Type of Probability Distributions

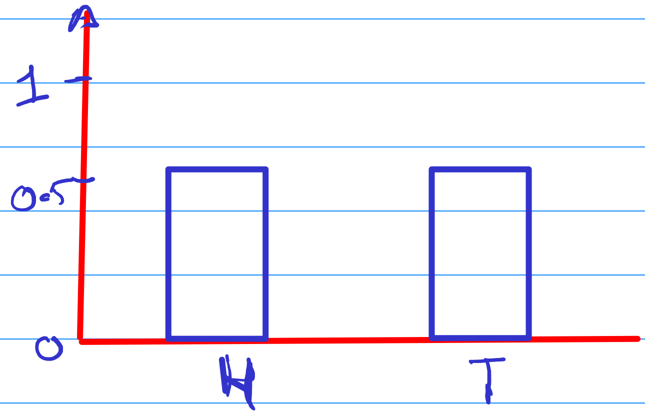
Bernoulli Distribution: -

- Bernoulli distribution is a discrete probability distribution
- it's concerned with discrete random variables {PMF} ✓
- Bernoulli distribution applies to events that have **one trial** and **two possible outcomes**. These are known as Bernoulli trials.

eg - Tossing a Coin {H, T}

$P(H) = 0.5 = p$

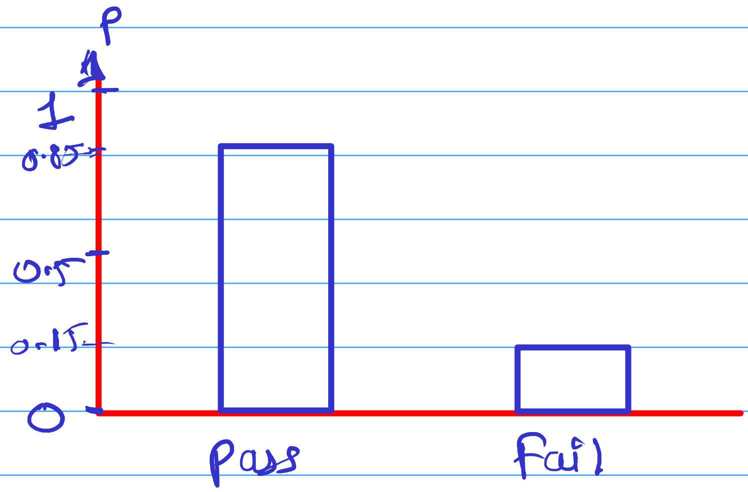
$P(T) = 1 - p = 0.5$
$= q$



eg - whether the person will pass / Fail

$P_r(\text{Pass}) = 0.85 = p$

$P_r(\text{Fail}) = 1 - 0.85$
$= 0.15 = q$

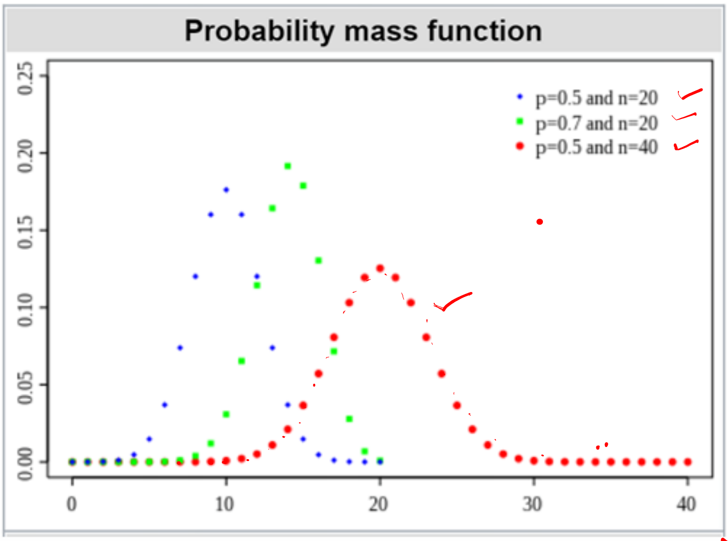


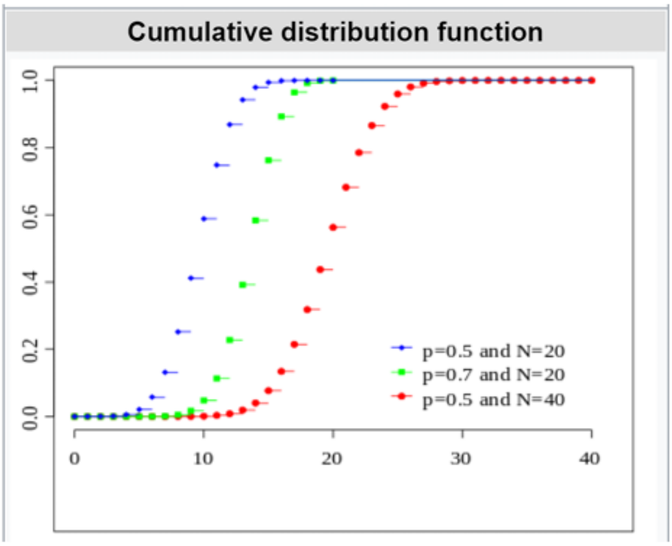
Binomial Distribution: -

- it's concerned with discrete random variables {PMF}
- There are two possible outcomes: true or false, success or failure, yes or no.
- These Experiments is Performs for n trials
- Every trial is an independent trial, which means the outcome of one trial does not affect the outcome of another trial.

eg - Tossing a Coin 10 times.

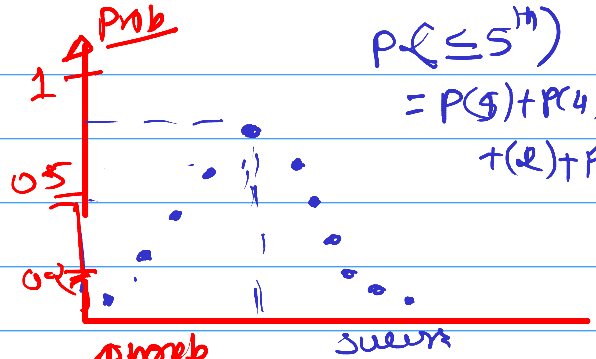
Binomial distribution



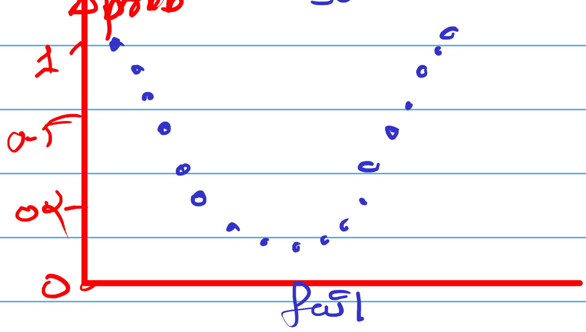


	success	fail
Trial 1 →	0.1	0.9
Trial 2 →	0.3	0.7
3 →	0.5	0.5
4	0.6	0.4
5	0.7	0.3
6	0.6	0.4
7	0.5	0.5
8	0.3	0.7
9	0.2	0.8
10	0.1	0.9
	0	1

