Mod 3 : Estimation & Sampling Theory

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→ **Large Sample Test - I**

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

$\bar{x}$: mean
σ : SD
n : possible samples
μ : mean of population
इसके Against test करो।

$$x + z \times \frac{\sigma}{\sqrt{n}} > \mu > x - z \times \frac{\sigma}{\sqrt{n}}$$

* **P-value approach**

① Identify
② Declare Hypothesis [H_0 & H_a based on μ]
③ Get Test statistic 'z'
④ Get $P(Z > \_\_\_\_) = 0.5 - A(0 \text{ to } \_\_\_\_)$ [x2 if two tailed]
⑤ Compare P & α (LOS)
if P value < α
H_0 rejected

* **Normal Sums (Hypt testing)**

① Identify
② Declare hypothesis
③ Get test statistic 'z'
④ Get z_α from table → LOS & Tail (based On)
if $|z| > z_\alpha$
H_0 rejected

→ **Large Sample Test - II**

$$z = \frac{|(\bar{x}_1 - \bar{x}_2)| - |(\mu_1 - \mu_2)|}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \quad \leftarrow \frac{x - m}{SE}$$

if $\mu_1 = \mu_2$ then $\mu_1 - \mu_2 = 0$

Interval Estimation
$(\bar{x}_1 - \bar{x}_2) \pm z_\alpha (SE)$

Similar steps to LST - I
Just difference in H_0 & H_a
That $\mu_1, \mu_2 \rightarrow$ equal unequal > < condition
& no exact value is given for μ.

→ Small Sample Test - I [< 30]

* Interval Questions

$\bar{x} \pm t_\alpha \sigma_x$

$\sigma_x = \frac{s}{\sqrt{n-1}}$

t_α : from table based on %
& dof = n-1

If sum of squares of deviation from this mean given
It is basically $\Sigma (x-\bar{x})^2$
Then $s = \sqrt{\frac{\Sigma (x-\bar{x})^2}{n}}$

* Hypothesis Testing

① Declare Hypothesis
② Get t_α (Critical Value)
③ Get t (Test statistic)

$t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}}$

④ If $|t| > t_\alpha$
H_0 rejected

If sample values given : find $\bar{x}$ & Make table x $(x-\bar{x})^2$

Get $s = \sqrt{\frac{\Sigma (x-\bar{x})^2}{n}}$

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→ Small Sample Test - II $[n_1+n_2-2 < 30]$

① $S_p = \sqrt{\dfrac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}}$

S_1 & S_2 → Capital [Unbiased SD]

② $S_p = \sqrt{\dfrac{n_1 s_1^2 + n_2 s_2^2}{n_1+n_2-2}}$

s_1 & s_2 → small

③ $S_p = \sqrt{\dfrac{\Sigma(x_{i1}-\bar{x}_1)^2 + \Sigma(x_{i2}-\bar{x}_2)^2}{n_1+n_2-2}}$

No mention of s

$SE = s_p \times \sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}$ dof : n_1+n_2-2

$t = \dfrac{\bar{x}_1 - \bar{x}_2}{SE}$

Remember : ① Left tailed test (<) t_α = -ve
② If σ is given in small sample questions, we treat it as large sample test - II (because σ_1 & σ_2)

→ Small Sample Test - III (based on difference)
(Paired t-test)

① Get x $(x-\bar{x})^2$

② Get $\bar{x}$ & $\Sigma(x-\bar{x})^2$

③ $s = \sqrt{\dfrac{\Sigma(x-\bar{x})^2}{n}}$

$t = \dfrac{\bar{x}}{s/\sqrt{n-1}}$

If two differences given
Use ③ of sample test - II [small]

Table required for $\bar{x}$ & $\Sigma(x-\bar{x})^2$

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→ χ^2 - Test

$$\chi^2 = \Sigma \frac{(O-E)^2}{E}$$

dof = n - 1

In relation table : dof = (r-1)(c-1)

* Steps :

① Make Table O E $\frac{(O-E)^2}{E}$

② Get χ^2 Calculated

③ Get χ^2 Table

④ Compare

* In mapping table

① Create new table of Expected (E)

Freq of cell = $\frac{\text{row total} \times \text{col total}}{\text{total freq}}$

② As normal continue

* Yate's Correction :

$$\chi^2 = \sum \left[\frac{(|O - E| - 0.5)^2}{E} \right]$$

Remember : if freq (E) is less than 10 → merge for $\frac{(O-E)^2}{E}$ & minus 1 from dof for each

Remember : if any formula eg $f_i x_i$ or f_i used, minus 1 for each

Remember : Goodness of fit

H_0 → fit is good.