



COMSATS University Islamabad
Islamabad Campus
Terminal Exam Fall-2019

Program: BCS
Semester: IV-A,B
Subject: Linear Algebra
Date: January 14, 2020.

Total Marks: 50
Time Allowed: 3 hours
Instructor: Dr. Shagufta

Instructions for attempting paper:

1. Carrying of digital dairies is not allowed.
2. Mobile phones will not be allowed in the examination hall.
3. Answer all questions.

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Q-1 Find basis for the row space, column space and null space of the following matrix

$$\begin{bmatrix} 1 & 0 & -2 \\ 3 & 1 & -2 \\ -5 & -1 & 9 \end{bmatrix}$$

Q-2 Show that the vectors

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$$

satisfying the conditions $x_1 = 0$; $x_3 = x_4$ form a subspace of R^4 , find a basis for that subspace. Furthermore, show that vectors satisfying $x_3 = 1$ do not form a subspace of R^4 .

Q-3 The two matrices A and B are row equivalent

$$A = \begin{bmatrix} 1 & 0 & -2 \\ 3 & 1 & -2 \\ -5 & -1 & 9 \end{bmatrix}, B = \begin{bmatrix} 1 & 0 & -2 \\ 0 & 1 & 4 \\ 0 & 0 & 3 \end{bmatrix}$$

The eigenvalues of A and B will be same or different? Justify your answer.

Q-4 Find the LU-factorization for given matrix.

$$A = \begin{bmatrix} 2 & -2 & 4 \\ 1 & -3 & 1 \\ 3 & 7 & 5 \end{bmatrix}$$

Q-5 Choose h and k such that the system has no solution, a unique solution, and many solutions.

$$x_1 + 3x_2 = k$$

$$4x_1 + hx_2 = 8$$

P.T.O

Q-6 The given set $\{x_1, x_2\}$ is a basis for $W = \text{Span}\{x_1, x_2\}$. Use Gram Schmidt process to construct an orthogonal basis W' where

$$x_1 = \begin{bmatrix} 3 \\ 0 \\ -1 \end{bmatrix}, x_2 = \begin{bmatrix} 8 \\ -5 \\ -6 \end{bmatrix}.$$

Q-7 For the matrix

$$A = \begin{bmatrix} 1 & 0 & -2 \\ 3 & 1 & -2 \\ -5 & -1 & 9 \end{bmatrix}$$

find the orthogonal space to row space of the matrix.

Q-8 For the matrix

$$A = \begin{bmatrix} 4 & 0 & 1 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$$

find the eigenvalues and basis for the eigen spaces of the matrix. Determine whether the given matrix is diagonalizable. Justify your answer.

Q-9 Use co-ordinate vectors to test whether the following set of polynomials span P_2
 $\{1+t^2, t+t^2, 1+2t+t^2\}$

Q-10 Let $T: R^2 \rightarrow R^2$ be a linear transformation such that
 $T(x_1, x_2) = (x_1 + x_2, 4x_1 + 5x_2)$. Find X such that $T(X) = (3, 8)$