$$\text{PROBABILITY} = P(X=x) = \lim_{N \to \infty} \frac{\text{Frequency}(x)}{N} \leftarrow \text{Relative Frequency}$$

Number of observations

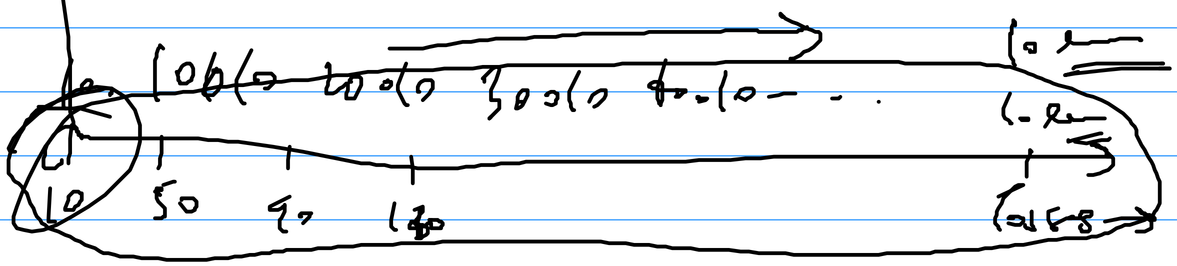
When N is small then it will be called a Sample but when N is large, its called Population

When N is small then $\frac{\text{Frequency}(x)}{N}$ will fluctuate a lot. but when N is large then it will almost get a stable to a constant value.

10, 50, 90, 140, 190, 240, 290, 340, 390,
440, 490

1 - lakh

Tail RE



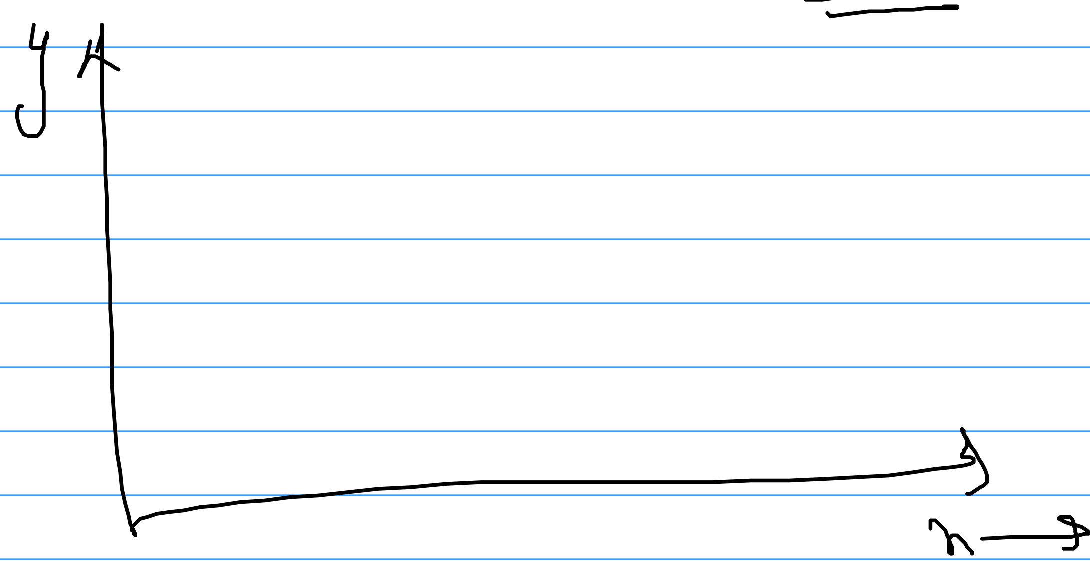
Binomial PDF :- Total Number of times a Bernoulli trial goes [illegible] done

