

AMATH 301
Homework 1: Spring 2009

DUE: see website for exact time and date. No late assignments accepted.

I The following expressions all result in zero:

$$3000 - \sum_{i=1}^{10000} 0.3, \quad 30000 - \sum_{i=1}^{100000} 0.3, \quad 300000 - \sum_{i=1}^{1000000} 0.3$$

Write a MATLAB algorithm to compute each of the above repeated subtractions. Note: in doing this you are calculating the Absolute Error resulting from roundoff error.

ANSWERS: Should be written out as A1.dat–A3.dat

II Let the following be defined:

$$\mathbf{A} = \begin{bmatrix} 10 & 2 \\ -1 & 1 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}, \mathbf{C} = \begin{bmatrix} 2 & 0 & -30 \\ 0 & 0 & -1 \end{bmatrix}, \mathbf{D} = \begin{bmatrix} 1 & -2 \\ 2 & -3 \\ -1 & 0 \end{bmatrix}, \mathbf{x} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \mathbf{y} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \mathbf{z} = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix},$$

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) $\mathbf{D}(2\mathbf{x})$, (f) $10(\mathbf{D}\mathbf{y}) + 4\mathbf{z}$, (g) $\mathbf{A}\mathbf{B}$, (h) $\mathbf{B}\mathbf{C}$, (i) $\mathbf{C}\mathbf{D}$

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

III Consider the logistic equation

$$x_{n+1} = \rho x_n(1 - x_n)$$

which was first developed to model the growth and decay of a population of some species. Iterate the equation for the following values of ρ with $x_1 = 0.55$:

$$\rho = 0.1, 1.0, 2.8, 3.25, 3.5, 3.65$$

Iterate the equation for each ρ value and calculate six column vectors (one for each ρ value) of length 50, each of which contains $x(1)$ to $x(50)$.

ANSWERS: Should be written out as A13.dat–A18.dat

NOTE: Do not put any exclamation marks (!) in your code.