**Badji Mokhtar university of Annaba** **S.T. 2**
**Numerical Methods .** **University year 2025/2026**

**Serie n° 4**

**Exercise 1** Let be the following system of linear equations

$$(S1)\begin{cases} x_1 + 3x_2 + 5x_3 + 2x_4 = 1 \\ -x_1 - 3x_2 + 4x_3 + x_4 = 5 \\ 2x_1 + 5x_2 + 3x_3 = -2 \\ -x_1 + 2x_2 + 3x_3 + 4x_4 = -4 \end{cases}$$

1- Write this system in matrix form $Ax = b$ and show that it has a unique solution.
2- Solve this system using Gauss's method, and deduce the value of the determinant of $A$.
3- Using Jordan's method, find the solution to this system and the inverse matrix $A^{-1}$.

**Exercice 2** Given the following system

$$(S2)\begin{cases} x_1 + 3x_2 + x_3 = 1 \\ -x_1 - 2x_2 + 2x_3 = 2 \\ 2x_1 + x_2 + 3x_3 = -2 \end{cases}$$

1- Write this system in matrix form $Ax = b$ and show that it has a unique solution.
2- Can the matrix $A$ be decomposed into the form $A = L.U$, where $L$ is a lower triangular matrix and $U$ is a upper triangular matrix?
3- If the answer is yes, solve the system using Doolittle's method and deduce the value of the determinant of $A$.

**Exercice 2** Given the following system

$$(S3)\begin{cases} 2x_1 - x_2 + x_3 = 1 \\ -x_1 + 2x_2 - x_3 = 2 \\ x_1 - x_2 + 2x_3 = 3 \end{cases}$$

1- Write this system in matrix form $Ax = b$ and show that it has a unique solution.
2- Can the matrix $A$ be decomposed into the form $A = L.L^t$, where $L$ is a lower triangular matrix?
3- If the answer is yes, solve the system using Doolittle's method and deduce the value of the determinant of $A$.