1, In the population, the average IQ is 100 with standard deviation of 15. A team of scientists want to test a new medication to see if it has either a positive or negative effect on intelligence, or not effect at all. A sample of 30 participants who have taken the medication has a mean of 140. Did the medication effect intelligence?

Ans ⇒

$H_0 \rightarrow \mu = 100$

$H_1 \rightarrow \mu \neq 100$

$\sigma = 15, \quad \alpha = 5\%$

$n = 30$

$\bar{x} = 140$

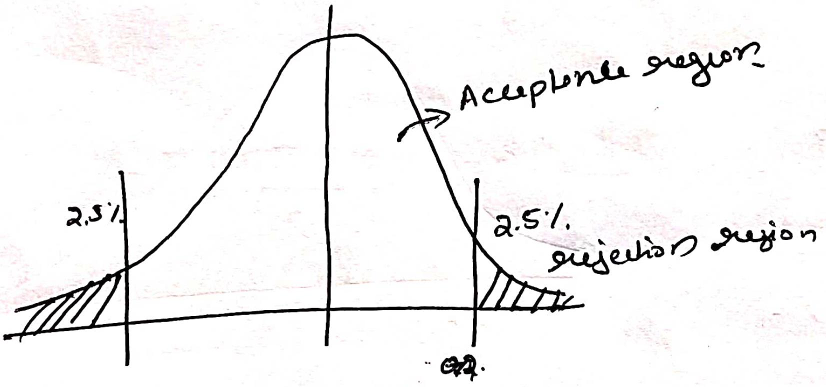
Z-test,

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{140 - 100}{15/\sqrt{30}} = 14.6$$

Z critical is 1.96.

Zcal > Z critical.

∴ reject null hypothesis



It lies in the rejection region. ~~[illegible]~~ we can reject the null hypothesis. ie, the medication has positive effect on in' intelligence.

2, A car manufacturer claims that the average fuel efficiency of its new model is 30 mpg. To test this claim, a random sample of 35 cars is selected, and their average fuel efficiency is found to be 29.2 mpg with a standard deviation of 2.5 mpg. perform Z-test at a 5% significance level to determine if the manufacturer's claim is supported.

Ans,

$H_0 \rightarrow \mu = 30$ mpg.

$H_1 \rightarrow \mu \neq 30$ mpg.

$\sigma = 2.5$,

$\bar{x} = 29.2$

$\alpha = 5\%$, $n = 35$

Critical value $= -1.96$

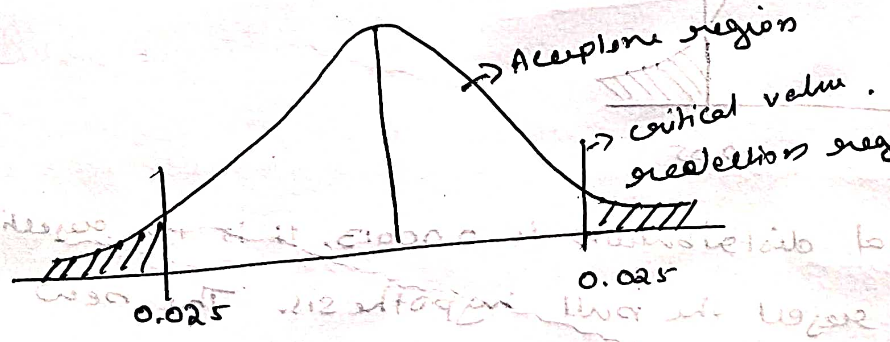
Z-test,

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{29.2 - 30}{2.5/\sqrt{35}} = -1.89$$

Zcal is falls in the critical values

$\therefore$ Fail to reject Ho

Standard normal distribution $= 0.02938$



The standard normal distribution lies in Acceptance region.

ie, the company claim of the company is valid.

3. A company claims that their new marketing campaign will increase website traffic by at least 20%. Before the campaign, the average daily traffic of 2000 visitors. ~~with a standard deviation of 150 visitors. perform~~ a After the campaign, a random sample of 30 days shows an average daily traffic of 2100 visitors with a standard deviation 150 visitors. perform a one sample z-test at a 5% significance level to determine if the claim is supported.

Ans:

$H_0 \rightarrow \mu <= 2000$

$H_1 \rightarrow \mu > 2000$

$\sigma = 150, \quad \alpha = 5\%$

$\bar{x} = 2100, \quad n = 30$

$Z_{critical} = 1.65$

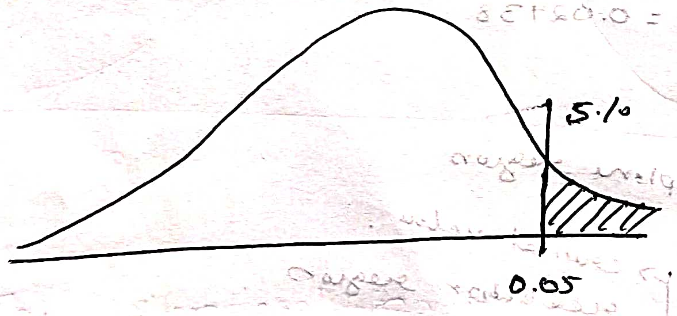
$Z_{cal} = 3.65$

Z-test

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{2100 - 2000}{150/\sqrt{30}} = 3.65$$

$Z_{cal} > Z_{critical}$

∴ reject null hypothesis



standard normal distribution is 0.00013, it is in rejection region ∴ we reject the null hypothesis. The new marketing campaign increases the website traffic.

4, A researcher wants to test if the average IQ score of a group of students is different from the national average IQ score of 100. A random sample of 40 students is taken and their average IQ score is 102 with a standard deviation of 15. perform a one sample z-test at a 1% significance level to determine if the groups average IQ score is significantly different from national average.

