1

Solution 12.13.3.22

Aditya Vikram Singh*

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: 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)	$0 \le X \le 7$

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

PMF of X is:
$$(2)$$

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

(3)

Probability of Hitting the target at least twice is $= p_X(k \ge 2)$ (4)

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

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

$$=1 - \left\{ \begin{pmatrix} 7 \\ 0 \end{pmatrix} p^0 (1-p)^7 + \begin{pmatrix} 7 \\ 1 \end{pmatrix} p^1 (1-p)^6 \right\}$$
 (7)

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

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

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

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

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

$$= 0.5550$$
 (13)

(14)

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

*The author is with the Department of Electrical Engineering, Indian Institute of Technology, Hyderabad 502285 India e-mail: gadepall@iith.ac.in. All content in this manual is released under GNU GPL. Free and open source.