Assignment 2

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Download all latex-tikz codes from

https://github.com/Kkuntal990/C−DS/blob/main/Assignment2/assignment2.tex

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1 Problem

Show that the points $\mathbf{A} = \begin{pmatrix}1\\2\\7\end{pmatrix}$, $\mathbf{B} = \begin{pmatrix}2\\6\\3\end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix}3\\10\\-1\end{pmatrix}$ are collinear.

2 Solution

We will solve for a general case of given **n** points of **m** dimensions. Check whether three points

$$A = \begin{pmatrix}x_1\\x_2\\\vdots\\x_n\end{pmatrix}, B = \begin{pmatrix}y_1\\y_2\\\vdots\\y_n\end{pmatrix}, C = \begin{pmatrix}z_1\\z_2\\\vdots\\z_n\end{pmatrix}$$

are collinear or not.

2.1 Necessary condition

Let's take three points **a**, **b** and **c**. We will say that these points are collinear if and only if the $max|\overrightarrow{AB}|, |\overrightarrow{AC}|, |\overrightarrow{BC}|$ = sum of other two distances. That is, let's say $\overrightarrow{AB}$ is the maximum of three,

$$\implies \overrightarrow{AB} = \overrightarrow{AC} + \overrightarrow{BC}$$

2.2 Proof:

Without loss of generality we can take the above example. Let's say that $\implies \overrightarrow{AB} < \overrightarrow{AC} + \overrightarrow{BC}$, then due to triangle inequality we can say that the points **a**, **b** and **c** form a triangle.

2.3 Example

Taking our above problem. $\mathbf{A} = \begin{pmatrix}1\\2\\7\end{pmatrix}$, $\mathbf{B} = \begin{pmatrix}2\\6\\3\end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix}3\\10\\-1\end{pmatrix}$

$$|\overrightarrow{AB}| = 5.744 \tag{2.3.1}$$

$$|\overrightarrow{AC}| = 11.489 \tag{2.3.2}$$

$$|\overrightarrow{BC}| = 5.744 \tag{2.3.3}$$

Therefore, the points are collinear.

2.4 Proof by plot

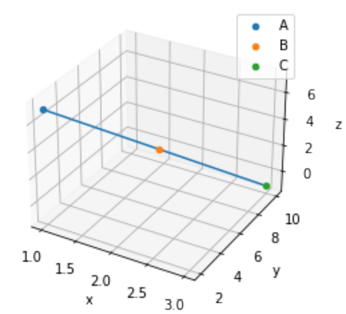

Fig. 0: Plotting the 3 points