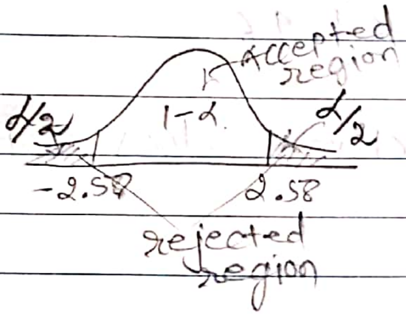
2) Calculation of statistic :

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$ (Large sample $n = 50 > 30$, $\sigma = s$)

$$= \frac{246.18 - 245}{3.60/\sqrt{50}}$$ (given $\bar{x} = 246.18$, $s = 3.60$, $n = 50$)

$$= 2.32$$

3) Critical region : (use significance level $\alpha = 1\% = 0.01$)



$Z < -2.58$ and $Z > 2.58$.

4) Conclusion : Null hypothesis Ho would not be rejected since

$$-2.58 < 2.32 < 2.58.$$

At the significance level, there is insufficient evidence to conclude that true average thickness differs from the target value.

Ex-5 A manufacturer claims that the average mileage of scooters of his company is 40 kms/litre. A random sample of 38 scooters of the company showed an average mileage of 42 kms/litre. Test the claim of the manufacturer on the assumption that the mileage of scooter is normally distributed with a standard deviation of 2 kms/litre.

Solⁿ: Here $n = 38$, $\bar{x} = 42$, $\mu = 40$, $\sigma = 2$.

1) H_0: Mileage of scooter is normally distributed with a standard deviation of 2 kms/litre.

$\therefore H_0 : \mu = 40$. (Null Hypothesis)

$H_1 : \mu \neq 40$ (two tailed test) (Alternative Hypo.)

2) Calculation of statistic:

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} = \frac{42 - 40}{2/\sqrt{38}} = 6.16$$

3) Critical region: (use significance level $\alpha = 5\%$)

$$Z < -1.96 \quad \& \quad Z > 1.96$$

4) Conclusion: As the calculated value of $Z = 6.16 > 1.96$ the significant value of Z at 5% level of significance.

$\therefore H_0$ is rejected

$\therefore$ mileage of scooter is not normally distributed with a standard deviation of 2 kms/litre.

Ex-6 A stenographer claims that she can type at the rate of 120 words per minute. Can we reject her claim on the basis of 100 trails in which she demonstrates a mean of 116 words with standard deviation of 15 words; use 5% level of significance.

Solⁿ: Here $n = 100$, $\bar{x} = 116$, $\mu = 120$, $S = 15$

1) H_0 : stenographer's claim is true.
i.e $H_0 : \mu = 120$ (Null hypothesis)

$\therefore H_1 : \mu \neq 120$ (Alternative hypothesis)
(two tailed test).

2) calculation of statistics :

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{\bar{x} - \mu}{S/\sqrt{n}} \text{ ; since } \sigma \text{ is unknown.}$$

$$= \frac{116 - 120}{15/\sqrt{100}} = -2.67.$$

3) Critical region : (Given, significance level is $\alpha = 5\% = 0.05$)

$\therefore Z < -1.96$ & $Z > 1.96$.

4) Conclusion : As the calculated value of $Z = 2.67 > 1.96$ is significant value of z at 5% level of significance,

$\therefore$ Ho is rejected.
i.e stenographer's claim is not true.

Ex-7 The mean life of a sample of 400 fluorescent bulbs produced by a company is found to be 1570 hours with a standard deviation of 150 hours. Test the hypothesis that the mean life time of the bulbs produced by the company is 1600 against the alternative hypothesis that it is greater than 1600 hours at 1% levels of significance

Solⁿ: Here $n = 400$, $\mu = 1600$, $\bar{x} = 1570$, $S = 150$.

1) H_0: mean life time of bulbs is 1600 hours, that is:

$H_0 : \mu = 1600$ (Null hypothesis)

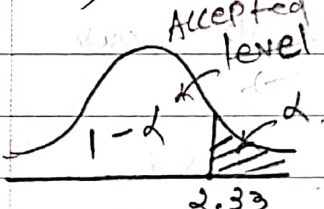
$H_1 : \mu > 1600$ (right tailed test)

2) Calculation of statistics:

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{\bar{x} - \mu}{s/\sqrt{n}} \; ; \text{ since } \sigma \text{ is unknown.}$$

$$= \frac{1570 - 1600}{150/\sqrt{400}} = \frac{-30}{7.5} = -4.$$

3) Critical region: (Given, significance level is $\alpha = 1\% = 0.01$)



$Z > 2.33$.

4) Conclusion: As the calculated value $|z| = 4 > 2.33$ the significant value of z at 1% level of significance for the right tailed test (from the table)

$\therefore$ H_0 is rejected

$\therefore$ the mean life time of bulbs produced by the company is higher than 1600 hours.

Ex-8 An ambulance service claims that it takes, on the average 8.9 minutes to reach its destination in emergency calls. To check on this claim, the agency which licenses ambulance service has then timed on 50 emergency calls, getting a mean of 9.3 minuts with a standard deviation of 1.8 minutes. Does this constitute evidence that the figure claimed is too low at the 1% significance level?

Sol^n:

1) Let Null hypothesis H_0: the claim is same as observed.

$H_0 : \mu = 8.9$

H_1 (Alternative hypothesis) : $\mu \neq 8.9$ (two tailed test)

Given $n = 50$, $\bar{x} = 9.3$, $s = 1.8$

2) Calculation of statistics:

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{\bar{x} - \mu}{s/\sqrt{n}} \quad ; \text{since } \sigma \text{ is unknown}$$

$$= \frac{9.3 - 8.9}{1.8/\sqrt{50}} = \frac{0.4}{0.254} = 1.57$$

3) Critical region: (given significance level is $\alpha = 1\% = 0.01$)

$\therefore Z < -2.58$ & $Z > 2.58$.

4) Conclusion: Null hypothesis H_0 would not be rejected as $-2.58 < 1.57 = Z < 2.58$

Thus, there is no difference betⁿ the average time observed and claimed.

Ex-9 The average marks in statistics of a sample of 100 students were 51 with a S.D. of 6 marks. Could this have been a random sample from a population with average marks 50 ?

Solⁿ

· Here $n = 100$, $\bar{x} = 51$, $\mu = 50$, $s = 6$,

1) Null Hypothesis H_0 : The sample has been drawn from the normal population with mean.

$H_0 : \mu = 50$.

$H_1 : \mu \neq 50$ (two tailed test)

2) Calculation of statistics:

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{\bar{x} - \mu}{s/\sqrt{n}} \quad ; \text{ since } \sigma \text{ is unknown.}$$

$$= \frac{51 - 50}{6/\sqrt{100}} = 1.67.$$

3) Critical region: (take significance level is $\alpha = 5\% = 0.05$

$\therefore Z < -1.96$ & $Z > 1.96$.

4) Conclusion: Null hypothesis H_0 would not be rejected as

$$-1.96 < z = 1.67 < 1.96$$

∴ The sample is drawn from the normal population with mean 50.