DEPARTMENT OF BASIC SCIENCES AND ISLAMIAT

University of Engineering and Technology, Peshawar Campus

(Computer System Engineering, 3rd Semester)

Linear Algebra (BSI-111) Fall Semester-2022

Assignment NO.2

CLO-2, Cognitive Domain, PLO-1, 2 Taxonomy Level-3

Q.1 (a) Discuss linear transformation and linear operator. Give at least three names of some well-known linear transformations.

(b) Sketch the image of the given point p or vector u under the given Linear Transformation being a counterclockwise rotation through P(-1,3)

Q.2 Use the substitution scheme and the matrix A and its inverse given by

(a) $A=\begin{bmatrix}1 & 2 & 3\\ 1 & 1 & 2\\ 0 & 1 & 2\end{bmatrix}$, $A^{-1}=\begin{bmatrix}0 & 1 & -1\\ 2 & -2 & -1\\ -1 & 1 & 1\end{bmatrix}$

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(b) Decode the massage 67 44 41 49 39 19 113 76 62 104 69 55.

Q.3 (a) Find a plane that passes through the point (2, 4, -3) and is parallel to the plane -2x+4y-5z+6=0.

(b) Find parametric equations of the line passing through the point (-2, 3, 4) and perpendicular to the line passing through the points (3,-2,4), and (0, 3, 4)

Q4 (a) Let $L:R^3\to R^3$ be the linear transformation defined by

$L\left(\begin{bmatrix}x\\ y\\ z\end{bmatrix}\right)=\begin{bmatrix}-1 & 2 & 0\\ 1 & 1 & 1\\ 2 & -1 & 1\end{bmatrix}\begin{bmatrix}x\\ y\\ z\end{bmatrix}$. Is $w=\begin{bmatrix}1\\ 2\\ -1\end{bmatrix}$ in range L?

(b) Find all constants a such that the vectors (a, 2) and (a,-2) are orthogonal.

Q5. (a) Determine whether the given set together with the given operations is a vector Space. The set of all positive real numbers u with the operations $u\oplus v=uv$ *and* $c\otimes u^c=u^c$.

(b) Determine whether the given subset of is a subspace.

The set of all Polynomials of the form

$a_2t^2 + a_1t + a_0$, *where* $a_0 = 2$

(c) Verify which of the following subsets of R^3 are subspaces of R^3

(i) $(a, b, 2)$

(ii) (a, b, c), Where $c = a + b$

(iii) (a, b, c), Where $c > 0$.

Q6. (a) Discuss basis for a vector space.

(b) Does the following set of vectors form a basis for R^3?
$\{(3,2,2), (-1,2,1), (0,1,0)\}$

Q7. (a) Find the Characteristic polynomial, eigenvalues, and eigenvectors of the matrix

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

(b) Find a 2x2 nondiagonal matrix whose eigenvalues are 2 and -3, and respective Eigenvectors are

$$\begin{bmatrix} -1 \\ 2 \end{bmatrix} \quad \textit{and} \quad \begin{bmatrix} 1 \\ 1 \end{bmatrix}.$$