$$P(X=k) = {}^{N}C_{k}\,(p)^{k}\,(q)^{(N-k)}$$

X is a Binomial Random Variable and x is a discrete RV

and it measures the total number of times DESIRED OUTCOME

$y = f(x)$

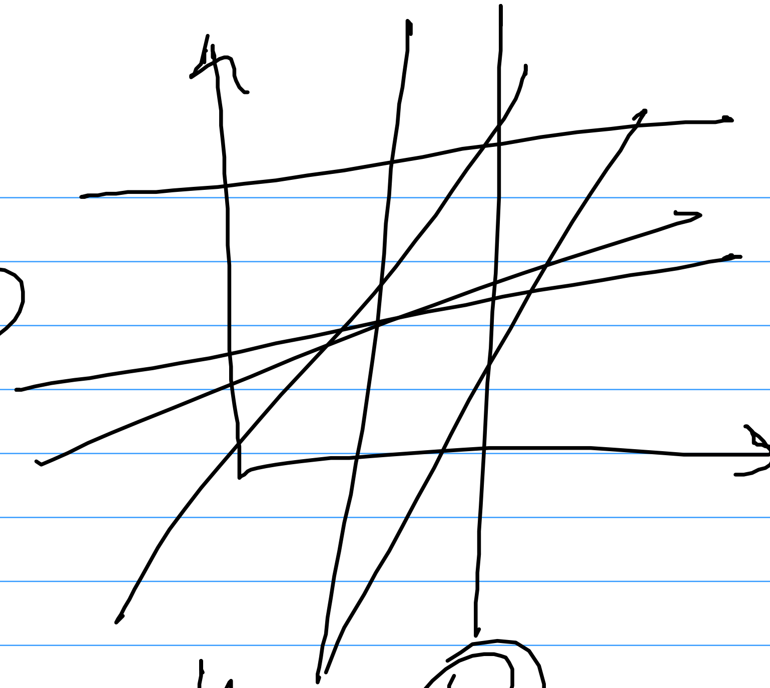


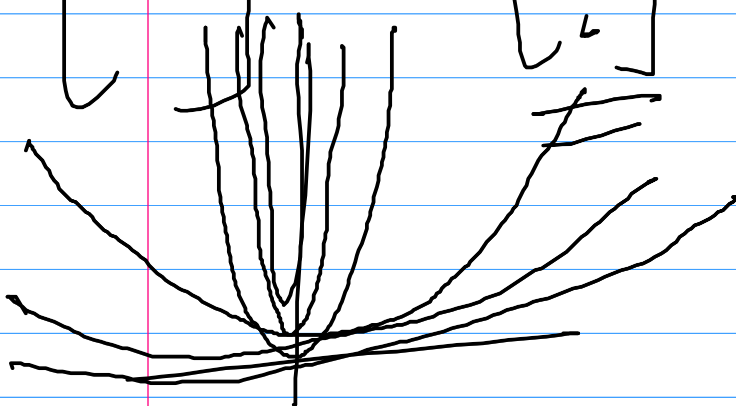

$$P(X=k) = y = \underbrace{{}^{N}C_{k}\,(p)^{k}\,(q)^{(N-k)}}_{x}$$

x

$y = f(x) = mx + c$

$\alpha$ $\quad$ 1 2 3 4 5 6 $\quad$ $\beta$





