Statistics Class 5

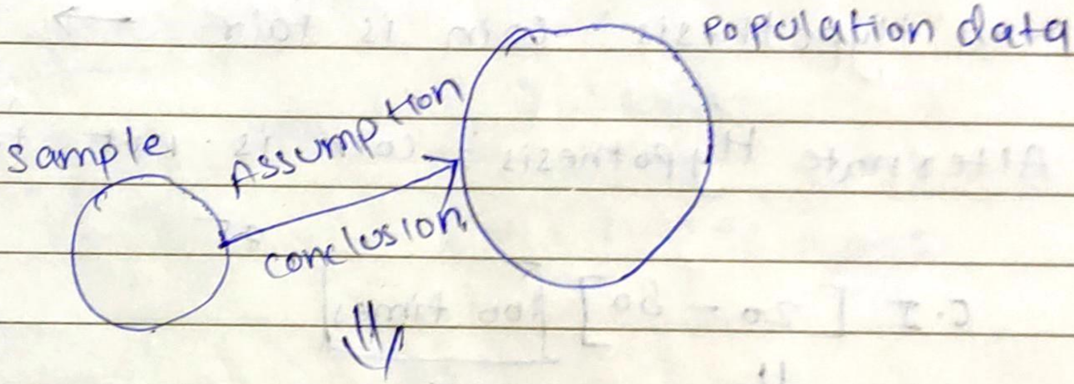
Inferential Statistics.

1. Hypothesis Testing
2. P-Value
3. Confidence Interval
4. significance Value.

z test
t test
chi square test
anova test

* Hypothesis Testing :

Inferential statistics.



steps of Hypothesis Testing

Hypothesis Testing:

(toss coin) fair or not

1. Null Hypothesis → coin is fair
2. Alternate Hypothesis. coin is not fair
3. perform Experiment.

Teacher's Signature.................................

Exeperiment

[coin is fair or not]

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

Null Hypothesis :- coin is fair → Accepted

Alternate Hypothesis :- coin is not fair

75

C.I [20 - 80] $\boxed{100 \text{ times}}$

⇓ ⇓

coin is fair $\boxed{50 \text{ times Head}}$ ⇒ fair

60 times Head

60 — 40

70 - 30

$\boxed{80 - 20}$

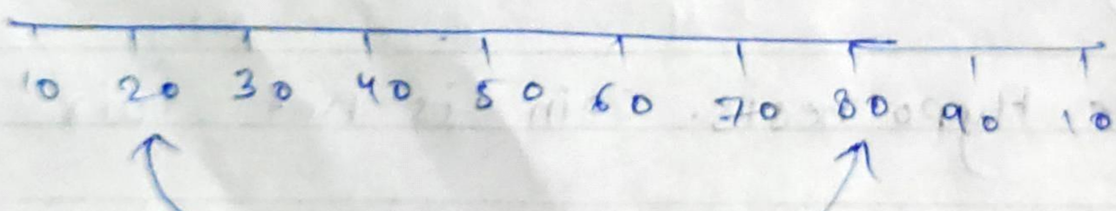
70 times

⇓

Domain Expert

⇓

C.I



Confidence Interval (C.I)

↳ we fail

↳ we fail to Reject Null Hypothesis [within C.I]

↳ we Reject Null Hypothesis

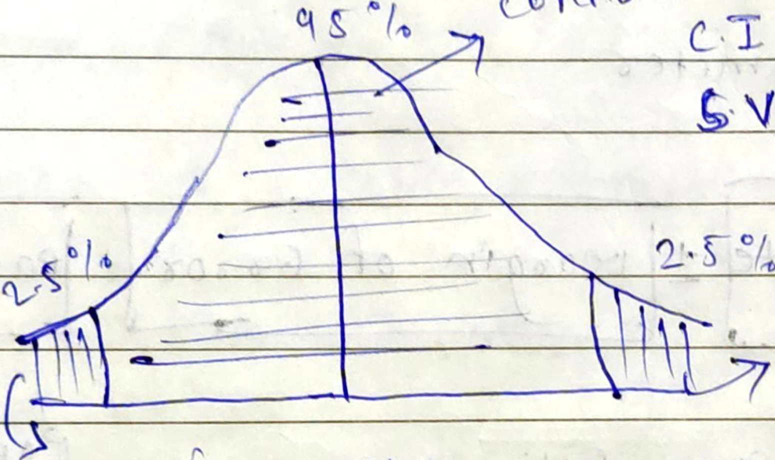
↳ [outside C.I]

