SELF PRACTICE

imp. Null hypothesis have equality;
Alternative " never " " .

# HYPOTHESIS TESTING :-

defined by alternative hypothesis ($H_1$)

Consider the following to understand 1 tail and 2 tail tests.

one tail test.

$H_0 \Rightarrow \mu = 23$
$H_1 \Rightarrow \mu \neq 23$
two tail test

$H_0 \Rightarrow \mu \geq 23$
$H_1 \Rightarrow \mu < 23$
left tailed

$H_0 \Rightarrow \mu \leq 23$
$H_1 \Rightarrow \mu > 23$
right-tailed.

Reject Null hypothesis $\Leftrightarrow$ Can support alternative hypothesis.

fail to Reject " $\Leftrightarrow$ Cannot support alternative hypothesis.

To determine when to reject the NULL hypothesis we select the significance level $\alpha$ usually 0.05.
(0.10 or 0.01 are also used)
↳ this specificies the size of the region where the NULL hypothesis should be rejected)

$\alpha$ is divided for 2 tail test and not for 1 tail.

our course standard: $n \geq 30$ for z-score OR and vice versa

when $\sigma$ is know we use z-test

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when $\sigma$ is unknow we use t-test.

Example ⇒ z-test.

$n = 42$ $\quad \mu = 23$.

$\sigma = 2.4$

$\bar{X} = 23.8$

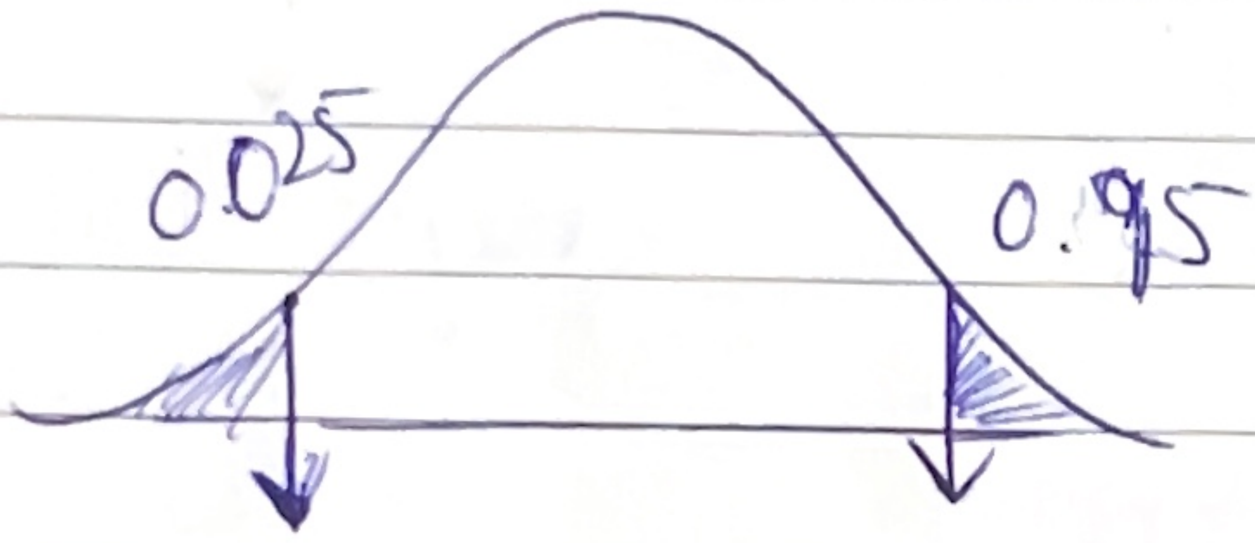
the NULL hypothesis. $H_0 = 23$.

the alternative hyposthesis ⇒ $H_1 \neq 23$

$\alpha = 0.05$

as it is two tailed ∴

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




$$= \frac{23.8 - 23}{2.4 / \sqrt{42}}$$

Now performing z-test for our hypothesis.

⇒ $z = 2.16 > 1.96$

we reject the NULL hypothesis

our range

$z < -1.96$ or $z > 1.96$

we reject.

Example ⇒ t-test.

$n = 27$ $\quad df ⇒ 27 - 1$

$\bar{X} = 22$. $\quad ⇒ 26$

$s = 4.8$

$\alpha = 0.01$

t critical value. if $t < -2.479$

we reject the NULL hypothesis.

$H_0 = \mu \geq 24$

$H_1 = \mu < 24$.

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$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} \Rightarrow \frac{22-24}{4.6/\sqrt{27}} \Rightarrow -2.165.$$

as $-2.165$ is not less than $-2.479$ we do not reject the NULL hypothesis.

Example:-

$H_0 \Rightarrow \mu \leq 10$

$H_1 \Rightarrow \mu > 10$ (right tail.)

$n = 50$ (Normal dist Z test).

$\alpha = 0.05$.

$s/\sigma \Rightarrow 0.5mm$.

