

Assignment 3: LU Decomposition
CL 249: Computational Methods Lab
Date: 20/08/24

1. Find the inverse of the following matrix using the LU decomposition method:

$$\text{Matrix} = \begin{bmatrix} 2 & 3 & 1 & 4 & 5 \\ 6 & 13 & 5 & 19 & 8 \\ 2 & 19 & 13 & 17 & 3 \\ 8 & 3 & 5 & 25 & 1 \\ 4 & 4 & 3 & 7 & 15 \end{bmatrix}$$

2. Suppose there exists a water management pipeline system in a town such that the water comes from 3 regions of town and merges into one single bigger drainage line, We know that the water flow depends on three-parameter, which are related to flow as

$$F_1 = x.T \quad (1)$$

$$F_2 = y.\mu \quad (2)$$

$$F_3 = z.\rho \quad (3)$$

Where T is temperature, μ is viscosity and ρ density (all in SI Units), and x,y, and z are proportionality constants. Flow rate units are m^3/hr .

The temperature, viscosity, and density values of the three pipelines are given below:

Temperature	Viscosity	Density
25.5	10.5	1.05
15.2	18.7	0.99
-5.1	8.9	1

As a wastewater management firm manager, you are tasked to find x,y, and z values to construct new pipelines for the town. You have data on the total flow rates of the 3 pipelines taken every 15 days.

Pipe\ Day	Day 1st	Day 15th	Day 30th
P1	12	11	10
P2	8	7	10
P3	10	11	10

Calculate the values of x,y, and z (with their units) using the LU Decomposition method for all three days and come up with an average value for them.

(Hint: Total flow is $F = x.T + y.\mu + z.\rho$)

Submission Details:

Q1.

1. Submit the Python script or Jupyter Notebook. Ensure your code is well-documented, with comments explaining the logic behind each step.
2. Submit a **PDF** file containing the final inverse of the matrix.
3. Also, mention the number of iterations that were required to be solved.

Q2.

- a. Submit the Python script or Jupyter Notebook. Ensure your code is well-documented, with comments explaining the logic behind each step.
- b. Submit a **PDF** file containing the table values of x,y, and z with their respective units and average values of three.

You can make a single PDF file containing answers to both questions.