Point Estimate : The value of any Statistics that estimates the value of a parameter is called Point Estimate.

$\boxed{\bar{x}}$ $\boxed{\mu}$ → population

sample mean

$\bar{x} - \mu$

Statistics → parameter

Parameter = population mean

sample mean = Statistics or Point Estimate

$\boxed{\text{Point Estimate}} \pm \boxed{\text{margin of error}}$ = Parameter (population mean)

Lower C.I :- Point Estimate − margin of error

higher C.I :- Point Estimate + margin of error

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

σ → Population S.D

$\frac{\sigma}{\sqrt{n}}$ ⇒ Standard error

α = S.I

Q. 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?

$n = 25$ Sample

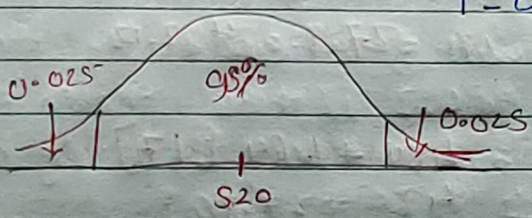
$\bar{x} = 520$ Sample mean

$\sigma = 100$ Sta population standard deviation

C.I = 95% Confidence Interval

$\alpha =$ S.V $= 0.05$ significance value

$1 - 0.025 = 0.975$



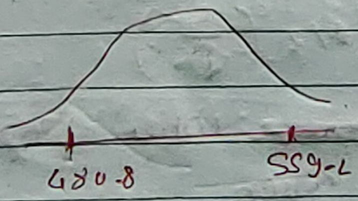
Lower C.I = Point Estimate − margin of Error

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

$= 520 - Z_{0.25} \frac{100}{5}$ 20

$= 520 - 1.96 \times 20 = 480.8$

Higher C.I = $\cancel{80}$ $520 + 1.96 \times 20 = 559.2$



C.I range between 480.8 to 559.2

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

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

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

$$= 480 - 1.64\,[17]$$

$$= 480 - 27.8 = 452.12$$

$$\text{Higher} = 480 + 1.64\,[17]$$
$$= 480 + 27.8$$
$$= 507.8$$

C.I Range between [452.12 ↔ 507.8]

→ on the quant test of Cat Exam, a Sample of 25 test taken a mean of 520, with a sample standard deviation of 80, construct 95% C.I about the mean?

→ $\bar{x} = 520$ $\quad S = 80$ $\quad$ C.I = 95% $\quad$ S.V = 0.05

$$= \bar{x} \pm t_{\alpha/2}\left(\frac{S}{\sqrt{n}}\right) \qquad n = 25$$

we use t-test ~~because~~ when population of standard deviation is not given.

t test

Degree of freedom = $n - 1 = 24$

$25 - 1 = 24$

Lower $C.I = 520 - t_{0.05/2}\left(\frac{80}{\sqrt{25}}\right)^{16}$ $t_{0.025}$

$= 520 - 2.064 \times 16$

$= 486.976$

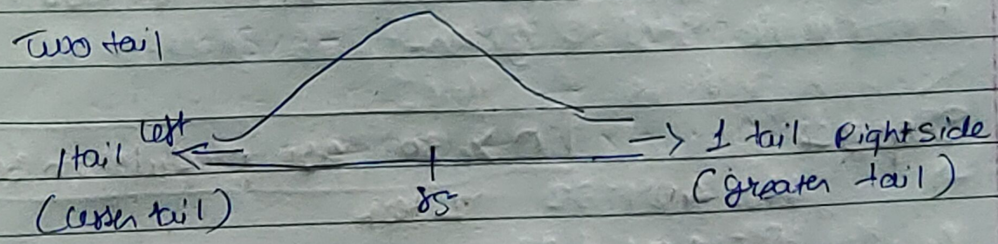
Higher $C.I = 553.024$

→ 1 tail and 2 tail test

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

⇒ greater than 85%

⇒ lesser than 85%



Hypothesis ~~Hyp~~ testing problem

→ A factory has a machine that fills 80 ml of Baby medicines in a bottle. An employee believes the average amount of baby medicine is not 80ml. Using 40 sample, he measures the ~~a~~ average amount dispensed by the machines. to be 78 ml 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.

Step 1

→ Null Hypothesis $\mu = 80$

~~A~~ Alternate Hypothesis $= \mu \neq 80$

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

Step 2

$C.I = \cancel{9.5}\ 0.95$ $S.V\ (\alpha) = 1 - 0.95 = 0.05$

Step 3 :

$n = 40$

$S = 2.5$

[n ≥ 30 or population sd]

Z test

[n ≤ 30 and sample sd]

t test

Ztest

Let perform Experiment

Calculate test statistics (Z test)

$$Z = \frac{\bar{x} - \mu}{\boxed{S/\sqrt{n}}}$$ → Standard error

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

→ Conclusion

Decision Rule → If $Z = -5.05$ is less than -1.96 or greater $+1.96$, Reject the Null Hypothesis with 95 % C.I

Reject the Null Hypothesis [There is some fault in the machine

→ A Complain was registered, the boys in 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

