AI1110 ASSIGNMENT-1
PROBABILITY AND RANDOM VARIABLES

CHANDRAHAS GURRALA
CS22BTECH11027

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:

$\Pr(E) = q = \frac{5}{6}$ 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	0,1	Number of hurdles player clears
n	10	Total number of hurdles to be crossed
p	0.16667	Probability to knock down a hurdle

$X = Bin(n, p)$

Using Cummulative Distribution Function(cdf),

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

Here,

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

r=1 for knocking down fewer than 2 hurdles.

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

$$= 0.48451 \tag{4}$$

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