⇒ Testing of hypothesis :

Def : The process which enables us to decide whether to accept or reject the statement on the basis of sample collected from population.

- sample data support statement = accept
- " " deny " = reject

rejection region / critical region.

① Null hypothesis : (H_0)

- which is to be tested for possible rejection under the assumption that it is true.

② Alternative hypothesis : (H_1) or (H_A)

- accept when null hypothesis rejected.

if Null hyp. rejected that average college student is 6 feet, then Alternative hyp. accepts that avergge will be less then 6 feet, greater then 6 feet or not 6 feet.

⇒ Simple and Composite hypothesis :

"Simple"	"Composite"
→ In which all parameters of distribution are specified.	In which not all parameters of dist. are specified.
e.g: $\sigma^2 = 4$, $H_0 : \mu = 62$	e.g: $\sigma^2 > 4$, $H_1 : \mu > 62$ $\sigma^2 < 4$, $H_1 : \mu < 62$

hypothesis

exact → unique value

inexact → more then 1 value

⇒ Type 'I' error, Type 'II' error :

"Type I"	"Type II"
→ reject H_0 when H_0 is true. (α)	→ accept H_0 when H_0 is false.

"P-test"

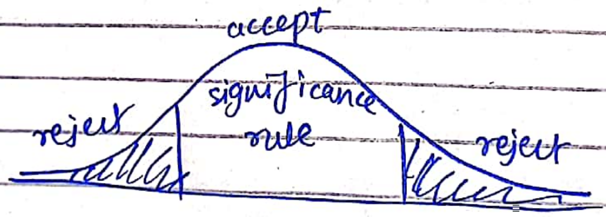
⇒ Power of test: it is the probability of rejecting a null hypothesis/ wrong thing.

power = P(reject H_0 / H_0 is false)

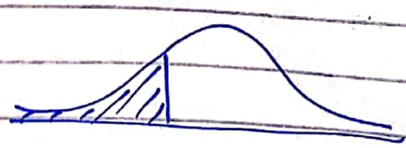
$= 1 - \beta$

⇒ significance level :- $\alpha = 5\%$ (5 percent chances of rejecting a Null hypothesis)

⇒ Test of significance :- Rule or Procedure in which we decide to accept or reject the null hypothesis.

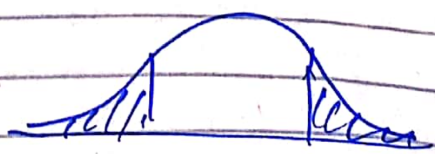


⇒ One tail test :-



one rejection region

⇒ Two tail test :-



two rejection regions

⇒ General procedure of testing hypothesis:-

→ Six Steps:

① **Hypothesis** :- $H_0 : \mu = 62^\circ$.
$H_1 : \mu \neq 62^\circ$, $\mu < 62^\circ$

② **Significance level**:- α is given in question.

"Kitnay percent confident hain k given statement true ~~hy~~ hy." e.g. $\alpha = 0.05$, 0.10, 0.01.

③ **Test statistics** :- which formula we use.

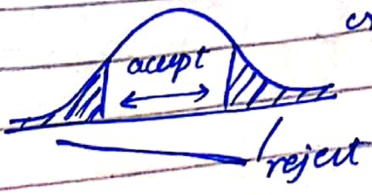
if σ is given, apply sigma formula,
if SD is given, apply SD formula.

④ **Critical region** :-

α	(two sides) one-tailed test	(one sided) Two-tailed test
0.10	$Z_{\alpha/2} = \pm 1.645$	$Z_\alpha = \pm 1.28$
0.05	$Z_{\alpha/2} = \pm 1.96$	$Z_\alpha = \pm 1.645$
0.01	$Z_{\alpha/2} = \pm 2.58$	$Z_\alpha = \pm 2.33$

⑤ **Computation** :- whether to accept or reject Null hypothesis.

⑥ **Conclusion** :- "if values lies in critical region, we reject null hypothesis and accept alternative."



① Testing hypothesis about mean of normal population when σ is known –

① example :– $n = 25$, $\bar{x} = 83$, $\mu = 80$, $\sigma = 7$.

