

1. (10 points)

Solve a linear system of equations given by

$$\begin{aligned}2x_1 + x_2 + x_4 &= 4 \\2x_1 + 2x_2 + 2x_3 + 4x_4 &= 10 \\4x_1 + 2x_2 - 3x_3 + 3x_4 &= 6 \\-2x_1 + x_2 + x_3 + 5x_4 &= 5\end{aligned}$$

You should first write the above system in matrix form, $Ax = b$. Then, use Gaussian Elimination to factor the matrix $A = LU$, where L is unit lower triangular and U is upper triangular. Now you have $Ax = b \Rightarrow (LU)x = b$. Use forward substitution to find y such that $Ly = b$, and as the last step use backward substitution to find the final answer x such that $Ux = y$.

Note 1: Do the above computations using pen/pencil and paper. Show all intermediate steps.

Note 2: Verify your answer in MATLAB using $A \setminus b$.

2. (10 points)

Write a program in Matlab $[x] = \text{lsolve}(A,b)$ to do the above computations. Note that A can be any matrix and b can be any right hand side. However, assume that A is nonsingular and that no “pivoting” is required to solve the linear system. You can use 'if', 'for', 'while' statements and '+', '-', '*', and '/' operations. DO NOT USE any MATLAB functions that directly solve the linear system, such as, LU `mldivide`, `\`, etc.