Assignment 1

AI1110:Probability and random variables
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Question 12.13.6.9 :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: Let X be the Random variable that represents the number of times the player will knock down the hurdle.

	parameter	value	description
1.	n	10	no.of trials
2.	p	$\frac{5}{6}$	probability of clearing hurdle
3.	q	$\frac{1}{6}$	probability of knocking down

Here

$$n = 10, p = \frac{5}{6}, q = 1 - p = \frac{1}{6}$$

Therefore

$$\Pr(X = x) = \binom{n}{x} \cdot \left(\frac{5}{6}\right)^{n-x} \left(\frac{1}{6}\right)^{x}$$

Now,we need $F_X(x) = \Pr(X \leqslant x)$ where F_X is cdf.

$$\begin{aligned} F_X(1) &= \Pr(X = 0) + \Pr(X = 1) \\ &= \binom{10}{0} \cdot \left(\frac{5}{6}\right)^{10} \left(\frac{1}{6}\right)^{0} + \binom{10}{1} \cdot \left(\frac{5}{6}\right)^{9} \left(\frac{1}{6}\right)^{1} \\ &= \left(\frac{5}{6}\right)^{9} \left[\frac{5}{6} + \frac{10}{6}\right] \\ &= \frac{(5)^{10}}{2 \times (6)^{9}} \end{aligned}$$