Assignment-3

Problem-1: Write a computer program for Cholesky's decomposition to the symmetric matrix $A=\begin{bmatrix} 4 & 3 & 2 & 1 \\ 3 & 3 & 2 & 1 \\ 2 & 2 & 2 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$. You have to show that $A = \mathcal{L}\mathcal{L}^T$, where $\mathcal{L}$ is a lower triangular matrix.

Answer:

$$\mathcal{L} = \begin{bmatrix} 2.000000 & 0.000000 & 0.000000 & 0.000000 \\ 1.500000 & 0.866025 & 0.000000 & 0.000000 \\ 1.000000 & 0.577350 & 0.816497 & 0.000000 \\ 0.500000 & 0.288675 & 0.408248 & 0.707107 \end{bmatrix}.$$

Problem-2: Solve the following set of equations by writing a code for the Gauss-Seidel method.

$$\begin{bmatrix} 12 & 3 & -5 \\ 1 & 5 & 3 \\ 3 & 7 & 13 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 28 \\ 76 \end{bmatrix}$$

Print results at each step of iteration till the last coverged result. Exact solution for this case is

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \\ 4 \end{bmatrix}$$