Q1. A factory Manufactures car with warranty of 5 years or more on the engine & transmission. An engineer believes that the engine or transmission will malfunction in less than 5 years. He test a sample of cars & find the Average time to be 4.8 years with standard deviation of 0.50

* State the Null & Alternative Hypothesis

* At a 2% Significance level, is there enough enough evidence to support the idea that warranty should Revised?

Soln:→ ①

$H_0 \rightarrow \mu = 5$

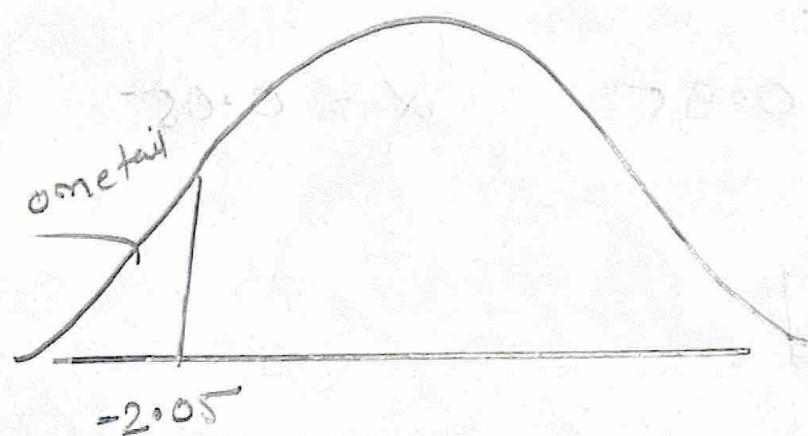$H_1 \rightarrow \mu \neq 5$

② $\alpha = 0.02$ $C.I = 1 - 0.02 = 0.98$

$Z \Rightarrow \dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}}$

$= \dfrac{4.8 - 5}{0.5/\sqrt{40}} = -2.53$

* hence, it is one tall test

ometail

−2·05

Conclusion :−

hence −2·53 > −2·05

* We Reject   Null Hypothesis

* Warranty Should be revised.

② In the Population the Average IQ is 100 with standard deviation of 15. A team of scientist want to test a medication to see if it has +ve, −ve, or no effect at all. A sample of 30 participants who have taken the medication has mean of 140. Did the medication affect intelligen at 95% C.I

