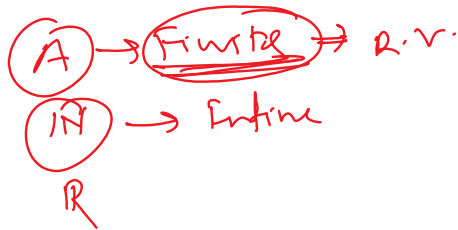


Unit - 3B.D.

1, 2, 3

Finite - Discrete \Rightarrow B.D.Infinite - Discrete \Rightarrow P.D.Infinite - Continuous \Rightarrow N.D.

Note :- Binomial Distribution \rightarrow Discrete type
 Poisson Distribution \rightarrow Discrete type
 Normal Distribution \rightarrow Continuous type

Note :- n is Finite in B.D. \times
 $n \rightarrow \infty$ in P.D. \times
 $n \in \mathbb{R}$ or (a, b) , $[a, b]$

Binomial Distribution :- $(a+b)^2 = \frac{a^2 + 2ab + b^2}{3}$

$$(a+b)^n = {}^nC_0 a^n b^0 + {}^nC_1 a^{n-1} b^1 + {}^nC_2 a^{n-2} b^2 + \dots + {}^nC_r a^{n-r} b^r + \dots + {}^nC_n a^0 b^n$$

$$\# (1+x)^n = 1 + nx + \frac{n(n-1)}{2!} x^2 + \frac{n(n-1)(n-2)}{3!} x^3 + \dots$$

A r.v. X is called follow the Binomial distribution if it has only non-negative values and probability defined by

$$p(x) = P(X=x) = \begin{cases} \binom{n}{x} p^x q^{n-x}, & x=0,1,2,3,\dots,n \\ 0 & \text{other wise} \end{cases} \quad q=1-p$$

Note :- If the event is repeated by N times then

$$p(x) = N \cdot \binom{n}{x} p^x q^{n-x}$$

Note :- In B.D. n is finity

Q :- Ten coins are tossed together then find the probability of getting the heads atleast 7 times.

Sol :- \because $\boxed{n=10}$ $\boxed{p=\frac{1}{2}}$ $\boxed{q=\frac{1}{2}}$

$$P(X \geq 7) = P(X=7) + P(X=8) + P(X=9) + P(X=10)$$

$$\because P(X=x) = \binom{n}{x} p^x q^{n-x}$$

$$\Rightarrow P(X=7) = {}^{10}C_7 \left(\frac{1}{2}\right)^7 \left(\frac{1}{2}\right)^3$$

Similarly

$$\begin{aligned} P(X=8) &= \underline{\hspace{2cm}} \\ P(X=9) &= \underline{\hspace{2cm}} \\ P(X=10) &= \underline{\hspace{2cm}} \end{aligned}$$

$$P(X=10) = \underline{\hspace{2cm}}$$

$$\begin{aligned} \Rightarrow P(X \geq 7) &= {}^{10}C_7 \left(\frac{1}{2}\right)^7 \left(\frac{1}{2}\right)^3 + {}^{10}C_8 \left(\frac{1}{2}\right)^8 \left(\frac{1}{2}\right)^2 + {}^{10}C_9 \left(\frac{1}{2}\right)^9 \left(\frac{1}{2}\right)^1 \\ &\quad + {}^{10}C_{10} \left(\frac{1}{2}\right)^{10} \left(\frac{1}{2}\right)^0 \\ &= \left({}^{10}C_7 + {}^{10}C_8 + {}^{10}C_9 + {}^{10}C_{10} \right) \left(\frac{1}{2}\right)^{10} \\ &= \frac{176}{1024} \quad \underline{\underline{A}} \end{aligned}$$

Ex 8.10 (your self)

moment of Binomial Distribution :-

$$\text{moment} = \mu'_1 = E(X)$$

$$\mu'_2 = E(X^2)$$

$$\mu'_3 = E(X^3)$$

$$\boxed{\mu'_r = E(X^r)}$$

$$E(X) = \sum x \cdot f(x) \\ \int x f(x) dx$$

$$E(X^r) = \sum x^r f(x) \\ = \int_{-\infty}^{\infty} x^r f(x) dx$$

moment of B.D :-

$$\boxed{\mu'_1 = np}$$

$$\boxed{\mu'_2 = n(n-1)p^2 + np}$$

$$\boxed{\begin{aligned} E(X^2) &= \sum x^2 \underline{\underline{f(x)}} \\ &= \sum_{x=0}^n x^2 \cdot {}^nC_x p^x q^{n-x} \end{aligned}}$$

$$\mu'_2 = n(n-1)p^2 + np$$

$$= \sum_{x=0}^n x^2 \cdot {}^n C_x p^x q^{n-x}$$

$$\mu'_3 = n(n-1)(n-2)p^3 + 3n(n-1)p^2 + np$$

Note :- mean = μ'_1 (First order moment)
 $= E(X)$ (First order expectation)

$$\mu = \mu'_1 = E(X)$$

Note :- Variance of B.D. = npq

$$\begin{aligned} \mu'_1 &= np \\ \mu &= np \\ E(X) &= np \end{aligned}$$

Note * :- Variance < mean

For Binomial Distribution

or $npq < np$

Ques :- Select the correct relation b/w mean and variance

- (i) mean < variance
- (ii) ~~mean > variance~~ ✓
- (iii) mean = variance
- (iv) All above are correct

Ans

Ex 0.11 and ~~8-12~~