

AI1110 ASSIGNMENT-1

PROBABILITY AND RANDOM VARIABLES

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QUESTION: In a hurdle race, a player has to cross 10 hurdles. The probability that he will clear each hurdle is $\frac{5}{6}$. What is the probability that he will knock down fewer than 2 hurdles?

Solution:

$$\Pr(E) = q = \frac{5}{6} \text{ and } \Pr(E') = p = 1 - \frac{5}{6} = \frac{1}{6}$$

Let,

X be the number of hurdles the player knocks down.

$$X = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

Parameter	Value	Description
X	0	Player clears all the hurdles
X	1	Player knocks down one hurdle

$$X = \text{Bin}(n, p)$$

Using Cumulative Distribution Function(cdf),

$$F_X(r) = \Pr(X \leq r) = \sum_{i=0}^r \Pr(X = i) = \sum_{i=0}^r \binom{n}{i} p^i q^{n-i} \quad (1)$$

Here,

$$F_X(r) = \sum_{i=0}^r \binom{10}{i} \left(\frac{1}{6}\right)^i \left(\frac{5}{6}\right)^{10-i} \quad (2)$$

$r=1$ for knocking down fewer than 2 hurdles.

$$\therefore F_X(1) = \sum_{i=0}^1 \binom{10}{i} \left(\frac{1}{6}\right)^i \left(\frac{5}{6}\right)^{10-i} \quad (3)$$

$$= 0.48451 \quad (4)$$

So, the probability that the player will knock down fewer than 2 hurdles is 0.48451 or approximately 48.45%.