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Set-II

1) A test is conducted which consisting of 20 MCQ, (multiple choice question) with every MCQ having its four options out of which only one is correct. Determine the probability that a person undertaking that test has answered exactly 5 question wrong.

=) Here, $n = 20$, $n - x = 5$, $x = 20 - 5 = 15$

Probability of success $= S = \frac{1}{4}$

Probability of failure $= 1 - S$

$= 1 - \frac{1}{4} =$

$= \frac{3}{4}$

To calculate the probability associated with each value i.e S

$$P(x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}$$

for $x = 0, 1, 2 \ldots, n$.

$$P(5 \text{ out of } 20) = \frac{20!}{5!\,15!} \times \left(\frac{1}{4}\right)^{15} \times \left(\frac{3}{4}\right)^{5}$$

$$= \frac{(20 \times 19 \times 18 \times 17 \times 16)\,15!}{5!\,15!} \times \left(\frac{1}{4}\right)^{15} \times \left(\frac{3}{4}\right)^{5}$$

$= 0.0000034$ (approx).

Thus the required probability is 0.0000034 approximately.

② A die marked A to E rolled 50 times. Find the probability of getting a "D" exactly 5 times.

⇒ Here, $n = 50$, $x = 5$, $n - x = 45$

The probability of success = The probability of getting a "D" $= s = \frac{1}{5}$

Hence the probability of failure = The probability of not getting a "D" $= 1 - s = \frac{4}{5}$

$=$

The p.m.f given by $P(X = x) = \binom{n}{x} p^x q^{n-x}$

$$P(\text{D 5 times}) = P(X = 5) = \binom{50}{5} \left(\frac{1}{5}\right)^5 \left(\frac{4}{5}\right)^{45}$$

$= 0.02953$ (Approxi)

$$= {}^{50}C_5 \left(\frac{1}{5}\right)^5 \left(\frac{4}{5}\right)^{45}$$

$= 0.02953$

③ Customer arrive at a Rate of 72 per hour to my shop. What is the probability of 4 customers arriving in 4 minutes.?

ⓐ 5 customs

ⓑ no more than 3 customes.

Give a pictorial representation of the same to validate your answer.

⇒ $\lambda = 72/\text{hour} = 72 \text{ per } 60 \text{ min.}$

for 4 minutes $= (4 * 72)/60 = 4.8$

a) 5 customs

$$P(5) = \frac{\lambda^k e^{-\lambda}}{k!}$$

$$= \frac{(4.8)^5 e^{-4.8}}{5!}$$

$$= 0.1747.$$

b) not more than 3 customes

$$P(k \leq 3) = \sum_{i=0}^{3} \frac{\lambda^k e^{-\lambda}}{k!}$$

$$= \frac{(4.8)^0 e^{-4.8}}{0!} + \frac{(4.8)^1 e^{-4.8}}{1!} + \frac{(4.8)^2 e^{-4.8}}{2!} + \frac{(4.8)^3 e^{-4.8}}{3!}$$

$$= 0.00823 + 0.039503 + 0.094807 + 0.15168$$

$$= 0.29422$$

c) more than 3 customers

$$P(k > 3) = 1 - P(k \leq 3)$$

$$= 1 - 0.244229916$$

$$= 0.705770084$$