n trial
10 time



$P(\leq 5^{th})$
$= P(5)+P(4)+P(3)$
$+P(2)+P(1)$

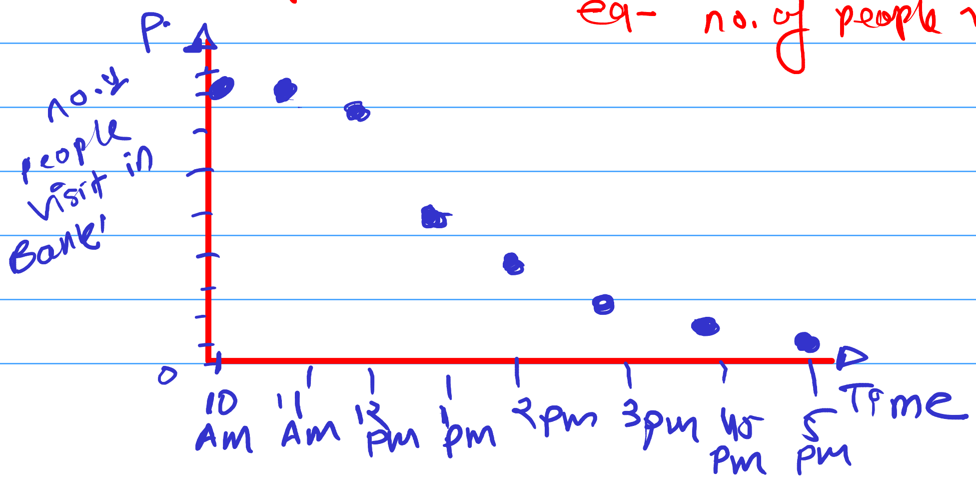


Poisson Distribution: -

- it's concerned with discrete random variables {PMF}
- Describe the number of events occurring in a fixed time interval

eq- no. of person visit in Bank.

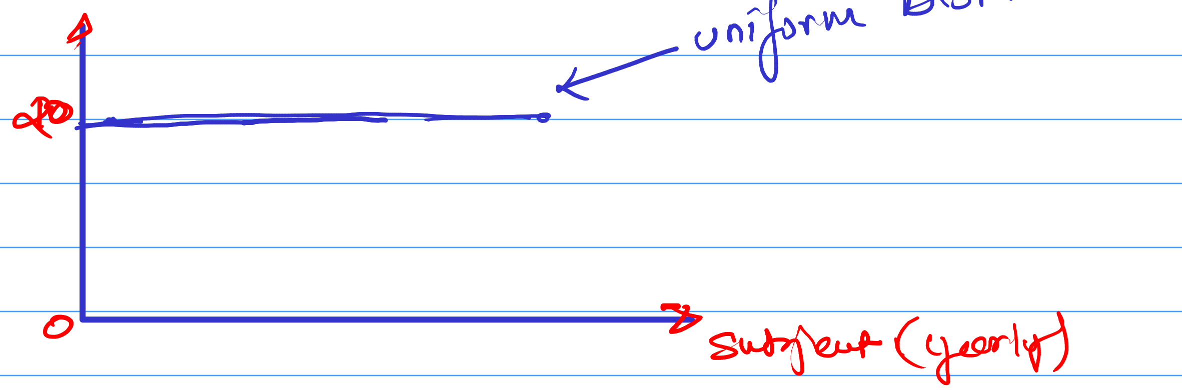
eq- no. of people visit in hosp.



