Solution 12.13.3.22

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Question 22 The Probability of a man hitting target is 0.25.He shoots 7 times. What is the probability of his hitting atleast twice?

Solution:

TABLE 0
RANDOM VARIABLE AND PROBABILITY TABLE

Random independent variable	value of R.V	Description
n	7	Total no. of trials
X	$0 \le X \le 7$	no. of times he hits the target

Let the probability of hitting the targets correctly be
$$p = \frac{1}{4} = 0.25$$
 (1)

CDF of binomial distribution is:

$$p(X \le k) = \sum_{k=0}^{k} {n \choose k} p^k (1-p)^{n-k}$$
 k = 0, 1, 2, ...7

(3)

(4)

(2)

Probability of Hitting the target at least twice is = $p(X \ge 2)$

$$p(X \ge 2) = 1 - p(X \le 1) \tag{5}$$

$$= 1 - \left\{ \sum_{k=0}^{1} {7 \choose k} \left(\frac{1}{4}\right)^k \left(\frac{3}{4}\right)^{7-k} \right\}$$
 Using CDF

(6)

$$=1 - \left\{ \left(\frac{1}{4}\right)^0 \left(\frac{3}{4}\right)^7 + 7\left(\frac{1}{4}\right)^1 \left(\frac{3}{4}\right)^6 \right\} \tag{7}$$

$$=1-\left(\frac{3}{4}\right)^6\frac{10}{4}\tag{8}$$

$$=1 - \left(\frac{729}{1096}\right) \frac{10}{4} \tag{9}$$

$$=1-\frac{7290}{16384}\tag{10}$$

$$=\frac{9094}{16384}\tag{11}$$

$$= 0.5550$$
 (12)

(13)

Hence, the probability of hitting the target atleast twice is 0.5550

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