Testing of hypothesis

When to use which test!

1- If we have to compare sample means then t-test or Z-test

<u>t-test</u> → if sample size ≤ 30

<u>Z-test</u> → if sample size > 30

2- If we have to compare sample variances then we use F-test.

3- For testing of goodness of fit or test of independent we use χ^2- test

4. If we have to compare sample means of more then 2 samples then one-way ANOVA or 2-way ANOVA.

<u>One-way</u> ⇒ If we have to check for one factor only.

t-test for one sample mean

(i) If S.D. of sample is given

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

(ii) If S.D. of sample is not given

$$t = \frac{\bar{x}-\mu}{S/\sqrt{n}} \quad \text{where } S = \sqrt{\frac{\Sigma(x_i-\bar{x})^2}{n-1}}$$

Degree of freedom for one sample $= n-1$

t-test for two sample means :

(i) If S.D. of samples are given

$$t = \frac{\bar{x}_1-\bar{x}_2}{S\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \quad \text{where } S^2 = \frac{n_1 s_1^2 + n_2 s_2^2}{n_1+n_2-2}$$

(ii) If S.D. of samples are not given

$$t = \frac{\bar{x}_1-\bar{x}_2}{S\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \quad \text{where } S^2 = \frac{\Sigma(x_1-\bar{x}_1)^2 + (\Sigma x_2 -}{n_1+n_2-2}$$

degree of freedom for 2 samples

$= n_1+n_2-2$

Z-test for one sample mean:

$$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \quad \text{if } \sigma \text{ is given}$$

$$Z = \frac{\bar{x} - \mu}{s/\sqrt{n}} \quad \text{if } \sigma \text{ is not given}$$

$d.f. = n-1$

Z-test for two sample means:

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \quad \text{or} \quad Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^3}{n_1} + \frac{s_2^3}{n_2}}}$$

$d.f. = n_1 + n_2 - 2$

F-test:

$$F = \frac{S_1^3}{S_2^2} \text{ or } \frac{S_2^2}{S_1^2} \text{ which is } \geq 1$$

(i) if s_1 & s_2 are given then

$$S_1^2 = \frac{n_1 s_1^2}{n_1 - 1} \quad \text{and} \quad S_2^2 = \frac{n_2 s_2^3}{n_2 - 1}$$

(ii) if s_1 and s_2 are not given.

then $$S_1^2 = \frac{\Sigma(X_1 - \bar{X}_1)^2}{n_1 - 1}, \quad S_2^2 = \frac{\Sigma(X_2 - \bar{X}_2)^3}{n_2 - 1}$$

Degree of freedom → $n_1 - 1$ & $n_2 - 1$ corresponding to whichever sample's varince is in numerator will be degree of freedom for numerator

Note: If mean or variance is not mention in question & question is asking whether the samples are from same normal population then

First we apply F-test if H_0 is accepted then we apply t-test. and if H_0 is rejected in F-test we conclude and no need to apply ~~t~~-test

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Symbols used in testing -

$\sigma^2 \rightarrow$ population variance

$s^2 \rightarrow$ sample variance

$\sigma \rightarrow$ population standard deviation

$s \rightarrow$ sample standard deviation

$\overline{x} \rightarrow$ sample mean

$\mu \rightarrow$ population mean

$n \rightarrow$ sample size