CSC 6013

Module 4 Coding Assignment

Create an algorithm to solve each problem and implement your algorithm in Python code as a function with the indicated input parameters and return value. Create a driver/main block of code that initializes the input parameters and makes the function call inside a print statement to print out the value returned by the function call. Submit your work for the entire assignment – codes and outputs - as a single docx or pdf file through Canvas.

1) Find the number of entries in an array of integers that are divisible by a given integer. Your function should have two input parameters – an array of integers and a positive integer – and should return an integer indicating the count using a return statement.

Run your algorithm on the problem instances:

a) [20, 25, 30, 35, 40, 45, 50, 55, 60, 65] number of entries that are divisible by 3

and

b) [18, 45, 77, 81, 33, 54, 99] number of entries that are divisible by 9

2) Given an array of real numbers, without sorting the array, find the smallest gap between all pairs of elements (for an array A, the absolute value of the difference between elements A[i] and A[j]). Your function should have one input parameter – an array of numbers – and should return a non-negative number indicating the smallest gap using a return statement.

Run your algorithm on the problem instances:

a) [50, 120, 250, 100, 20, 300, 200]

b) [12.4, 45.9, 8.1, 79.8, -13.64, 5.09]

3) Given an integer n>=2 and two nxn matrices A and B of real numbers, find the product AB of the matrices. Your function should have three input parameters – a positive integer n and two nxn matrices of numbers– and should return the nxn product matrix using a return statement.

Run your algorithm on the problem instances:

a) n=2, A = $\begin{pmatrix} 2 & 7 \\ 3 & 5 \end{pmatrix}$, B = $\begin{pmatrix} 8 & -4 \\ 6 & 6 \end{pmatrix}$

b) n=3, $A = \begin{pmatrix} 1 & 0 & 2 \\ 3 & -2 & 5 \\ 6 & 2 & -3 \end{pmatrix}$, $B = \begin{pmatrix} .3 & .25 & .1 \\ .4 & .8 & 0 \\ -.5 & .75 & .6 \end{pmatrix}$

If you are not familiar with matrix multiplication, you might the following internet resources helpful. (Thanks to Dr. Paulo Fernandes for these references.)

The definition of matrix multiplication from Wikipedia:
https://en.wikipedia.org/wiki/Matrix_multiplication

A simpler definition of matrix multiplication:
https://www.mathsisfun.com/algebra/matrix-multiplying.html

Two videos of matrix multiplication:
https://youtu.be/sYlOjyPyX3g
https://youtu.be/n8ICyS8CKIQ

An automatic calculator that will multiply two matrices that you provide:
https://matrix.reshish.com/multiplication.php