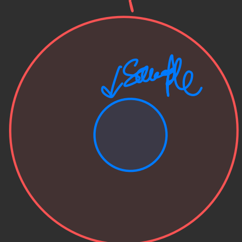
Sampling Distribution & CLT → central Limit Theorem

(distribution of incomes of all the people in the world.)

X :

Population vs Sample

population



→ (not necessarily Gaussian)

Population Distribution

n

$n = 30$

Sample mean

1 → random sample of size $(n=30)$ → S_1 → $\bar{x}_1$

2 → " " " " $(n=30)$ → S_2 → $\bar{x}_2$

⋮

m → m " " " " $(n=30)$ → S_m → $\bar{x}_m$

$$\underbrace{\bar{x}_1, \bar{x}_2, \bar{x}_3 \ldots\ldots\ldots \bar{x}_m}_{\bar{x}_i} \longrightarrow m \text{ Sample Mean}$$

$\bar{x}_i \sim$ distribution of Sample Mean

$\boxed{\text{dist of } \bar{x}_i = \text{Sampling distribution of Sample Mean}}$

CLT: $\quad \bar{x}_i \longrightarrow N\left(\mu, \frac{\sigma^2}{n}\right.$

CLT

X : random variable with finite μ, σ^2
(Sample size = n)

S_1, S_2, S_3, ... S_m (Samples)

$\downarrow$ $\downarrow$ $\downarrow$ $\downarrow$

$\bar{x}_1$ $\bar{x}_2$ $\bar{x}_3$ .... $\bar{x}_m$ (Sample Mean)

dist of $\bar{x}_i$ = Sampling dist. of Sample Mean

$$\bar{x}_i \longrightarrow N\left(\mu, \frac{\sigma^2}{n}\right) \text{ as } n \to \infty$$

$n \geq 30$

Any dist. X : $\rightarrow$ Income μ, σ^2 (Need not be Gaussian)

$S_1, S_2, S_3, \text{------} S_m$ of sample size $= n$

$n = 30$

$m = 1000$

$1000 \times 30 = 30K$

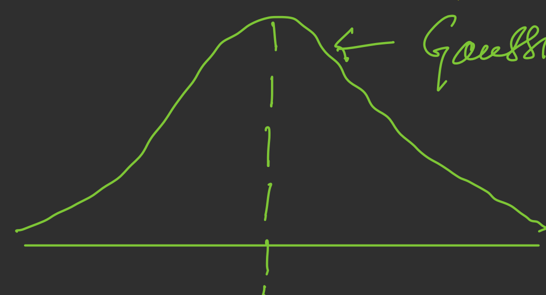
$m \times n = mn$

$\bar{x}_1, \bar{x}_2, \bar{x}_3 \text{------} \bar{x}_m$ (Mean in each sample)

Mean of $\bar{x}_i$'s $\simeq \mu$

Variance of $\bar{x}_i \simeq \frac{\sigma^2}{n}$

$n \geq 30$



$\leftarrow$ Gaussian

CLT → Statisticians → to make inferences about Population parameters.

↓

Sample size large enough.

when do we have infinite Mean?

Yes

like Pareto Distribution

For those dist. CLT will not work.