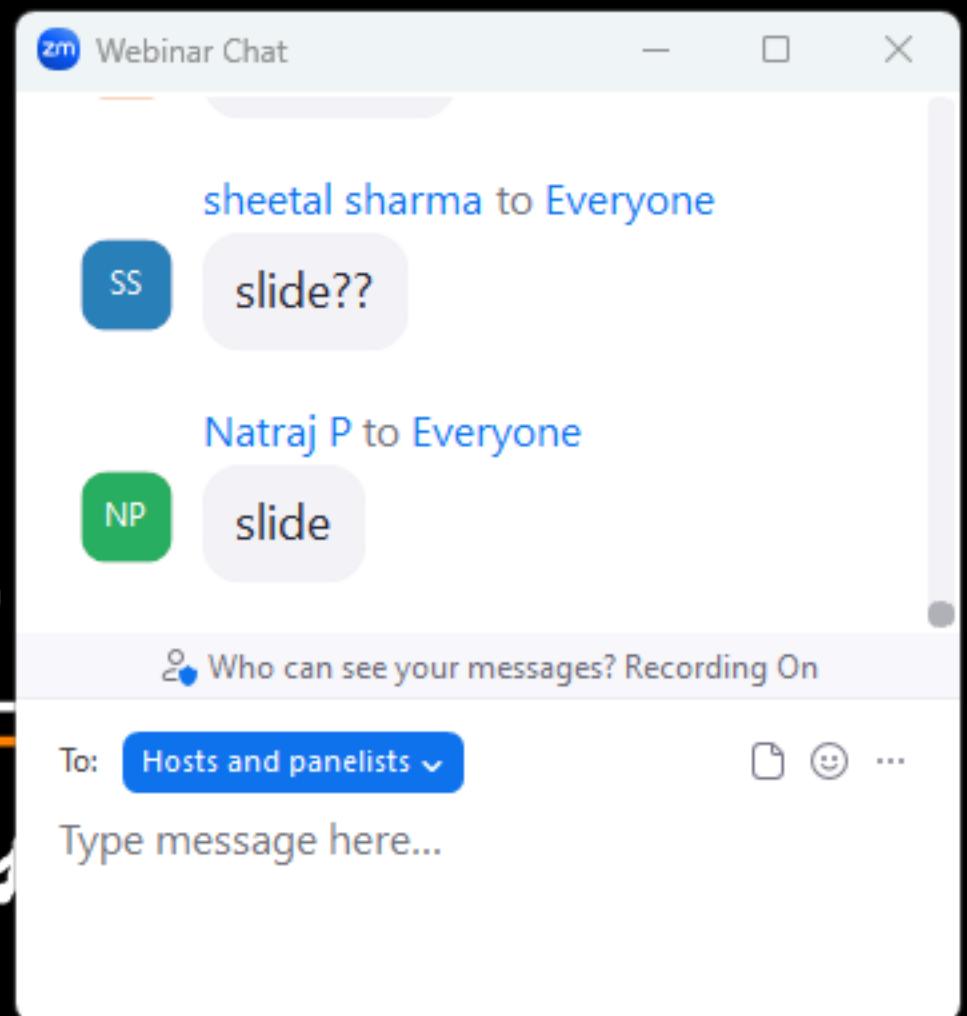


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## Binomial Distribution

### Condition

- ① Binomial distribution has two discrete outcomes (head or tail), Pass or Fail, Success
- ② Trial should be made up of independent trial.
- ③ fixed no. of trial
- ④ The objective is to find the probability of getting  $K$  successes out of  $n$  trials ( $K \leq n$ )
- ⑤ The Prob of Success is " $P$ ", and prob of failure is  $(1-P)$



⑥ The Prob P is constant and does not change between trials

any one of them true

Please note, given above listed condition does not  
matter, it is considered binomial dist prob

General formula

PMF of Binomial dist

$$\text{PMF}(x) = P(X=x) = \binom{n}{x} * p^x * (1-p)^{n-x}$$

where,

$x$  = Total no. of "successes"

$n$  = number of trials

$P$  = prob. of success

$1-P$  =

, Failure

$$\binom{n}{x} * P^x * (1-P)^{n-x}$$

$$\binom{10}{6} * (0.5)^6 * (0.5)^4$$

$$\frac{10!}{6! 4!} * (0.5)^{6+4}$$

\* A fair coin is flipped 10 times, what is the probability of getting exactly 6 heads?

$$\rightarrow n = 10$$

$$\text{Failure} = 1-P$$

$$\rightarrow x = 6$$

$$= 1-0.5$$

$$\rightarrow P = 0.5 \text{ (Success) } \text{Failure} = 0.5$$

$$n_C_x = \frac{n!}{x!(n-x)!}$$

$$\binom{n}{x} = \frac{n^2}{x^2} * \frac{(n-1)^3}{x^3}$$

$$\frac{10!}{6! 4!} \times (0.5)^{10} = \frac{10 \times 9 \times 8 \times 7 \times 6!}{6! \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1} \times (0.5)^{10}$$

$$= 10 \times 3 \times 7 \times (0.5)^{10}$$
$$= 210 \times (0.5)^{10} = 0.2050$$

Hence, the prob of getting exactly 6 heads

is 20%.