→ Condition for the 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 donot know the population S.d
(2) our Sample size is small $n < 30$
(3) Sample Std is given

Step 1
→ $H_0 : \mu = 32$
$H_1 : \mu \neq 32$

→ C.I = 0.95 $\alpha = 1 - 0.95 = 0.05$

→ Z test

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

Conclusion $\Rightarrow$ $-1.39 > -1.96$ Accept the Null hypothesis 95% C.I

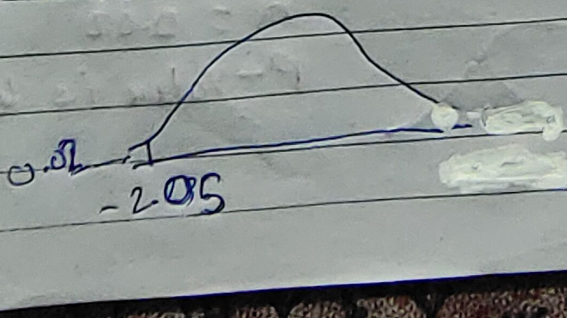
We fail to reject the Null Hypothesis
The Boys are fed well.

→ A factory manufactures cars with a warranty of 5 years or more on the engine and transmission. An engineer believes that the engine or transmission will malfunctions in less than 5 years. He tests a sample of 40 cars and finds 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 revised?

Step 1: $H_0 : \mu \geq 5$
$H_1 : \mu < 5$

2): $\alpha : 0.02$ $C.I = 0.98$



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Z score table

Confidence Interval	Significance value	S
90%	0.10	1.64
95%	0.05	1.96
98%	0.02	2.32
99%	0.01	2.576

$$Z\,score = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{4.8 - 5}{0.90/\sqrt{40}}$$

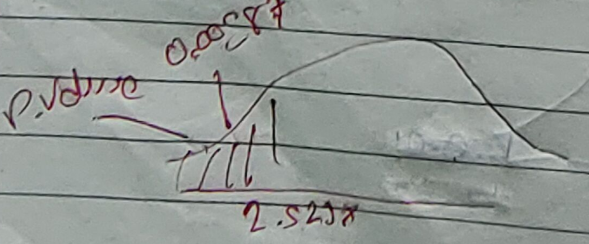
$$= \frac{-0.2}{0.0790}$$

$$Z = -2.52$$

Conclusion : $-2.52 > -2.206$ Reject the null hypothesis 98% CI

With the P.Value

Out of all 100% Z time is -



$\alpha = 0.02$

P-Value is less than

→ A company manufactures bike batteries an average life span of 2 year or more years. An Engineer believes this value to be less using 10 samples, he measures the average life span to be 1.8 year with a standard deviation of 0.15?

a) State the Null and Alternate hypothesis?

(2) At a 99% C.I, is there enough evidence to discard the H_0?

$\boxed{n < 30}$ → sample standard deviation.

Step (1)

$H_0 = \mu \geq 2$

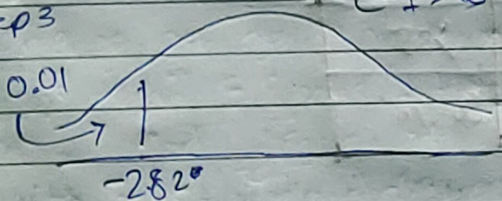
$H_1 = \mu < 2$

(2) Step (2)

$C.I = 0.99$ $\alpha = 0.01$

$C.I = 0.99$ $\alpha = 0.01$

Step 3



Degree of freedom $= n-1$

$= 10 - 1 = 9$

Calculate T-test Statistics

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

$$= \frac{1.8 - 2}{0.15/\sqrt{10}} = -4.216$$

Conclussion $-4.216 < -2.82$ {Reject the Null Hypothesis

The average life of the battery is less than 2 years.

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→ Chi Square test

(1) Chi square test claims about population propo[rtion]
(2) It is a non parametric test that is performed on categorical data.
↓
Ordinal Data
Nominal Data

→ In the 2000 U.S census the age of individu[als] in a small town found to be the following

<18	18-35	>35
20%	30%	50%

In 2010, ages of n = 500 individuals were sampled. Below are the results.

<18	18-35	>35
121	288	91

using $\alpha = 0.05$, would you conclude the population distribution of ages has changed the last 10 years

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Ans →

	<18	18-35	>35
Expected	20%	30%	50%

$n = 500$

	<18	18-35	>35
Observed	121	288	91
Expected	100	150	250

Step 1: Null Hypothesis H_0 = The data meets the expected distribution
H_1 = The data does not meet the expected distribution.

Step 2) $\alpha = 0.05$ C.I = 95%

Step 3: Degree of freedom
$df = c - 1 = 3 - 1 = 2$
↳ No. of Categories

Step 4: Decision Boundary = 5.991

Step 5: Chi Square Test Statistics

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e} = \frac{(121 - 100)^2}{100} + \frac{(288 - 150)^2}{150} + \frac{(91 - 250)^2}{250}$$

$$\chi^2 = 252.494$$

Conclusion

$x^2 > 5.99$ Reject H_0

Distribution has been Changed.