(5) The average weight of all residents in a town XYZ is 168 pounds. A nutritionist believes ~~bcb~~ the ~~two~~ true mean to be different. She measured the weight of 36 individuals and found the mean to be 169.5 pounds with a standard deviation of 3.9

(a) Null & Alternate hypothesis

(b) 95%. Is there enough evidence to discard the null Hypothesis?

Sol:- $\mu = 168$ $n = 36$ $\bar{x} = 169.5$ $S = 3.9$

Step-1:-

(1) Null hypothesis : $\mu = 168$

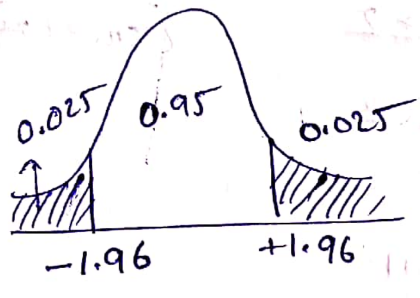
(2) Alternate hypothesis: $\mu \neq 168$

step-2:

$CI = 0.95$

$\alpha = 1 - 0.95 = 0.05$

step-3



Step-4:-

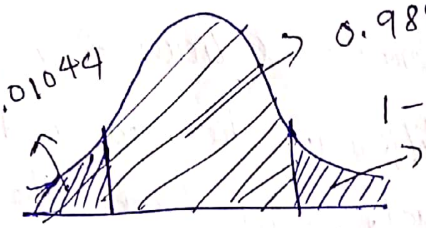
$$Z_{score} = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{169.5 - 168}{3.9/\sqrt{36}} = \frac{1.5}{0.65} = 2.307$$

Conclusion:

$2.307 > 1.96$, Reject the Null hypothesis

Average weight of people is not equal to 168 pounds.

P-value :



$$\text{P-value} = 0.01044 + 0.01044 = 0.02088$$

$$0.02088 < \underset{\alpha}{0.05} \quad \{\text{Reject the Null hypothesis}\}$$

⑥ A company manufactures Bikes Batteries with 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 years with a standard deviation of 0.15.

a). State the Null and alternate hypothesis?

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

Sol: $\mu = 2 \quad n = 10 \quad \bar{x} = 1.8 \quad s = 0.15$

Step-1 :

Null Hypothesis: $\mu \geq 2$ {we use One tail test

Alternate Hypothesis: $\mu < 2$

Step-2:

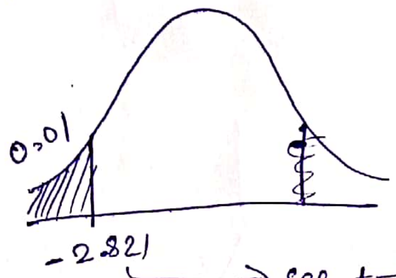
$CI = 0.99 \quad \alpha = 0.01$

Here $n < 30$ & sample standard deviation given so, we have to ~~use~~ use t-test.

for t-test we need to find degree of freedom.

$$\text{Degree of freedom} = n - 1$$
$$= 10 - 1 = 9$$

Step-3



→ see t-table value for one tail with degree of freedom is 9.

Step-4: calculate t test statistics

$$t = \frac{\bar{x}-\mu}{s/\sqrt{n}} = \frac{1.8-2}{0.15/\sqrt{10}} = -4.216$$

Step 5:

$-4.216 < -2.82$ {Reject the Null hypothesis}

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

Z-test with proportions:

① A tech company believes that the percentage of residents in town XYZ that owns a cell phone is 70%. A marketing manager believes that this value to be different. He conducts a survey of 200 individuals and found that 130 responded yes owning a cell phone?

(a) State Null and Alternate hypothesis?

(b) At a 95% CI, is there enough evidence to reject the null hypothesis?

Sol: Step 1:

$\boxed{n = 200}$ $\boxed{x = 130}$

Null hypothesis: $P_0 = 0.70$

Alternate hypothesis: $P_0 \neq 0.70$

$$\hat{p} = \frac{x}{n} = \frac{130}{200} = 0.65$$

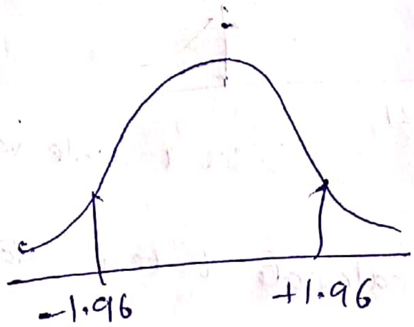
$q_0 = 1 - P_0 = 0.30$

Step-2:

$CI = 0.95 \quad \alpha = 0.05$

Step-3:

$$\boxed{Z_{test} = \frac{\hat{P} - P_0}{\sqrt{\frac{P_0 q_0}{n}}}}$$

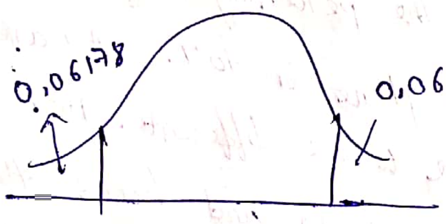


$$= \frac{0.65 - 0.70}{\sqrt{\frac{0.70 \times 0.3}{200}}} \approx -1.54$$

conclusion:

$-1.54 > -1.96$ {Fail to Reject the null hypothesis

P-value:



p-value = 0.06178 + 0.06171

= 0.12356

Pvalue > Significance value

Fail to reject null hypothesis

② A car company believes that the percentage of residents in city ABC that owns a vehicle is 60%. or less. A Sales manager disagrees with this. He conducts a hypothesis testing surveying 250 residents and found that 170 responded yes to owning a vehicle.

(a) State the Null & alternate hypothesis

(b) At 10%. Significance level, is there enough evidence to support the idea that vehicle ownership in city ABC is 60%. or less?

sol: Step-1

$n = 250$ $x = 170$

Null hypothesis : $P_0 \leq .60$

Alternate hypothesis : $P_0 > .60$

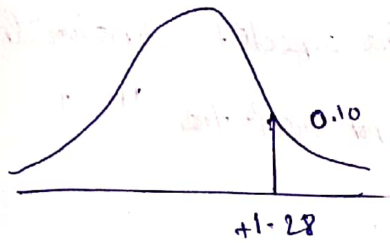
$\hat{P} = \frac{170}{250} = 0.68$

$q_0 = 1 - P_0 = 0.40$

step-2:

$\alpha = 0.10$ CI = 0.90

Step-3:



$$Z_{test} = \frac{0.68 - 0.60}{\sqrt{\frac{0.6 \times 0.4}{250}}}$$

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

Reject the null hypothesis

Chi-Square test

* Chi-square test claims about populations.

ORDINAL DATA
Nominal data

It is a non-parametric test that is performed on categorical data

(*) In 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 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 in the ~~in~~ last 10 years?

Sol:

	<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 : The data meets the expected distribution

Alternate hypothesis : The data does not meet the " "

Step-2: $\alpha = 0.05$ CI = 95%

Step-3 : Degree of freedom {categories}

$df = c - 1 = 3 - 1 = 2$

↳ No of categories

Step 4 : Decision boundary = $\boxed{5.991}$ → {chi square table}

Step 5 : Chi square test statistics

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

$$\boxed{\chi^2 = 232.494}$$

χ^2 → notation for chi square

f_o → observed value

f_e → expected value

~~Correct~~

conclusion :

$\chi^2 > 5.99$ {Reject the null Hypothesis}.