$y = a^x$

$a > 1$

$a < 1$

$(x-a)^2 + (y-b)^2 = r^2$

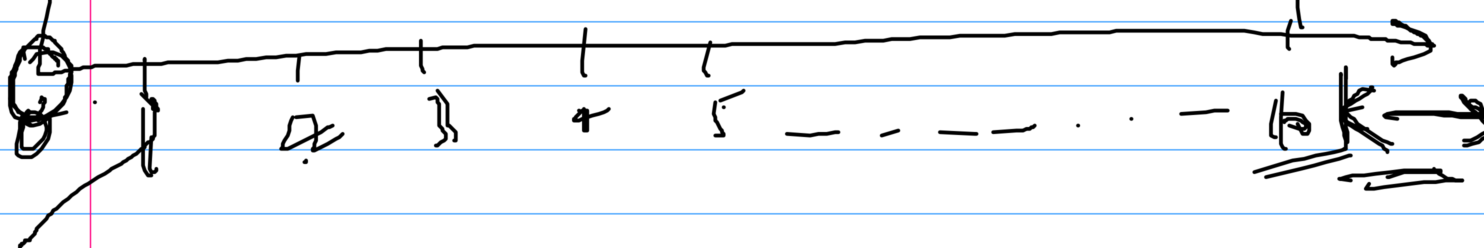
$N, p$ $\quad$ $N = 10$, $p = 0.35$

$P(X = k)$

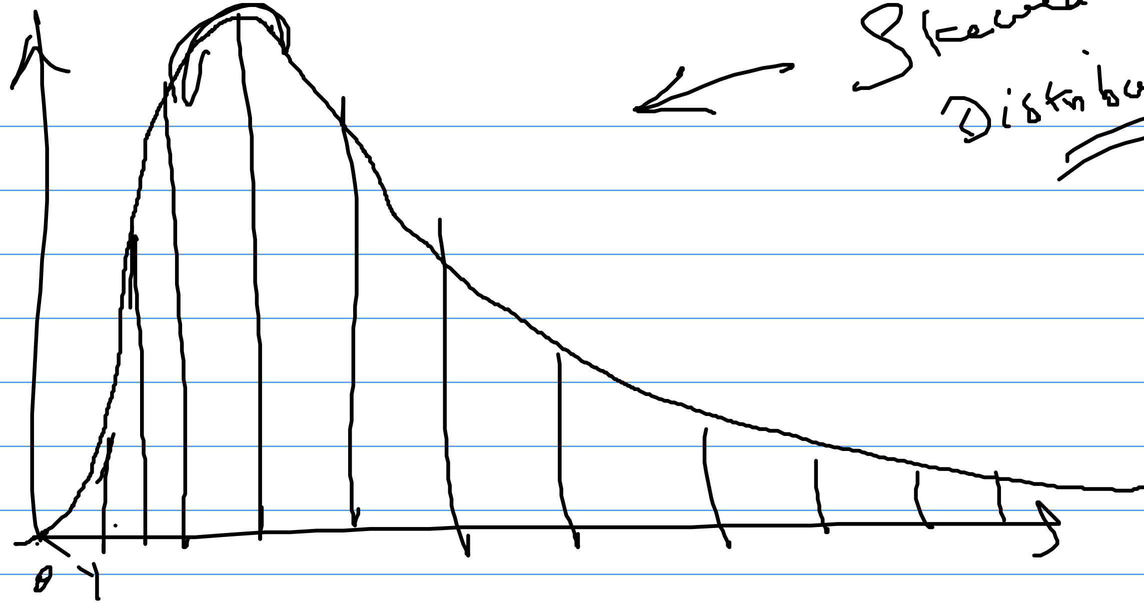
$P(X=0) = {}^{10}C_0 (0.35)^0 (0.65)^{10}$ $\quad$ $q = 0.65$

$= 1 \cdot 1 \cdot \quad = 0.0134$

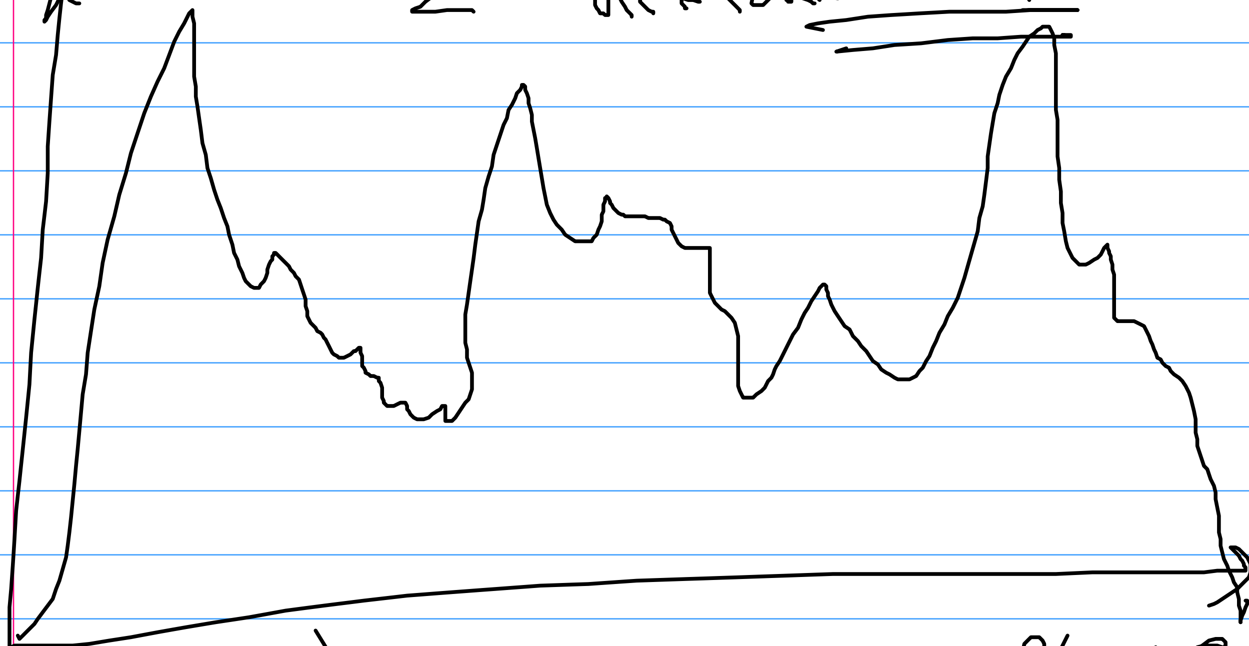
$P(X=0)$ $P(X=1)$ $P(X=2)$ $\quad$ $P(X=10)$



