

STATISTICS 1 & 2

TASK 2 – 1-

A test is conducted which is consisting of 20 MCQs (multiple choices questions) 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 questions wrong.

Solution –

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

Here the probability of success = probability of giving a right answer = $p = 1/4$

Hence, the probability of failure = probability of giving a wrong answer = $1 - p$
 $= 1 - 1/4 = 3/4$

When we substitute these values in the formula for Binomial distribution we get,

So, $P(\text{exactly 5 out of 20 answers incorrect}) =$

$$\begin{aligned} \text{So, } P(\text{exactly 5 wrong out of 20 answers}) &= P(x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x} \quad \text{for, } x = 0, 1, 2, 3, \dots, n \\ &= \frac{20!}{15! \cdot 5!} \left(\frac{1}{4}\right)^{15} \left(1 - \frac{1}{4}\right)^5 \\ &= \frac{20 \cdot 19 \cdot 18 \cdot 17 \cdot 16 \cdot 15!}{15! \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} \left(\frac{1}{4}\right)^{15} \left(\frac{3}{4}\right)^5 \\ &= 0.0000034 \end{aligned}$$

Thus the required probability is **0.0000034** approximately.

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TASK 2 –2-

A die marked A to E is rolled 50 times. Find the probability of getting a “D” exactly 5 times.

Solution –

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

The probability of success = probability of getting a “D” = $p = 1/5$

Hence, the probability of failure = probability of not getting a “D” = $1 - p = 4/5$.

$$\begin{aligned} \text{So, } P(\text{exactly 5 D's out of 50 times}) &= P(x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x} \quad \text{for, } x = 0, 1, 2, 3, \dots, n \\ &= \frac{50!}{5! \cdot 45!} \left(\frac{1}{5}\right)^5 \left(1 - \frac{1}{5}\right)^{45} \\ &= \frac{50 \cdot 49 \cdot 48 \cdot 47 \cdot 46 \cdot 45!}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 45!} \left(\frac{1}{5}\right)^5 \left(\frac{4}{5}\right)^{45} \\ &= 0.0295 \end{aligned}$$

TASK 2 –3-

Two balls are drawn at random in succession without replacement from an urn containing 4 red balls and 6 black balls. Find the probabilities of all the possible outcomes.

Solution –

First determine the probabilities of the events.

Events	Probability
RR =	$(4/10)(3/9) = 2/15$
RB =	$(4/10)(6/9) = 4/15$
BR =	$(6/10)(4/9) = 4/15$
BB =	$(6/10)(5/9) = 1/3$

The probability of 0 black balls (RR) is $2/15$

The probability of 1 black ball is (RB or BR) is $4/15 + 4/15 = 8/15$

The probability of 2 black balls (BB) is $1/3$

So the probability distribution is: Z p(Z)

0 = $2/15$

1 = $8/15$

2 = $1/3$