Lab 3 – Vectors and Matrices. Basic Algorithms

3.1 Number of Occurrences

Specify function n = n_copies(k,M) that returns the number of times k occurs in array M

Note: M may be a vector, a matrix or a multidimensional array.

3.2 Maximum Element and Position of a Matrix

Specify function [k,m,n] = max_pos(M) that for matrix M returns the position (row m, column n) of its largest element (picked arbitrarily if there are more than one)

Note: **M** may be a vector, a matrix or a multidimensional array.

3.3 Distance between two Points

Specify function d = distance(P,Q) that returns the Euclidian distance between two points P e Q, represented by their coordinates in an n dimensional space (i..e P and Q are vectors with the same length, n).

3.4 Weighted Averages

In the five courses it took, a student got marks 11, 15, 18, 16, and 12.

a) Assuming that all courses have the same weight, assess the student final grade (the average of the course grades)

b) Assuming now that the courses have different importance, and this is reflected in the weights 3,1,3,2 and 1, respectively given to the courses, what is now the final grade of the student (the weighted average of the course grades)

3.5 Solving Systems of Linear Equations

a) Given a n × n matrix A with the coeficients of the variables of a system of linear equations and a n × 1 vector B with left hand sides of the system, specify function X = solve(A,B) that returns a n × 1 vector with the value of the variables.

b) Use the above function to solve the system

$$\begin{aligned} 2x + 3y - z &= 5 \\ 3x - 2y + z &= 2 \\ -2x + y + z &= 3 \end{aligned}$$

3.6. Minor of a Matrix

Given a matrix m × n matrix A (as shown below where A is 4 × 5) the minor(i,j) of matrix A is the sub-matrix obtained from A by removing its ith row and jth colum. For example, the matrix on the right is the minor(2,3) of A.

Matriz A

4	1	9	1	9
1	4	1	6	6
1	6	2	6	2
9	6	3	1	4

M = minor(A,2,4) →

4	1	9	9
1	6	2	2
9	6	3	4

Define function **B = minor(A,i,j)** that returns the minor(i,j) of matrix A.

3.7. Linearization of a Matrix

a) Define function **V = linear_tdlr(M)** that returns a vector composed of all elements of the matrix M obtained in a top down, left to right order. For the 3 × 2 matrix M = [1 2; 3 4; 5 6] the function should return the 1 × 6 vector V = [1 2 3 4 5 6].

b) Define function **V = linear_rlbu(M)** that returns a vector composed of all elements of the matrix M obtained in a right to left, bottom up, order. For the 3 × 2 matrix M = [1 2; 3 4; 5 6] the function should return the 1 × 6 vector V = [6 3 5 2 4 1].