ASSIGNMENT 1

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***Abstract*—This document illustrates the ratio in which line divides another line joining two points**

Download all python codes from

https://github.com/EE20MTECH14019/EE5609/tree/master/Assignment_1/Codes

and latex-tikz codes from

https://github.com/EE20MTECH14019/EE5609/tree/master/Assignment_1

1 Problem

In what ratio is the line joining $\begin{pmatrix}-1\\1\end{pmatrix}$ and $\begin{pmatrix}5\\7\end{pmatrix}$ divided by the line

$$\begin{pmatrix}1 & 1\end{pmatrix}\mathbf{x} = 4 \tag{1.0.1}$$

2 Construction

2.1 Intersecting Point

The intersecting point of two line segments can be found by row reducing the augmented matrix formed using two line segments. Let's say the intersecting point is $\mathbf{X}$

2.2 Ratio

The point $\mathbf{X}$ divides the line segment joining the two points $\mathbf{A}$=$\begin{pmatrix}-1\\1\end{pmatrix}$ and $\mathbf{B}$=$\begin{pmatrix}5\\7\end{pmatrix}$ in ratio k : 1. Then,

$$\mathbf{X} = \frac{(k\mathbf{B} + \mathbf{A})}{(k+1)} \tag{2.2.1}$$

3 solution

The line joining the points $\mathbf{A}$ and $\mathbf{B}$ is:

$$\begin{pmatrix}-1 & 1\end{pmatrix}\mathbf{X} = 2$$

Given another line CD:

$$\begin{pmatrix}1 & 1\end{pmatrix}\mathbf{X} = 4$$

The intersection of these lines is obtained from:

$$\begin{pmatrix}-11 & 1\\1 & 1\end{pmatrix}\mathbf{X} = \begin{pmatrix}2\\4\end{pmatrix}$$

The augmented matrix for the above equations is row reduced as follows

$$\begin{pmatrix}-1 & 1 & 2\\1 & 1 & 4\end{pmatrix} \xleftrightarrow{R_1\leftarrow R_2-R_1} \begin{pmatrix}2 & 0 & 2\\1 & 1 & 4\end{pmatrix}$$
$$\xleftrightarrow{R_1\leftarrow R_1/2} \begin{pmatrix}1 & 0 & 1\\1 & 1 & 4\end{pmatrix}$$
$$\xleftrightarrow{R_2\leftarrow R_2-R_1} \begin{pmatrix}1 & 0 & 1\\0 & 1 & 3\end{pmatrix}$$
$$\implies \mathbf{X} = \begin{pmatrix}1\\3\end{pmatrix}$$

Substituting the point $\mathbf{X}$ in equation (2.2.1) :

$$\mathbf{X} = \frac{(k\mathbf{B} + \mathbf{A})}{(k+1)}$$
$$\implies \begin{pmatrix}1\\3\end{pmatrix} = \frac{k\begin{pmatrix}5\\7\end{pmatrix} + \begin{pmatrix}-1\\1\end{pmatrix}}{k+1}$$
$$\implies \begin{pmatrix}1\\3\end{pmatrix} = \frac{\begin{pmatrix}5k\\7k\end{pmatrix} + \begin{pmatrix}-1\\1\end{pmatrix}}{k+1}$$
$$\implies \begin{pmatrix}1\\3\end{pmatrix} = \frac{\begin{pmatrix}5k-1\\7k+1\end{pmatrix}}{k+1}$$

Equating both sides,

$$1 = \frac{5k-1}{k+1}$$
$$\implies k+1 = 5k-1$$
$$\implies 4k = 2$$
$$\implies k = 1/2$$

4 FIGURE