Uniform Distribution

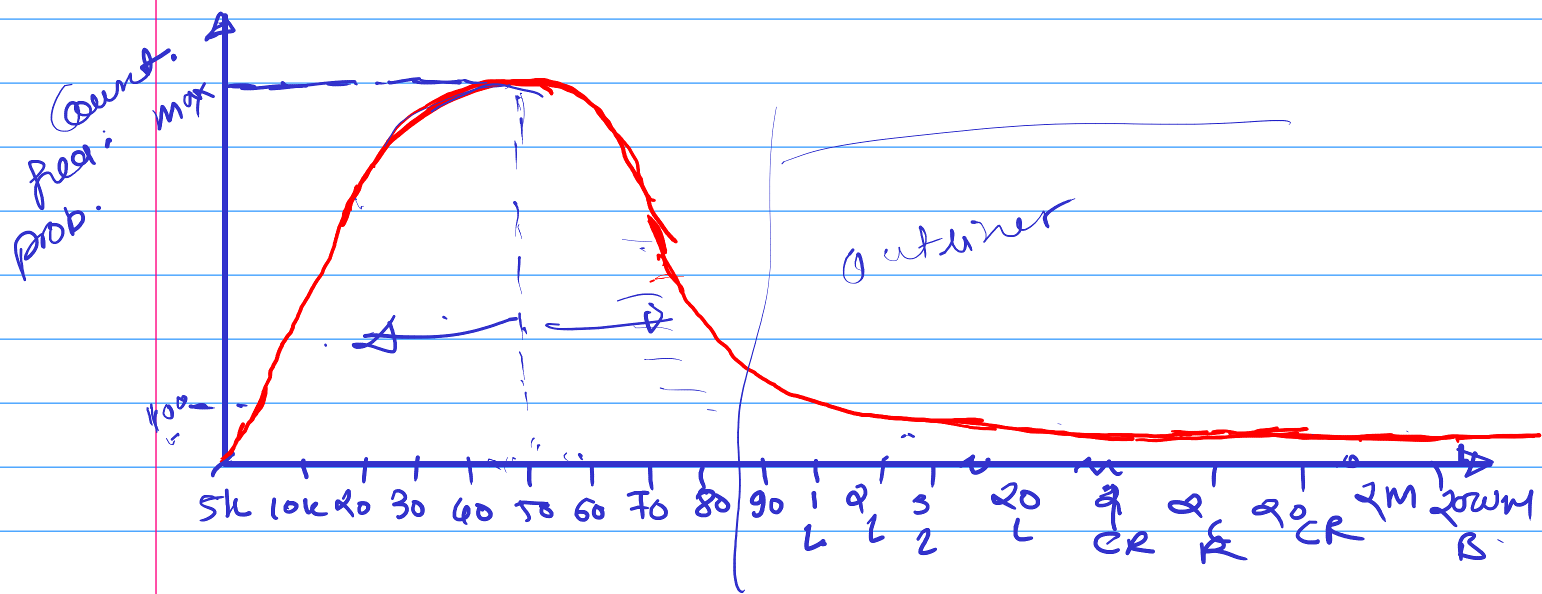
→ Continious Distribution

eg → Sale of any product.
eg → Topper marks in a class.



Log-Normal Distribution: - A log-normal distribution is a continuous distribution of random variable y whose natural logarithm is normally distributed. For example, if random variable y = exp { y } has log-normal distribution then x = log (y) has normal distribution.