$\bar{X} = 10.2mm$.

$\mu_0 \Rightarrow 10$.

0.05 in one tail.
$\Rightarrow 1.68 / 1.645$ is the $z$ critical value
if z-test value > $z_c$ we reject.

$$Z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}}$$

$\Rightarrow 2.83 > 1.645$ hence we reject Null hypothesis!

# P-VALUE METHOD:-

Rules of P-values.

① Calculate the P-value.

② if $P < \alpha$ reject $H_0$

③ if $P > \alpha$, donot reject $H_0$.

Example:-

$\mu \Rightarrow 168$

$\bar{X} = 169.5$

$\sigma = 3.9.$

$n = 36.$

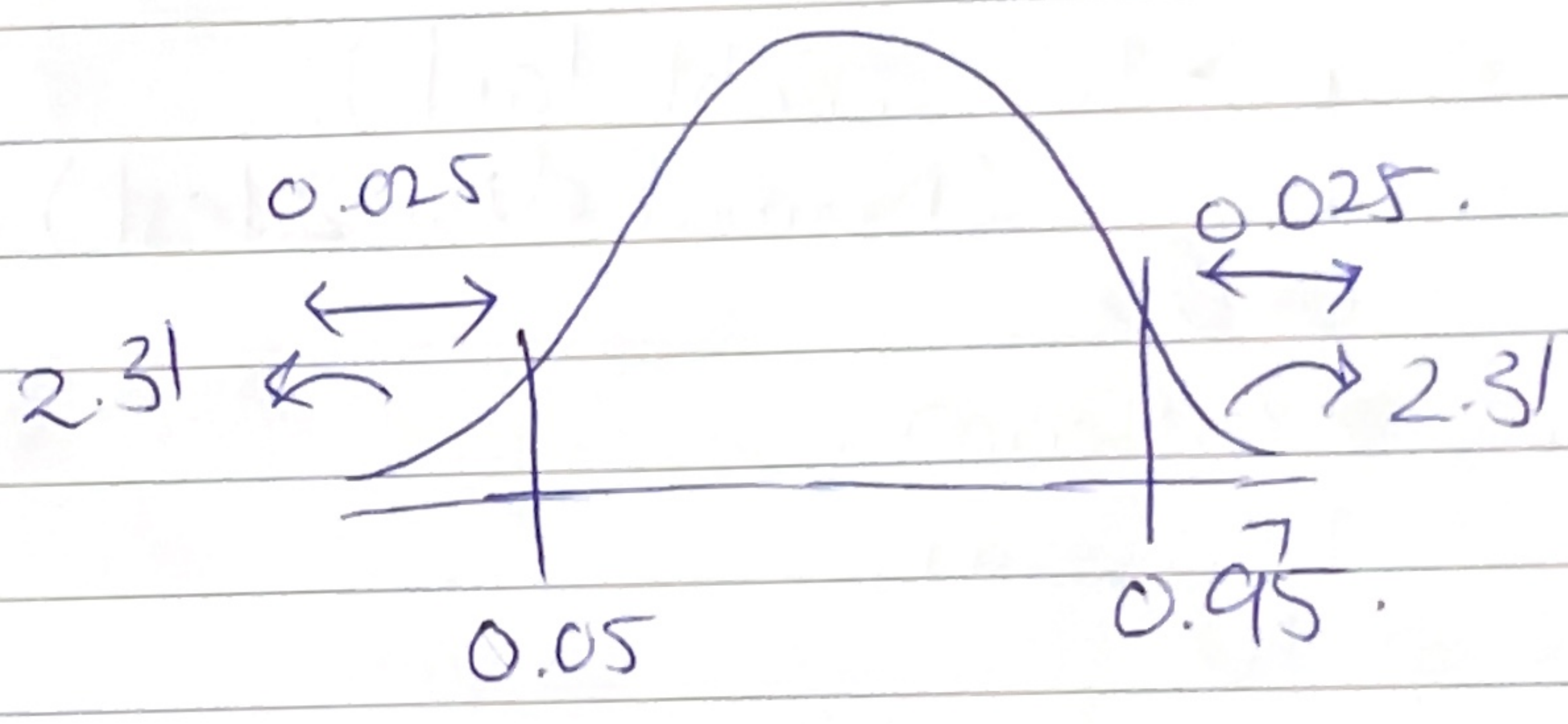
$H_0: \mu_0 = 168$

$\mu_0 \neq 168.$

$CI = 95\%$

$1 - \alpha = CI$

$\alpha = 0.05$




$Z_c \Rightarrow \pm 1.96.$

how to calculate the P-value.

