DPP-1 Maths-4 Unit - IV

Topic - Random Variables

Q-1- A box has 5 Blue, 3 Red Balls. If 2 balls are to be drawn at random without replacement and X denotes the number of Blue Balls, find probability distribution for X.

Sol- Number of Blue Balls = 5

Number of Red Balls = 3

Total number of Balls = 8

X = Number of Blue Balls

X = 0, 1, 2

Probabilities ⇒

$$P(X=0) = \frac{{}^3C_2}{{}^8C_2} = \frac{3!}{2!} \times \frac{6! \times 2!}{8!}$$

$$= \frac{3 \times 2}{48 \times 7}$$

$$P(X=0) = \frac{3}{28}$$

Gateway Classes

$$P(X=1) = \frac{{}^5C_1 \times {}^3C_1}{{}^8C_2}$$

$$= \frac{5 \times 3 \times 2}{4 \cancel{8} \times 7}$$

$$P(X=1) = \frac{15}{28}$$

$$P(X=2) = \frac{{}^5C_2}{{}^8C_2}$$

$$= \frac{5!}{3!2!} \times \frac{6! \times 2!}{8!}$$

$$= \frac{5 \times \cancel{4}}{\cancel{2}} \times \frac{\cancel{2}}{\cancel{8} \times 7}$$

$$P(X=2) = \frac{5}{14}$$

X	0	1	2
P(X)	$\frac{3}{28}$	$\frac{15}{28}$	$\frac{5}{14}$

Gateway Classes

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Q-2- A random variable X has the following probability distribution

x:	0	1	2	3	4	5	6	7	8
P(x):	a	3a	5a	7a	9a	11a	13a	15a	17a

Sol- i) We know, $\Sigma P(x_i) = 1$

$$a + 3a + 5a + 7a + 9a + 11a + 13a + 15a + 17a = 1$$

$$81a = 1$$

$$\boxed{a = \frac{1}{81}}$$

ii) $P(X<3) = P(x=0) + P(x=1) + P(x=2)$

$= a + 3a + 5a$

$= 9a$

$= 9 \times \frac{1}{81}$

$$\boxed{P(X<3) = 1/9}$$

$P(X \geq 3) = P(X=3) + P(X=4) + P(X=5) + P(X=6) + P(X=7) + P(X=8)$

$= 7a + 9a + 11a + 13a + 15a + 17a$

$= 72a$

$= 72 \times 1/81$

$$\boxed{P(x \geq 3) = \frac{8}{9}}$$

Gateway Classes

$P(2 \leq X < 5) = P(X=2) + P(X=3) + P(X=4)$

$= 5a + 7a + 9a$

$= 21a$

$= 21 \times \frac{1}{81}$

$\boxed{P(2 \leq X < 5) = \frac{7}{27}}$

v) $P(X \leq 1) = a + 3a$

$= 4a$

$= \frac{4}{81} < \frac{1}{2}$

$P(X \leq 3) = a + 3a + 5a + 7a$

$= 16a$

$= \frac{16}{81} < \frac{1}{2}$

$P(X \leq 5) = a + 3a + 5a + 7a + 9a + 11a$

$= \frac{36}{81} < \frac{1}{2}$

$P(X \leq 6) = a + 3a + 5a + 7a + 9a + 11a + 13a$

$= \frac{49}{81} > \frac{1}{2}$

Hence minimum value of X is 6.

Gateway Classes