Ans. $H_0 \rightarrow \mu = 100$

$H_1 \rightarrow \mu \neq 100$

$\sigma = 15, \alpha = 1\%$

$\bar{x} = 102, n = 40$

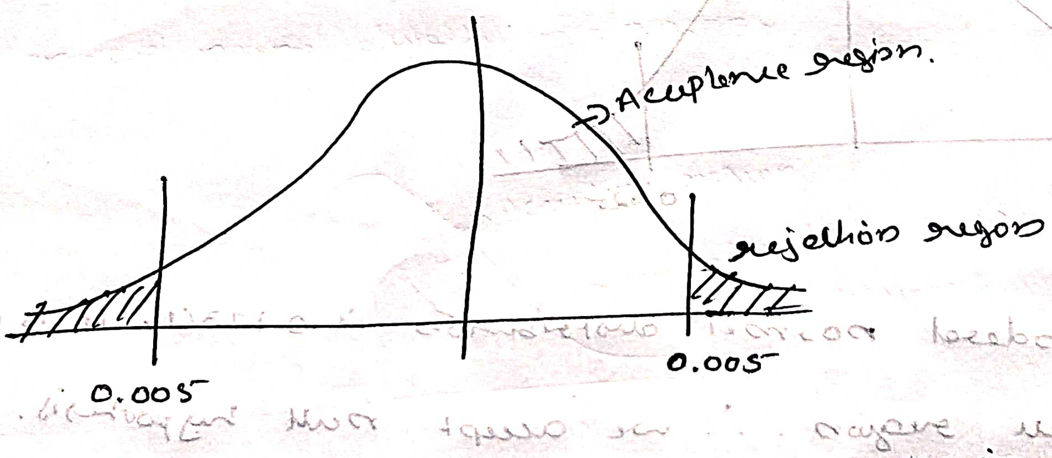
Z-test

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{102-100}{15/\sqrt{40}} = 0.84$$

$Z_{critical} = 2.57$

$Z_{critical} > Z_{cal}.$

$\therefore$ we accept H_0.



standard normal distribution is 0.2. It lies in acceptence region. $\therefore$ we accept the null hypothesis. The groups average IQ score is not different from national average.

5. You know that the standard deviation of IQ in the general population is 15. You test your drug on 36 patients and obtain a mean IQ of 97.65. using an alpha value of 0.05, is this IQ significantly different than the population mean of 100?

Ans:

$H_0 \rightarrow \mu = 100$

$H_1 \rightarrow \mu \neq 100$

$\sigma = 15$, $\bar{x} = 97.65$

$\alpha = 5\%$, $n = 36$

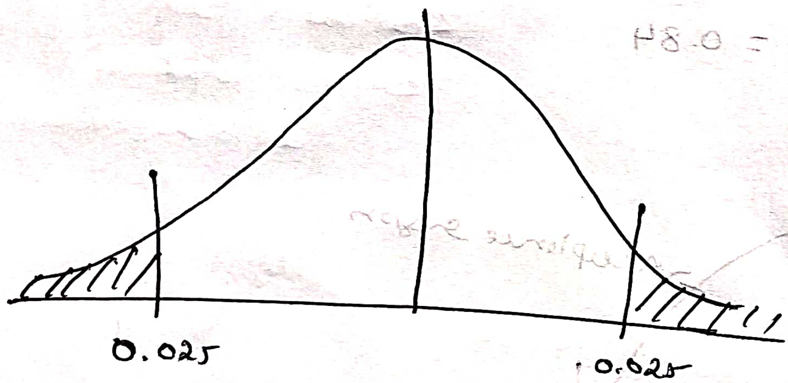
Z-test

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{97.65 - 100}{15/\sqrt{36}} = -0.94$$

Zcritical = -1.96

Zcalculated falls in the range of Zcritical

∴ we accept null hypothesis.



The standard normal distribution is 0.17361. It is in acceptance region. ∴ we accept null hypothesis. There is no change in population mean.

1, In the case of blood donation.

Ho : The person does not contain toxin in the blood.

Ha : The person contain toxin in the blood.

Type 1 error : The person's blood is clean and ~~do~~ not contain any toxins. but It says the persons blood contain toxin.

Type 2 error : The persons. blood contains toxins. but It conclude It does not.

2. A company believes that their new product increases customer satisfaction.

Ho : The new product doesnot increase customer satisfaction.

H_1 : The new product increases customer satisfaction.

Type 1 error : Actually the the new product does not increase customer satisfaction. but It concludes It increases customer satisfaction.

Type 2 error : Actually the product increases customer satisfaction but concludes that It doesnot increase customer satisfaction

3. A researcher wants to investigate ... program leads to weight loss

Ho : The new exercise program does not lead to weight loss.

H1 : The new exercise program leads to weight loss.

Type 1 error: The new exercise does not lead to weight loss but concludes it leads to weight loss.

Type 2 error: The new exercise leads to weight loss, but it concludes it does not.

4. A school district wants to determine if a new teaching method improves student test score.

Ho : The new teaching method does not improve student test score.

H1 : The new teaching method improves student test score.

Type 1 error: The new teaching method does not improve the student test scores, but it concludes it does.

Type 2 error: The new teaching method improves the student test scores, but it concludes it does not.

5. A company claims that their new advertising campaign increases sales.

Ho: The new advertising does not increase sales.

HA: The new advertising campaign increases sales.

Type 1 error: The new ~~campa~~ advertising campaign does not increase sales. but concludes it increases sales.

Type 2 error: The new ~~cam~~ advertising campaign increases sales but concludes it does not.