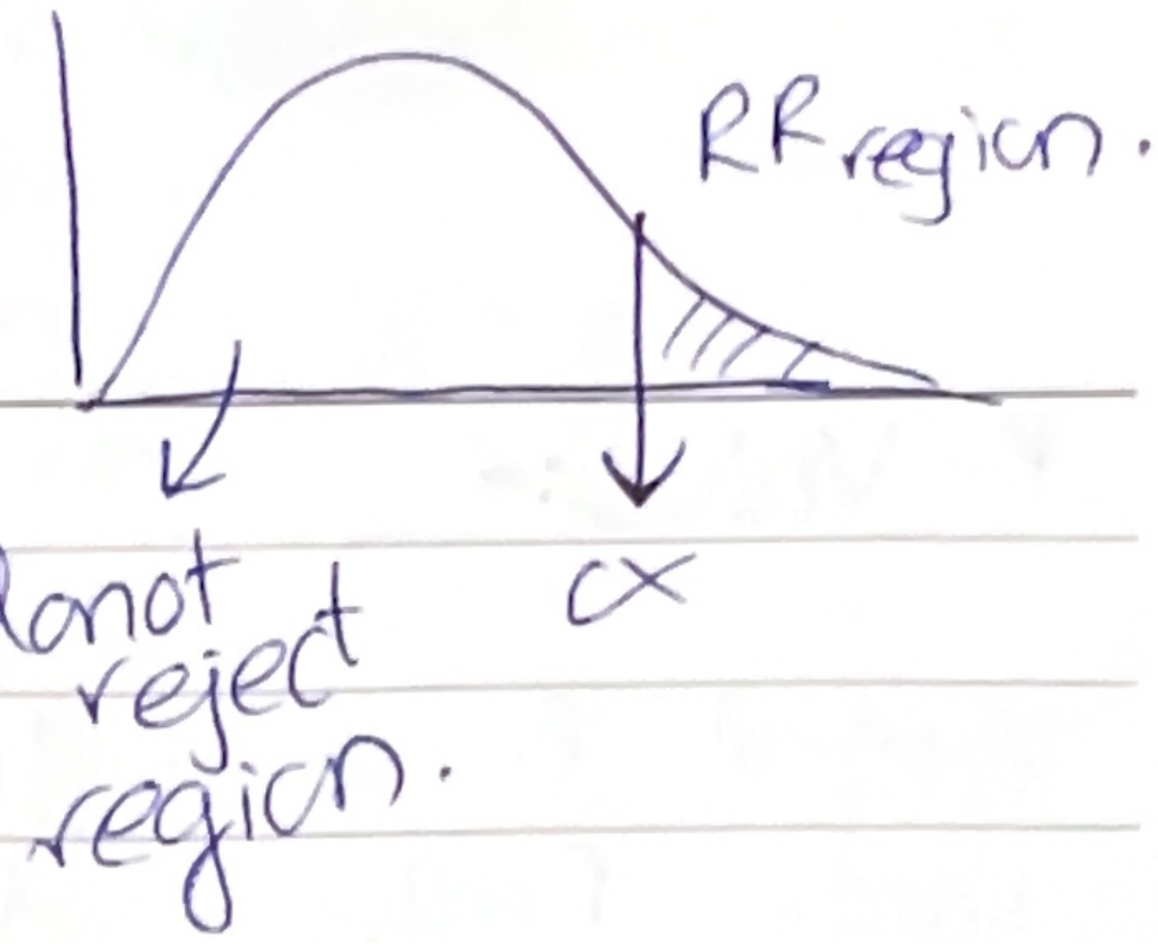
Now perform required/any relevant test.

$$Z_{\text{value}} = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \Rightarrow \frac{169.5 - 168}{3.9/\sqrt{36}} \Rightarrow 2.31.$$

Now using z value find the points in graph that represent end points of 2.31 on b.s.

Sum them $\Rightarrow$ p value and then compare with alpha.

$$X_c^2 \Rightarrow \sum \frac{(\text{observed value} - \text{Expected value})}{\text{expected value}}$$

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# Hypothesis Testing

**Lecture no. 39.**

↳ always a statement about population or distribution

↳ a statement or assumption about the population parametres that we can test using sample data.

NULL Hypothesis :- The hypothesis we assume as true unless proven otherwise.

Alternative Hypothesis :- statement that contradicts the Ho, it is the outcome we might observe if Ho = false.

* Even with all the best statistic skills there are four situations that are possible.

| | Result of the test | |
|---|---|---|
| | Reject Ho | Accept Ho |
| Ho is True | Type I error | correct. |
| $H_o$ is false | correct | Type II error |

→ Type I error and Type II error are sampling errors.

→ Type I errors are more undesired, their probability is denoted by α 'the significance level', they are kept small as undesireable.

Date

## P-Value:-

Small-Pvalue: data is unlikely under NULL hypothesis, reject the data.

Large Pvalue: data is consistent with the NULL hypothesis, so we fail to reject it.

$p < 0.05$ means only in 5 out of 100 experiments, a result would appear significant by chance ('Type I error')

* NULL hypothesis is rejected means; something has not occurred by chance but by evidence collected in hypothesis testing.

"Check all e.gs from slides"