Skewed Distribution



MIXTURE OF GAUSSIANS



P(X=0.000000(013)

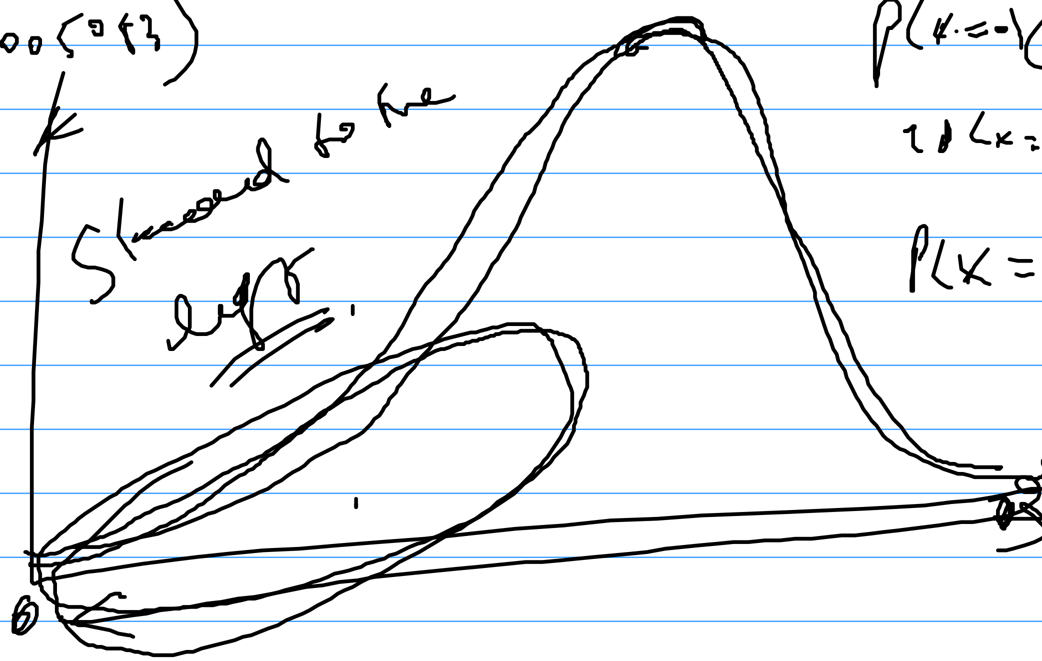
P(X=0) ≈ P(X=1)

≈ P(X=2) ≈ - - -

P(X=10) = 1

e.g.

Skewed to the left.



Mean

$$\frac{[10, 15, 38, 40, 37, 44]}{6}$$

[40, 43, 41, 42, 5, 8] N/6

28.5

$$\frac{1600 + 1000 + \ldots}{60} = 100$$

[−1, −18, 0, 99, 108, 44]

[18, 19, 20, 44, 39, 55] 

5000 laddu

[3.5, 5.5, 6, 4, 8, 4, 4.5, ......]

4 4 4 4 4 4 4 4 ..

