CS 314 - IMAGE PROCESSING PRACTICAL (2020/2021)
Assignment 02 - NumPy & Matplotlib Libraries

Due date: July 04th 2022, 11.59 pm

This assignment requires you to practice using the Numpy and Matplotlib libraries to do simple tasks with python.

1. Use bare python to accomplish the following tasks
   a. Create a 2D array with 5 rows and 5 columns with random numbers initialized to all the indices.
   b. Create a function which returns a 2D list with left diagonal 1s and all the other indices 0s (Identity matrix), function should take in the lengths of rows and columns as parameters.
   c. Write a function to multiply 2D python arrays as matrices, checking for conformity and error handling should be built into the function. And this function should be able to multiply any size matrix
   d. Test how long it takes for this function to multiply previously created matrices.

2. Numpy is an open source python library which adds support for large multi-dimensional arrays & matrices along with some useful mathematical functions. Following is a task you are supposed to complete using **Numpy**.
   a. Create an array with a length of 10 and initialize all the indices to 0. What other functions are there to perform the same thing?
   b. Convert the previously created matrices (Q1) to numpy arrays.
   c. Multiply the newly created numpy arrays using numpy matrix multiplication(dot product), compare the times of the previous function with this.
   d. Perform matrix addition and subtraction for the previous numpy arrays.
   e. Create a numpy array with the following elements, [4,7,9,-1,3,5,8] and find the maximum, minimum and the summation of each element.
   f. Find the index of the minimum value of the previous array.
   g. Create an array(A) which has values starting from 5 to 23 with increments of 2.
   h. Create an array(B) which has 9 values between 5 and 9.
   i. Change the previous array(B) so that it has a shape of 3x3 instead.
   j. Find the cosine of each index of the array(A).
   k. Find the exponential of each index of the array(A). Look into other shape manipulation mechanisms.
   l. Display the values of the array (A) of indices 2 to 6.
   m. Display all the values of column 1 of the array (B).
   n. Create two arrays with random numbers (Shape=4), stack these arrays into one matrix using vertical and horizontal stacks. Save this array as C.
   o. Split the array(C) into 2 sub arrays again horizontally and vertically.

3. Use **Matplotlib.pyplot** to do the following tasks.
   a. Create an array ranging from 0 to $\pi/2$ with steps of 0.1 name the variable of this array as x
   b. Plot the function $y = 5 * \sin(x) - 12$ in a graph.
   c. Create another array with 0 to 5 with 0.1 increments and name it as t.
   d. Plot both y & $f = 2t + 3$ in the same plot. Change how the lines are displayed in the graph.