① Null & Alternative ?
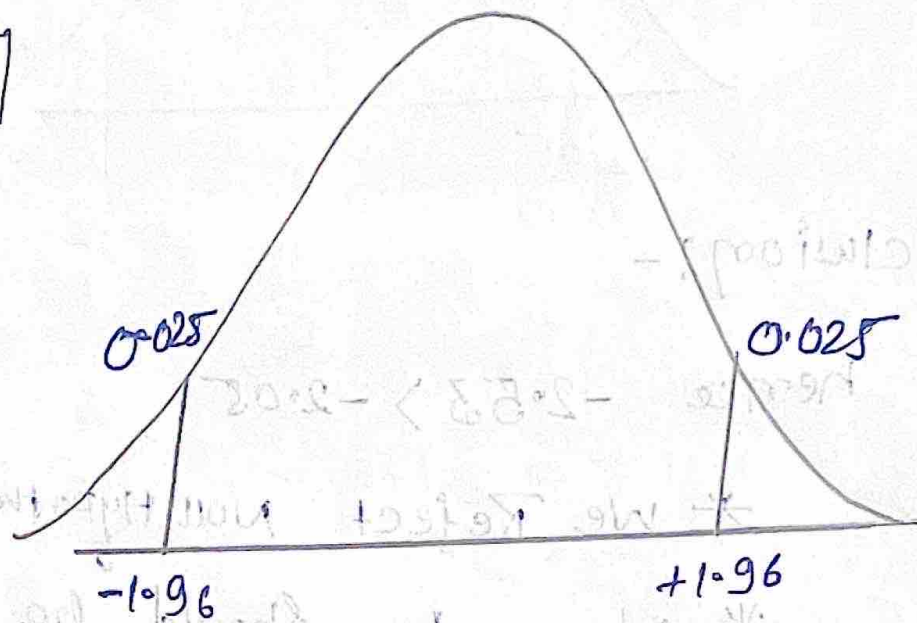
⇒ Step−1

H_0 = μ =100

H_L = μ ≠ 100

Step 2

C.I = 0.95 $\alpha = 0.05$

Step.3

0.025   0.025
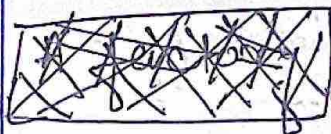
−1.96   +1.96

Step 4

$$z \longrightarrow \frac{\bar{x} - \mu}{\sigma / \sqrt{m}} = \frac{140 - 100}{15 / \sqrt{30}}$$

$$= 14.609$$

* We Reject the Null value.

5

③ The Average weight of All the resident in a town xyz is 168 pounds. A Nutrithonist believes the true mean to be different. She measured the weight of 36 individuals & found the Mean to be 169.5 with Standard deviation of 3.9. C.I = 95%.
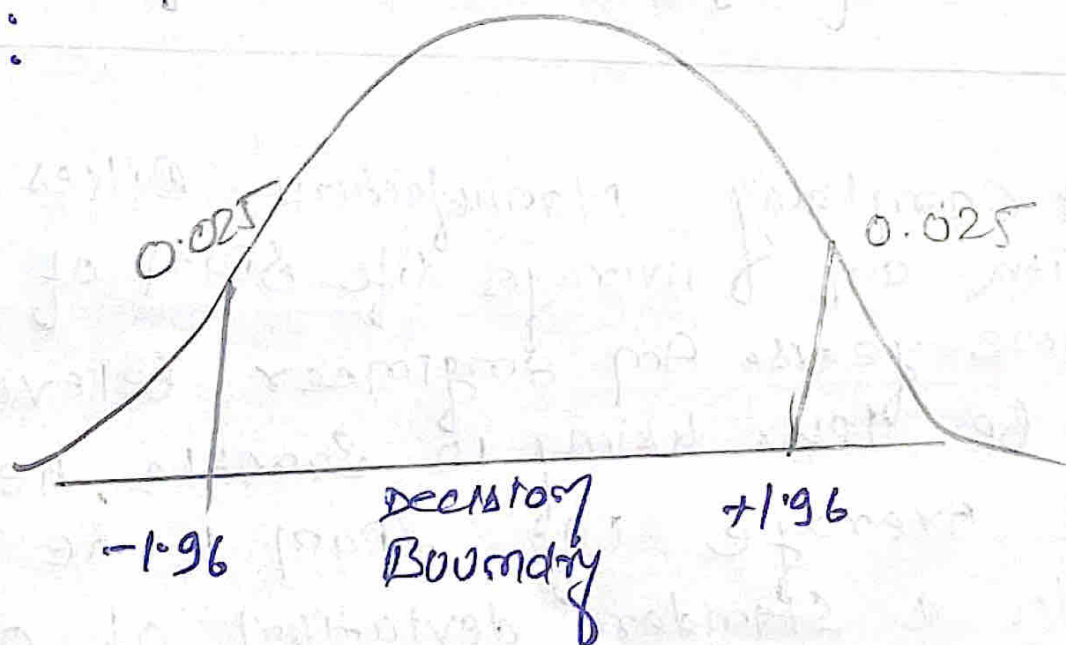
Soln :→

Step 1.

Null $H_0 \Rightarrow \mu = 168$

Alternative $H_1 \Rightarrow \mu \neq 168$

Step 2.

