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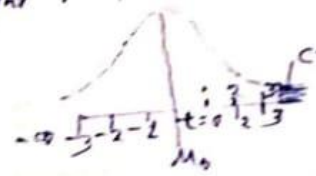
1:- Test of Significance

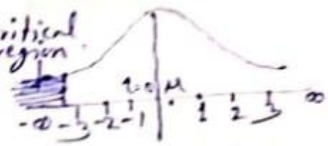
Definition: A statistical test is a procedure governed by certain rules, which leads to take a decision about the hypothesis for its acceptance or rejection on the basis of sample values.

One tail and two tailed test: These are classified on the basis of type of alternative hypothesis. If alternative hypothesis $H_A : \mu < \mu_0$ or $H_A : \mu > \mu_0$, then critical region lies on only one tail of the probability density curve. In this situation the test is called one tail test. If $H_A : \mu > \mu_0$ the critical region is located at the right tail.

if $H_A : \mu > \mu_0$

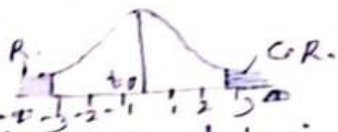


if $H_A : \mu < \mu_0$



μ = Actual mean
μ_0 = Mean assumed under null hypothesis

if $H_A : \mu \neq \mu_0$



Then critical region is located in both the tail therefore it is two tailed test.

Test of significance are performed on the basis of observational data. It is performed to decide whether the postulated hypothesis is accepted or not at particular amount of risk. This risk is called level of significance. When the hypothesis under test is accepted, test is non-significant, if it is rejected, test is significant.

2 Hypotheses : A hypothesis is an assertion or conjecture about the parameter(s) of the population distribution. A hypothesis may be an assertion about the parameters of a single population or more than one population.

eg. $H_0 : \mu = 50$ cm (Single population)

$H_0 : \mu_1 = \mu_2$ (Two different populations)

(a) Null hypothesis : A hypothesis which is to be actually tested for acceptance or rejection is termed as null hypothesis. It is denoted by H_0.

(b) Alternative hypothesis: It is statement about the population parameter(s) which gives an alternative to the null hypothesis (H_0) within the range of pertinent values of the parameters. i.e. if H_0 is accepted what hypothesis is to be rejected and vice versa. Alternative hypothesis is denoted by H_1 or H_A.

e.g. $H_0: \mu = 50$ (There may be 3 H_A)

$H_A: \mu < 50$

OR

$H_A: \mu > 50$

OR

$H_A: \mu \neq 50$.

(c) Simple hypothesis: If a hypothesis completely specifies the distribution, it is called a simple hypothesis, otherwise it is called composite hypothesis. e.g. $H_0 = 50$ against $H_A: \mu = 60$

Here μ can take either of two values 50 or 60. In this case H_0 & H_A both are simple hypothesis. But $H_A: \mu \neq 50$ it is composite hypothesis because here $H_0: \mu < 50$ or $H_0: \mu > 50$

3- Errors. There is always possibility of committing an error during taking decision about the rejection or acceptance of a null hypothesis.

The errors can be of two types.

(i) Type I error: Rejection of H_0 when it is true

(ii) Type II error: Acceptance of H_0 when it is false

Type II error is much more severe than Type I error. Hence drawing inferences about H_0, practice is followed that Type II error be minimized even at certain risk of Type I error.

	H_0 True	H_0 False
Acceptance	Correct Decision	Type II Error
Rejection	Type I Error	Correct Decision.

4. Level of significance (α): It is ~~quantity~~ quantity of risk of Type I Error which we are ready to tolerate in making decision about H_0. It is probability of Type I error which is tolerable. $\alpha = 0.01$ is used for high precision and $\alpha = 0.05$ for moderate precision. In terms of percentage, these are 1% and 5%.

5. Critical region : The test statistic follows some known distribution viz. t-distribution curve, χ^2 distribution curve, F distribution curve. The area under the probability density curve is divided into two regions viz., region of acceptance and region of rejection. Region of rejection is the region in which H_0 is rejected. The region of rejection is called critical region. It means that if the value of test statistic lies in this region H_0 is rejected. It is always located in the tail of the curve. In one tail test it is located one side and in 2-tailed test, it is located on both the tails. It's starting point ~~may be~~ is marked by putting the table value at particular level of significance and particular degree of freedom.

6. Degree of freedom (d.f)

The degree of freedom is the number of independent observations in a set. Different test ~~formulae~~ have different formulae for the calculation of degree of freedom. It is denoted by 'v' (nu).

7- Size and Power of a test.

The size of a test is the probability of rejecting the H_0 when it is true and is denoted by α (level of significance)

The power of test is defined as the probability of rejecting the null hypothesis when it is actually false. i.e. when H_0 is true.

8. P-value concept Here we ~~for~~ find out the smallest level α at which H_0 is rejected. In this situation, it is not inferred whether H_0 is accepted or rejected at $\alpha = 0.05$ or 0.01 or any pre-decided level of significance. This facilitate the individual to decide for himself as to how much significant the data are. This approach avoids the imposition of a fixed level of significance. The experimenter can himself decide the α by comparing it with p-value the acceptance or rejection of H_0.

Steps / Procedure for performing test of significance.

1. Frame the hypotheses: H_0 and H_A.
2. Decide the level of significance(α): 0.05 or 0.01 or other
3. Calculation (Formula for particular statistics)
4. Procure the table value at particular α and degree of freedom.
5. Take the decision about acceptance or rejection of H_0. If H_0 is rejected mention the H_A to be accepted.