Matrix theory Assignment 13

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Abstract—**This document contains the concept of linear transformations.**

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1 Problem

Let **T** and **U** be the linear operators on $\mathbb{R}^2$ defined by $\mathbf{T}(x_1, x_2) = (x_2, x_1)$ and $\mathbf{U}(x_1, x_2) = (x_1, 0)$.

Give rules like the ones defining **T** and **U** for each of the transformations **U** + **T**, **UT**, **TU**, $\mathbf{T}^2$, $\mathbf{U}^2$. $\mathbb{R}^2$ into $\mathbb{R}^2$ is linear transformation?

2 Solution

Let **T** and **U** defined by matrices **A** and **B** such that ,

$$\mathbf{T(x) = Ax}; \quad \mathbf{U(x) = Bx} \qquad (2.0.1)$$

Where,

$$\mathbf{A} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}; \quad \mathbf{B} = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \qquad (2.0.2)$$

Table 0 lists the summary of each Transformations.

Transformations	Matrix	Vector
U + T	**(B + A)**	$\begin{pmatrix} x_1 + x_2 \\ x_1 \end{pmatrix}$
UT	**BA**	$\begin{pmatrix} x_2 \\ 0 \end{pmatrix}$
TU	**AB**	$\begin{pmatrix} 0 \\ x_1 \end{pmatrix}$
T^2	**A**^{2}	$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$
U^2	**B**^{2}	$\begin{pmatrix} x_1 \\ 0 \end{pmatrix}$

TABLE 0: Summary