ML:

Hypothesis Testing:- To test a claim about the value of a Parameter

① **Null Hypothesis**
* always contains the equal sign.

e.g greater than or equal to K

$H_0: \mu \geq K$

② **Alternative Hypothesis**
* alternate of H_0
* contains only in equality.

e.g company advertises mean of its furnace is more than 18 yrs

$H_0: \mu \leq 18$

$H_a: \mu > 18$

Types of error:

	H_0 is True	H_0 is false
Accept H_0	corr decision	Type 2 error
Reject H_0	Type 1 error	corr decision

α = Prob of committing Type 1 error.
= significance level.

β = Prob of comm of Type 2 error..

Steps for Testing a Hypothesis: using P-values for Z-Test

① Find out Z.

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

cond: Normal distr or $n \geq 30$.

② state the Null & Alternative hypothesis Mathematically.

H_a:

H_0:

(3) specify level of significance
identify α

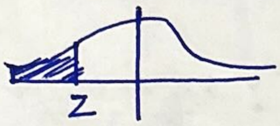
(4) Find out the standardised test statistic: find Z

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

(5) Draw the distribution and mark Z.

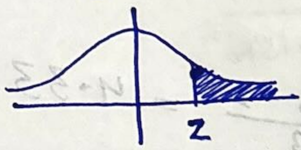
(6) Find the P-value.

(1) For left tailed test



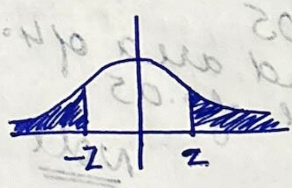
P = Area in left Tail
= value at Z from Normal Table

(2) For Right Tailed:



P = Area in Right Tail
= 1 − N(Z)

(3) Two Tailed Test



P = Area of shaded region.

(7) Make a decision:

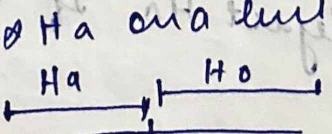
If $P \le \alpha$ Reject Ho

If $P > \alpha$ Fail to Reject Ho.

(8) Interpret the decision.

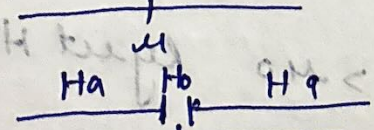
IMP: Map Ho & Ha on a line

If (i)



left Tailed

(ii)



Two-Tailed [when equality is given]

Finding Critical Values (z values) [σ – is known]

① specify the α value

② Determine whether the test is left, right or 2 tailed

③ For:

(i) left Tailed = z value corresponding to α

(ii) Right Tailed = z value corr to $1-\alpha$.

(iii) Two-Tailed = z values corr to $\frac{1}{2}\alpha$ & $1-\frac{1}{2}\alpha$

④ sketch the distribution.

Question: claim : $\mu = 22$.

$H_0 : \mu = 22$

$H_a : \mu \neq 22$

$N = 121$

$\bar{x} = 23.3$

$\sigma = 3.3$

$$z = \frac{23.3 - 22}{\frac{3.3}{\sqrt{121}}} = 4.33$$

$\alpha = 0.05$

Note: Here I couldn't find area of 4.33 so I find z value of 0.05 $= -1.65$

Now $z > 1.65$

Reject H_0.

Note During this process for Right Tailed Test Take z as +ve

Decision criteria:

① Two Tailed : Reject H_0 if $\boxed{Z > Z_{\alpha/2}}$ or $\boxed{Z < -Z_{\alpha/2}}$

② left Tailed Reject H_0 if $z < z_\alpha$

$H_a : \mu < \mu_0$

③ Right Tailed

$H_a : \mu > \mu_0$ Reject H_0 if $z \geq z_\alpha$

[σ is Not Known]

Find critical values in a t-distribution :-

1. specify α
2. calculate degrees of freedom $= n-1$
3. Find the critical values at (DOF, α)
   (1) left tailed : Put -ve sign
   (2) Right Tailed : +ve
   (3) Two Tailed : -ve & +ve

