(Statistics - day 6)

→ The average weight of all residents in a town xy2 is 168 ponds. A resistagnist believes the true mean to be different. She measured the weight of 36 individuals and found the mean to be 69.5 pounds with a standard deviation of 3.9.

a) Null hypothesis

b) 95% is these enough evidence tho decide the null hypothesis?

Step1:- H_0 : $\mu = 168$ (null hypothesis)

H_1 : $\mu \neq 168$ (Alternate hypothesis)

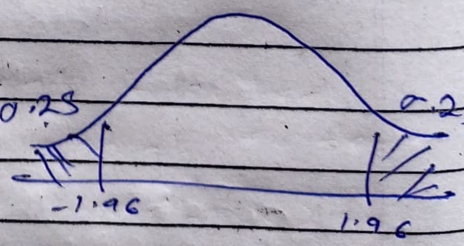
step2:-

CI = 0.95

SI = 1 - 0.95 = 0.05

Step3:- $\mu = 166$, $n = 36$, $\bar{x} = 169.5$, $sd = 3.9$

$$z\text{-test} = \frac{\bar{x} - \mu}{sd \sqrt{n}}$$



$$z_{0.025} = \frac{169.5 - 168}{3.9/\sqrt{36}}$$

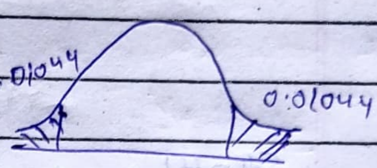
$$= \frac{1.5}{0.65} = 2.3076$$

Step 4:- $Z_{\alpha/2} = 1.96$

Steps:- $1.96 < 2.3046$

→ Reject null hypothesis

P-value 2 tail test



Area under z-score is 0.01044

P-value $= 0.01044 + 0.01044$

$= 0.02081$

$0.02081 < 0.05$

∴ we reject null hypothesis

- A company manufacture bike battries with an average life span of 2 year or more year. An engineer believe their value to be less using 10 samples, he measures the average life span to be 1.6 years with a SD of 0.15.
  a) State the null and Alternative hypothesis?
  b) At a 99% CI, is there enough evidence to discard the H_0?

Sol:- $\mu = 2$, $n = 10$, $\bar{x} = 1.8$, $sd = 0.15$

Step 1:- null hypothesis (H_0) $\mu \geq 2$

Alternate hypothesis (H_1) $\mu < 2$

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step 2 :- $CI = 0.99$

$SI = 1 - CI = 1 - 0.99$

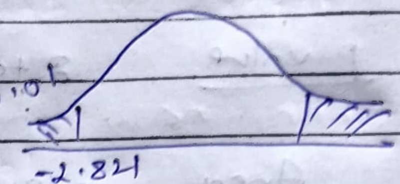
$= 0.01$

step 3 :- degree of freedom

$= n-1$

$= 10-1$

$= 9$



Step 4 :- $t\text{-test} = \dfrac{\bar{x} - \mu}{s/\sqrt{n}} = \dfrac{1.8 - 2}{0.15/\sqrt{10}}$

$= -4.26$

Step 5 :- conclusion

$-4.216 < -2.82$

we reject the null hypothesis

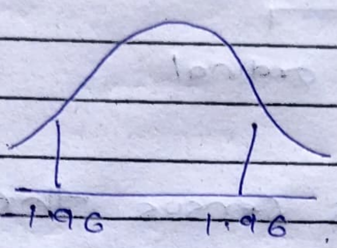
Q.) A tech company believe that the percentage of residence in town turn XYZ that owns a cell phones is 70%. A marketing manager believes that this value to be different. He conducts survey of 200 individuals and found that 130 responded yes owning a cell phone?

a) State null and alternate hypothesis

b) 95% CI is there enough evidence to reject the null hypothesis?

Sol: Step 1:-
H_0 = proportion (P_0) = 0.70
H_1 = $P_0 \neq 0.70$

Step 2:- CI = 0.95
(α) SV = 0.05



z - test with proportion

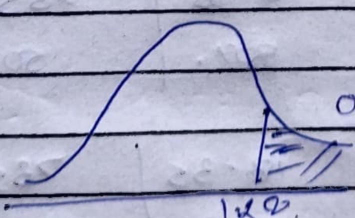
n = 250 ; x = 170 ; $\hat{p} = \frac{170}{250} = 0.68$

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

z - test $= \frac{\hat{p} - P_0}{\sqrt{\frac{P_0 q_0}{n}}}$

$= \frac{0.68 - 0.60}{\sqrt{\frac{0.60 \times 0.40}{250}}} = 2.66$

SV = 0.10 CI = 0.90



1-tail test

p-value = 0.10027

2.66 > 1.70 , Reject the null hypothesis chi- square test

Chis Square test claims ~~that~~ about population proportion. It is a non parametric test that is preformed on Categorical Data

Categorical Data → nominal, ordinal

1) In the 2000 US census the age of individuals in a small town found to be the following

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

In 2010, ages of n =500 individuals were samples. 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 in the last 10 years.

Ans:

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

n=500	<18	18-35	>35
observed	121	288	91
expered	100	150	250

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Step 1: Null hypothesis
H_0 : the data meets the expected distribution
H_1 : Data doesn't meet expected distribution

Step 2: SV (α) = 0.05 CF = 95%.

Step 3: Degree of freedom {categorical}
df = C-1 = 3-1 = 2

Step 4:- decision boundry = 5.991

Step 5: chi-square test statistic

$$\chi^2 = \Sigma \left(\frac{(F_o - F_e)^2}{F_e} \right)$$

$$= \frac{121-100}{100} + \frac{(228-150)^2}{150} + \frac{(91-250)^2}{250}$$

$$\chi^2 = 232.494$$

Conclusion:- $\chi^2 > 5.99 \Rightarrow$ Reject H_0