

# 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
$X(\text{no. of times he hits the target})$	$0 \leq X \leq 7$

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

PMF of X is: (2)

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

(3)

Probability of Hitting the target atleast twice is  $p_X(k \geq 2)$  (4)

$$= 1 - p_X(k \leq 1) \quad (5)$$

$$= 1 - \{p_X(k=0) + p_X(k=1)\} \quad (6)$$

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

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

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

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

$$= 1 - \frac{7290}{16384} \quad (11)$$

$$= \frac{9094}{16384} \quad (12)$$

$$= \frac{4547}{8192} \quad (13)$$

$$= 0.5550 \quad (14)$$

(15)

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.