Additional Exercises for Week5

Input

Create a 10×10 matrix **A** with random integers $\in [1, 99]$.

#Ex12

Save odd columns of the matrix A into a new matrix.

Hint: odd columns of the matrix are the 1st column, 3rd column, 5th column, and so on.

- For ex., input matrix $= \begin{bmatrix} 2 & 5 & 9 \\ 3 & 5 & 8 \\ 4 & 4 & 7 \end{bmatrix} \rightarrow$ output $= \begin{bmatrix} 2 & 9 \\ 3 & 8 \\ 4 & 7 \end{bmatrix}$

#Ex13

Save even rows of the matrix A into a new matrix.

Hint: even rows of the matrix are the 2nd row, 4th row, 6th row, and so on.

- For ex., input matrix $= \begin{bmatrix} 2 & 5 & 9 & 1 \\ 3 & 5 & 8 & 9 \\ 4 & 4 & 7 & 1 \\ 7 & 6 & 5 & 4 \end{bmatrix} \rightarrow$ output $= \begin{bmatrix} 3 & 5 & 8 & 9 \\ 7 & 6 & 5 & 4 \end{bmatrix}$

#Ex14

Save even integer numbers in the matrix A into a vector.

- For ex., input matrix $= \begin{bmatrix} 2 & 5 & 9 & 1 \\ 3 & 5 & 8 & 9 \\ 4 & 4 & 7 & 1 \\ 7 & 6 & 5 & 12 \end{bmatrix} \rightarrow$ output $= \begin{bmatrix} 2 & 8 & 4 & 4 & 6 & 12 \end{bmatrix}$

#Ex15

Reverse elements in the even rows of the matrix A, and save the results into a new matrix.

- For ex., input matrix $= \begin{bmatrix} 2 & 5 & 9 & 1 \\ \mathbf{3} & \mathbf{5} & \mathbf{7} & \mathbf{9} \\ 4 & 4 & 7 & 1 \\ \mathbf{6} & \mathbf{2} & \mathbf{10} & \mathbf{14} \end{bmatrix} \rightarrow$ output $= \begin{bmatrix} 2 & 5 & 9 & 1 \\ \mathbf{9} & \mathbf{7} & \mathbf{5} & \mathbf{3} \\ 4 & 4 & 7 & 1 \\ \mathbf{14} & \mathbf{10} & \mathbf{2} & \mathbf{6} \end{bmatrix}$

#Ex16

Replace odd integer numbers in the matrix A by the maximum odd integer number of A.

- For ex., input matrix $= \begin{bmatrix} 2 & 5 & \mathbf{9} \\ 3 & 5 & 8 \\ 4 & 4 & 7 \end{bmatrix} \rightarrow$ output $= \begin{bmatrix} 2 & 9 & 9 \\ 9 & 9 & 8 \\ 4 & 4 & 9 \end{bmatrix}$

#Ex17

Swap the first column and the last column of the matrix A, and save the results into a new matrix.

Note: it is different with matrix flipping.

- For ex., input matrix $= \begin{bmatrix} 2 & 5 & 9 \\ 3 & 5 & 8 \\ 4 & 4 & 7 \end{bmatrix} \rightarrow$ output $= \begin{bmatrix} 9 & 5 & 2 \\ 8 & 5 & 3 \\ 7 & 4 & 4 \end{bmatrix}$

#Ex18

Calculate sum of all Boundary elements of the matrix A, and save the result into a variable.

Hint:

- Boundary elements are those elements that are not surrounded by elements in all four directions, i.e. elements in the first row, first column, last row, and last column.
- To avoid duplicated calculation, each element must be used only one time in the sum calculation.

- For ex., input matrix = $\begin{bmatrix} 2 & 5 & 9 \\ 3 & 5 & 8 \\ 4 & 4 & 7 \end{bmatrix}$ → output = 2 + 5 + 9 + 8 + 7 + 4 + 4 + 3

#Ex19

Calculate sum of all major and minor Diagonal elements of the matrix A, and save the result into a variable.

Hint:

- Major diagonal elements are the ones that occur from TOP LEFT of matrix down to BOTTOM RIGHT corner. Minor diagonal elements are the ones that occur from TOP RIGHT of matrix down to BOTTOM LEFT corner.
- To avoid duplicated calculation, each element must be used only one time in the sum calculation.
- For ex., input matrix = $\begin{bmatrix} 2 & 5 & 9 \\ 3 & 5 & 8 \\ 4 & 4 & 7 \end{bmatrix}$ → output = 2 + 5 + 7 + 9 + 4

#Ex20

Given a table containing the values of the coordinate points of the graph $(x) = c_1 + c_2 x + c_3 x^2 + c_4 x^3$.

x	1	2	3	4
$f(x)$	1000	2000	3000	4000

Find the coefficients c_1, c_2, c_3, c_4.

#Ex21

Try interesting examples of plotting vector fields in the following link:

https://www.geeksforgeeks.org/how-to-plot-a-simple-vector-field-in-matplotlib/

Vector fields represent **fluid flow** (among many other things). You can think of a vector field as representing **a multivariable function** whose input and output spaces each have the same dimension.

Read more about vector fields:

- https://www.khanacademy.org/math/multivariable-calculus/thinking-about-multivariable-function/ways-to-represent-multivariable-functions/a/multivariable-functions
- https://www.khanacademy.org/math/multivariable-calculus/thinking-about-multivariable-function/ways-to-represent-multivariable-functions/a/vector-fields

END

Feel tired, relax here:

3D vector field - https://www.youtube.com/watch?v=xi0P5JZgUHo

Fluid flow and vector fields - https://www.youtube.com/watch?v=VJ2ZDLQk3IQ

3d vector fields, introduction - https://www.youtube.com/watch?v=Go3UvzbsSGo

THE LINEAR EQUATIONS SONG - https://www.youtube.com/watch?v=2OpuD67v8QY

a simple equation - https://www.youtube.com/watch?v=tTJuOgmVmOY