

**ST. LAWRENCE HIGH SCHOOL** A JESUIT CHRISTIAN MINORITY INSTITUTION



## <u>STUDY MATERIAL-10</u> SUBJECT – STATISTICS

Pre-test

**Chapter: THEORITICAL PROBABILITY DISTRIBUTION** 

**Topic: BINOMIAL PROBABILITY DISTRIBUTION** 

Class: XII

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## PROBABILITY

## DISTRIBUTION



1. Children inherit their blood type from their parents, with probability that reflects the parents' genetic makeup. Each of 4 children of Mr. and Mrs. Kulkarni has probability  $\frac{1}{4}$  of having blood type O and inherit independently of each other.

(i) What is the distribution of the children having blood type O?

- (ii) What is the probability that none of them has blood type O?
- (iii) What is the mean number of children with type O blood? What is its s.d.?

Solution:

Define the random variable X : number of children having blood type O

(i) 
$$X \sim Bin(4, \frac{1}{4})$$
  
(ii)  $f(0) = (\frac{3}{4})^4 = \frac{243}{256}$   
(iii) mean = 1 and s. d. =  $\frac{3}{4}$ 

2. Seventy percent of all trucks undergoing a brake inspection at a certain inspection facility pass the inspection. What is the probability that out of five randomly selected trucks exactly three trucks fail the inspection?

Solution:

Define X: Out of five randomly selected trucks number of trucks fail the inspection

So  $X \sim Bin$  (5, 0.7)

Required probability =  $5_{C_3} (0.7)^3 (0.3)^2 = 0.3087$ 

3. If 20% of a population suffers from endemic goiter, find the probability of getting 2 goiter cases in a sample of 5.

Solution:

Define X: Number of goiter cases in a sample of 5

So  $X \sim Bin$  (5, 0.7)

Required probability =  $5_{C_2}$  (0.2)<sup>2</sup>(0.8)<sup>3</sup>

= 10 \* 0.04 \* 0.512 = 0.2048

4. A new surgical procedure is said to be successful 80% of the time. Suppose the operation is performed five times and the results are assumed to be independent of one another. What are the probabilities of these event :

(i) All five operations are successful?

(ii) Exactly four are successful?

(iii) Less than two are successful?

Solution :

- X : operations are successful out of 5 operations So  $X \sim Bin$  (5,0.8) (i) P(All five operations are successful) =f(5) = (0.8)<sup>5</sup> = 0.327 (ii) P (Exactly four operations are successful) = f(4) = 5 \* (0.8)<sup>4</sup> \* (0.2) = 0.4096
- 5. Suppose that the probability of a customer buying an egg roll at a fast food centre is 0.6. If there are 5 customers in line and 2 egg rolls already prepared, what is the probability that a customer will have to wait for an egg roll?

Solution:

Define X: Number of customer will have to wait for an egg roll

 $X \sim Bin(5,0.6)$ 

Required probability = P(X>2)

$$= 1 - \{f(0) + f(1) + f(2)\}$$
$$= 1 - \{(0.4)^5 + 5 * 0.6 * (0.4)^4 + 10 * (0.6)^2 (0.4)^3\} = 0.682$$

6. If ten honest coins are tossed, what is the probability that there are (i) exactly 3 heads, (ii) not more than 3 heads?

Solution:

Define X: number of heads in 10 tosses

X ~ Bin(10,0.5) (i) P(X=3) =  $10_{C_3} (0.5)^{10} = 0.117$ (ii) P(X ≤ 3) =  $\{10_{C_0} + 10_{C_1} + 10_{C_2} + 10_{C_3}\} (0.5)^{10}$ = 0.1718

7. The probability that a randomly selected consumer will choose Coke oven Pepsi is 0.4. Find the probability that exactly four out of five randomly selected consumers choose Coke.

Define X: number of consumers choose Coke out of five

X ~ Bin( 5, 0.4)

P(X=4) =  $5_{C_4}$  (0.4)<sup>4</sup> (0.6) = 0.0768

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