Microsoft Introduction to AI and Machine Learning
Instructor: **J. Nathan Kutz**

HOMEWORK #1: WARM UP

I Set up your own GitHub account (private) and share your Git with me your TAs

II The following expressions all result in zero:

$$1000 - \sum_{i=1}^{10000} 0.1\,, \qquad 10000 - \sum_{i=1}^{100000} 0.1\,, \qquad 100000 - \sum_{i=1}^{1000000} 0.1$$

Write an algorithm to compute each of the above repeated subtractions and compare the answer to the exact answer of zero (i.e. calculate the Absolute Error).

III 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) $\mathbf{Ax}$, (d) $\mathbf{B}(\mathbf{x}\text{-}\mathbf{y})$, (e) $\mathbf{D}\,\mathbf{x}$, (f) $\mathbf{D}\,\mathbf{y} + \mathbf{z}$, (g) $\mathbf{AB}$, (h) $\mathbf{BC}$, (i) $\mathbf{CD}$

IV 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 $x_1 = 0.5$:

$$\rho = 0.8, 1.5, 2.8, 3.2, 3.5, 3.65$$

Iterate the equation for each ρ value and calculate six column vectors (one for each ρ value) of length 50 which contains $x(1)$ to $x(50)$ (or in python $x(0)$ to $x(49)$).

NOTE: You will write a narrative report about this homework on your github page.