

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 \Downarrow i) Population std ii) $n \geq 30$

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 169.5cm. With a $\sigma = 3.9$

(a) State null and Alternate hypothesis

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

Ans) $\mu = 168\text{cm}$, $\sigma = 3.9$, $n = 36$ $\bar{x} = 169.5\text{cm}$

a) Null hypothesis H_0 $\mu = 168\text{cm}$

b) Alternate hypothesis H_1 $\mu \neq 168\text{cm}$ { 2 Tail Test }

c) C.I. = 0.95 $\alpha = 1 - 0.95 = 0.05$

Decision Boundary



① Z test

② p value

$$1 - 0.05 = \underline{\underline{0.9750}}$$

-1.96

168

+1.96

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

d) Statistical Analysis

$$Z_{\text{test}} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$\boxed{\sigma/\sqrt{n}}$$

$$= \frac{169.5 - 168}{3.9/\sqrt{36}} = 2.31$$

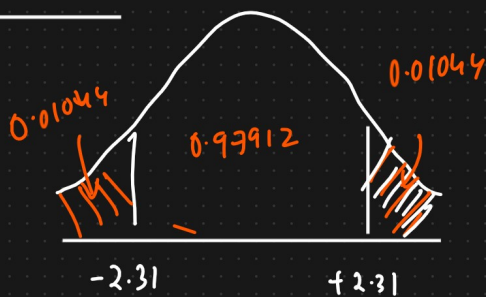
If Z-test value is less than -1.96 or greater than +1.96 We Reject the Null Hypothesis

Else

We Accept Null Hypothesis

$2.31 > +1.96$ { We Reject the Null Hypothesis }

② P-value



1 - Area under the curve of ± 2.31

$1 - 0.98956$

=

$$p\text{ value} = 0.01044 + 0.01044 = 0.02088$$

if $P\text{-value} < \text{Significance}$

0.02088 < 0.05 { 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) $\mu = 5$ $\sigma = 0.50$ $n = 40$ $\bar{x} = 4.8$

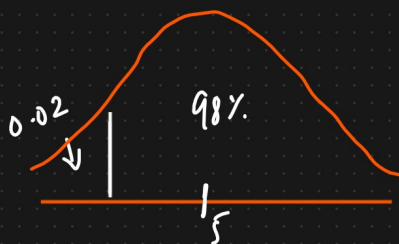
① Null hypothesis $H_0: \mu = 5$

② Alternate hypothesis $H_1: \mu < 5$ {1 Tail Test}

③ Decision Boundary

$$C.I = 0.98$$

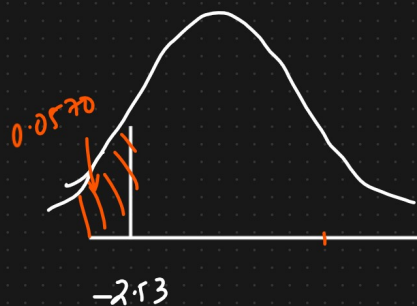
$$\alpha = 1 - 0.98 = 0.02$$



④ P value

$$\begin{aligned} Z_{-test} &= \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} \\ &= \frac{4.8 - 5}{0.50 / \sqrt{40}} \end{aligned}$$

$$Z_{-test} = -2.53$$



Area Under the Curve of -2.53

$$Z \text{ value is } = \underline{\underline{0.0570}}$$

$$P\text{-value} = 0.0570$$

if $p\text{-value} < \text{Significance}$

$$0.0570 < 0.02 \Rightarrow \text{False}$$

{We accept the Null Hypothesis}

Conclusion : The Warranty needs to be revised.