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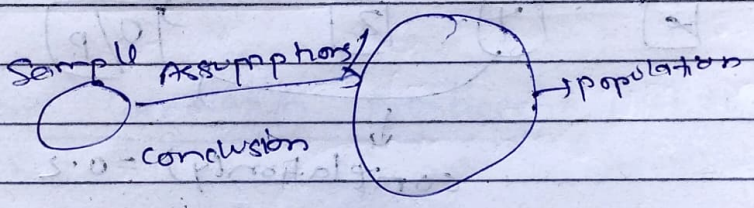
[Day - 5]

→ Inferential Statistics:-
1. Hypothesis testing
2. P-value
3. Confidence interval
4. Significant value

- Z test
- P-test
- chi Square test
- Anova test

Steps of hypothesis testing:-



1. null hypothesis: Peson is not criminal.
2. Alternate hypothesis: peson is criminal
3. experiment / proof :- DNA, fingerprint, weapons etc
   ↓
   Judge = conclusion

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② Coin is fair or not:

if $P(H) = 0.5$ and $P(T) = 0.5$

① null hypothesis:- coin is fair

② Alternate hypothesis:- coin is not fair

③ Perform experiment:-

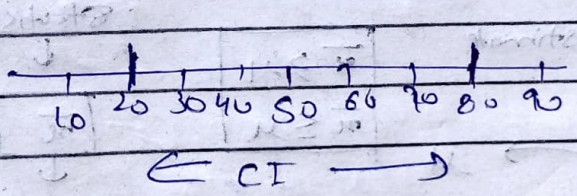
taken a coin tossed 100 times
[50 times heads 50 Tails] → fair

on this situation we are going to make

(CI) confidence interval by [Domain expert]

↓

[20 - 80]



If comes between [20 and 80] ie. (CI)

then

we fail to reject null hypothesis → conclusion

else:

we reject the null hypothesis

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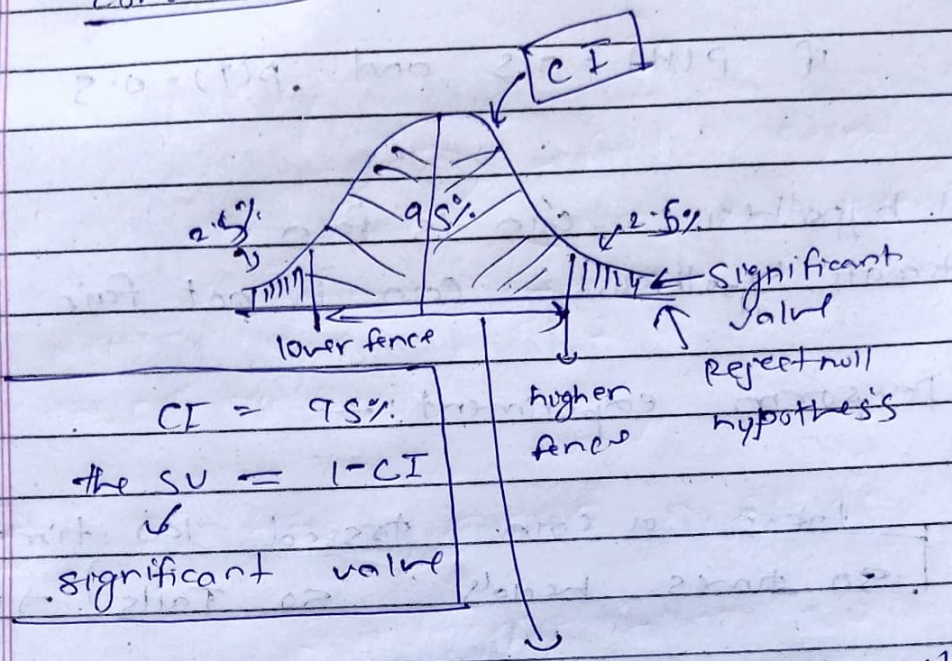
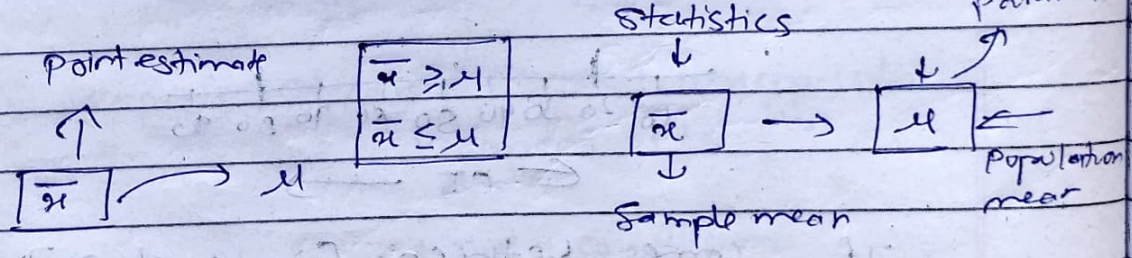
conclusion:-



