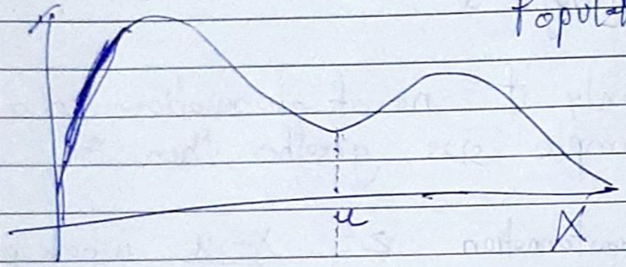
Sampling distributⁿ :-

— Theoretical distributⁿ

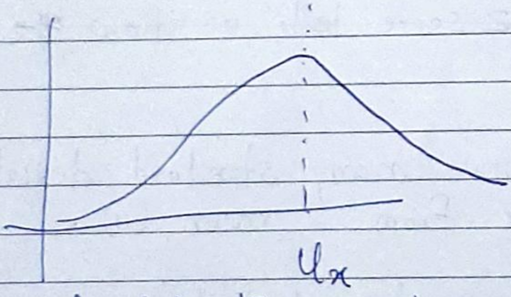
The distributⁿ of a statistic like - mean, etc where

we take 1 sample calculate mean & then take another sample calculate mean & ~~when~~ when we do this repeatedly we get a distributⁿ for the mean statistic. Central Limit Theorem says that if we have enough samples no matter which statistic we compute we get a Normal distribution.

Populatⁿ distributⁿ



Sampling Distributⁿ



Populatⁿ distributⁿ is unknown we will never know mean or std of Populatⁿ distributⁿ

Sampling distributⁿ is a theoretical distributⁿ. If we take many samples from populatⁿ distributⁿ calculate the static we will get the Sampling Distributⁿ which is a Normal distributⁿ.

CLT even tells us the mean & std of the sampling distributⁿ.

Parameter	Populatⁿ Distributⁿ	1 Sample drawn from populatⁿ	Sampling Distributⁿ
Mean	μ	$\bar{X}$	$\mu_{\bar{x}}$ & $E(\mu_{\bar{x}}) = \mu$
std	σ	s	$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

n = sample size

Because we are taking samples calculating their means & plotting the mean of ~~Target populatⁿ & Sampling di~~ ~~for~~ Populatⁿ & Sampling distributⁿ will be same

So $E[\mu_{\bar{x}}] = \mu$

CLT holds only if no of observations in a sample ie sample size greather then 30.

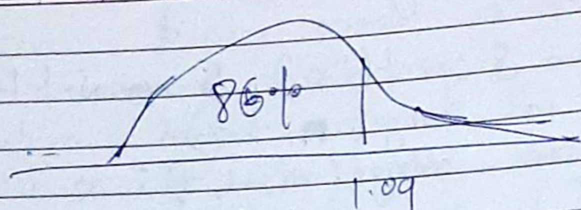
There is a transformation $z = \frac{X - \mu}{\sigma}$ which produces

$Z \sim N(0,1)$ ~~z score tells us how the far the datapoint x~~

Zscore tells us how many standard deviations is the datapt x from mean (μ).

Ztable or standard Normal table is a table which gives what percentage of values below a zscore.

Suppose a zscore = 1.09 & ~~here~~ is our input & ztable gives 0.862 ie 86% of values fall below these value



Standardizing formula for sampling distribut^n

$$Z = \frac{\bar{X} - u_{x}}{\sigma_{\bar{x}}} = \frac{\bar{X} - u}{\frac{\sigma}{\sqrt{n}}}$$

$\bar{X}$ = ~~Pleo~~ Sample pt of Sampling Distributth ie a statistic like mean

* CI for populat^n standard deviat^n or Large Sample size

$$Z = \left(\frac{\bar{X} - u}{\sigma}\right)\sqrt{n} = \frac{\bar{X} - u_{x}}{\sigma_{\bar{x}}}$$

we know $\bar{X}$, n ~~u_x~~, σ because ~~either~~
pop std is given.
we don't know u ($u = u_x$)

~~$u = Z \bar{X}$~~

$$CI = \bar{X} - Z_{\alpha}\left(\frac{\sigma}{\sqrt{n}}\right) \leq u \leq \bar{X} + Z_{\alpha}\left(\frac{\sigma}{\sqrt{n}}\right)$$

we have to decide level of confidence.
α is the probability that CI will not contain the True populat^n Mean. $(1-\alpha)$ & is confidence level

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Sub :

School / College :

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If we choose $Z_\alpha = 1.96$ ~~te~~ we are asking for 95% confidence interval because we are setting the propablity that True mean lies within the CI to 0.95
ie $1-\alpha = 0.95$ $\therefore \alpha = 0.05$

Suppose our CI ~~w~~ is very wide & has very high confidence level. But these is of no use bcoz ~~to~~ it hardly qualifies as meaningful
The best CI is narrow with high confidence level.
There is a Tradeoff betn confidencelevel & width of CI.
As $Z_\alpha \uparrow$ the width of CI $\uparrow$ & Z_α increases bcoz ~~of~~ the level of confidence is increasing.
~~The~~ The role of sample size n is that as $n \uparrow$ the std will $\downarrow$ & the CI will get narrower

Large Sample size

Date :

Given
Now we want to make inference abt populatn mean (μ).
We take a sample.
Sample Mean = $\bar{X}$
Sample std = ~~S~~ S
we choose confidence level = 0.95, so
$Z_{0.95} = 1.96$
& Large Sample size $n = 200$

→ ~~To~~ With above given we know that Central Limit Theorem is true & the Sampling distributn is a Normal & our sample mean comes from the sampling distributn.
No we create a band around our sample mean so the true populatn mean falls in this band 95% of time.

$$\left[\bar{X} - \frac{1.96 \times S}{\sqrt{n}}, \quad \bar{X} + \frac{1.96 \times S}{\sqrt{n}}\right)$$

we just say that populatn std is known infact we never know any parameter of populatn but bcoz the sample size is large enough the Central Limit Theorem is true & we can use sample std dev as a point estimate for populatn std.