Laboratory Work 3

Exercise 1 :

1. Define the matrix $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ e^{-3} & m/(l * \cos\left(\frac{2\pi}{3}\right)) \end{pmatrix}$ for m = 10 and l = 1.3.
2. Define the matrix $B = \begin{pmatrix} \cos(\theta) & \sin(\theta) \\ -\sin(\theta) & \cos(\theta) \end{pmatrix}$ for $\theta = \frac{\pi}{4}$.
3. Compute the product of A and B.
4. Add 1 to the elements of matrix A.
5. Compute the transpose of A.
6. Raise each element of A to the power of 3.
7. Compute $B + I$, where I is the identity matrix.
8. Define the matrix $X = \begin{pmatrix} A & -A \\ 0 & I \end{pmatrix}$.
9. Extract the submatrix formed by rows 2 and 3 and column 2 of X.
10. Swap columns 2 and 4 of X.
11. Remove the first row of X.
12. Insert the vector (1, 1, 3, 4) into the second row of X.
13. Solve the linear system $BX = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$.

Exercise 2 :

1. Using the **`diag`** and **`ones`** commands, define the following square matrix:

$$\mathbf{A}=\begin{pmatrix}\mathbf{1} & \mathbf{2} & \mathbf{0} & \mathbf{0} & \mathbf{0}\\ \mathbf{3} & \mathbf{1} & \mathbf{2} & \mathbf{0} & \mathbf{0}\\ \mathbf{0} & \mathbf{3} & \mathbf{1} & \mathbf{2} & \mathbf{0}\\ \mathbf{0} & \mathbf{0} & \mathbf{3} & \mathbf{1} & \mathbf{2}\\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{3} & \mathbf{1}\end{pmatrix}$$

Exercise 3 :

1. Generate a diagonal matrix with random numbers.
2. Reverse rows or columns to create an anti-diagonal matrix.
3. Generate two random matrices **A** and **B** and find the Boolean matrix corresponding to elements of A greater than those of B.
4. Generate a random matrix of size **5×5** and subtract **1** from elements greater than **0.5**.
5. Generate a random matrix of size **5×5** with integers between **0** and **10**, and find the positions of elements equal to zero.
6. Let $\mathbf{x}=(1,2,...,10)'$. Calculate its Euclidean norm.

Exercise 4 :

1. Define a vector **`x`** that represents the uniform discretization of the interval **[-4, 2]** into **9** equal intervals.
2. Determine **`x(1)`**, **`x(4)`**, and explain why **`x(0)`** does not exist.
3. Explain **`x($)`**, **`length(x)`**, **`x(2:3)`**, **`x(:)`**, and **`x([1,1])`**.
4. Reverse the vector **`x`**.

Exercise 5 :

1. Let the vector **C = [-2, 5, -1 , 0, 2, 13, 6, 9, -4, 6, 1, 8, 2, -3, 11]**. Find the elements of **C** that are greater than **-1** and less than **7**, then replace them with **1**.
2. Construct a vector **D** containing the unique elements of **C** without duplicates.