$C.I = 0.95$ $\qquad \alpha = 0.05$

Step 3:

0.025 $\qquad\qquad$ 0.025
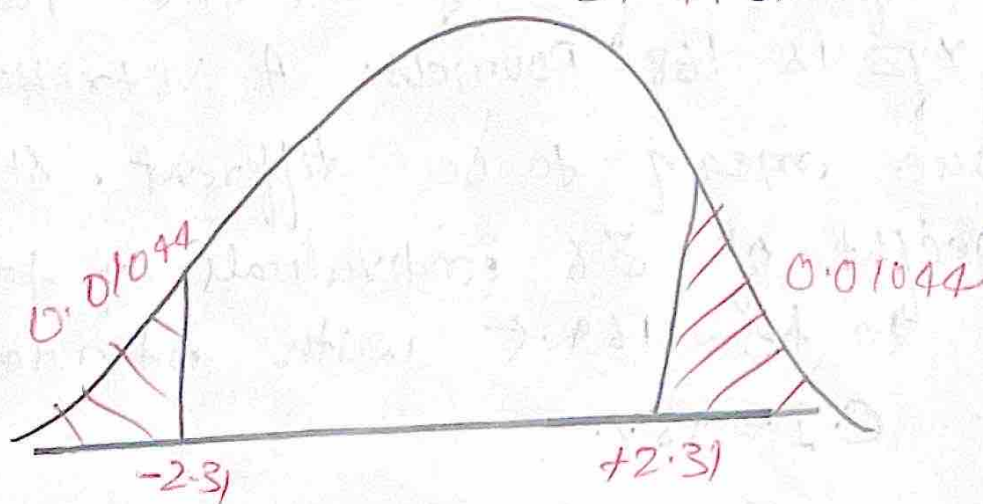
$-1.96 \qquad$ Decision Boundary $\qquad +1.96$

Step 4:-

$Z \text{score} = \dfrac{\bar{X} - \mu}{\sigma / \sqrt{n}} = \dfrac{169.5 - 168}{3.9 / \sqrt{36}} = \dfrac{1.50}{0.65}$

$= 2.30$

Step 4 :- $\qquad$ 2.30 > 1.96 Reject the Null hypothesis

with help of P-value

2 tail test

0.01044   0.01044

−2.31   +2.31

Area under the curve

P. value = 0.01044 + 0.01044

= 0.02088

P. value < significant value

$$0.02088 < 0.05$$

{ Reject the Null Hypothesis }

\# A Company Manufactures Bikes Battery
with an Average life span of 2 years or
more years. An Engineer believes this value
to be less. using 10 Sample, he Measure
the Average life span to be 1.8 years.
with a standard deviation of 0.15.

(A) State Null & Alternative Hypothesis ?

(B) At a 99% C.I, is there enough evedence
to Discard Ho..?

Step 1

$H_0 = \mu = 2$

$H_1 = \mu \neq 2$

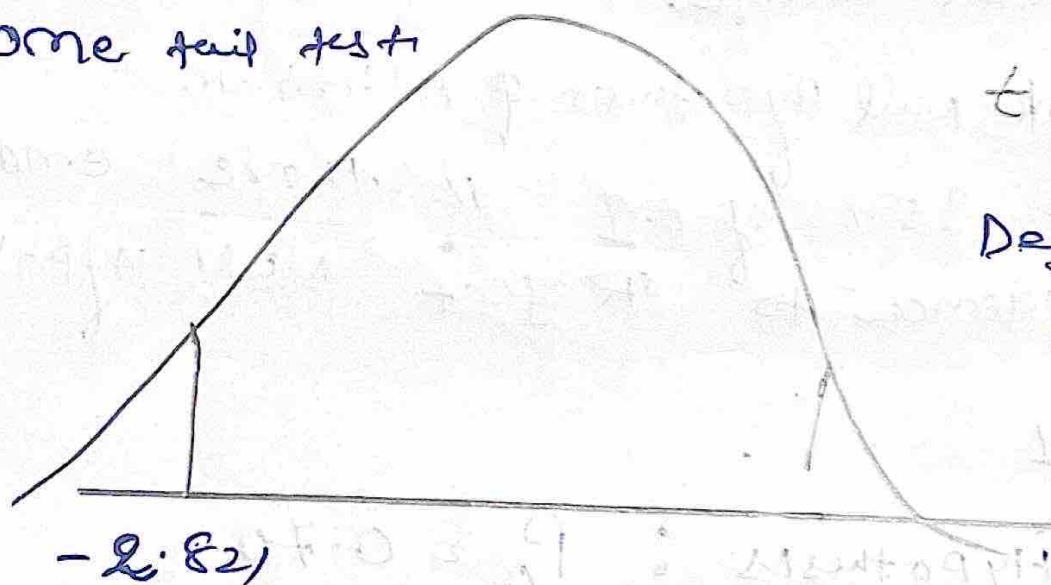Step 2:

