Matrix theory Assignment 12

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Abstract—**This document explains zero and Identity transformations.**

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 **V** has dimension n. Table 0 provides the properties of range, rank, null space and nullity of zero and identity transformation on a vector space **V**

3 EXAMPLE

Let T_0, T_I be the zero and identity transformation on the vector space **V** of dimension 2. Let,

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

be a vector in **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 **V** and nullity as 2(The dimension of **V**) 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 **V**, Rank of 2, Null space as {0} and nullity as 0(The dimension of zero subspace). Because identity transformation is the transformation $T_I : \mathbf{R}_n \rightarrow \mathbf{R}_n$ defined by $T_I(x) = x$ for every vector x

Properties	Zero Transformation	Identity Transformation
Range	Zero subspace {0}	whole vector space $\mathbf{V}$
Rank	Zero	n
Null space	whole vector space $\mathbf{V}$	Zero subspace {0}
Nullity	whole vector space $\mathbf{V}$ $\implies n$	Zero subspace {0} $\implies 0$

TABLE 0: Properties of Zero and Identity transformation