

Hypothesis Testing And Statistical Analysis

- ① Z Test } \Rightarrow Average \Rightarrow Z table \rightarrow Z score And p value
- ② t Test } \Rightarrow t \Rightarrow t table
- ③ CHI SQUARE \Rightarrow Categorical Data
- ④ ANNOVA \Rightarrow Variance

Z test . i) Population std ii) $n \geq 30$

With a $\sigma = 3.9$
i) The average heights of all residents in a city is 168cm. A doctor believes the mean to be different. He measured the height of 36 individuals and found the average height to be 169.5 cm.

(a) State null and Alternate hypothesis

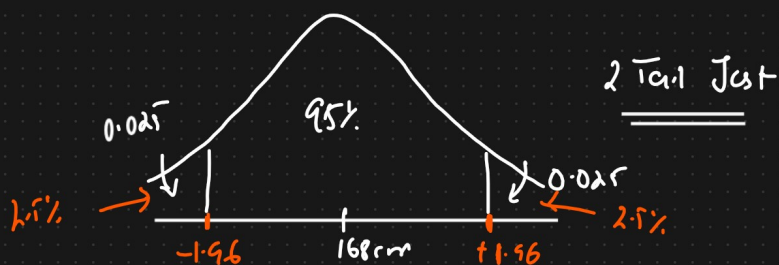
(b) At a 95% confidence level, is there enough evidence to reject the null hypothesis.

Ans) $\mu = 168\text{cm}$ $\sigma = 3.9$ $n = 36$ $\bar{x} = 169.5$
 $C.I = 0.95$ $\alpha = 1 - C.I = 1 - 0.95 = 0.05$

① Null Hypothesis $H_0 = \mu = 168\text{cm}$

② Alternate Hypothesis $H_1 = \mu \neq 168\text{cm}$

③ Based on C.I we will draw Decision Boundary



$$1 - 0.025 = 0.9750 \Rightarrow Z\text{-score}$$

$$\downarrow$$

$$\text{Area} \Rightarrow +1.96$$

if Z is less than -1.96 or greater than $+1.96$, Reject the Null Hypothesis.

⊛ Z-test

$$Z\text{-score} = \frac{\bar{X} - \mu}{\sigma}$$

$$Z_d = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$$

$$\downarrow$$

$$\frac{\sigma}{\sqrt{n}}$$

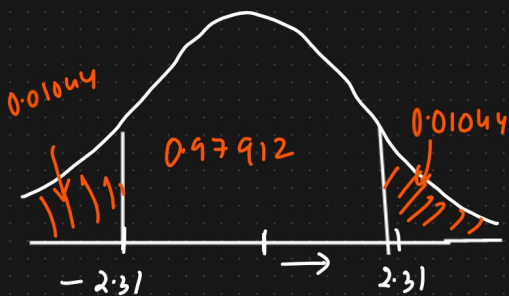
$$= \frac{169.5 - 168}{3.9/\sqrt{36}}$$

$$Z_d = \frac{1.5}{0.65} = \boxed{2.31}$$

Conclusion

$2.31 > 1.96$ Reject the Null Hypothesis

$$p < 0.05$$



$$0.98956$$

$$1 - 0.98956 = 0$$

⊛ Final Conclusion the Average \neq 168cm

The average height seems to be increasing based on sample height.

$$\textcircled{1} p\text{ value} = 0.01044 + 0.01044$$

$$= 0.02088$$

$$p < 0.05$$

$0.02088 < 0.05 \Rightarrow$ Reject the Null Hypothesis

② A factory manufactures bulbs with a average warranty of 5 years with standard deviation of 0.50. A worker believes that the bulb will malfunction in less than 5 years. He tests a sample of 40 bulbs and find the average time to be 4.8 years.

(a) State null and alternate hypothesis

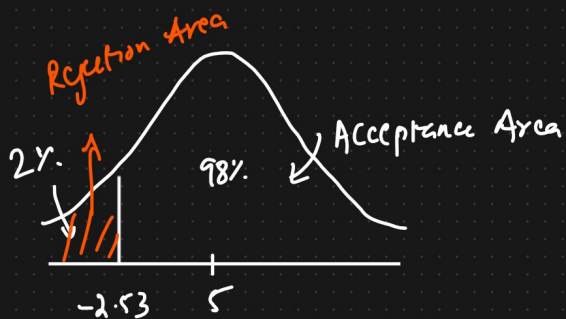
(b) At a 2% significance level, is there enough evidence to support the idea that the warranty should be revised?

Ans) $\mu = 5$ $\sigma = 0.50$ $n = 40$ $\bar{x} = 4.8$

a) Null hypothesis $H_0: \mu = 5$

Alternate Hypothesis $H_1: \mu < 5$ {1 Tail Test}

b) Decision Boundary



c) Z-test

$$Z_d = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{4.8 - 5}{0.50 / \sqrt{40}} = -2.53$$

Area under curve with Z score $-2.53 = 0.0570$.

P-value = 0.0570

$\alpha = 0.02$

Compare P-value with α

$0.0570 < 0.02 \Rightarrow$ False

We accept the Null Hypothesis

We Fail to Reject the Null Hypothesis.