eg → Income Rate. in India

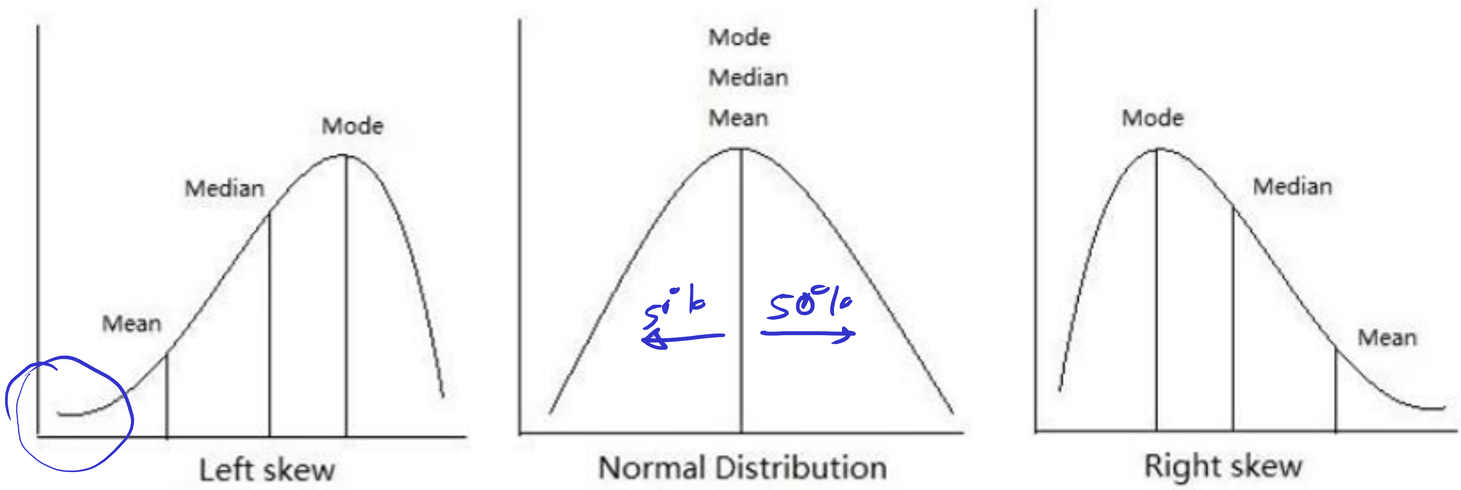


Normal or Gaussian Distribution: -

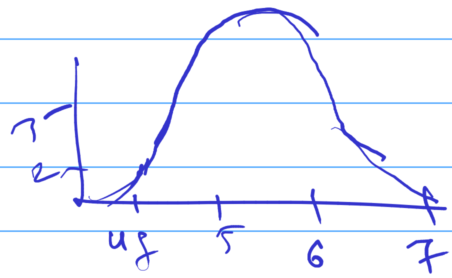
- it's concerned with Continuous random variables {PDF}
- Normal distributions are symmetrical, but not all symmetrical distributions are normal

Characteristics of Normal Distribution

- mean = median = mode
- Symmetrical about the center
- Unimodal
- 50% of values less than the mean and 50% greater than the mean

