AI1103 : Assignment 1

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PROBLEM 5.12

A Random Variable X has the following Probability Distribution

X	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2$ + k

Determine:
1) k
2) P(X < 3)
3) P(X > 6)
4) P(0 < X < 3)

Solution

(i) It is known that the sum of probabilities of a probability distribution is always one.

$$\therefore 0 + k + 2k + 3k + k^2 + 2k^2 + (7k^2 + k) = 1 \tag{5.12.1}$$

$$\implies 10k^2 + 9k - 1 = 0 \implies (10k - 1)(k + 1) = 0 \tag{5.12.2}$$

$$\implies k = -1, \frac{1}{10} \tag{5.12.3}$$

$$\therefore k = \frac{1}{10} (\because k \geq 0) \tag{1}$$

(ii)

$$P(X < 3) = P(X = 2) + P(X = 1) + P(X = 0) \tag{5.12.4}$$

$$\implies P(X < 3) = 0 + k + 2k = 3k \tag{5.12.5}$$

$$\therefore P(X < 3) = \frac{3}{10} \tag{2}$$

(iii)

$$P(X > 6) = P(X = 7) = 7k^2 + k \tag{5.12.6}$$

$$\implies P(X > 6) = \frac{7}{100} + \frac{1}{10} \tag{5.12.7}$$

$$\therefore P(X > 6) = \frac{17}{100} \tag{3}$$

(iv)

$$P(0 < X < 3) = P(X = 1) + P(X = 2) \tag{5.12.8}$$

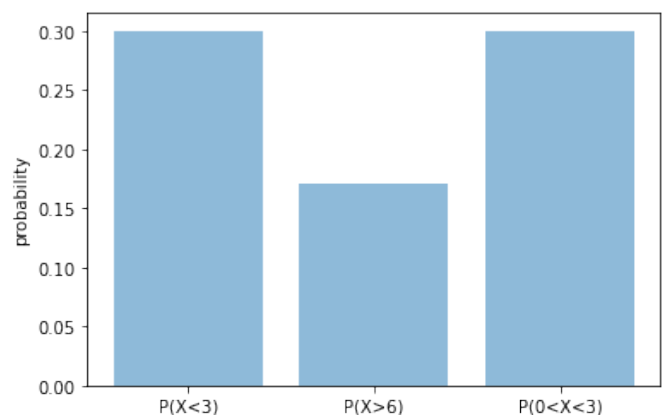$$\implies P(0 < X < 3) = k + 2k = 3k \tag{5.12.9}$$

$$\therefore P(0 < X < 3) = \frac{3}{10} \tag{4}$$

Fig. 4: Probability graph