Assignment - 12.10.5.4

Surajit Sarkar

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

CONTENTS

I. PROBLEM

if $\mathbf{a} = \mathbf{b} + \mathbf{c}$, then is true that $|\mathbf{a}| = |\mathbf{b}| + |\mathbf{c}|$? Justify your answer .

II. SOLUTION

Given

$$\mathbf{a} = \mathbf{b} + \mathbf{c} \tag{1}$$

let

$$\mathbf{b} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \mathbf{c} = \begin{pmatrix} 2 \\ -1 \\ -2 \end{pmatrix} \tag{2}$$

thus

$$\mathbf{a} = \mathbf{b} + \mathbf{c} \tag{3}$$

$$= \begin{pmatrix} 3 \\ 1 \\ 1 \end{pmatrix} \tag{4}$$

$$\|\mathbf{a}\| = \sqrt{\mathbf{a}^\top \mathbf{a}} \tag{5}$$

$$= \sqrt{\begin{pmatrix} 3 & 1 & 1 \end{pmatrix} \begin{pmatrix} 3 \\ 1 \\ 1 \end{pmatrix}} \tag{6}$$

$$= \sqrt{9+1+1} \tag{7}$$

$$= \sqrt{11} \tag{8}$$

$$\|\mathbf{b}\| = \sqrt{\mathbf{b}^\top \mathbf{b}} \tag{9}$$

$$= \sqrt{\begin{pmatrix} 1 & 2 & 3 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}} \tag{10}$$

$$= \sqrt{1+4+9} \tag{11}$$

$$= \sqrt{14} \tag{12}$$

$$\|\mathbf{c}\| = \sqrt{\mathbf{c}^\top \mathbf{c}} \tag{13}$$

$$= \sqrt{\begin{pmatrix} 2 & -1 & -2 \end{pmatrix} \begin{pmatrix} 2 \\ -1 \\ -2 \end{pmatrix}} \tag{14}$$

$$= \sqrt{4+1+4} \tag{15}$$

$$= \sqrt{9} \tag{16}$$

$$= 3 \tag{17}$$

Now

$$|\mathbf{a}| \neq |\mathbf{b}| + |\mathbf{c}|$$

https://github.com/sssurajit/fwc/blob/main/vectors/12.10.5.4/codes/code.py

Execute the code by using the command
python3 code.py