

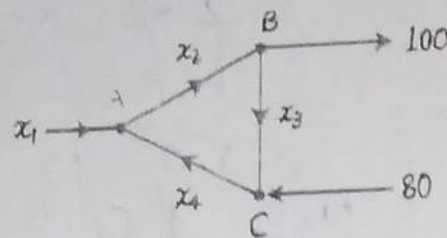


COMSATS University Islamabad (CUI)
(Islamabad Campus)
Midterm Exam, FALL 2024

Program: BCS-4B, BAI-4A
Linear Algebra (MTH-231)
November 07, 2024

Total Marks: 25
Time Allowed: 1½ hrs.
Instructor: Dr. Adeel Ahmad

1. Find the general flow pattern of the network shown in the figure. Assuming that the flows are all non-negative, what is the smallest possible value of x_4 ? (5)



2. Find an LU factorization of the following matrix: (5)

$$\begin{bmatrix} 2 & -3 & 4 \\ -4 & 8 & -7 \\ 6 & -5 & 14 \\ -6 & 9 & -12 \\ 8 & -6 & 19 \end{bmatrix}$$

3. Find the inverses of the following matrix, if possible, using elementary row operations: (5)

$$\begin{bmatrix} 1 & 2 & -1 \\ -4 & -7 & 3 \\ -2 & -6 & 4 \end{bmatrix}$$

4. Let (10)

$$A = \begin{bmatrix} 2 & 0 & 6 \\ -1 & 8 & 5 \\ 1 & -2 & 1 \end{bmatrix}$$

Let $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be a linear transformation with $T(\mathbf{x}) = A\mathbf{x}$.

- Find $\mathbf{x}$ such that $T(\mathbf{x}) = (0, -1, -4)$.
- Determine the linear dependence/independence of the columns of A .
- Determine if the columns of A span the space $\mathbb{R}^3$.
- Determine if the given transformation is (a) one-to-one and (b) onto.

Best of luck