Hypothesis Testing And Statistical Analysis

① Z Test } ⇒ Average ⇒ Z table → Z score And p value
② t Test } ⇒ Average ⇒ t table

③ CHI SQUARE ⇒ Categorical Data

④ ANNOVA ⇒ Variance

Conditions for Z-test

Usually Applied for Average data

Z test i) Population std (mean/Expected value) ii) $n \geq 30$ → population size

1) The average heights of all residents in a city is 168cm with a $\sigma = 3.9$. 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) $\mu = 168cm$ $\quad \sigma = 3.9$ $\quad n = 36$ $\quad \bar{x} = 169.5$

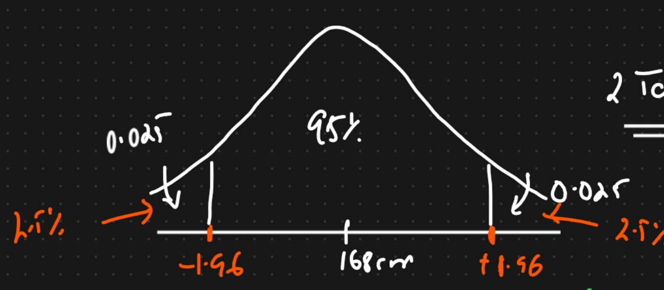
$C.I = 0.95$ $\quad \alpha = 1 - C.I = 1 - 0.95 = 0.05$

① Null Hypothesis $H_0 = \mu = 168cms$

② Alternate Hypothesis $H_1 = \mu \neq 168cm$

We check if less than 168 / greater than 168 — 2 Tail test

③ Based on C.I We will draw Decision Boundary



2 Tail Test

2 tail

$1 - 0.025 = 0.9750 \Rightarrow$ Z-score

Area $\Rightarrow +1.96$ (Z score)

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

Z-score $= \dfrac{\bar{X} - \mu}{\sigma}$ sample

$\dfrac{\sigma}{\sqrt{n}}$ population

Z-test

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

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

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

Conclusion

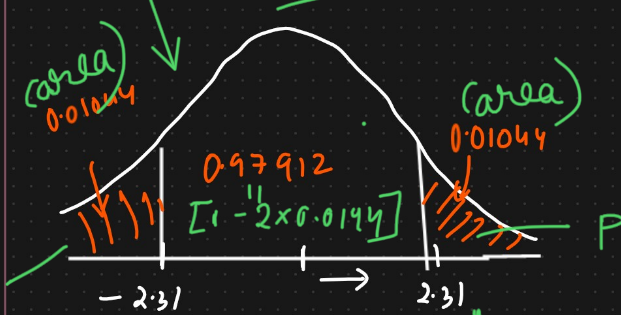
Z-score

$2.31 > 1.96$ Reject the NULL Hypothesis } Ans

$p < 0.05$ C.I we conclude

doing with 2.31

Computing P value



0.98956

$1 - 0.98956 = 0.01044$

$2.31 = 0.98567$ (area)

0.98950 Z Table

① p value $= 0.01044 + 0.01044$

$= 0.02088$ (area)

$p < 0.05$

$0.02088 < 0.05 \Rightarrow$ Reject the NULL Hypothesis

Final Conclusion the Average $\neq$ 168cm

The average height seems to increasing based on sample heights.

+ 2.31 (+ive) to high is increasing

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

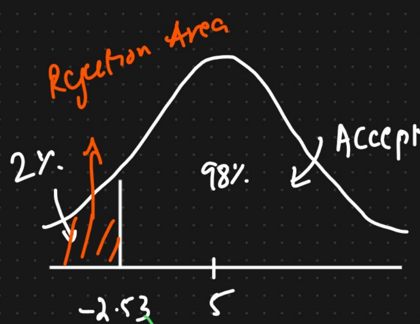
(b) At a 2% significance level, is there enough evidence to support the idea that the warranty should be revised?

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

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

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

b) Decision Boundary ⟶ for condifence interval



z table = 0.00570

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.