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SUBJECT – STATISTICS

B.SC. PART-I SEMISTER- I

STATISTICS PAPER – II

TOPIC NAME : GEOMETRIC DISTRIBUTION

GEOMETRIC DISTRIBUTION

- **Definition:**

  Let, x be a discrete random variable it is said to follow a geometric distribution with parameter ‘p’ if its pmf is given by,

$P(X=x) = pq^x , x=0,1,2,3,\ldots..$

$p+q=1 , 0<=p<=1$

It is denoted by $x \sim G(p)$

CHARACTERISTICS OF GEOMETRIC DISTRIBUTION

- In geometric distribution we continue the experiment till we get first success as soon as first success we obtain the experiment is stopped.

- The probability, p, of a success and the probability, q, of a failure is the same for each trial. $p + q = 1$ and $q = 1 - p$. For example, the probability of rolling a three when you throw one fair die is . This is true no matter how many times you roll the die. Suppose you want to know the probability of getting the first three on the fifth roll. On rolls one through four, you do not get a face with a three. The probability for each of the rolls is $q =$, the probability of a failure. The probability of getting a three on the fifth roll is $= 0.0804$.

- In theory, the number of trials could go on forever.

- **Mean:**

  Mean of geometric distribution is q/p.

  E(x) = q/p

- **Variance:**

  Variance of geometric distribution is q/p^2.

  v(x) = q/p^2

- **Cummulative Generating Function**:

  F(x) = 1-q^(x+1)

LACK OF MEMORYLESS PROPERTY:

- **Statement:**

  If the discrete random variable 'X' having geometric distribution with parameter 'p then it has lack of memory property which is given by ,

  $$P[x>s+t / x>s] = p[x > t]$$

- **Remark:**

  In geometric distribution we continue the experiment till we get first success as soon as first success we obtain the experiment is stopped.

◉ Examples of Gemetric Distribution

1) Throwing a dice.

2) Surveying customers to find one with a faulty product.

3) Basket Ball Shooters.

4) Estimating failures.

SOLVED EXAMPLES

Example 1:

A baseball player has a batting average of 0.320. This is the general probability that he gets a hit each time he is at bat.

What is the probability that he gets his first hit in the third trip to bat?

Solution:

$$P(x=3) = (1-0.32)^{3-1} \times .32$$
$$= 0.1480$$

In this case the sequence is failure, failure success.

Example 2 :

There is an 80% chance that a Dalmatian dog has 13 black spots. You go to a dog show and count the spots on Dalmatians. What is the probability that you will review the spots on 3 dogs before you find one that has 13 black spots?

Solution:

$$P(x=3) = (1 - 0.80)^3 \times 0.80$$
$$= 0.0064$$

The probability that you will review the spots on 3 dogs before you find one that has 13 black spots

- **Example 3 :**

(Lack of memory property)

If X ~ G(p=0.3) find p(x>10 / x>2)

Solution :

By lack of memory property,

P(x > 10 / x > 2) = p (x > 8)

=1 – p(x<= 8)

=1-(1-q^(8+1))

= 1-1+q^9

=q^9

=(0.7)^9

Therefore, p [x > 10/ x > 2] = 0.04035

THANK YOU