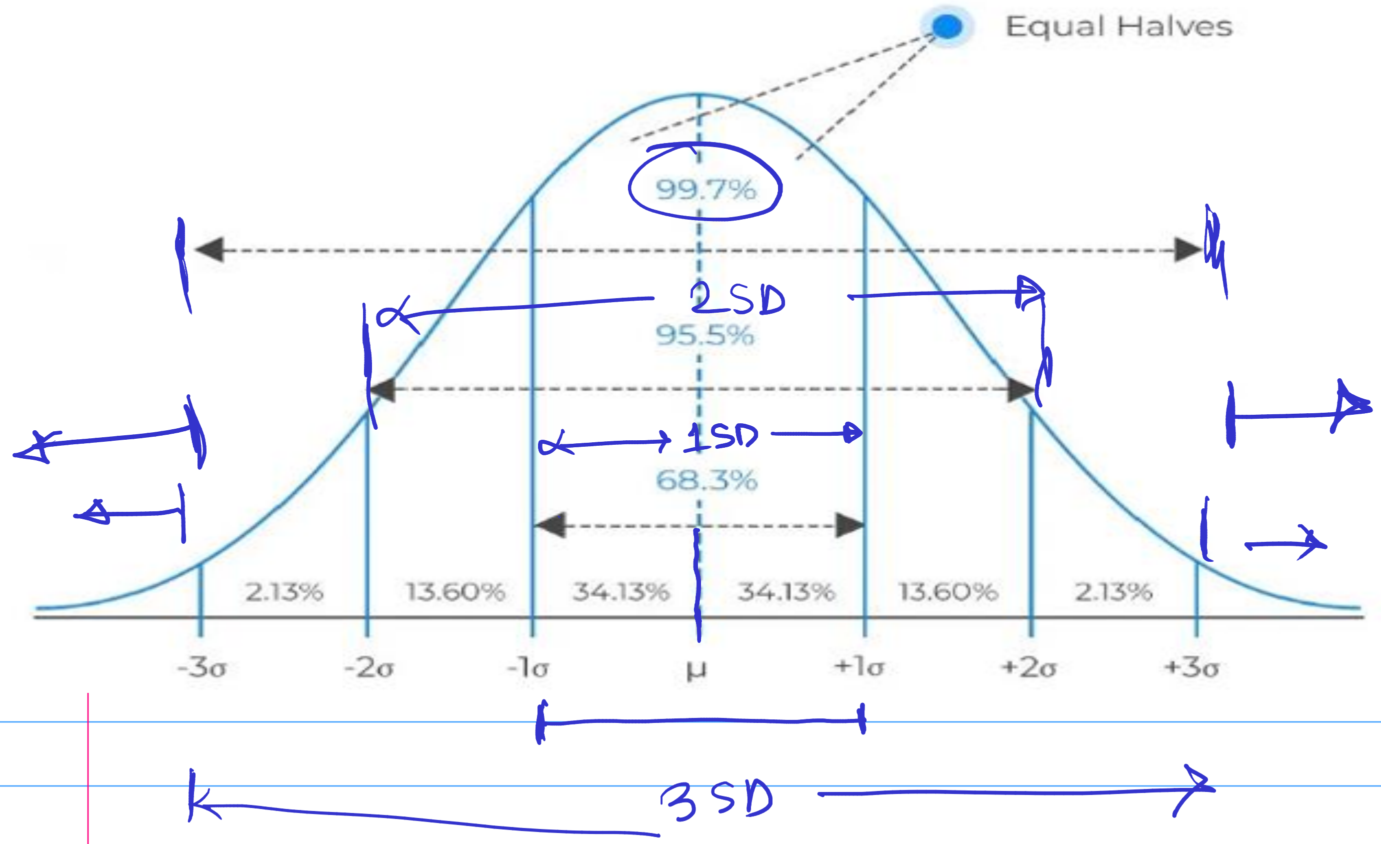