<u>confidence Interval</u>:

confidence Interval

C.I = 95%

S.V = 1 − 0.95 = 0.05



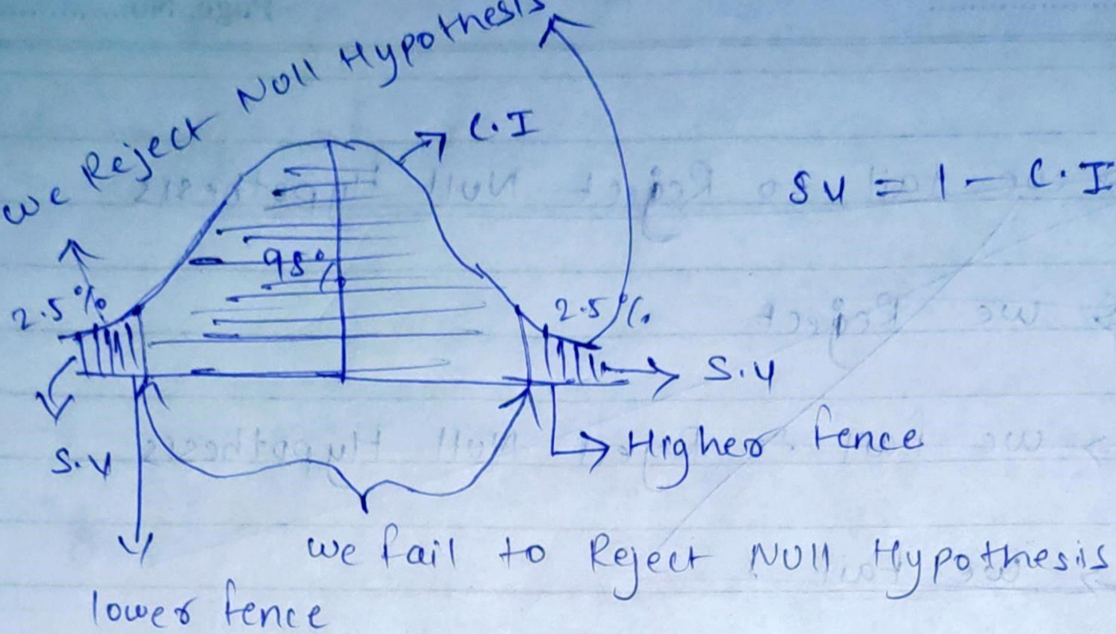
Significance value

significance value

C.I ⇒ confidence Interval

S.V ⇒ significance value

S.V = 1 − C.I



SV = 1 − C.I

Point Estimate :- The value of any statistics that estimates the value of a parameter

$\bar{x} > \mu$
$\bar{x} \leq \mu$

$\bar{x} \longrightarrow \mu \leftarrow$ Population mean

↓ Statistics (sample mean)

↳ parameter

Point Estimate

↓

$\bar{x} \longrightarrow \mu$

↑ parameter

$\boxed{\text{Point Estimate}} \pm \boxed{\text{Margin of Error}} = \boxed{\text{Parameter}}$

↑ Population mean

lower C.I : Point Estimate − Margin of Error

Higher C.I : point Estimate + Margin of error

Margin of Error = $Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

σ → Population S.D

$\frac{\sigma}{\sqrt{n}}$ ⇒ standard Error

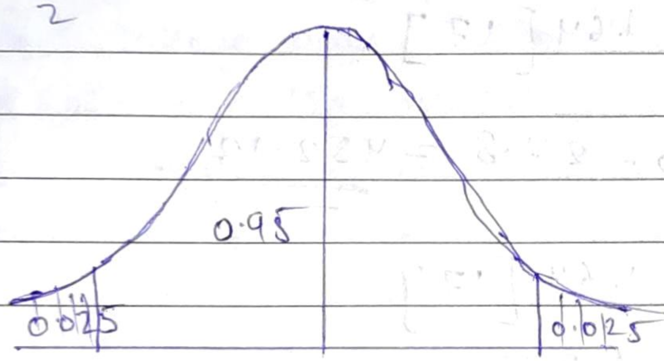
α = significance Value

* On the quant test of CAT Exam, a sample of 25 test takers has a mean of 520 with a population standard Deviation of 100. construct a 95% about the mean?

$n = 25 \quad \bar{x} = 520 \quad \sigma = 100 \quad C.I = 95\%$

$\frac{5}{2} = 2.5 \Rightarrow 0.025 \qquad S.V = 1 - C.I = 0.05$

$\boxed{1 - 0.025 = 0.975}$

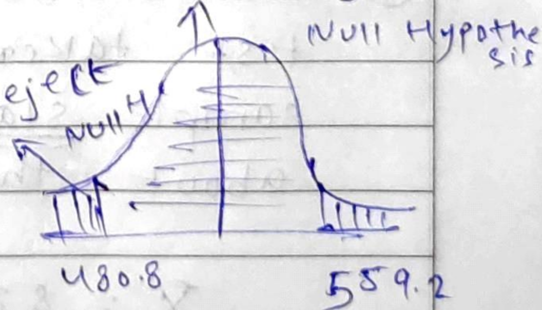


$\alpha = 0.05$

lower C.I = Point Estimate − Margin of Error

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

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



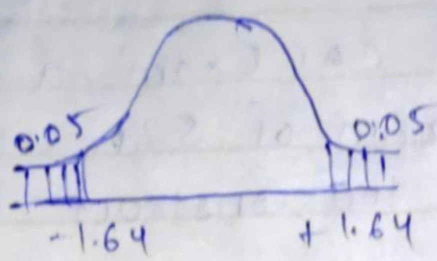
$= 520 - 1.96 \times 20 = \underline{480.8}$

