

Experiment - 8

AIM : Solution of linear system of equation using L-U decomposition method

CODE:

```
clc;
clear;
disp("Prattayaya || 13601 || B.sc Electronics (Hons)")
disp("Enter the dimensions of the matrix (n for n x n):");
n = input("Dimension (n): ");
disp("Enter the coefficients of the matrix (A) row-wise:");
A = zeros(n, n);
for i = 1:n
    for j = 1:n
        A(i, j) = input("Element A[" + string(i) + "," + string(j) +
    "]: ");
    end
end
disp("Enter the constants (b) row-wise:");
b = zeros(n, 1);
for i = 1:n
    b(i) = input("Element b[" + string(i) + "]: ");
end
N = n; // Dimension of the matrix
L = zeros(N, N); // Lower triangular matrix
U = zeros(N, N); // Upper triangular matrix
// Initialize L
for a = 1:N
    L(a, a) = 1; // Set diagonal elements of L to 1
end
// LU Decomposition
U(1, :) = A(1, :);
L(:, 1) = A(:, 1) / U(1, 1);
for i = 2:N
    for j = 1:N
        U(i, j) = A(i, j) - L(i, 1:i-1) * U(1:i-1, j);
    end
    for k = i+1:N
        L(k, i) = (A(k, i) - L(k, 1:i-1) * U(1:i-1, i)) / U(i, i);
    end
end
// Forward substitution to solve Ly = b
Y = zeros(N, 1);
Y(1) = b(1) / L(1, 1);
for k = 2:N
    Y(k) = (b(k) - L(k, 1:k-1) * Y(1:k-1)) / L(k, k);
end
// Back substitution to solve Ux = y
X = zeros(N, 1);
X(N) = Y(N) / U(N, N);
for k = N-1:-1:1
    X(k) = (Y(k) - U(k, k+1:N) * X(k+1:N)) / U(k, k);
end
```

```
// Display results
disp("Original Matrix A:");
disp(A);
disp("Constants Vector b:");
disp(b);
disp("Lower Triangular Matrix L:");
disp(L);
disp("Upper Triangular Matrix U:");
disp(U);
disp("Solution Vector x ");
disp(X);
```

CONSOLE:

```
"Prattayaya || 13601 || B.sc Electronics (Hons)"
"Enter the dimensions of the matrix (n for n x n):"
Dimension (n): 3

"Enter the coefficients of the matrix (A) row-wise:"
Element A[1,1]: 2

Element A[1,2]: 3

Element A[1,3]: 4

Element A[2,1]: 6

Element A[2,2]: 7

Element A[2,3]: 8

Element A[3,1]: 4

Element A[3,2]: 9

Element A[3,3]: 4

"Enter the constants (b) row-wise:"
Element b[1]: 2

Element b[2]: 1

Element b[3]: 4
```

"Enter the constants (b) row-wise:"

Element b[1]: 2

Element b[2]: 1

Element b[3]: 4

"Original Matrix A:"

2. 3. 4.

6. 7. 8.

4. 9. 4.

"Constants Vector b:"

2.

1.

4.

"Lower Triangular Matrix L:"

1. 0. 0.

3. 1. 0.

2. -1.5 1.

"Upper Triangular Matrix U:"

2. 3. 4.

0. -2. -4.

0. 0. -10.

"Solution Vector x "

-2.

1.

0.75

--> |
