* Hare Krishna *

Inferential Statistics:

1. Hypothesis testing
2. P- Value
3. confidence interval
4. Significance value.

Z-test

t- test

chi square test

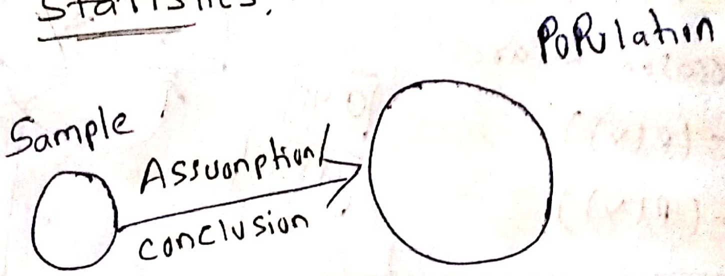
Annova test (F-test)

3 Distr...
1. Bernoulli...
2. Binom...
3. Poisson dist...

transformation

~~① Hypothesis Testing:~~

⇒ Inferential Statistics:



⇓

Hypothesis testing

steps of hypothesis testing:

[coin is fair]

① Null hypothesis:- basically takes the default. unless or until it is ~~not~~ proved not proven by default Null hypothesis always be true.

Experiment:

[coin is fair or not]

$P(H) = 0.5 \quad P(T) = 0.5$

(2) Alternate hypothesis: Opposite to Null hypothesis.
[coin is not fair]

(3) Perform Experiments:

$\boxed{75}$

Head	Tail
60	40
70	30
80	20

$\boxed{\text{100 times}}$

⇓

$\boxed{\text{50 time head}}$ ⇒ fair

$\boxed{\text{60 time head}}$

10 → Null hypothesis is rejected
→ Alternate hypothesis is Accepts

10 20 30 40 50 60 70 80 90

70 time head ⇒ Domain Expert

⇓

Confidence interval

C.I = [20-80] . C.I = Confidence Interval

⇓

coin is fair

↳ We fail to reject the null hypothesis [with in C.I]

↳ We Reject the Null hypothesis [out side C.I]

Conclusion

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2 Example :- Person is criminal or not. {murder case}

Null hypothesis: Person is not criminal

Alternate hypothesis: Person is criminal.

Experiment / Proof :- DNA, finger points, weapons, eye witness, footage

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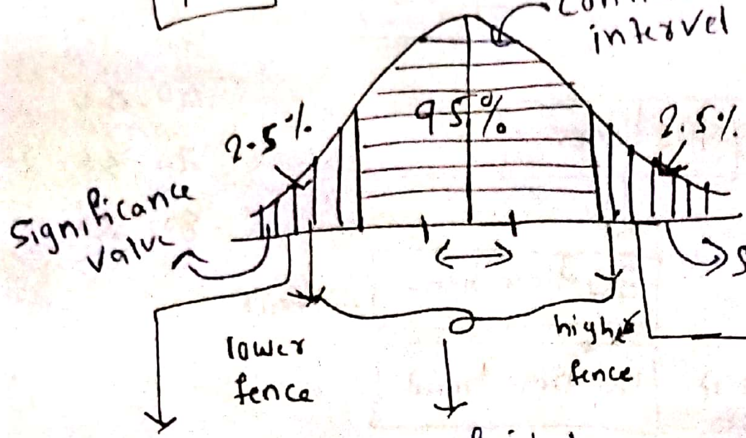
...tion. Judge ⇒ will Perform or gather the case.

Confidence interval :- (C.I)

Significance value (S.V)

$\boxed{95\%}$



significance value → Reject the null hypothesis
Vaccination ⇒ medical ⇒ critical

Reject the null hypothesis

we fail to reject the null hypothesis

C.I = 95%

Significance value = 1 − C.I

S.V = 1 − 0.95

= 0.05

Point estimate:- The value of any statistics that estimate the value of a parameter is called point estimate.

