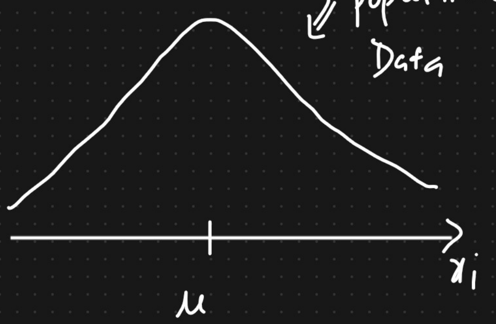
Central Limit Theorem (CLT)

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.

$n = 20$

① $X \approx N(\mu, \sigma)$



$S_1 = \{x_1, x_2, x_3 \cdots x_{20}\} = \bar{x}_1$

$S_2 = \{x_2, x_3, x_5 \cdots x_{20}\} = \bar{x}_2$

$S_3 = \{ \quad \} = \bar{x}_3$

$\vdots$

$S_m = \{ \cdots \} \quad \bar{x}_m$

$\bar{X} = \{\bar{x}_1, \bar{x}_2, \bar{x}_3 \cdots \bar{x}_m\}$

$\Downarrow$

② $X \not\approx N(\mu, \sigma)$

$\Rightarrow$

$\rightarrow \boxed{n \geq 30} \leftarrow$

$S_1 = \{x_1, x_2 \cdots x_{30}\} = \bar{X}_1$

$S_2 = \{x_2\ x_3 \cdots x_{30}\} = \bar{X}_2$

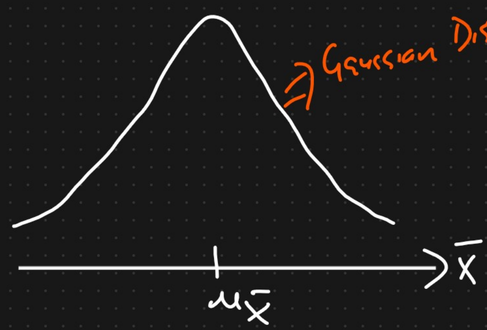
$S_3 = \quad \vdots \quad = \bar{X}_3$

S_4

$\vdots$

$S_m \quad \vdots \quad \bar{X}_m$

$\Downarrow$



$\Rightarrow$ Gaussian Distribution

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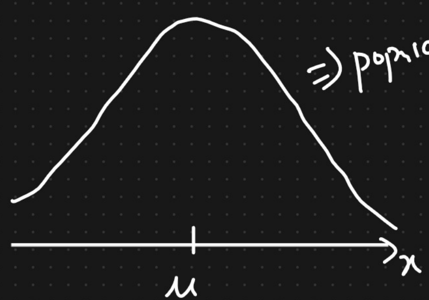


$\Rightarrow$ population

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

σ = population std

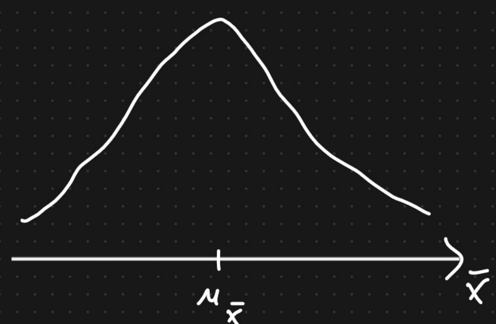
μ = population mean

n = sample size

$\Downarrow$

Sampling distribution of mean

CLT



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

n can be any value