Higher C.I = $520 + 1.96 * 20 = \underline{559.2}$

Teacher's Signature..............................

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

$S.V = 1 - 0.90 = 0.10$



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 $C.I = 480 + 1.64\,[17]$

$= 480 + 27.8$

$= 507.8$ $\qquad [\,452.12 \leftrightarrow 507.8\,]$

(2) on the quant test of CAT exam, sample of 25 test takers has a mean of 520, with sample Standard Deviation of 80. construct 95% about the mean?

$\bar{x} = 520$ $s = 80$ $C.I = 95\%$ $S.V = 1 - 0.95 = 0.05$

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

Degree of freedom $= n - 1 = 24$

Expt. No........................ Page. No........................

lower C.I $= 520 - t_{0.05/2}\left(\frac{\overset{16}{\cancel{80}}}{\sqrt{25}}\right)$

$= 520 - 2.064 * 16$

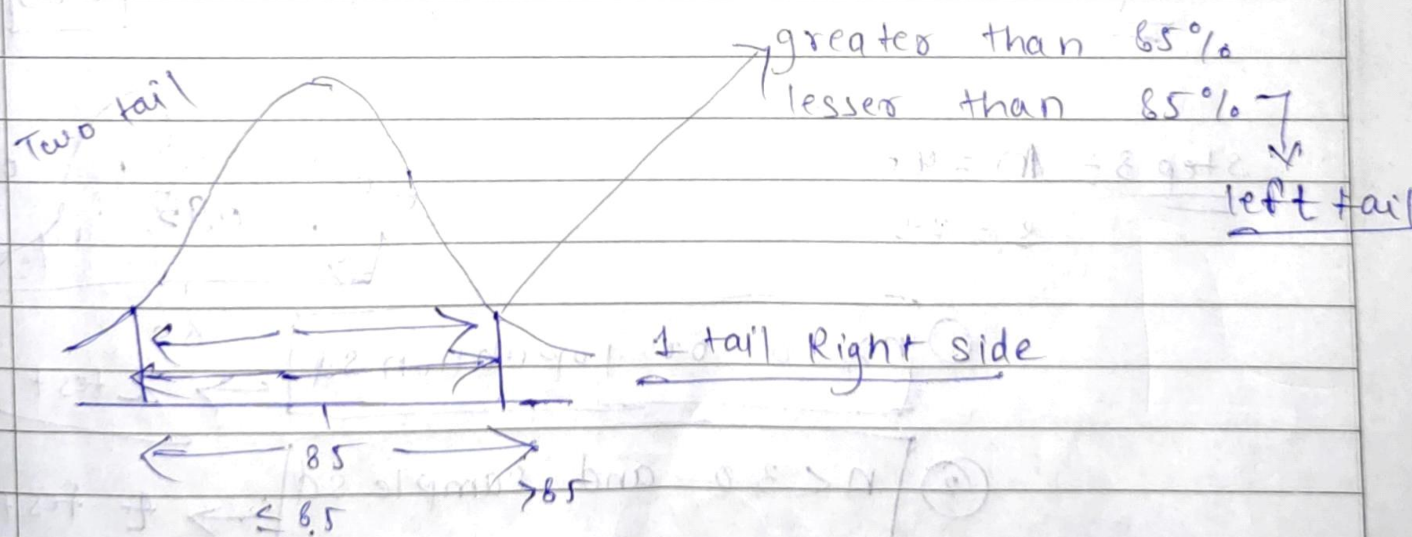
lower C.I = 486.976

Higher C.I = 553.024

Degree of freedom
$n - 1 = 25 - 1$
$= 24$
↓
t table

* colleges in Town A has 85% placement rate. A new college was opened and it was found that a sample of 150 students had a placement rate of 88% with a standard Deviation of 4%. Does this college has a different placement rate with 95% C.I

① 1 Tail and 2 tail test.



① z test
② t test

Teacher's Signature...............................

Hypothesis Testing

* A factory has a machine that fills 80ml of Baby medicine in a bottle. An employee believes the average amount of baby medicine is not 80ml. Using 40 sample, He measure the average amount dispersed by the machine to be 78ml with a standard deviation of 2.5.