T-test for mean μ :

$$t = \frac{(\text{Sample Mean}) - (\text{Hypothesized mean})}{\text{standard error} = \frac{s}{\sqrt{n}}}$$

$\boxed{t = -t_0}$

Determine the rejection region :-

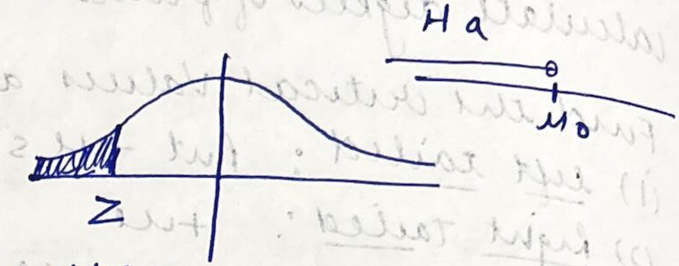
For 2 tailed : $t < -t_0$

$t > t_0$

left tailed

chi-square

(1) Left Tailed Test



$H_0 : \mu = \mu_0$

$H_a : \mu < \mu_0$

Critical Region :

① For Z-Test :

→ z value corr to $\boxed{\alpha}$

→ Take z -ve

→ Reject Ho If $\boxed{Z < Z_\alpha}$

② For T-test : → t value corr to $(n-1, \alpha)$

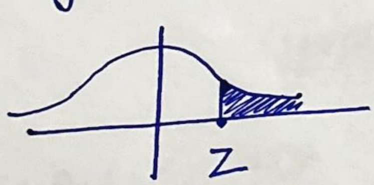
→ Put -ve sign

$\boxed{t < -t_0}$

P-Value : ① Z-Test : $\boxed{N(z)}$

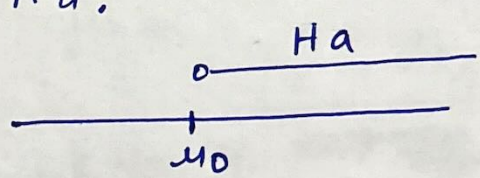
② T-test : calculate t value & test it in critical Region

(2) Right Tailed :



$H_0 : \mu = \mu_0$

$H_a : \mu > \mu_0$



Critical Region :

① Z-Test : z-value corr to $\boxed{1-\alpha}$

→ Take +ve Z value

→ Reject Ho if $\boxed{Z > Z_\alpha}$

② T-test : t value corr to $(n-1, \alpha)$

→ Put -ve sign

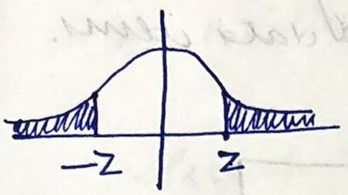
→ Rejection Region is $\boxed{t > t_0}$

P-Value : ① Z-Test : $\boxed{P = 1 - N(z)}$

② T-test : Rejection Region

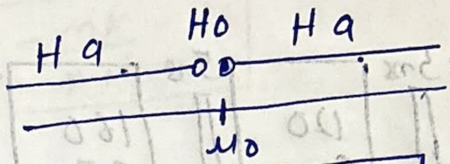
$t > t_0$

(3) Two Tailed:



$H_0 : \mu = \mu_0$

$H_a : \mu \neq \mu_0$



Critical Region :

① Z-Test : Z value corr to $\boxed{\frac{\alpha}{2}, 1 - \frac{\alpha}{2}}$

→ one -ve & +ve

→ Reject Ho if $\boxed{Z > Z_{\alpha/2}}$ $\boxed{Z < -Z_{\alpha/2}}$

② T-test : T-value corr to $(n-1, \alpha)$

$[-t_0, t_0]$

Rejection Region : $\boxed{\begin{matrix} t < -t_0 \\ t > t_0 \end{matrix}}$

P-Value : ① Z-test

$P = 2 * N(-Z)$

② T-test : Rejection Region