$\bar{x} \rightarrow \mu$

Statistics　　Parameter

Point estimate

$\boxed{\bar{x}} \rightarrow \mu$

$\boxed{\begin{matrix} \bar{x} \geq \mu \\ \bar{x} \leq \mu \end{matrix}}$

statistics
$\bar{x} \rightarrow \boxed{\mu}$ ← parameter
← Population mean

Sample mean

α = Significance value

Parameter ⇒ Population Mean

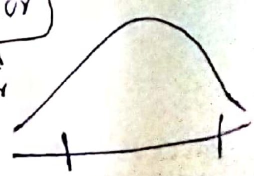
$\boxed{\text{Parameter} \Rightarrow \text{Population mean}} = \boxed{\text{Point estimate}} \pm \boxed{\text{Margin of error}}$

lower fence:- Point Estimate − Margin of error

higher fence:- Point estimate + margin of error

margin of error = $Z_{\alpha/2} \boxed{\frac{\sigma}{\sqrt{n}}}$ → standard error

σ → Population standard deviation



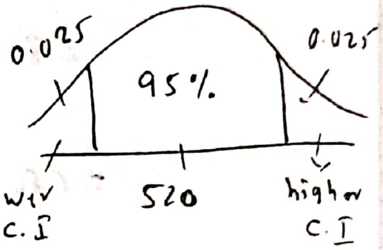
* On the Quant test of CAT EXAM, a sample of 25 test takers has a mean of 520 with a population standard deviation of 80. Construct a 95% C.I about the mean?

Ans: $n = 25, \quad \bar{x} = 520, \quad \sigma = 100$

$C.I = 95\% \quad S.V = 1 - C.I = 0.05$

lower C.I = Point Estimate − margin of error.

$\alpha = 0.05$



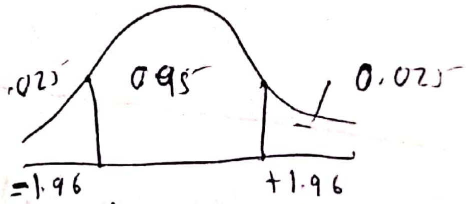
lower C.I = Point Estimate − margin of error

$= 520 - Z_{0.05/2} \frac{\sigma}{\sqrt{n}}$

$= 520 - Z_{0.025} \frac{\cancel{100}\ 20}{5}$

$= 520 - 1.96 \times 20$

$= 480.8$



$\alpha = 1 - C.I$

$= 1 - 0.95$

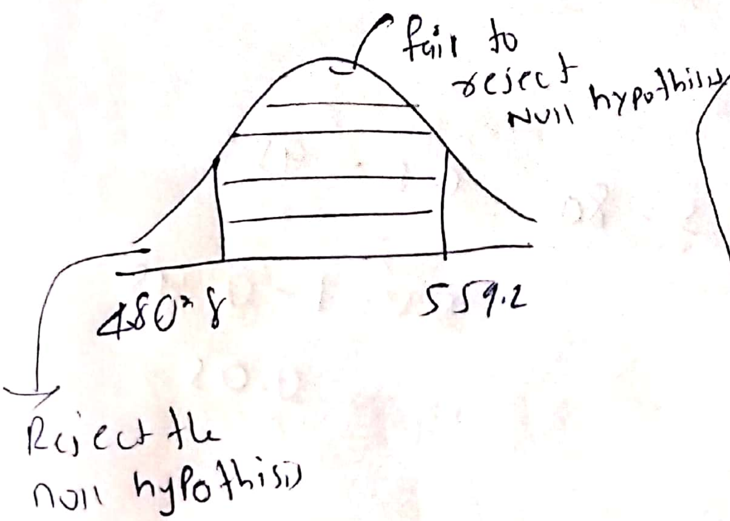
$= 0.05$

higher C.I $= 520 + 1.96 \times 20 = 559.2$

$C.I = 0.95$

$S.V = 1 - 0.95$

$= 0.05$

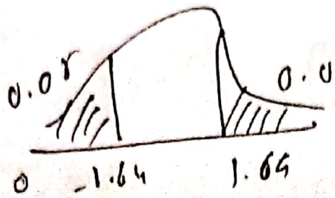


$Z_{\alpha/2} \Rightarrow$

$Z_{0.05/2} = \boxed{Z_{0.025}}$

(*) $\bar{X} = 480$ $\sigma = 85$ $n = 25$ C.I = 90%

Significance
$= 1 - 0.90$
$\boxed{= 0.10}$



lower C.I $= 480 - Z_{0.10/2}\left[\frac{85}{5}\right]$

$480 - Z_{0.05}\left[\frac{85}{5}\right]$

$= 480 - 1.64[17]$

$= 480 - 27.8 = 452.12$

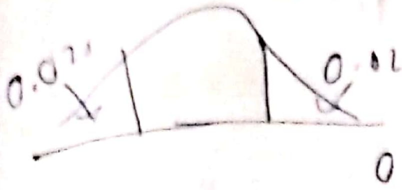
higher C.I $= 480 + 1.64[17]$
$= 480 + 27.8$
$= 507.8$

(*) On the quant test of CAT exam a sample of 25 test takers has a mean of 520, with a sample standard deviation of 80 construct 95% of C.I about the mean?