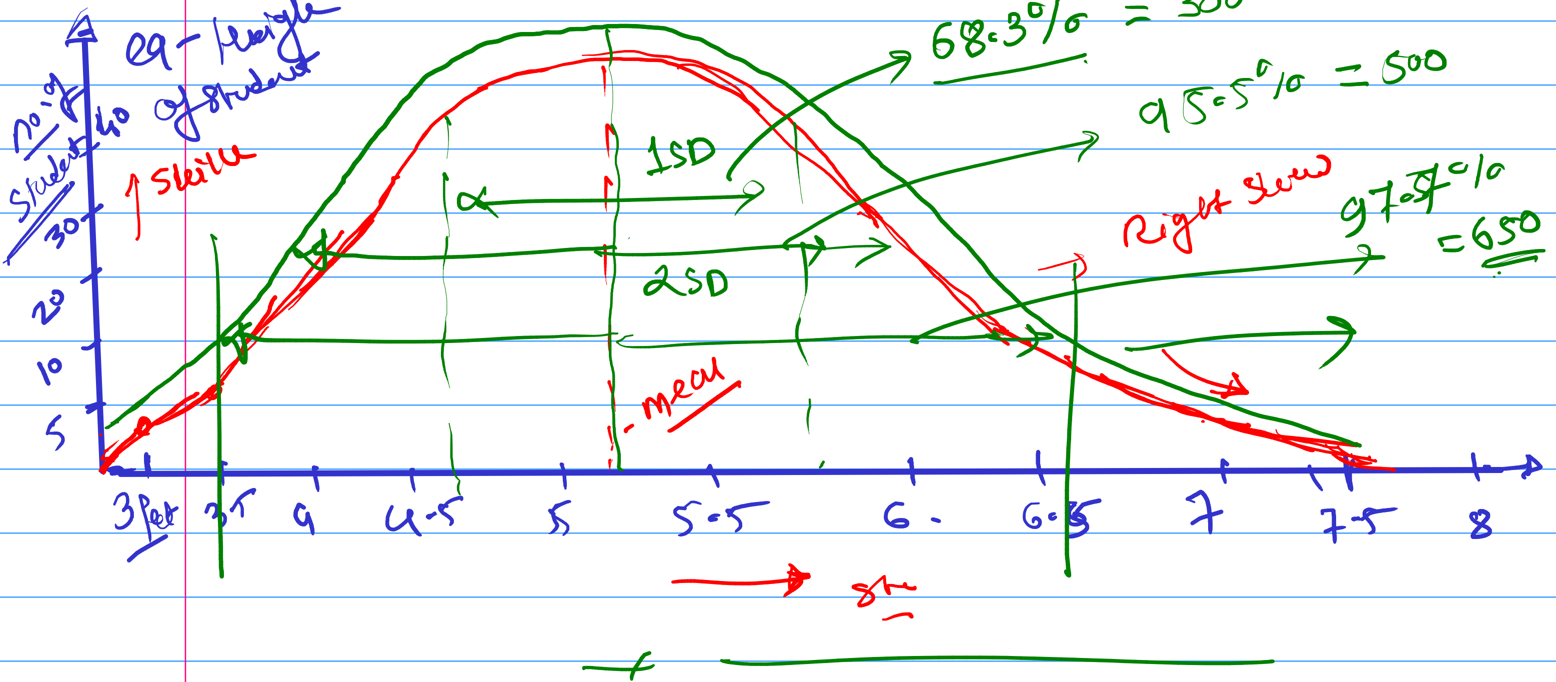
eg – Blood pressure.
Height.



