Matrix theory Assignment 11

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***Abstract*—This document contains the concept of sub space.**

Download all python codes from

https://github.com/saipranavkr/EE5609/codes

and latex-tikz codes from

https://github.com/saipranavkr/EE5609

1 Problem

Find the range, rank, null space, and nullity for the zero transformation and the identity transformation on a finite-dimensional space V.

2 Solution

Suppose vector space $\mathbf{V}$ has dim($\mathbf{V}$) = n. Table 0 provides the properties of range, rank, null space and nullity of zero and identity transformation on a vector space $\mathbf{V}$

3 Example

Let T_0, T_I be the zero and identity transformation on the vector space $\mathbf{V}$ such that dim($\mathbf{V}$) = 2. Let,

$$\mathbf{v} = \begin{pmatrix} v_1 \\ v_2 \end{pmatrix}$$

be a vector in $\mathbf{V}$. Now,

$$T_0\mathbf{v} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \tag{3.0.1}$$

From (3.0.1) we can tell that, it has range of {0}, Rank of Zero, Null space as $\mathbf{V}$ and nullity as 2 ($\because$dim($\mathbf{V}$) = 2) Now,

$$T_I\mathbf{v} = \begin{pmatrix} v_1 \\ v_2 \end{pmatrix} \tag{3.0.2}$$

From (3.0.2) we can tell that, it has range of $\mathbf{V}$, Rank of 2, Null space as {0} and nullity as $\mathbf{0}$($\because$dim($\mathbf{0}$) = 0). Because identity transformation is the transformation $T_I : \mathbf{R}_n \to \mathbf{R}_n$ defined by $T_I(x) = x$ for every vector x

Properties	**Zero Transformation**	**Identity Transformation**
Transformation	$T_0(\mathbf{v}) = \mathbf{0}$	$T_I(\mathbf{v}) = \mathbf{v}$
Range	Zero subspace {0}	**V**
Rank	dim(**0**) = 0	dim(**V**) = n
Null space	**V**	Zero subspace {0}
Nullity	dim(**V**) = n	dim(**0**) = 0

TABLE 0: Properties of Zero and Identity transformation