Assignment 3. Solution of linear equations Marks 15

re-Posted on 20.09.2022 and due on 09.10.2022 midnight

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1. Given below is a system of linear equations. Use Gauss-Jordon and LU decomposition to solve it. **[5]**

$$
\begin{aligned}
19 &= a_1 - a_2 + 4a_3 + 2a_5 + 9a_6 \\
2 &= 5a_2 - 2a_3 + 7a_4 + 8a_5 + 4a_6 \\
13 &= a_1 + 5a_3 + 7a_4 + 3a_5 - 2a_6 \\
-7 &= 6a_1 - a_2 + 2a_3 + 3a_4 + 8a_6 \\
-9 &= -4a_1 + 2a_2 + 5a_4 - 5a_5 + 3a_6 \\
2 &= 7a_2 - a_3 + 5a_4 + 4a_5 - 2a_6
\end{aligned}
$$

2. Solve the following linear equation by Cholesky decomposition (check for symmetric matrix) and Gauss-Seidel to a precision of 10^{-6}. **[5]**

$$
\begin{pmatrix}
4 & -1 & 0 & -1 & 0 & 0 \\
-1 & 4 & -1 & 0 & -1 & 0 \\
0 & -1 & 4 & 0 & 0 & -1 \\
-1 & 0 & 0 & 4 & -1 & 0 \\
0 & -1 & 0 & -1 & 4 & -1 \\
0 & 0 & -1 & 0 & -1 & 4
\end{pmatrix}
\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{pmatrix}
=
\begin{pmatrix} 2 \\ 1 \\ 2 \\ 2 \\ 1 \\ 2 \end{pmatrix}
$$

3. Solve the following linear equation by LU decomposition (without rearranging) and Jacobi & Gauss-Seidel (with rearranging to make diagonally dominant using code) to a precision of 10^{-6}. **[5]**

$$
\begin{pmatrix}
4 & 0 & 4 & 10 & 1 \\
0 & 4 & 2 & 0 & 1 \\
2 & 5 & 1 & 3 & 13 \\
11 & 3 & 0 & 1 & 2 \\
3 & 2 & 7 & 1 & 0
\end{pmatrix}
\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{pmatrix}
=
\begin{pmatrix} 20 \\ 15 \\ 92 \\ 51 \\ 15 \end{pmatrix}
$$