Problem Statement 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,

Answered questions wrong = 5 (exactly)

Answered questions right = 20-5 = 15

There are 4 options for each question. Out of 4 options, one option is correct.

Therefore,

The probability of success = probability of giving a right answer = p = ¼ = 0.25

The probability of failure = probability of giving a wrong answer = q = 1 - s = = 1 – 0.25 = 0.75

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

$$P(X) = \frac{n!}{(n-X)!\,X!} \cdot (p)^X \cdot (q)^{n-X}$$

Where n= 20
X = 5
p = 0.25 (probability of correct answer)
q = 0.75 (probability of wrong answer)

P(x) = ((16∗17∗18∗19∗20)/(5∗4∗3∗2∗1)) * $(0.25)^{15}$ * $(0.75)^{5}$

P(X) = 0.0000034

Thus the required probability is 0.0000034 approximately.

Problem Statement 2:
A die marked A to E is rolled 50 times. Find the probability of getting a “D” exactly 5 times.

Solution:

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

The probability of success = probability of getting a “D”= $p = 1/5 = 0.2$

Hence, the probability of failure = probability of not getting a “D” = $1 - p = 0.8$

Problem Statement 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:

There will be 3 outcome:

1) To get 2 red balls
2) To get 2 black balls
3) To get 1 red and 1 black ball

Probability of getting 2 red balls out of 4 red balls = ${}^{4}C_{2} / {}^{10}C_{2} = 0.13$

Probability of getting 2 black balls out of 6 black balls = ${}^{6}C_{2} / {}^{10}C_{2} = 0.366$

Probability of getting 1 black 1 red = $({}^{4}C_{1} * {}^{6}C_{1}) / {}^{10}C_{2} = 0.5333$

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