Quiz 6

S Nithish

Abstract—**This document contains the solution of the question from NCERT 12th standard chapter 10 exercise 10.3 problem 14**

1 EXERCISE 10.3

1) If either $\mathbf{a} = 0$ or $\mathbf{b} = 0$, then $\mathbf{a}^\top\mathbf{b} = 0$. But the converse need not be true. Justify your answer with an example.

   If either $\mathbf{a} = 0$ or $\mathbf{b} = 0$, then either $a_i = 0 \ \forall i$ or $b_i = 0 \ \forall i$.
   This implies,

$$a_i b_i = 0 \forall i \Rightarrow \sum_i a_i b_i = 0 \quad (1.0.1)$$

$$\mathbf{a}^\top\mathbf{b} = \sum_i a_i b_i = 0 \quad (1.0.2)$$

   The converse need not be true, i.e if $\mathbf{a}^\top\mathbf{b}$ then it is possible that both $\mathbf{a}$ and $\mathbf{b}$ are non zero, and perpendicular to each other.
   Example:

$$\mathbf{a} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (1.0.3)$$

$$\mathbf{a}^\top\mathbf{b} = \begin{pmatrix} 1 & 1 \end{pmatrix}\begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (1.0.4)$$

$$= 1 - 1 \quad (1.0.5)$$

$$= 0 \quad (1.0.6)$$

   We, have $\mathbf{a}^\top\mathbf{b} = 0$ but $\mathbf{a} \neq 0$ and $\mathbf{b} \neq 0$.