Probability and Random Processes

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Q) Find the intersection **G** of BC and CF

A) **A**,**B** and **C** are vertices of triangle:

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \tag{1}$$

$$\mathbf{B} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} \tag{2}$$

$$\mathbf{C} = \begin{pmatrix} -3 \\ -5 \end{pmatrix} \tag{3}$$

Since E and F are midpoints of CA and AB,

$$\mathbf{E} = \frac{\mathbf{A} + \mathbf{C}}{2} \tag{4}$$

$$= \begin{pmatrix} -1 \\ -3 \end{pmatrix} \tag{5}$$

$$\mathbf{F} = \frac{\mathbf{B} + \mathbf{A}}{2} \tag{6}$$

$$= \begin{pmatrix} -1.5 \\ 2.5 \end{pmatrix} \tag{7}$$

The direction vector **CF** and equation of CF are given by

$$\mathbf{F} - \mathbf{C} = \begin{pmatrix} 1.5 \\ 7.5 \end{pmatrix} \tag{8}$$

$$\mathbf{CF} = \begin{pmatrix} -3 \\ -5 \end{pmatrix} + k \begin{pmatrix} 1.5 \\ 7.5 \end{pmatrix} \tag{9}$$

The direction vector **BE** and equation of BE are given by

$$\mathbf{E} - \mathbf{B} = \begin{pmatrix} 3 \\ -9 \end{pmatrix} \tag{10}$$

$$\mathbf{BE} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} + k \begin{pmatrix} 3 \\ -9 \end{pmatrix} \tag{11}$$

The augmented matrix is:

$$\begin{pmatrix} 3 & 1 & -6 \\ 5 & -1 & -10 \end{pmatrix} \tag{12}$$

Using Guass-Elimination method:

$$\begin{pmatrix} 3 & 1 & -6 \\ 5 & -1 & -10 \end{pmatrix} \xrightarrow{R_1 \to R_1 + R_2} \begin{pmatrix} 8 & 0 & -16 \\ 5 & -1 & -10 \end{pmatrix} \tag{13}$$

$$\begin{pmatrix} 8 & 0 & -16 \\ 5 & -1 & -10 \end{pmatrix} \xrightarrow{R_1 \to R_1/8} \begin{pmatrix} 1 & 0 & -2 \\ 5 & -1 & -10 \end{pmatrix} \tag{14}$$

$$\begin{pmatrix} 1 & 0 & -2 \\ 5 & -1 & -10 \end{pmatrix} \xrightarrow{R_2 \to R_2 - 5R_1} \begin{pmatrix} 1 & 0 & -2 \\ 0 & -1 & 0 \end{pmatrix} \tag{15}$$

$$\begin{pmatrix} 1 & 0 & -2 \\ 0 & -1 & 0 \end{pmatrix} \xrightarrow{R_2 \to -R_2} \begin{pmatrix} 1 & 0 & -2 \\ 0 & 1 & 0 \end{pmatrix} \tag{16}$$

Therefore, $\mathbf{G} = \begin{pmatrix} -2 \\ 0 \end{pmatrix}$