Day-5 - Stat

17th - Sept
17/9/22

Inferential Stats Ps

1) Hypothesis testing — Z test
2) P-value — t Test
3) Confidence Interval — chi square
4) Significant value — ANNOVA (F

1) Hypothesis Testing.

* To make the Assumption or conclusion by using Sample & Population Data then the order's to do that we have to use Hypothesis testing.

Steps of Hyp Testing

① Null hypothesis [Coin is fair]

* Ex: By a person is committed in Crime Ever though we can't say that person is criminal unless until it's proven.

* So, we have to say the person is not a criminal. This State as Null hypothesis.

* Null hypothesis means it define always default scenario.

② Alternate hypothesis [coin is not fair]

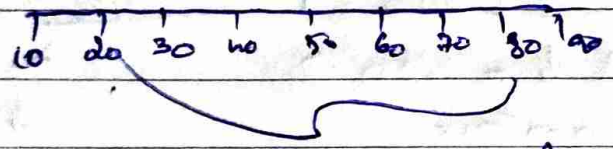
* Always be the opposite of default or Null hypo. we can say.

③ Perform Experiment.

Coin Toss 100 times

↓

50 Times Head } This is
50 Times Tail } fair



C.I → Confidence Interval

C.I = [20-80]

↓

Coin is fair.

∴ so Null hypothesis is accepted.

What is hypothesis?

A message expressing an opinion based on incomplete evidence.

(or)

A proposal intended to explain certain facts or observation.

H_0 ⇒ Null Hypothesis

H_1 ⇒ Alternate Hypothesis

Confidence Interval [CI]

Significance value (or) level of significance

95 %.

1 - 95 = 5 %.

or

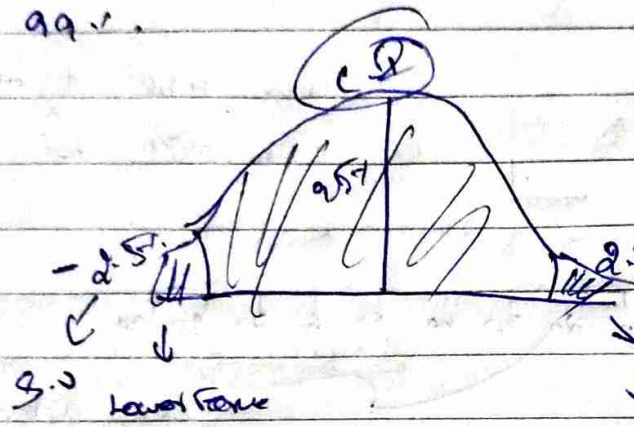
1 - 0.95 = 0.05

99 %.

1 - 0.099 = 0.01

or

1 - 99 = 1 %



* By our Z value is come's between -2.5 & 2.5 then we have to accept the H_0 otherwise H_0 rejected and H_1 is accepted.

How to find out L.f & H.f significance

* by using the point Estimation.
* The value of any statistics that estimate the value of a Parameter is called point Estimate.

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* value of the statistics ($\bar{x}$) to estimate the value of Parameter (μ) is called point Estimate.
* Here with the value of sample mean($\bar{x}$) ⇒ to estimating the population mean(μ) Parameter

$\bar{x} \rightarrow \mu$

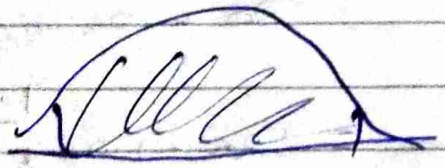
Point estimate ± Margin of Error = parameters (population mean)

Lower Force (negative value of significance) or C.I (less)

Point Estimate − Margin of Error

Higher Force (positive value of significance) or (C.I)

Point Estimate + margin of Error



Margin of Error $\Rightarrow z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$ Standard Error

$\therefore \alpha$ = Significance value.

Problem - 1

On the awards test of CAT Exam, a sample of 85 test takers has a mean of 520 with a population S.d of 100. Construct a 95% C.I about the mean.

Sol

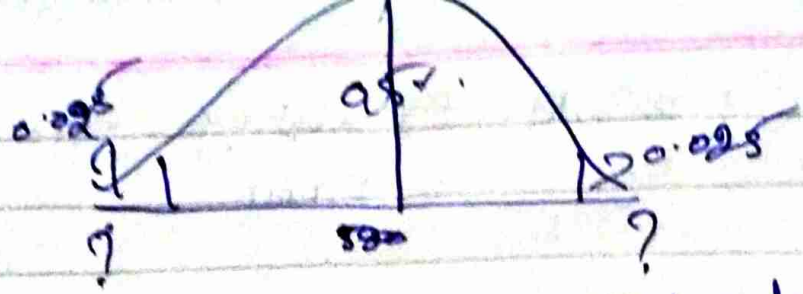
$\bar{x} = 520$

$n = 85$

$\sigma = 100$

C.I = 95%.

