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 hiiting atleast twice?

Solution: The total no. of trials is $n = 7$

TABLE 0
RANDOM VARIABLE AND PROBABILITY TABLE

Random independent variable	value of R.V
X(no. of times he hits the target)	$0 \leq X \leq 7$

$$\text{Let the probability of hitting the targets correctly be } p = \frac{1}{4} \tag{1}$$

$$\text{PMF of X is:} \tag{2}$$

$$p_X(k) = \binom{n}{k} p^k (1-p)^{n-k} \qquad k = 1, 2, ..7 \tag{3}$$

$$\text{Probability of Hitting the target atleast twice is} = p_X(k \geq 2) \tag{4}$$

$$= 1 - p_X(k \leq 2) \tag{5}$$

$$= 1 - \left\{ p_X(k = 0) + p_X(k = 1) \right\} \tag{6}$$

$$= 1 - \left\{ \binom{7}{0} p^0 (1-p)^7 + \binom{7}{1} p^1 (1-p)^6 \right\} \tag{7}$$

$$= 1 - \left\{ \frac{1}{4}^0 \left(\frac{3}{4}\right)^7 + 7\frac{1}{4}^1 \left(\frac{3}{4}\right)^6 \right\} \tag{8}$$

$$= 1 - \left(\frac{3}{4}\right)^6 \frac{10}{4} \tag{9}$$

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

$$= 1 - \frac{7290}{16384} \tag{11}$$

$$= \frac{9094}{16384} \tag{12}$$

$$= \frac{4547}{8192} \tag{13}$$

$$= 0.5550 \tag{14}$$

$$\tag{15}$$

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