Hypothesis testing and statistical analysis

① Z test
② t test
→ Average

③ Chi-square → Categorical data
④ Annova → variance

Z test criteria → CLT → $\mu = \mu$, $\sigma = \sigma/\sqrt{n}$ $\quad n \geq 30$

- S.S ≥ 30
- σ population should be given

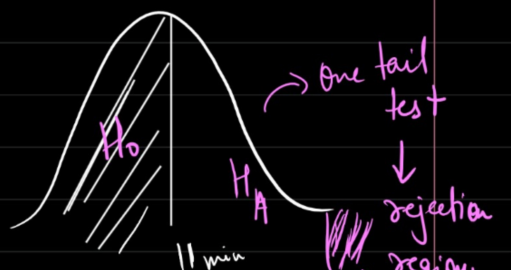
$Z_{score} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$

Q. Suppose a child Psychologist says that the average time working mother spend talking their children is upto 11 minutes per day.
To test the hypothesis you conducted an experiment with random sample of 100 working mother and find that they spend 11.5 minutes per day talking with their children. Assume prior research suggests the population standard deviation is 2.3 mins. Conduct the test with 5% level of significance ($\alpha = 0.05$)

Ans

① frame the hypothesis

$H_0 : \mu \leq 11$
$H_A : \mu > 11$



② level of significance = 5%

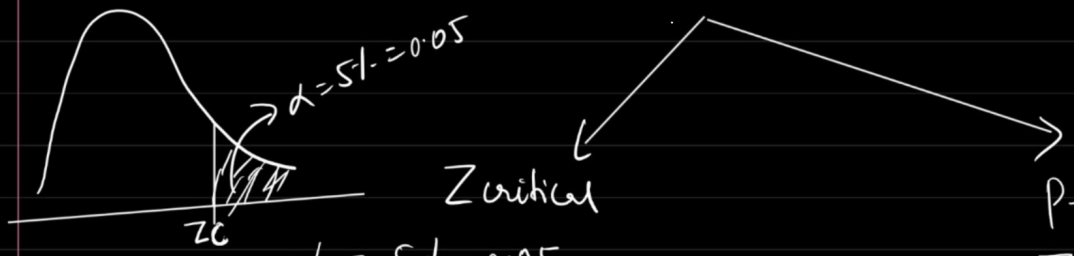
③ Type of test → Z test

* To identify if its two tail test H_A has $\mu \neq 11$

④ Z score $\bar{x}$ (test statistics) $= \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$

↓ Z statistics

$= \frac{11.5 - 11}{2.3/\sqrt{100}} = 2.17.$



Zcritical

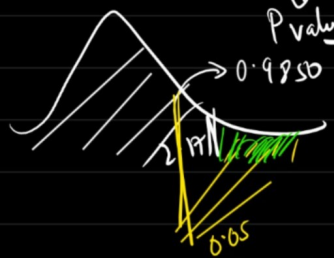
p-value

→ $\alpha = 5\% = 0.05$

$Z_{critical} = 1.64$

$Z_{statistic} = 2.17$

Pvalue → 0.9850



1 − 0.9850

⇒ 0.015

pvalue < 0.05

↓

reject the Ho

if Zstatistics lies in Zcr region, you reject the Ho

Step-5 – Conclusion → $Z_{statistic} > Z_{cr}$

reject the Ho

meaning > 11 mins

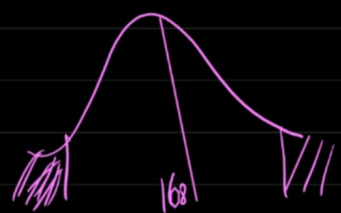
Q: The average heights of all residents in a city is 168 cm with a $\sigma = 3.9$ cm. One researchers believes the mean to be different. He measured the height of 36 individuals and found the average height to be 169.5 cm. Test the hypothesis with 95% confidence interval. $\alpha = 5\%$

Ans Step-1 $H_0 : \mu_{age} = 168$ cm

$H_A : \mu_{age} \neq 168$ cm

Step-2 level of significance ⇒ Its a two tail test $\alpha = 5/2 = 2.5\%$ or 0.025

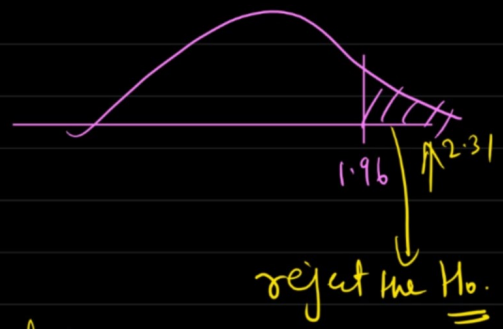
Step-3 type of test — Z test



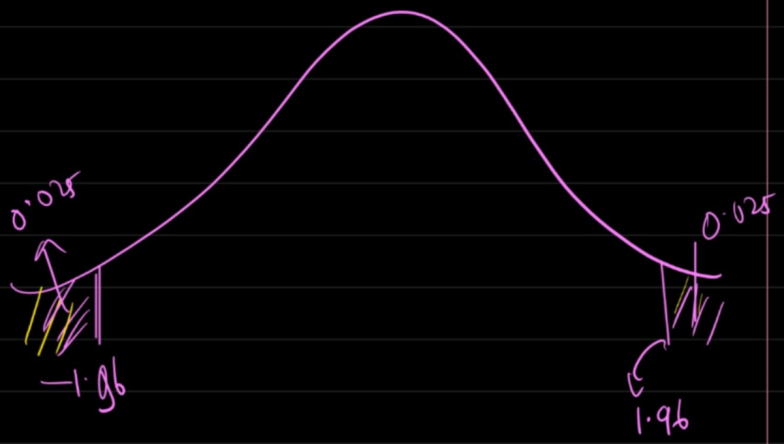
Step-4 Z statistics → $\frac{\bar{x}-\mu}{\sigma/\sqrt{n}} = \frac{169.5-168}{3.9/\sqrt{36}}$

Z statistics = 2.31

Step-5 Z critical → 1.96



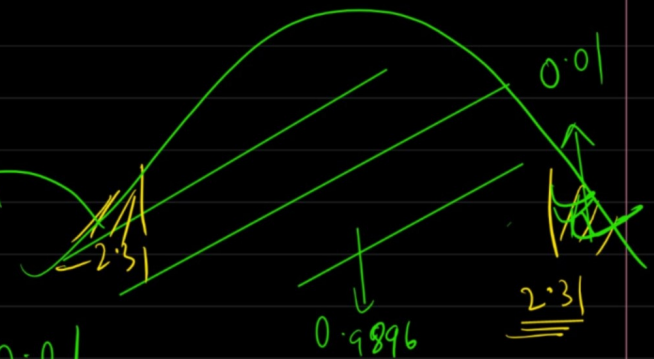
reject the H_0.



Conclusion the Avg height ≠ 168 cm

2nd approach — p value

$\alpha = 5\%$



p value = 0.01 + 0.01

⇒ 0.02

1 − 0.9896 ⇒ 0.01

p value < 0.05

↳ Reject the H_0