Empirical Rule of Normal Distribution: - The empirical rule

in statistics, also known as the 68 95 99 rule, states that for normal distributions, 68% of observed data points will lie inside one standard deviation of the mean, 95% will fall within two standard deviations, and 99.7% will occur within three standard deviations.





➤ **Standard Normal Distribution Z-Score:- The standard normal distribution is a specific type of normal distribution where the mean is equal to 0 and the standard deviation is equal to 1.**

Height
mean = 5 feet
SD = -

Height
mean = 50
SD =

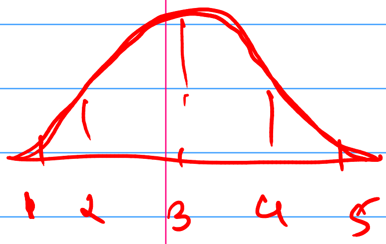
mean = 0
SD = 1

$$Zscore = \frac{x_i - \mu}{\sigma}$$

eg → $x = \{1, 2, 3, 4, 5\}$

Standardize

$$Zscore = \frac{x_i - \mu}{\sigma}$$



$\mu = \frac{1+2+3+4+5}{5} = \boxed{3 = \mu}$

$\boxed{\sigma \approx 1}$

$z(1) = \frac{1-3}{1} = -2$

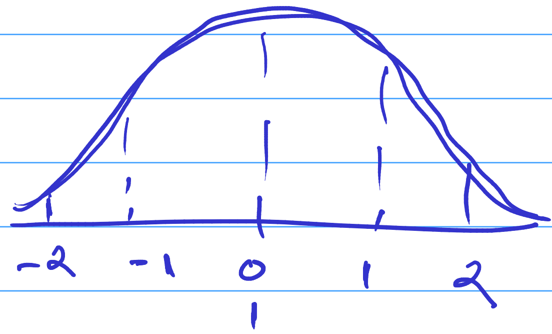
$z(2) = \frac{2-3}{1} = -1$

$z(3) = \frac{3-3}{1} = 0$

$z(4) = \frac{4-3}{1} = 1$

$z(5) = \frac{5-3}{1} = 2$

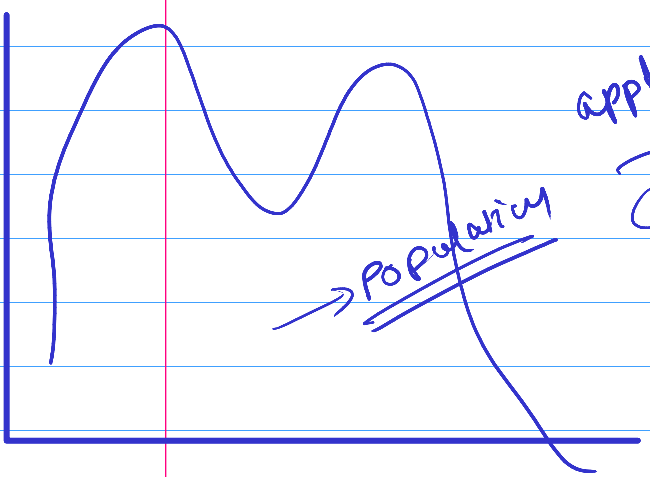
$x = \{-2, -1, 0, 1, 2\}$



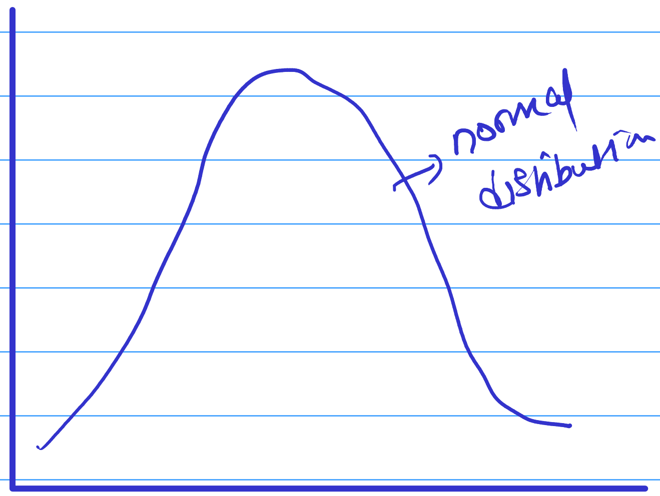
$\boxed{\begin{matrix} \mu = 0 \\ SD = 1 \end{matrix}}$

Central limit Theorem: - For large sample sizes, the sampling distribution of means will approximate to normal distribution even if the population distribution is not normal.

1. The sample size is **sufficiently large**. This condition is usually met if the size of the sample is $n \geq 30$.