B

Q: 60% of people who purchase a sports car are men, if 10 sports car owners are selected randomly then what is the prob that exactly 7 are men?

$$n = 10$$

$$x = 7$$

$$P = 0.6$$

$$1-P = 0.4$$

$$\binom{n}{x} \times (P)^x \times (1-P)^{n-x} = \binom{10}{7} \times (0.6)^7 \times (0.4)^3$$

$$= \frac{10!}{7! 3!} \times (0.6)^7 \times (0.4)^3$$

$$= \frac{10 \times 9 \times 8 \times 7 \times 6}{7 \times 6 \times 5 \times 4 \times 3 \times 2} \times (0.6)^7 \times (0.4)^3 = 210.49\%$$

Solutions

Q : Amazon - 10% of their customer return the purchased items . On the particular days , 20 customers purchased items from Amazon .

- (a) The Prob that exactly five customer will return item ?
- (b) " " " maximum of five customer will return the Prob .
- (c) " " " more than 5 customer will return the Prob
- (d) The avg no. of customer likely to return items
- (e) The variance of the std of the no. of return .

Prob of Success ( $P$ ) = 0.1

Prob of failure ( $1-P$ ) = 0.9

$$\text{CDF} \\ P(X \leq x) = \sum_{k=0}^{\infty} \binom{n}{k} (P)^k \times (1-P)^{n-k}$$

$$n = 20$$

$$x = 5$$

$$Q(1) \binom{20}{5} (0.1)^5 \times (0.9)^{15} =$$

$$\boxed{P(X \leq x)}$$

$$Q_2: \binom{20}{0} (0.1)^0 \times (0.9)^{20} + \binom{20}{1} \times (0.1) \times (0.9)^{19} + \binom{20}{2} (0.1)^2 \times (0.9)^{18}$$

$$+ \binom{20}{3} \times (0.1)^3 \times (0.9)^{17} + \binom{20}{4} \times (0.1)^4 \times (0.9)^{16} + \binom{20}{5} (0.1)^5 \times (0.9)^{15}$$

CDF

- - 0.9887

Q3:  $1 - 0.9887 = 0.0113$  ↗

Q4: Avg no. in Binomial dist =  $\boxed{n \times p}$

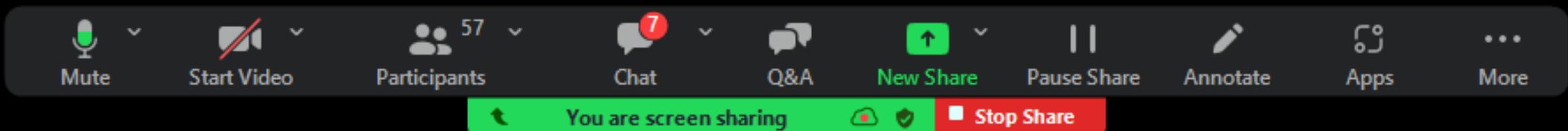
$$20 \times 0.1 = \underline{\underline{2}}$$

Q5:- Variance =  $n \times P \times (1-P) = \frac{20 \times 0.1 \times 0.9}{100}$

$$= 1.8$$

$$\text{Std} = \sqrt{\text{Var}} = \sqrt{1.8} \quad \text{↗}$$

Logistic



Poisson Distribution  $\rightarrow$  discrete prob dist

$\rightarrow$  it express the prob of a given no. of event occurring in a fixed interval of time or some other continuous inst

$$P(x: \lambda) = \frac{\lambda^x \cdot e^{-\lambda}}{x!}$$

e = A constant equal to approx 2.718

$\lambda$  = mean no. of success  
x = Actual no. of 1's

Q:- The avg no. of houses sold by a company is 2 houses per day. What is the prob that exactly 3 houses will be sold tomorrow?

$$\lambda = 2$$

$$x = 3$$

$$e = 2.718$$

$$P(x; \lambda) = \frac{\lambda^x \cdot e^{-\lambda}}{x!} = \frac{2^3 \cdot (2.718)^{-2}}{3!}$$

$$= \frac{8}{6} \times \frac{1}{(2.718)^2} = 0.18 \rightarrow$$

$$\bar{x} = \frac{1}{n}$$

$$\bar{x}^2 = \frac{1}{n^2}$$

Q :- Mark's tape  $\rightarrow$  no. of cancellations in a day  
 is exactly 20 and the prob that  
 the max<sup>m</sup> no. of cancellation is 25.

$$\textcircled{1} \quad \lambda = 20, x = 20 \rightarrow \frac{\lambda^x e^{-\lambda}}{x!}$$

$$\textcircled{2} \quad \lambda = 20, x \leq 25$$

$$\sum_{x=0}^{25} \frac{\lambda^x e^{-\lambda}}{x!}$$

Q: the avg no. of houses sold by a company is 2 houses per day, what is the probability that lower than 3 house will be sold tomorrow?

$$\lambda = 2, \alpha < 3$$

$$\text{poissom.cdf}(2, 2) =$$

Q: 16 houses per day, no house "4 PM to 5 PM" tomorrow

$$\lambda = 16, \text{Hour} = \frac{\text{Day}}{24}, \alpha = 0$$

$$\text{Hour} = \frac{16}{24} = \frac{2}{3} = 0.666$$