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National University of Computer and Emerging Sciences, Lahore Campus

Course:	Linear Algebra	Course Code:	MT1004
Program:	BS (SE)	Semester:	Spring 2024
Duration:	60 Minutes	Total Marks:	40
Paper Date:	29-02-2024	Weight	15%
Section:	ALL	Page(s):	1
Exam:	Sessional-1	Roll No:	22L-7971

Instruction/Notes:

1. **Programmable calculators are not allowed.**
2. **Do all the questions in the given order as mentioned in the paper.**
3. **Do not ask any questions regarding contents. If you feel any essential information missing make your own assumption.**

Question # 1 (CLO-1) [10] The given matrix represents an augmented matrix for a linear system.

$$\left[\begin{array}{ccc|c} 1 & 3 & 0 & 2 \\ 0 & 2 & 7 & 8 \\ 0 & 4 & -2 & 5 \\ 0 & 0 & 0 & 0 \end{array}\right] \qquad \begin{bmatrix} 1 & 3 & 0 & 2 \\ -2 & -4 & 7 & 4 \\ 3 & 5 & 2 & 1 \\ 1 & -1 & 2 & -3 \end{bmatrix}$$

$x_1 + 3x_2 + 0x_3 = 2$
$-2x_1 - 4x_2 + 7x_3 = 4$
$3x_1 + 5x_2 + 2x_3 = 1$
$x_1 - x_2 + 2x_3 = -3$

a. Write the corresponding set of linear equations for the system.
b. Use Gaussian elimination to solve the linear system.

$x_3 = 11/16$
$x_2 = 5\,1/32$
$x_1 = -\frac{89}{32}$

Question # 2 (CLO-1) [10] Given the matrix $\begin{bmatrix} -1 & 1 & 2 \\ 3 & 0 & -5 \\ 1 & 7 & 2 \end{bmatrix}$

a. Find the minor M_{21} and cofactor C_{21}. -12 12
b. Evaluate the determinant by cofactor expansion. -4

Question # 3 (CLO-1) [10]

a. Find an equation of plane passing through a point $P(1, 1, 4)$ having normal vector $\vec{n} = (1, 9, 8)$. $x + 9y + 8z - 42$
b. Also find the distance between the point Q(-1, -1, 2) and the plane . Using the equation of the plane in part (a). $36/\sqrt{146}$

Question # 4 (CLO-1) [10] Find the vector component of $\vec{u}$ along $\vec{a}$ and the vector component of $\vec{u}$ orthogonal to $\vec{a}$ given that $\vec{u} = (2, 1, 1, 2)$ & $\vec{a} = (4, -4, 2, -2)$.

Proj $= \left(\frac{1}{5}, -\frac{1}{5}, \frac{1}{10}, -\frac{1}{10}\right)$

Orthogonal $= \left(\frac{9}{5}, \frac{6}{5}, \frac{9}{10}, \frac{21}{10}\right)$