Ch- Probability distribution.

☆ Random variable:-
set of Real values which are associate with sample space is called random variable.

☆ Types of Random variable:-

① Discrete random variable:-
Random variable X which take finitely countable values is called discrete random variables.

e.g:- ① No. of children in a family.

② Continuous random variable:-
Random variable X which can take all real values within a given interval is called continuous random variable.

e.g:- ① Life of an electric bulb in hours.

☆ Probability mass function:-
If the random variable X takes the value $x_1, x_2, x_3 \ldots, x_n$ then $P[X = x_i]$ is called probability mass function.
such that,

i) $0 \leq p_i \leq 1$

ii) $\sum_{i=1}^{n} p_i = 1$

★ Probability distribution function :-
set of ordered pairs (x_i, p_i) $i = 1, 2, 3 \ldots n$ is called distribution of discrete random variable. Can be given as

$x = x_i$	x_1	x_2 - - - - -	x_n
$P(x = x_i)$	P_1	P_2 - - - - -	P_n

★ Cummilative distribution function :
It is denoted by $F(x)$ and defined as

$$P[X \leq x_i] \longrightarrow x \in R$$

★ Consider the following probability distribution

$X = x_i$	x_1	x_2	x_3	. . . . .	x_n
$P(X = x_i)$	P_1	P_2	P_3	. . . . .	P_n

① Expected value $[E(x)]$:-

$$E(x) = \sum_{i=1}^{n} x_i * p_i$$

② Variance $V(x)$

$$V(X) = E(x^2) - [E(x)]^2$$

where

$$E(x^2) = \sum_{i=1}^{n} x_i^2 \cdot p_i$$

③ Standard deviation :-

$$\sigma = \sqrt{V(x)}$$

★ Continuous random variable :-

1) Probability density function :-

A real value function $f(x)$ is called p.d.f of continuous random variable if it satisfies the following conditions :-

i) $f(x) \geq 0 \quad — \quad x \in R$

ii) $\int_{-\infty}^{\infty} f(x)\,dx = 1$

2) Cummilative distinguish function :-

It is denoted by $F(x)$ and defined as :-

$$F(x) = \int_{-\infty}^{\infty} f(x)\,dx$$

(1) $$E(x) = \int_{-\infty}^{\infty} x_i \cdot f x\,dx$$

(2) $$V(x) = E(x^2) - [E(x)]^2$$

where,

$$E(x^2) = \int_{-\infty}^{\infty} x_i^2 \cdot f(x)\,dx$$

(3) Standard deviation

$$\sigma = \sqrt{V(x)}$$

* $\int x^n dx = \frac{x^{n+1}}{n+1}$

$\int \frac{1}{x} dx = \log x$

Ch- Binomial Theorem

If X is a discreate random variable belongs to Binomial distribution are in parameter n and p then p.m.f of X is given by,

$$P(X = x) = {}^nC_x \cdot p^x \cdot q^{n-x}$$

where,

p :- probability of success
q :- probability of failure
x :- $1, 2, 3, \ldots, n$
$p + q = 1$

* ${}^nCr = \frac{n!}{(n-r)!r!}$

* ${}^nC_0 = {}^nC_n = 1$, ${}^nC_{n-1} = n$

* ${}^nC_1 = n$

$E(X) = np$

$V(X) = npq$

$\sigma = \sqrt{npq}$