



National University of Computer & Emerging Sciences Islamabad

FAST School of Computing

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Islamabad Campus

MT1004 – Linear Algebra

Homework # 8

Question # 1

Let S be a tetrahedron with vertices $A(0, 0, 0)$, $B(1, 0, 0)$, $C(0, 1, 0)$, and $D(1, 1, 1)$. Find the image of S onto the plane $z = 2$ under the perspective projection with center of projection/perspectivity at $(2, -1, 1)$.

Question # 2

Find the matrix of the given linear transformations. Describe $\ker(T)$ and $\text{range}(T)$. Determine whether the linear transformation T is one-to-one, onto and isomorphism.

(i) $T: \mathbb{P}_2 \rightarrow \mathbb{R}^3$ by $T(a + bx + cx^2) = \begin{bmatrix} 2a - b \\ a + b - 3c \\ c - a \end{bmatrix}$.

(ii) $T: M_{22} \rightarrow M_{22}$ by $T(A) = AB$, where $B = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$.

(iii) $T: \mathbb{R}^3 \rightarrow W$ by $T \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} a + b + c & b - 2c \\ b - 2c & a - c \end{bmatrix}$, where W is the vector space of all symmetric 2×2 matrices.

Question # 3

Let $T: \mathbb{R}^2 \rightarrow \mathbb{P}_2$ be a linear transformation for which $T \begin{bmatrix} 1 \\ 1 \end{bmatrix} = 1 - 2x$ and $T \begin{bmatrix} 3 \\ -1 \end{bmatrix} = x + x^2$

Find $T \begin{bmatrix} -7 \\ 9 \end{bmatrix}$ and $T \begin{bmatrix} a \\ b \end{bmatrix}$.