National University of Computer & Emerging Sciences, Karachi
Spring-2022 CS/AI/CYS -Department
Mid-Term
March 11, 2022 Friday 08:30-09:30

Course Code: MT – 1004	Course Name: Linear Algebra
Instructor Name : Amber Sheikh/ Alishba Tariq	
Student Roll No:	Section No:

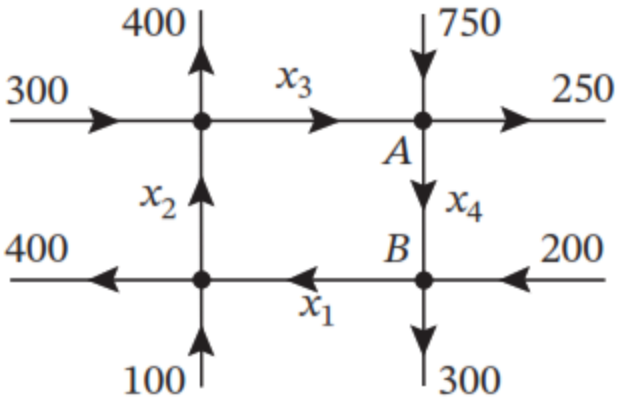
Instructions:

- Return the question paper.
- Read each question completely before answering it. **There are 03 Questions and 02 pages.**
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.
- Graphical Calculator is not allowed.

Time: 60 minutes **Max Marks: 30**

Question 01: **[04+04+02=10]**

Q: 3 The accompanying figure shows a network of one-way streets with traffic flowing in the directions indicated. The flow rates along streets are measured as the average number of vehicles per hour.



a. Set up a linear system whose solution provides the unknown flow rates.
b. Solve the system of for unknown flow rates.
c. If the flow along the road from *A* to *B* must be reduced for construction, what is the minimum flow that is required to keep traffic flowing on all roads?

Question 02: **[05+05=10]**

a. Evaluate the determinant of $\boldsymbol{A}$ by a cofactor expansion along a row or column of your choice.

$$\boldsymbol{A} = \begin{bmatrix} 1 & 2 & 0 & 4 \\ 2 & 5 & 0 & 8 \\ 3 & 6 & -1 & 12 \\ -2 & -5 & 3 & -7 \end{bmatrix}$$

b. Determine whether $\boldsymbol{T}$ a matrix transformation is or not?

$$\boldsymbol{T}(\boldsymbol{x}, \boldsymbol{y}, \boldsymbol{z}) = (\boldsymbol{x} + \boldsymbol{y}, \boldsymbol{y} + \boldsymbol{z}, \boldsymbol{x})$$

Question 03: **[06+04=10]**

a. Find the inverse by inversion algorithm:

$$A = \begin{bmatrix} -5 & 0 & -12 \\ 3 & 1 & -1 \\ 1 & 0 & 3 \end{bmatrix}$$

b. Let

$$\begin{bmatrix} 1 & 2 & k \\ 3 & h & 8 \end{bmatrix}$$

Be the augmented matrix for a linear system. Find for what values of $\boldsymbol{h}$ and $\boldsymbol{k}$ the System as

i. a unique solution.
ii. a parametric solution
iii. no solution