$CI = 0.99$ $\qquad \alpha = 0.01$

Step 3:

one tail test

Degree of freedom
$= 10 - 1 = 9$

-2.821

Step 4:

Calculate t-test Statistics

$$t = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{1.8 - 2}{0.15 / \sqrt{10}} = \frac{-0.2}{0.048} = -4.16$$

Step:

$-4.16 < -2.821$ $\left\{ \text{we Reject the null hypothesis} \right\}$

※ The Average life span of Battery is less than 2 years.

Q. A Tech company believes that the Percenty
of Resident in town xyz. that @wn a
cell phone is 70%. A marketing Manager
Baleive that the value is different. He
conduct a survey of 200 individual P
found that 130 Responded yes. owning
a cell phone.

① State Null Hypothesis & Alternate

② At 95% of C.I is there enough
evidence to Reject Null Hypothesis!

⇒ Step 1

Null Hypothesis : $P_0 = 0.70$

Alternative Hypo : $P_1 = 0.30$
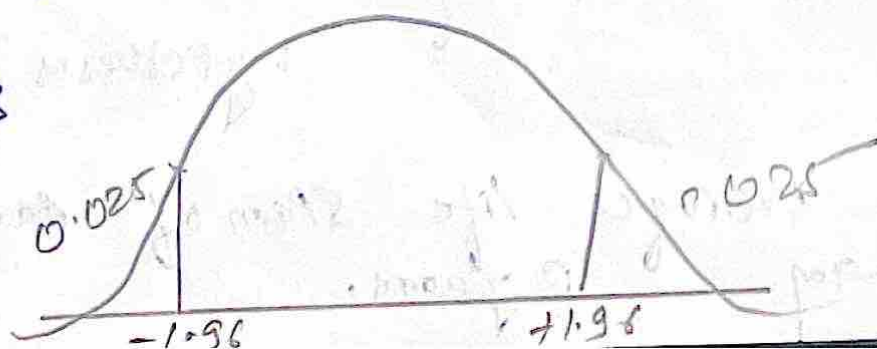
$$\boxed{q_0 = 1 - P_0 = 0.30}$$

$$\hat{P} = \frac{130}{200} = 0.65$$

Step-2

C.I = 0.95   Significance value $(\alpha) = 0.05$

Step-3

0.025   0.025

-1.96   +1.96

Formula for Z test with Proportion

$$Z \text{ test} = \frac{\hat{P} - P_0}{\sqrt{\frac{P_0 q_0}{n}}} = \frac{0.65 - 0.70}{\sqrt{\frac{0.7 \times 0.3}{200}}}$$

$$Z = -1.54$$

Conclusion

$$-1.54 > -1.96$$

So, we fail to Reject Null Hypothesis

Q. * A car company believes that Percentage of Resident in ABC own a vechile is that own a vechile is 60% or less. A Sales manager Dis agree with this conduct hypothesis testing survey @ 250 residents found that 170 Responded yes to owning a vechile

① State Null & Alternative Hypothesis

② At 10% Significance value, is there enough evidence to support the idea that vechile ownership in City ABC is 60 or less