S.V = 0.05 or 5%.



Lower fence
?

Higher fence
?

Lower fence = Point estimate − Margin of error

$$= 580 - z_{0.05/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

$$= 580 - z_{0.025}\left(\frac{100}{5}\right)$$

$$= 580 - 1.96 \times 20$$

$$= 580 - 39.20$$

$$L.f = 480.8$$

calculate $1 - 0.025 = 0.975$ b

z table value 1.96

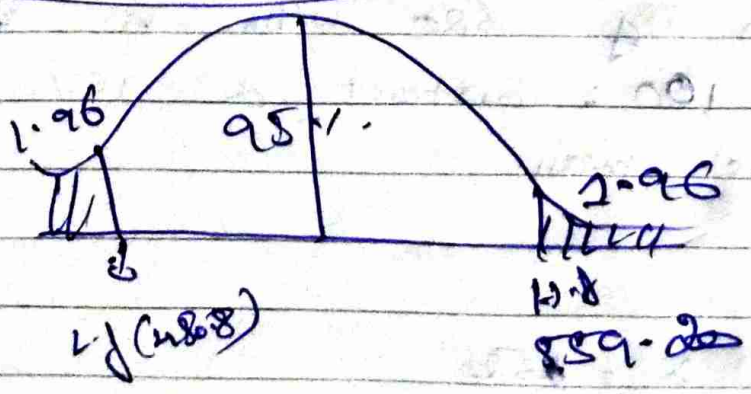
$$U.f = P.e + M.o.e$$

$$= 580 + z_{0.05/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

$$= 580 + 1.96(20)$$

$$= 580 + 39.20$$

$$U.f = 559.20$$



Problem - II

On the Quality test of CAT exam sample of 25 testees has mean 500 with a sample s.d 80. Construct 95% C.I about the mean

Ans

$\bar{x} = 580$

$n = 25$

$s = 80$

C.I : 95%

S.V 20.05

Note : Here we don't have been given Population S.d then the formula is

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

$\therefore t$ = t at degree of freedom $(n-1)$

$\therefore$ the d.f $= 25 - 1 = 24$

L.F $= \bar{x} - t_{\frac{0.05}{2}}\left(\frac{80}{5}\right)$

$= 580 - t_{0.025}(16) \quad \therefore d.f = 24$

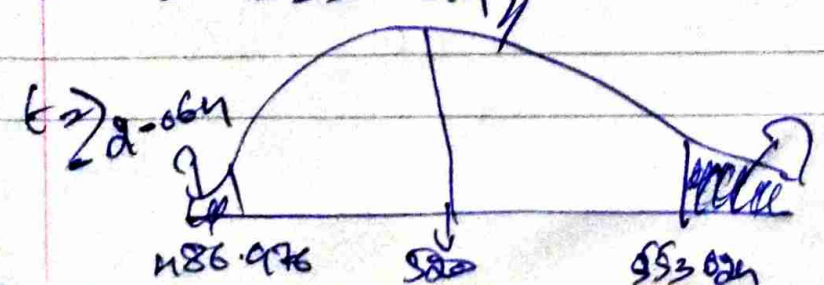
$= 580 - 2.064(16)$

$= 580 - 33.024$

L.F $= 486.976$

H.F $= 580 + 33.024$

$= 553.024$ //

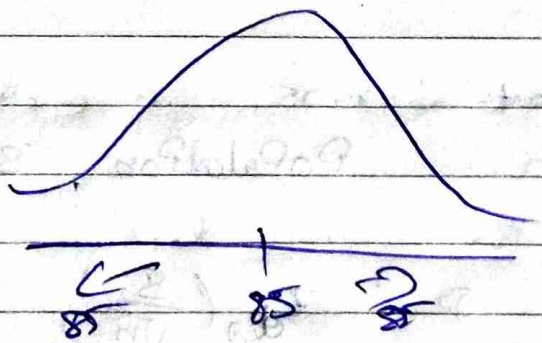


1 Tailed & 2 Tailed Test

* 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 s.d of 4%. Does this college has a diffent placement rate with 95% CI

$\bar{x}_1 \geq 88\%$

$\bar{x}_2 \geq 88\%$



college can be > or < 85 so we have to focus on both side.

* If the question is does the College have greater than 85% then we have to focus on only one side so that is called One tailed test.

Hypothesis Testing Problem

Z-Test

T-Test

Problems

A Factory has a machine that fills 80ml of Baby medicine in a bottle. An employee believes the avg amount of baby medicine is not 80ml using his sample he measure the avg amount disposed by the machine to be 78ml. with S.D of 2.5ml.

a.) State Ho & H1 Hypothesis

b) At 95% C.I is the enough evidence to support Machine is working Properly or Not.