Point estimation:-

The value of any statistics that estimates the value of a parameter is called Point estimate.



Point estimate	$\pm$	Margin of Error	=	Parameter ↓ population mean

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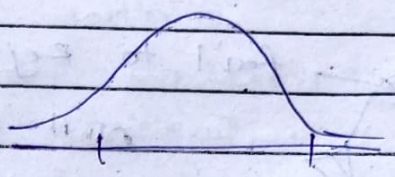
lower CI = Point Estimate − Margin of error

High CI = Point Estimate + Margin of error



Margin of Error = $2\ \alpha/2 \left| \frac{\sigma}{\sqrt{n}} \right|$ ⇒ standard deviation

Population Sd

α = significance value

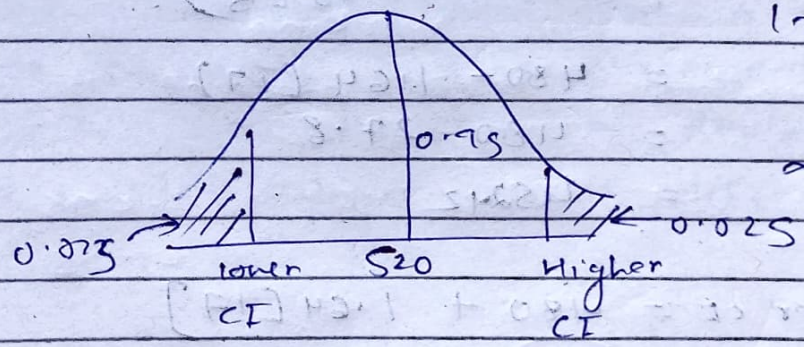
(*) on the quant test of CAT Exam, a sample of 25 test takers has a mean of 520 with a population standard deviation of 110. Construct a 95% CI about the mean?

Ans =) $n = 25$ $\bar{x} = 520$ $\sigma = 100$ CI = 95%.

SU = 1 − CI = 0.05

$\frac{5}{2} = 2.5 = 0.025$

1 − 0.25 = 0.975



$\alpha = 0.05$

lower CI = Point estimate − Margin of Error

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

$= 520 - 2_{0.025} \frac{100}{5} = 480.8$

$= 520 + 2_{0.025} \frac{100}{5}$

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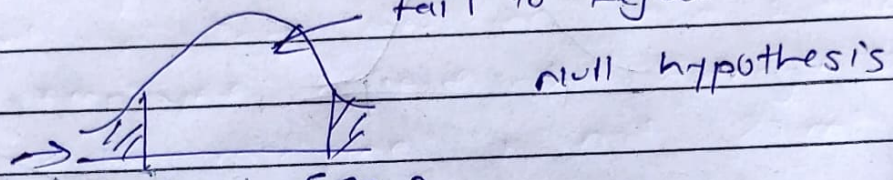
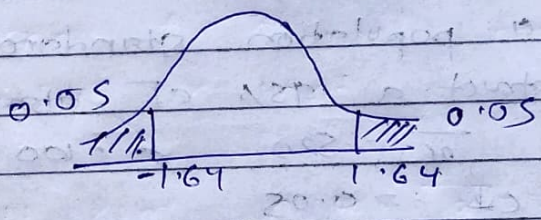
higher CI = 520 + 196 * 20
= 559.2



the null hypothesis

(a) $\bar{x} = 480$ $\sigma = 85$ $n = 25$ CI = 90%.