−0.5 +1.5

$$\frac{|3.5-4| + |5.5-4| + |6-4| + |4-4| + \ldots}{5000}$$

4 cm

16, 86, 106, 85, 106 → 0

$$(3.95\ cm - 4) = (0.05)^2 \to 0$$

$$(6cm - 4cm)^2 = 4$$

Spotlight effect

Variance

Regularization effect

$$(3 \cdot (3 + 4 \ldots)^2 + (6 \ldots - \ldots)^2 + \ldots$$

Standard deviation

Shoe size

$X$

$$3 + 4 + 4 + 5 + 6 + 7 + 7 + 3 + 7 + 5 + 7$$

$$\frac{2 \times 3 + 2 \times 4 + 2 \times 5 + 1 \times 6 + 3 \times 7}{10} = \bar{X}$$

$$\frac{2 \times 3}{10} + \frac{2 \times 4}{10} + \frac{2 \times 5}{10} + \frac{1 \times 6}{10} + \frac{3 \times 7}{10}$$

$$\left(\frac{2}{10}\right) \cdot 3 + \left(\frac{2}{10}\right) \cdot 4 + \left(\frac{2}{10}\right) \cdot 5 + \left(\frac{1}{10}\right) \cdot 6 + \left(\frac{3}{10}\right) \cdot 7$$

$$3 \cdot P(X=3) + 4 \cdot P(X=4) + 5 \cdot P(X=5) + 6 \cdot P(X=6)$$

$$\sum_{k=0}^{6} k \cdot P(X=k) = \text{Population mean of Discrete RV}$$

Population mean of DRV $= \sum_{k=-\infty}^{+\infty} k \cdot P(X=k) = \mu = E[X]$

$E[\;] \longrightarrow$ EXPECTATION OPERATOR

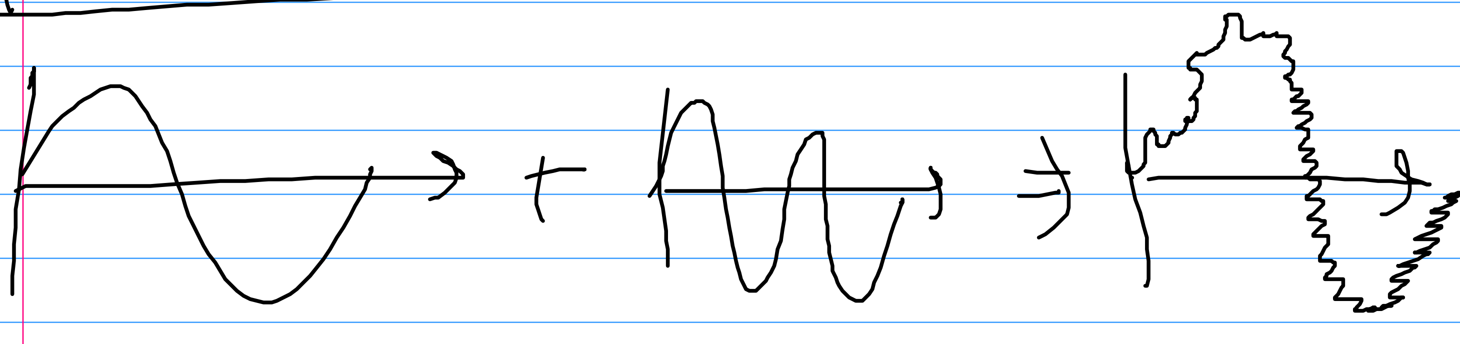
$\cancel{E[X]}$ $\quad E[\log_e X] = \sum_{k=-\infty}^{+\infty} (\log_e k) \cdot P(X=k)$

$$E[X] = \sum_{k=-\infty}^{+\infty} k \cdot P(X=k)$$

$$E[\log_e X] = \sum_{k=-\infty}^{+\infty} \log_e k \; P(X=k)$$

$N=5 \quad X = 0, 1, 2, 3, 4, 5$

$$\boxed{E[X] = \sum_{k=-\infty}^{+\infty} k \cdot P(X=k)} \longrightarrow \text{Population mean}$$



$\boxed{i.i.d}$

$P(G|R)$

$$P(G|R) = \frac{P(G \cap R)}{P(R)} \Rightarrow \frac{1}{4} \cdot \frac{1}{2}$$

$P(G \cap S)$

Naive

$$P(G|R) = \frac{P(G \cap R)}{P(R)} \Rightarrow P(G) \cdot P(R)$$