① Central Limit Theorem

The central limit theorem relies on the concept of a sampling distribution, which is the probability distribution of a statistic for a large number of samples taken from a population.

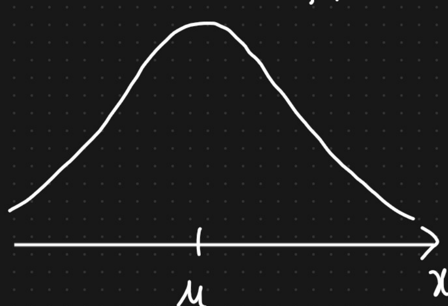
The central limit theorem says that the sampling distribution of the mean will always be normally distributed, as long as the sample size is large enough. Regardless of whether the population has a normal, Poisson, binomial, or any other distribution, the sampling distribution of the mean will be normal.

now :

case ①

$X \approx N(\mu, \sigma) \rightarrow$ random varaible follows normal distribution

Population DATA



n = Sample Size $\Rightarrow$ any value

$S_1 = \{x_1, x_2, x_4 \ldots x_n\} = \bar{x}_1$

$S_2 = \{x_2, x_3 \ldots x_n\} = \bar{x}_2$

S_3 — $\bar{x}_3$

S_4

$\vdots$

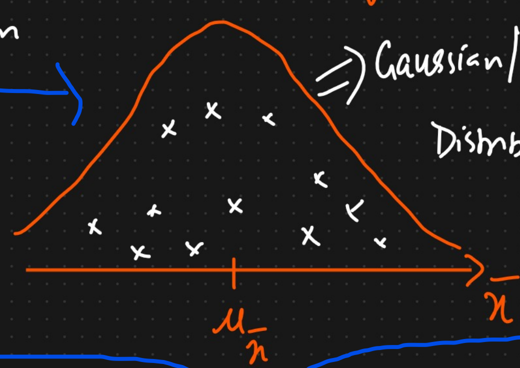
S_m — $\bar{x}_m$

mean

1. hence CLT states that, if random variable follows normal distribution for any value of n then, the sampling distribution of mean will always be normally distributed.

$\Downarrow$ $\boxed{CLT}$

Sampling distribution of the mean $\rightarrow$



$\Rightarrow$ Gaussian/Normal Distribution

case ②

$X \not\approx N(\mu, \sigma) \rightarrow$ dont follow normal distribution

$\Rightarrow$ $\boxed{n \geq 30}$ $\Rightarrow$ sample size

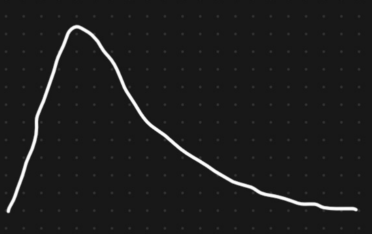
n should be greater than equal to 30

S_1 — $\bar{x}_1$

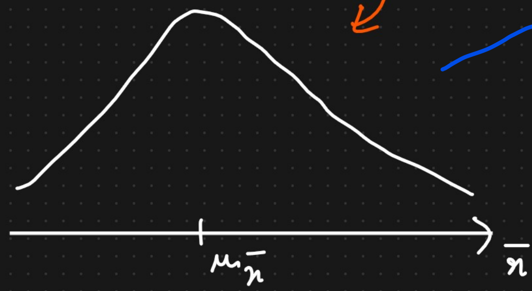
S_2 — $\bar{x}_2$

$\vdots$

$\bar{x}_m$



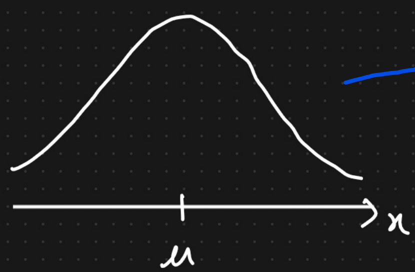
$\Downarrow$ $\boxed{CLT}$



2. And , if random variable does not follows normal distribution and n>=30 , then the sampling distribution of mean will always be normally distributed.
(note : poision and normal distribution does not follow normal distribution , hence this point is for them.

note once we apply sampling distribution of mean we will see some changes :

Normal Distribution



$$X \sim N(\mu, \sigma)$$

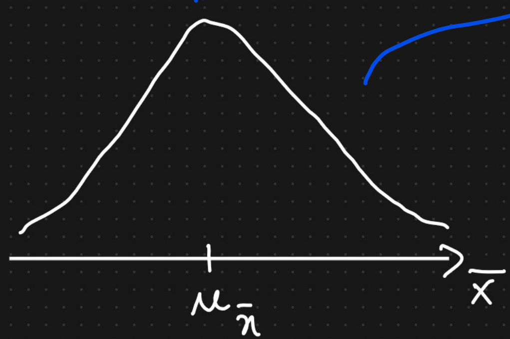
Applying the :

Sampling Distribution of mean

σ = population standard deviation

μ = population mean

n: sample size



$$X \sim N\left(\mu, \frac{\sigma}{\sqrt{n}}\right)$$

standard deviation