(a) State Null and Alternate Hypothesis:-
(b) At 95% C.I, is there enough evidence to support machine is working properly or not.

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

Step 1

Null Hypothesis $\mu = 80$ →
Alternate Hypothesis $\mu \neq 80$ →

Step 2 C.I = 0.95 S.V(α) = 1 - 0.95 = $\boxed{0.05}$

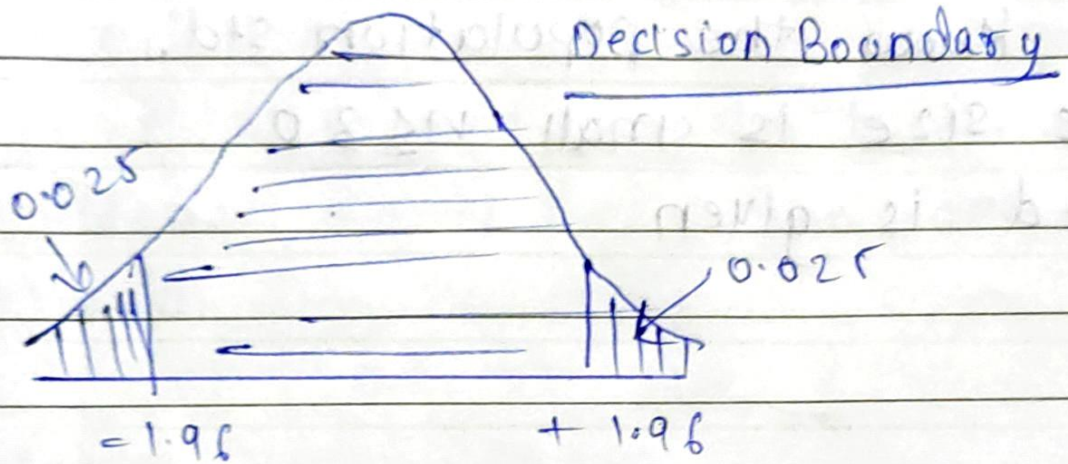
Step 3:- $n = 40$
$s = 2.5$

① $\boxed{n \geq 30 \text{ or population sd}}$ → Z test

② $\boxed{n < 30 \text{ and sample sd}}$ → t test

Z test

let perform the Experiment



$1 - 0.025 = 0.975$

* calculate test statistics (z-test)

$$Z = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

→ standard Error

$$\frac{78 - 80}{2.5/\sqrt{40}} = -5.05$$

Teacher's Signature............................

* A complain was registered (the boys in a Government school are underfed. Average weight of the boys of age 10 is 32 kgs with S.D = 9 kgs. A sample of 25 boys were selected from the Government school and the average weight was found to be 29.5 kgs? with C.I = 95% check it is True or false.

$n = 25 \quad \mu = 32 \quad \sigma = 9 \quad \bar{x} = 29.5$

Ans: condition for Z test

① we know the population sd. or

② we do not know the population sd but our sample is large $n \geq 30$

condition for T test

① we do not know the population std.

② our sample size is small $n \leq 30$

③ sample std is given

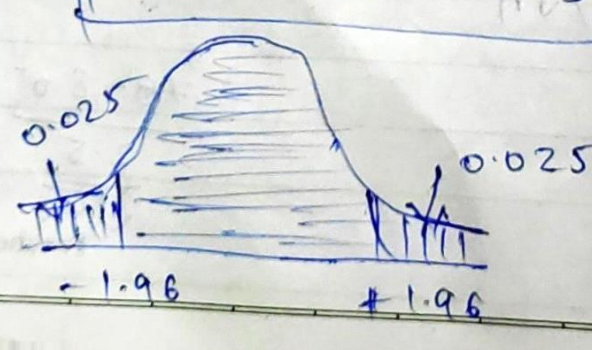
Step 1

$H_0 : \mu = 32$

$H_1 : \mu \neq 32$

② $C.I = 0.95$ $\boxed{\alpha = 1 - 0.95 = 0.05}$

③ Z test



$$z\text{-Score} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{29.5 - 32}{9/\sqrt{25}} = -1.39$$

conclution: $-1.39 > -1.96$ Accept the ~~H~~ Null Hypothesis 95% C.I we fail to Reject Null Hypothesis.

The Boys are fed well.

* A factory manufactures cars with warranty of 5 years on the engine and transmission. An engineer believes that the engine or transmission will malfuntion in less than 5 years. He tests a sample of 40 cars and funds the average time to be 4.8 years with a standard Deviation of 0.50 (1) state the null & Alternate Hypothesis.
(2) At a 2% significance level, is there enough evidence to support the idea that the warranty should be revived?

step 1 $H_0 : \mu \geq 5$

$H_1 : \mu < 5$

step : $\alpha = 0.02$ C.I $= 0.98$