National University of Computer and Emerging Sciences, Lahore Campus				
	Course:	Linear Algebra	Course Code:	MT-1004
	Program:	BS(CS)/BS(DS)/ BS(SE)	Semester:	Fall 2022
	Duration:	60 mins	Total Marks:	40
	Date:	26-09-2022	Weight	12.5%
	Section:	All	Page(s):	2
	Exam:	Mid 1	Roll No:	
Name:				

Instruction/Notes:
Attempt all questions. If you believe that some essential piece of information is missing, make an appropriate assumption and use it to solve the problem. Use of programmable calculators is not allowed. Exchange of stationary is strictly prohibited. Best of luck!

Question no. 1: (5+5+5+3+2 marks) (CLO #1)

a) Suppose that the augmented matrix of a system of linear equations has been partially reduced using elementary row operations to

$$\left[\begin{array}{cccc|c} 1 & -1 & a-2 & & 3 \\ 0 & 1 & 2b+1 & & -1 \\ 0 & 0 & a-1 & & b+3 \end{array}\right]$$

Find all values of a and b for which the given system has no solution, exactly one solution and infinitely many solutions.

b) Find the matrix B by using the given information

$$(5B^T)^{-1} = \begin{bmatrix} 1 & 5 \\ 3 & -4 \end{bmatrix}$$

c) Evaluate the given determinant by using row reduction method.

$$\begin{vmatrix} 1 & -1 & 5 & 5 \\ 3 & 1 & 2 & 4 \\ -1 & -3 & 8 & 0 \\ 1 & 1 & 2 & -1 \end{vmatrix}$$

d) For the following linear system of equation, find the general solution in parametric form and also give the geometric representation.

$$x + 3y = 3$$
$$2x + 6y = 6$$

e) Identify the row operation corresponding to E and verify that the product EC results from applying the row operation to C.

$$E = \begin{bmatrix} 1 & 0 & 0 \\ -4 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \qquad C = \begin{bmatrix} 2 & -1 & 0 & -4 & -4 \\ 1 & -3 & -1 & 5 & 3 \\ 2 & 0 & 1 & 3 & -1 \end{bmatrix}$$

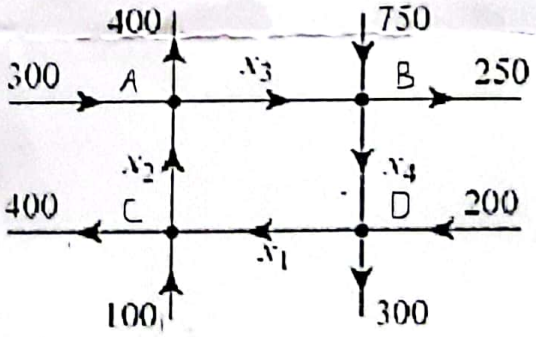
Question no. 2: (10 marks) (CLO #1)

Use inversion algorithm to find the inverse of the following matrix.

$$\begin{bmatrix} 1 & 4 & 0 \\ -2 & 2 & 3 \\ 3 & 8 & 7 \end{bmatrix}$$

Question no. 3: (10 marks) (CLO #1)

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



Set up a linear system whose solution provides the unknown flow rates and solve the system for the unknown flow rates using Gauss Elimination.