**1.3.1**. Show that the nullspace ofcontains the nullspace of. Ifthen …

**Sol**. If, . Proved.

**1.3.2**. Find a square matrix with. Confirm that.

**Sol**. of rank 1of rank 0. of rank 1.

**1.3.3**. How is the nullspace ofrelated to the nullspaces ofand, if ?

**Sol**. Ifandshare their nullspaces where&, can also share the same nullspaces:

**1.3.4**. If row space ofcolumn space of, and also, issymmetric?

**Sol**. No. Like

**1.3.5\***. Four possibilities for the rankand sizematch four possibilities for. Find four matricestothat show those possibilities: has 1 solution for every

hassolutions

has 0 or 1 solution

, has 0 orsolutions

**Sol**.

**1.3.6**. (Important) Show thathas the same nullspace as. Here is one approach: First, ifthen\_\_\_ . This proves . Second, ifthen . Deduce.

**Sol**.

**1.3.7**. Doandalways have the same nullspace?is a square matrix.

**Sol**.

But

.

So ifexists,andhave the same nullspace.

**1.3.8**. Find the column spaceand the nullspaceof. Remember that those are vector spaces, not just single vectors. This is an unusual example with. It could not happen thatbecause those two subspaces are orthogonal.

**Sol**.

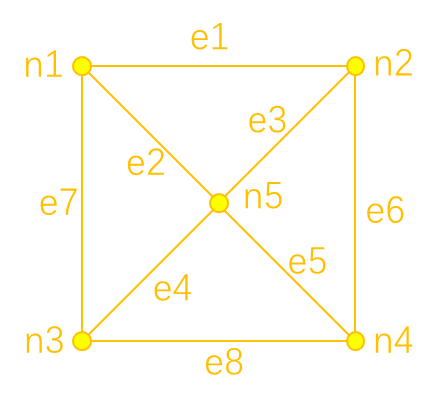
,

**1.3.9**. Draw a square and connect its corners to the center point: 5 nodes and 8 edges. Find the 8 by 5 incidence matrix of this graph (rank ). Find a vector in and independent vectors in .

**Sol**.

(Cluster)

(Kirchhoff’s Loop Law)



**1.3.10**. Ifis the zero vector, what vectors are in the nullspace of ?

**Sol**.

**1.3.11**. For subspaces S and T of with dimensions 2 and 7, what are all the possible dimensions of

(i)

(ii)

(iii)

**Sol.** and may have 0, 1, or 2 intersectional dimensions, so

(i) may be 0, 1, or 2.

(ii) may be 9, 8, or 7.

(iii)