Date

⇒ Discrete Probability Distribution function / p.m.f. / p.d.f

discrete r.v. $X \underset{\text{follows}}{\sim} P(x)$

$0 \leq P(x) \leq 1$

$\sum_{S} P(x) = 1$

- if a function holds the two properties then its discrete Probability dis. function

⇒ Expected Value: / $E(x)$:
Using the available data we predict the probability.
* Average is for past data.
* Expected value is for future data.

$$E(x) = \sum x \cdot P(x) \quad \Rightarrow \quad E(\underbrace{g(x)}_{\text{function of } x}) = \sum g(x) \cdot P(x)$$

⇒ Variance of Expected value:-

$$V(x) = E(x - E(x))^2$$
$$= \sum x^2 P(x) - \left[\sum x P(x)\right]^2$$

Standard Deviation = $\sqrt{V(x)}$

$$V(x) = \frac{\sum (x - \bar{x})^2}{n}$$
$$= E(x - \bar{x})^2$$
$$= E(x) - (E(x))^2$$

expected value is mean. $\frac{\sum x}{n}$

⇒ Continuous Probability Distribution function:
continuous r.v. $X \sim P(x)$

- $0 \leq P(x) \leq 1$

$$\int_{-\infty}^{+\infty} P(x)\, dx = 1$$

- at specific point probability will be zero. so we find area between two points.

Date

$E(x) = \int_R x\, P(x)\, dx$

$V(x) = E(X - E(x))^2 dx$

$= \int x^2 P(x) - \int [x P(x)]^2 dx$

R - Language

x = c (1 : 6)
→ vector
px = rep (1/6, 6)
mean(x)
Ex = sum (x * px)
Vx = sum((x^2 * px) - Ex^2)^2
sdx = sqrt vx

c (round (Ex - sdx), (Ex + sdx))
c (2 , 5)

r:- rbinom ⇒ random no generator.

P:- p binom ⇒ probability

d:- density :

q:- quartiles:-

⇒ Discrete Probability Distribution:-

1) ⇒ Binomial Probability distribution :

* where we have two possibilities e.g pass & fail.
* $X \sim b(n, p)$
* P (success) = P
* P (failure) = 1 - P

n :- no. of time exp. repeated.
x :- no. of success. where x = 0, 1 - n

$P(X = x) = {}^{n}C_{x}\, p^{x} (1-p)^{n-x}$

$n = 10,\ P = 0.7,$
$P(X = 1)$

$P(X = 1) = {}^{10}C_{1} (0.7)^{1} (1-0.7)^{10-1}$
$= 0.000137$

Date

$\Rightarrow$ 4 properties/characteristics ~~to~~ follow Binomial:-

1) Two Possible outcomes either success or failure.
2) P(Success) = constant in each trial (full-time repetition).
3) If trial is constant, then independent.
4) Repeated fixed no. of time "n"

- e.g Coin Tossing follows Binomial distribution.
- in a deck of cards it is not constant like $1/52, 1/51, 1/50$

Example:- Coin is Tossed 10 times. and to get exactly 2 heads.

$n = 10 \quad P = 1/2 \quad P(X=2) = {}^{10}C_{2} \, (1/2)^2 (1 - 1/2)^{10-2}$

$= 0.0439$

$\Rightarrow$ for at least 1 Head $\Rightarrow P(X \leq 1) \Rightarrow 1 - [P(x=0) + P(x=1)]$

$\Rightarrow$ for ~~ate~~ x is greater than 2 $\Rightarrow P(X > 2) \Rightarrow 1 - [P(x=0) + P(x=1)]$

$\Rightarrow$ for $P(X > 1)$ ya tu saari $n = 2, 3, 4, 5 \ldots 10$ karke add karlein ya $1 - P(x=0) + P(x=1)$

$\underbrace{0, 1}, \underbrace{2, 3 \ldots 10}$

Example:- rolls a dice 10 times what is probability of at least getting 6 for one time?

$n = 10 \quad P = 1/6 \quad (1-P) = 5/6$

$P(X \leq 1) = 1 - [{}^{10}C_{0} \, (1/6)^0 (1 - 1/6)^{10-0}]$

$= 0.8384$

Date

$\Rightarrow$ 2 ya 2 se zyada tu uska liye 0. or 1 ka hi nikalein gay. $\underbrace{0, 1}, \underbrace{2, 3, 4 \ldots 10}$

$\Rightarrow$ Kam se Kam ek theek hoga $(x > 1)$

$$E(x) = \sum x \cdot P(x)$$
$$= \sum x \binom{n}{x} p^x (1-p)^{n-x}$$
$$= n \cdot p$$

$$V(x) = E(x^2) - [E(x)]^2$$
$$= \sum x \binom{n}{x} p - [(\sum x p^x)]^2$$
$$= n \cdot p (1-p)$$

Stdev. = $\sqrt{V(x)}$

$\Rightarrow$ What is the ~~probability~~ expectedvalue of getting head if we toss 10 coins.

$$E(x) = n \cdot p$$
$$= 10 \cdot \tfrac{1}{2} = 5 \text{ times}$$

$$V(x) = 5(1 - \tfrac{1}{2}) = 2.5$$

St dev = $\sqrt{2.5}$

Measure of dispersion = $5 \pm \sqrt{2.5}$