2. The samples are **independent and identically distributed, i.e., random variables**. The sampling should be random.
3. The population's distribution has a **finite variance**. The central limit theorem doesn't apply to distributions with infinite variance.



applying → central limit



Population
$N = \{3, 4, 3, 5, 6 \dots\}$ Indian heights

100Cr

Population

Central Limit Theorem

Sample 1 $= \{x_1, x_2, x_3 \dots x_{30}, x_{31}\} = \bar{x}_1$

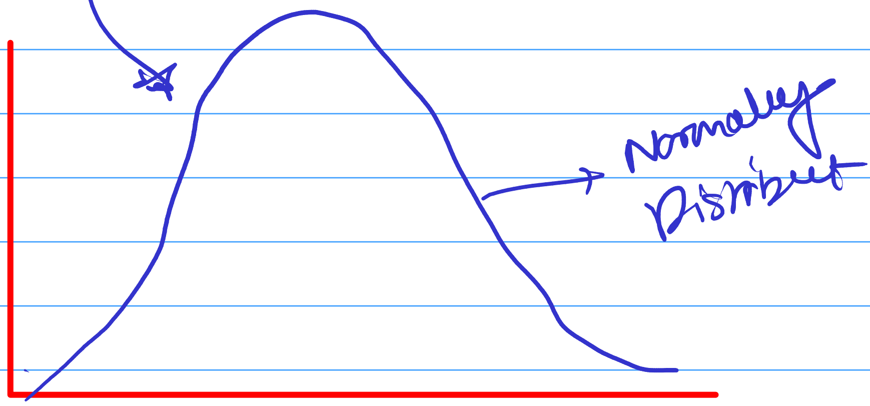
Sample 2 $= \{x_1, x_2 \dots x_{31}\} = \bar{x}_2$

Sample $\dots$ $= \bar{x}_3$

$= \bar{x}_4$

Sample 31 $= \{x_1, x_2 \dots x_{31}\} = \bar{x}_{31}$

Sample mean $= \{\bar{x}_1, \bar{x}_2, \bar{x}_3, \bar{x}_4 \dots \bar{x}_{31}\}$



If $= n \rightarrow$ normally

then $N \approx$ Normally.

1. **What is Central Limit Theorem in Statistics?**

Central Limit Theorem in statistics states that whenever we take a large sample size of a population then the distribution of sample mean approximates to the normal distribution.

$n \geq 30$

2. **When does Central Limit Theorem apply?**

Central Limit theorem applies when the sample size is larger usually greater than 30.

3. **Why is Central Limit Theorem important?**

Central Limit Theorem is important as it helps to make accurate prediction about a population just by analyzing the sample.

4. **How to solve Central Limit Theorem?**

The Central Limit Theorem can be solved by finding Z score which is calculated by using the formula.

$$Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$