Significance = 1 − 0.90 = 0.10



lower CI = $480 - z_{0.10/2}\left[\frac{85}{5}\right]$

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

$= 480 - 1.64\,[17]$

$= 480 - 27.8$

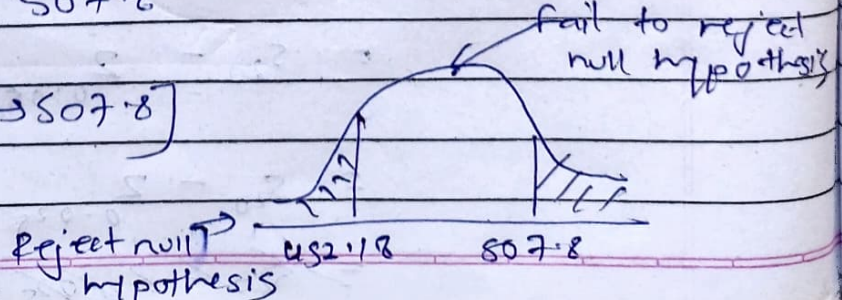
$= 452.12$

Higher CI = $480 + 1.64\,[17]$

$= 480 + 27.8$

$= 507.8$

[452.12 ⟷ 507.8]



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(2) 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% CI about the mean?

Ans:- $\bar{x} = 520 \quad s = 80 \quad CI = 95\%$

$SV = 1 - 0.95 = 0.05$

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

lower $CI = 520 - t_{0.05/2}\left(\frac{80}{5}\right)$

$= 520 - 2.064 \times 16$

lower CI = 486.976

Higher CI = 553.024

(1) 1 tail and 2 tail test

(*) Colleges in town a has 85% placement rate. A new college was recently 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% CI?

greater than 85%.

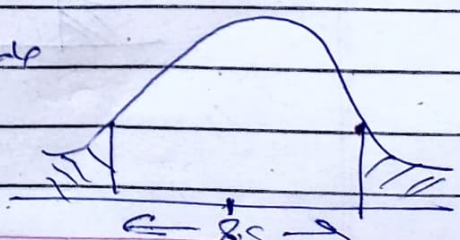
↓

1 tail test Right side

- Lesser than 85%.

↓

1 tail test left side



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Hypothesis Testing Problem:

1) A factory has a machine that fills 80 ml of Baby medicines in a bottle. An employee believe the average amount of baby medicine is not 80 ml. Using [Two Tailed test] 40 samples, he measure the average amount dispressed by the medichine is to be 78 ml with a standard deviation of 2.5.

State a) Null hypothesis.

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

Given:- $\mu = 80ml$, $n = 40$, $\bar{x} = 78$, $s = 2.5$

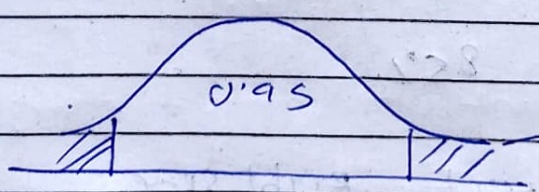
$CI = 95\% = 0.95$

Step1:- null hypothesis: $\mu = 80$ i.e machine is working

Alt hypothesis: $\mu \neq 80$ machine is not working

Step2:- $S.V.(\alpha) = 1 - CI = 1 - 0.95$

$= 0.05$



Step 3:- t-test

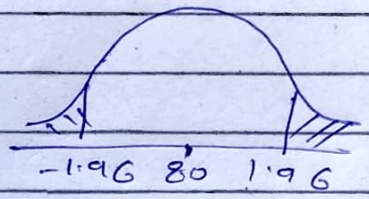
$t_{0.025} = 1.96$

when $n \geq 30$ or population SD is given
↓
use z test

when $n < 30$ and sample SD is given used t test

Decision Boundry

-1.96 to 1.96



z-test

$$z = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{78}{2.5/\sqrt{40}} = \frac{-2}{2.5/\sqrt{40}} = -5.0596$$

Conclusion:

$[-1.96 \leftrightarrow 1.96]$

-5.0596 is not in range.

∴ we reject null hypothesis

i.e. machine is not working