Step-1

Null $P_0 = 60\%$

Alternative $P_1 \neq 60\%$
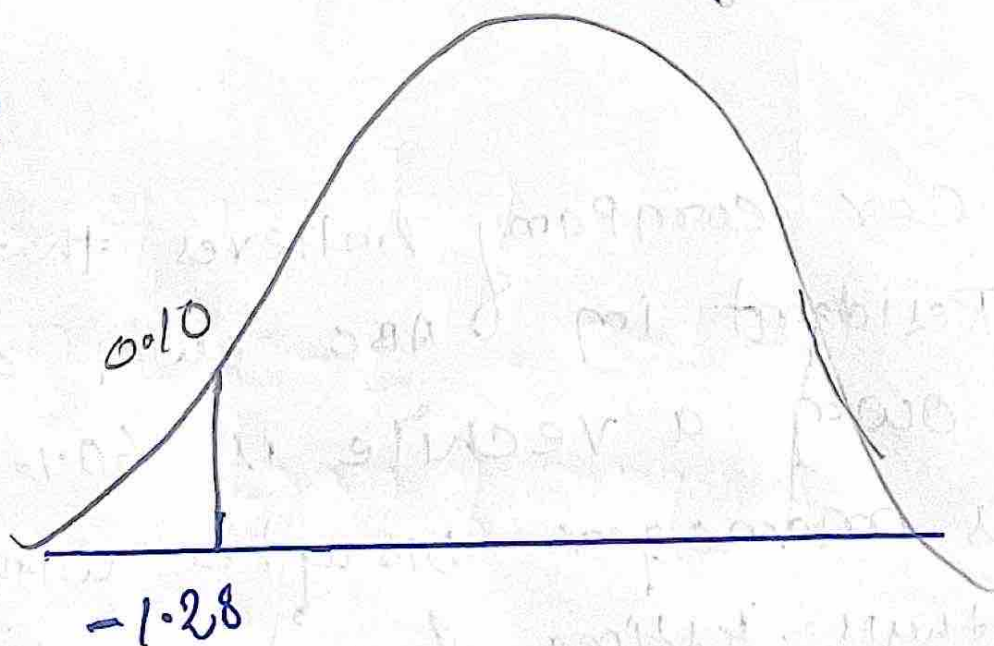
Step 2

$$q_0 = 1 - P_0$$
$$= 1 - 0.60$$
$$= 0.40$$

$$\hat{P} = \frac{170}{250} = 0.68$$

Step 3

$C \cdot I = 0.90 \; ; \; \alpha = 0.10$

Step 4:

0.10

-1.28

Step

$$Z \text{ test} = \frac{\hat{P} - P_0}{\sqrt{\dfrac{q_0 P_0}{\sqrt{n}}}} = \frac{0.68 - 0.60}{\sqrt{\dfrac{0.24}{\sqrt{250}}}}$$

$$= \frac{0.08}{0.0309} = 2.588$$

$2.588 > 1.28$

hence Reject the Null hypothesis.

Chi-Square Test

→ Chi-Square test claims about Population Proportion.

→ It is a non Parameter test that is Performed on Categorical Data

  ↳ ORDINAL DATA
     OR
     NOMINAL DATA

Q. In the 2000 U.S census the Age of individual in small town found to be following

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

In 2010, Ages of $n=500$ individual were Sampled. Below are clark.

<18	18-35	>35	
121	288	91	→ OBServed

Soln:-

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

Step 1:-

Null Hypothesis:

$H_0 = $ The Data meet the expected Distribution.

$H_1 = $ The Data Doesnot meet the expected Distribution

Step 2:

Degree of freedom

$$df = C - 1 = 3 - 1 = 2$$

$\hookrightarrow$ No. of categories

Step 3

$$\alpha = 0.05 \qquad C.I = 0.95$$

Step 4:-

Decision Boundry = $\boxed{5.991}$

According to Chi Square table

Step 5:→

Chi square test Statistics

$$\chi^2 = \sum \left(\frac{f_0 - f_e}{f_e}\right)^2$$

$$= \frac{(121-100)^2}{100} + \frac{(288-150)^2}{150} + \frac{(9+250)^2}{250}$$

$$\chi^2 = 232.494$$

Step 6:-

Conclusion

$$\chi^2 > 5.99$$

→ Reject the Null Hypothesis

→ The Data Doesnot Meet expected Distribution