① Hypothesis :– $H_0 : \mu = 80$
$H_1 : \mu \neq 80$ (two side)

② Level of significance :– (if not given then)

$\alpha = 0.05$

③ Test statistics :–

(if sigma is known, then z-test)

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

④ Critical region :–

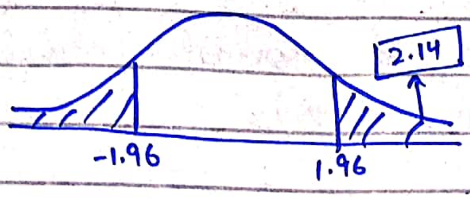
$|z| \geq 1.96$.

⑤ Computation :–

$$= \frac{83 - 80}{7 / \sqrt{25}}, \quad \boxed{z = 2.14}$$

⑥ Conclusion :–

($z = 2.14$ falls in critical region, so we reject H_0 and accept H_1)



2 example :- 2 Testing hypothesis about mean of normal population when variance is known. (sigma square)

$\sigma^2 = 70$, $\mu = 31$, $n = 13$, $\bar{x} = 34$, $\sigma = \sqrt{70}$

$H_1 : \mu > 31$, $\alpha = 0.10$

1 Hypothesis :- $H_0 : \mu = 31$

$H_1 : \mu > 31$ (one sided)

2 level of significance :- $\alpha = 0.10$

3 Test statistics :-

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

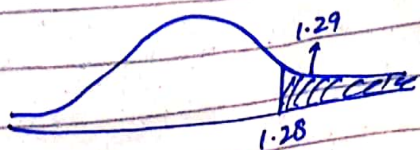
4 Critical region :-

$z > 1.28$.

5 Computation :-

$$= \frac{34-31}{\sqrt{70}/\sqrt{13}} \quad , \quad \boxed{z = 1.29}$$

6 Conclusion :-



$z = 1.29$ falls in critical region, so we reject H_0 and accept H_1)

(3) Testing hypothesis of normal population when σ is unknown).

(3) example : $\mu = 25$, $n = 36$, $\bar{X} = 27$, S.D. = 5

(1) Hypothesis :- $H_0 : \mu = 25$
$H_1 : \mu \neq 25$ (two sided)

(2) Level of significance :- $\alpha = 0.05$

(3) Test statistics :-

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

(4) Critical region :-

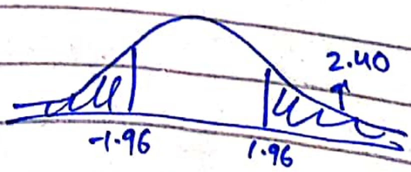
$$|z| \geq 1.96$$

(5) Computation :-

$$= \frac{27-25}{5/\sqrt{36}} \rightarrow \boxed{z = 2.40}$$

(6) Conclusion :-

($z = 2.40$ falls in critical region so we reject H_0 and accept H_1).



(4) Non-normal population when n is large :-

(4) <u>example</u> :- $n = 100$, $\bar{X} = 2600$, $S.D = 500$

claim $= H_1 : \mu > 2500$, $\alpha = 0.05$

(1) <u>Hypothesis</u> :- $H_0 : \mu \leq 2500$

$H_1 : \mu > 2500$ (one sided)

(2) <u>level of significance</u> :- $\alpha = 0.05$

(3) <u>Test statistics</u> :-

$$z = \frac{\bar{x} - \mu}{S.D / \sqrt{n}}$$

(4) <u>Critical region</u> :-

$z \geq 1.645$.

(5) <u>Computation</u> :-

$$= \frac{2600 - 2500}{500 / \sqrt{100}}, \quad \boxed{z = 2}$$

(6) <u>Conclusion</u> :-

($z = 2$ falls in critical region so we reject H_0 and accept H_1)

(5) Non-normal population when n is large

(5) example :-

$n = 100$, $\bar{X} = 182$, $S^2 = 299$, $\alpha = 0.05$

$H_0 : \mu \leq 180$, $H_1 : \mu > 180$

① Hypothesis :- $H_0 : \mu \leq 180$

$H_1 : \mu > 180$ (one sided)

② level of significance :- $\alpha = 0.05$

③ Test statistics :-

$$z = \frac{\bar{X} - \mu}{\sqrt{s^2} / \sqrt{n}}$$

④ Critical region :-

$z > 1.645$

⑤ Computation :-

$$= \frac{180 - 180}{\sqrt{299} / \sqrt{100}} , \boxed{z = 1.16}$$

⑥ Conclusion :-

($z = 1.16$ falls in acceptance region so we accept H_0 and reject H_1).