Practical 4: Perform Operations on a Matrix Using SciLab

Aim:

To perform the operations (+, -, *, transpose ('), determinant (det()), and inverse (inv())) on a matrix using SciLab.

Materials Required:

- SciLab software (version 6.1 or higher)
- A computer system with SciLab installed

Theory (In Brief):

A matrix is a rectangular array of numbers or elements arranged in rows and columns. Matrix operations are fundamental in mathematics, particularly in linear algebra. SciLab provides built-in functions to perform matrix operations efficiently.

Matrix Operations Covered:

1. Addition (+): The sum of two matrices is obtained by adding corresponding elements. This operation is only possible for matrices of the same dimensions.
2. Subtraction (-): The difference of two matrices is obtained by subtracting corresponding elements.
3. Multiplication (*): Matrix multiplication involves the dot product of rows and columns. The number of columns in the first matrix must match the number of rows in the second matrix.
4. Transpose ('): The transpose of a matrix is obtained by swapping rows and columns.
5. Determinant (det()): The determinant is a scalar value that can be computed from a square matrix and provides important properties of the matrix.
6. Inverse (inv()): The inverse of a square matrix A is a matrix A■¹ such that A × A■¹ = I, where I is the identity matrix.

Applications:

- Solving systems of linear equations.
- Computer graphics and image processing.
- Engineering simulations and modeling.

Formulas Required:

1. Matrix Addition: C_ij = A_ij + B_ij
2. Matrix Subtraction: C_ij = A_ij - B_ij
3. Matrix Multiplication: C_ij = sum(A_ik * B_kj)

4. Transpose: (A■)_ij = A_ji

5. Determinant of a 2x2 Matrix: det(A) = ad - bc for A = [[a, b], [c, d]]

6. Inverse of a 2x2 Matrix: A■¹ = (1/det(A)) * [[d, -b], [-c, a]] if det(A) ≠ 0

7. Determinant of an m x n Matrix: For a square matrix A of size n x n, the determinant is defined recursively as: det(A) = ∑ (-1)^(i+j) * a_ij * M_ij, where M_ij is the minor obtained by deleting the i-th row and j-th column of A.

8. Inverse of an m x n Matrix: The inverse of a square matrix A exists if and only if det(A) ≠ 0. It is calculated as: A■¹ = (1/det(A)) * Adj(A), where Adj(A) is the adjoint of A consisting of the transposed matrix of cofactors.

Result:

Matrix operations including addition, subtraction, multiplication, transpose, determinant, and inverse were successfully performed using SciLab.