Solution

a.) Null hypothesis Ho $\Rightarrow \mu = 80$ → machine working

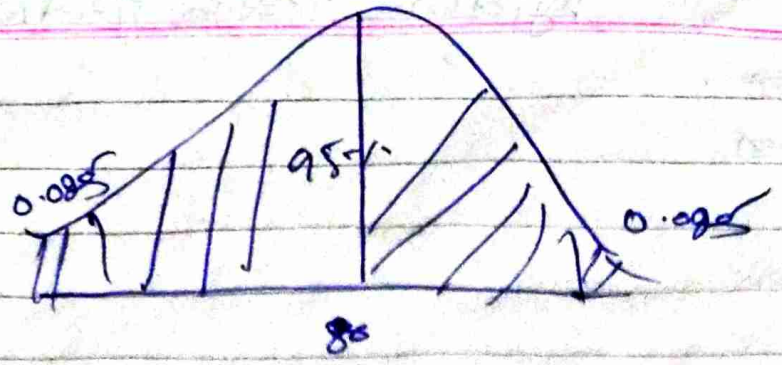
Alternate " H1 $\Rightarrow \mu \neq 80$ → machine not working Proper

b.)

$\mu = 80ml$

$n = 40$

$\bar{x} = 78$, $S = 2.5$, C.I = 0.95 (95%), $\alpha = 0.05$



* Here if we are given data sample $n \geq 30$ or population S.d given then we have to do 'Z' Test.

* If we are given data as sample $n < 30$ and sample S.d given then we have to do 'T' TEST.

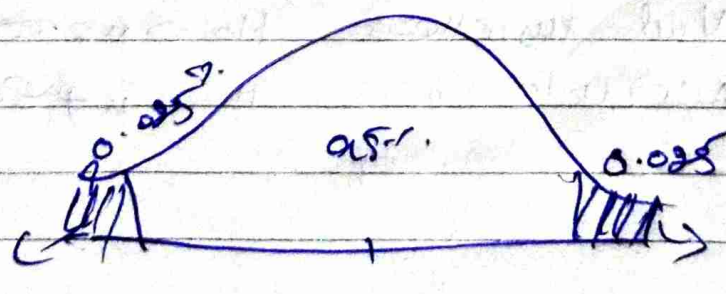
$n \geq 30$ or population S.d $\Rightarrow$ Z Test

$n < 30$ and sample S.d $\Rightarrow$ T Test

Experiment

Z

So here we have to use Z Test because we have sample $n \geq 40$



Z value $= 1 - 0.025$

$= 0.975$

* we have check 0.975 value in Z table and then take X & Y axis values that is 1.9 & 6 so (1.96).

Z Test

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

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

$$= \frac{78 - 80}{\frac{2.5}{\sqrt{10}}}$$

$$= \frac{78 - 80}{\frac{2.5}{6.32}}$$

$$= \frac{-2 + 6.32}{2.5}$$

$$= \frac{-12.64}{2.5}$$

$$\boxed{Z = -5.05}$$

Conclusion:

Decision Rule:

If $Z = -5.05$ is less than -1.96 or greather than $+1.96$, Reject the null Hypothesis with 95% C.I

Reject the Ho : if There is some fault in the machine.

Problem - 2

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 Govt School and the avg weight was found to be 29.5 kgs with C.I = 95%. Check Pt is T or False?

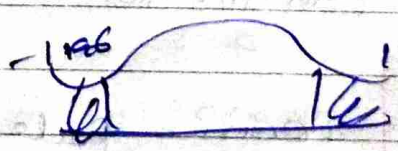
Solution

$H_0 \Rightarrow \bar{x} = 29.5$ kgs
$H_1 \Rightarrow \bar{x} \neq 29.5$ kgs

$\bar{x} = 29.5$
$\mu = 32$
C.I = 95%.
Sig V = 0.05
$z = 1.96$
$n = 25$

1) $H_0 \Rightarrow \mu = 32$
2) $H_1 \Rightarrow \mu \neq 32$

3) PoP S.d given $\Rightarrow$ So = Test goes to do



$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$= \frac{29.5 - 32}{9/\sqrt{25}}$$

$$z = \frac{-0.5 \times 25}{9} = \frac{-12.5}{9} = -1.388$$

Z score = 1.39

4.) Decision

If $Z_t \Rightarrow 1.388$ < -1.96 or > 1.96 then H_0 should be rejected.

Here,

1.388 is < 1.96 & > -1.96 so H_0 is accepted,

Conclusion

$H_0 \Rightarrow$ The average age is 32 yrs