathbf{x}$, (d) $\mathbf{B}(\mathbf{x} - \mathbf{y})$, (e) $\mathbf{D}\,\mathbf{x}$, (f) $\mathbf{D}\,\mathbf{y} + \mathbf{z}$, (g) $\mathbf{A}\mathbf{B}$, (h) $\mathbf{B}\mathbf{C}$, (i) $\mathbf{C}\mathbf{D}$

ANSWERS: Should be written out as A2.dat–A10.dat

Exercise 3 Root Finding

Consider the function $f(x) = -x - cos(x)$ and solve to find the root near $x \approx -0.74$, i.e., x-value that satisfies $f(x) = 0$. In the first part, use the Newton-Raphson method with the initial guess $x(1) = -3$ to converge (in absolute value) to the solution within 10^{-6}. Keep track of the number of iterations until convergence is achieved (NOTE: please check convergence with $f(x_{n+1})$). In the second part, use bisection with the interval end points $x_a = -3$ and $x_b = 1$. Keep track of the mid point values and number of iterations until an accuracy of 10^{-6} is achieved.

ANSWERS: Should be written out as A11.dat–A13.dat. A11.dat is the *column* vector of x-values in the Newton method starting with the initial guess x(1) = -3. A12.dat is the *column* vector of midpoint (x_{mid}) values in the bisection method for successive iterations. A13.dat is a 1x2 vector with the number of iterations for the Newton and bisection respectively as the two components.