2.4.18

EE25BTECH11023 - Venkata Sai

Question:
Find the values of **p** so that the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are at right angles.
Solution:

Variable	Description
m_1	Direction vector of Line 1
m_2	Direction vector of line 2

TABLE 0: Variables Used

Line 1:

$$\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2} \implies \frac{x-1}{-3} = \frac{y-2}{\frac{2p}{7}} = \frac{z-3}{2} \tag{1}$$

Line 2:

$$\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5} \implies \frac{x-1}{-\frac{3p}{7}} = \frac{y-5}{1} = \frac{z-6}{-5} \tag{2}$$

Direction vector for line 1:

$$m_1 = \begin{pmatrix} -3 \\ \frac{2p}{7} \\ 2 \end{pmatrix} \tag{3}$$

Direction vector for line 2:

$$m_2 = \begin{pmatrix} -\frac{3p}{7} \\ 1 \\ -5 \end{pmatrix} \tag{4}$$

Since the lines are at right angles

$$\left(m_1\right)^\top \left(m_2\right) = 0 \tag{5}$$

$$\begin{pmatrix} -3 & \frac{2p}{7} & 2 \end{pmatrix} \begin{pmatrix} -\frac{3p}{7} \\ 1 \\ -5 \end{pmatrix} = 0 \tag{6}$$

$$(-3)(-\frac{3p}{7}) + (\frac{2p}{7})(1) + (2)(-5) = 0 \tag{7}$$

$$p = \frac{70}{11} \tag{8}$$

Hence the value of $\mathbf{p}$ is $\frac{70}{11}$

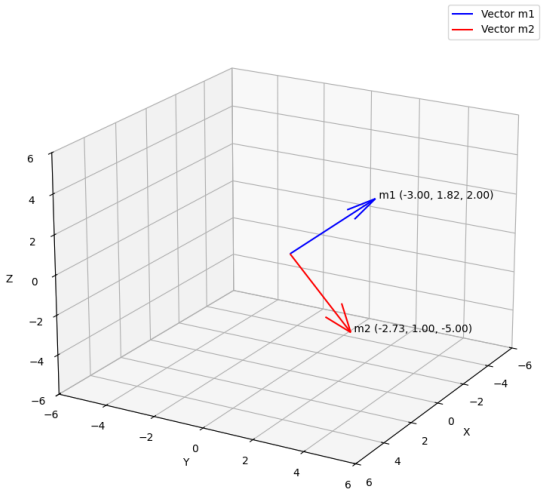

Fig. 0.1: Stem Plot of y(n)