Ans $\bar{X} = 520$ $S = 80$ C.I = 95%

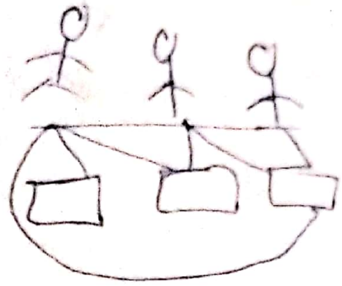
$S.V = 1 - 0.95$
$= 0.05$

$\bar{x} \pm t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$ t test



Degree of freedom
$= n-1 = 25-1$
$= 24$ //

$t = 0.025$



lower
$C.I = 520 - t_{0.05/2}\left(\frac{80}{5}\right)$ (16)

$= 520 - 2.064 * 16$

lower C.I = 486.976

high C.I = 553.024 //

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① <u>1 tail and 2 tail test</u> :-

A colleges in town A has 85% Placement rate. A new college was recently opend and it was found that a sample of 150 students had a Placements rate of $\boxed{88\%}$ with standard. deviation of $\boxed{4\%}$ does this college has a <u>different Placement</u> rate with 95% C.I ?

Hypothesis testinal.

* A factor has a machine that fills 80ml of Baby medicene in a bottel. An employee belives that average amount of baby medicine is not 80ml. Using 40 samples, he measures the average amount dispered by the machines to be 78ml. with a standard deviation of 2.5

a) State Null & Alternate hypothesis

b) At 95% C.I is there enough evidence to support machine is working properly or not

$\boxed{\mu = 80ml \quad n = 40 \quad \bar{x} = 78 \quad s = 2.5}$

~~Step~~ Step:- 1

Null hypothesis $\mu = 80 \Rightarrow$

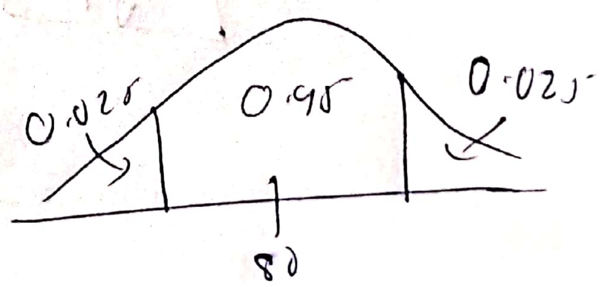
Alternative hypothesis. $\mu \neq 80 \Rightarrow$

Step:- 2

$S.V(\alpha) = 1 - 0.95$

$= 0.05$

$C.I = 0.95$



Step 3:

(1) $\boxed{n \geq 30 \quad \sigma \cdot \text{population std}}$

(2) $\boxed{n < 30 \text{ and sample std}}$

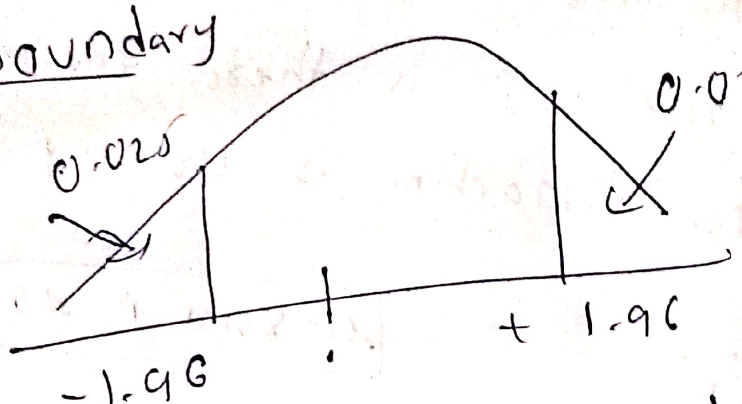
$n = 40$

$s = 2.5$

z-test

let perform the experiment

Decision Boundary



$1 - 0.125$
$= 0.9$

Calculate test statistics (z-test)

$$z = \frac{\bar{x} - \mu}{\boxed{\frac{s}{\sqrt{n}}}} \rightarrow \text{standard error}$$

$$= \frac{78 - 80}{\frac{2.5}{\sqrt{40}}} = -5.0$$

Conclusion

$Z = -5.05$

Decision rule - if ~~Z = 5.0~~ is less than -1.96 or greater $+1.96$, reject the null hypothesis with 95% C.I

Reject the Null hypothesis $\left\{ \begin{array}{l} \text{there is some} \\ \text{fault in the} \\ \text{machine.} \end{array} \right.$