



THIRUTHANGAL NADAR COLLEGE

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Selavayal, Chennai-51.

A Self-Financing Co-educational College of Arts & Science

Affiliated to the University of Madras

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An ISO 9001: 2015 Certified Institution

NAME OF THE DEPARTMENT : MATHEMATICS

SUBJECT : STATISTICS

TOPIC : TEST OF SIGNIFICANCE

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TEST OF SIGNIFICANCE

Populations and Samples

- A **Population** is the set of all items or individuals of interest

- **Examples:**
 - All likely voters in the next election
 - All parts produced today
 - All sales receipts for November

- A **Sample** is a subset of the population

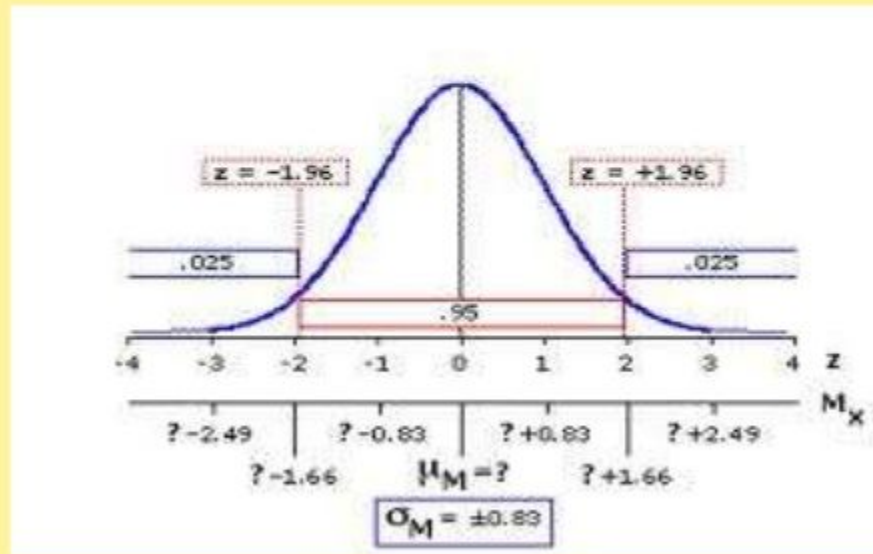
- **Examples:**
 - 1000 voters selected at random for interview
 - A few parts selected for destructive testing
 - Random receipts selected for audit

DEFINITIONS

Distinction	Population	Sample
Definition	Collection of items under consideration.	Part of the population selected for study.
Characteristics	Parameter	Statistics
Symbols	N= population μ = population mean σ = population standard deviation π = population percentage	n = sample size x = sample mean s = sample standard deviation p = sample percentage

Sampling Distribution:

- The distribution of the value of statistics which would arise from all possible samples are called sampling distribution.



Standard Error (SE):

- The standard deviation of sampling distribution is called as the Standard Error. It provides the estimate that how far from the true value the estimated value is likely to be.

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

- **Hypothesis:**

A statistical Hypothesis is a statement about the parameter (forms of population).

i.e. $x_1 = x_2$ or $x = \mu$ or $p_1 = p_2$ or $p = P$

- **Null Hypothesis (H_0):**

It is hypothesis of no difference between two outcome variables.

- **Alternative Hypothesis (H_1):**

There is difference between the two variables under study.

- Hypotheses are *always* about parameters of populations, never about **Statistic** from samples.

- **Test of Significance:**

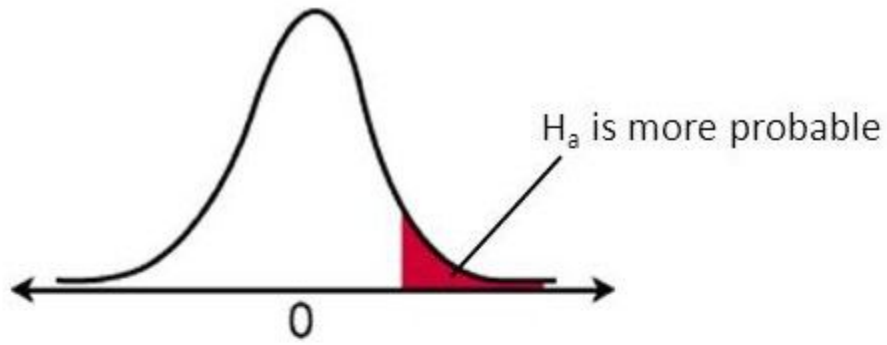
Testing the null hypothesis.

Type I and Type II Error

Null hypothesis is...	True	False
Rejected	Type I error False positive Probability = α	Correct decision True positive Probability = $1 - \beta$
Not rejected	Correct decision True negative Probability = $1 - \alpha$	Type II error False negative Probability = β

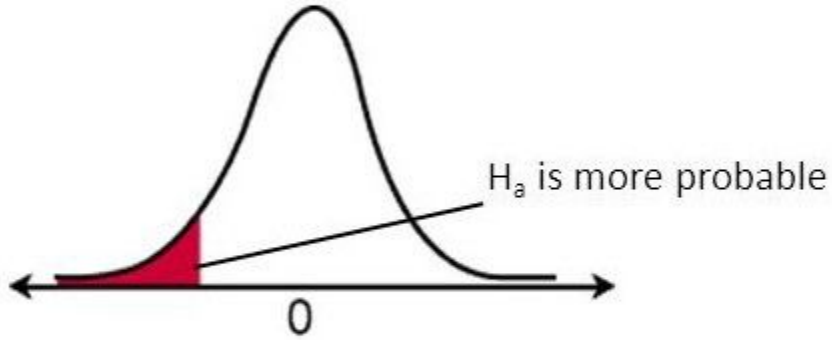
One tail & two tailed tests

- Two-tailed Test
 - If the alternative hypothesis contains the not-equal-to symbol (\neq), the hypothesis test is a **two-tailed test**. In a two-tailed test, each tail has an area of $0.5P$.
 - $H_0: \mu = k$
 - $H_a: \mu \neq k$
- Left-tailed Test
 - If the alternative hypothesis contains the less-than inequality symbol ($<$), the hypothesis test is a left-tailed test.
 - $H_0: \mu \geq k$
 - $H_a: \mu < k$
- Right-tailed Test
 - If the alternative hypothesis contains the less-than inequality symbol ($>$), the hypothesis test is a right-tailed test.
 - $H_0: \mu \leq k$
 - $H_a: \mu > k$



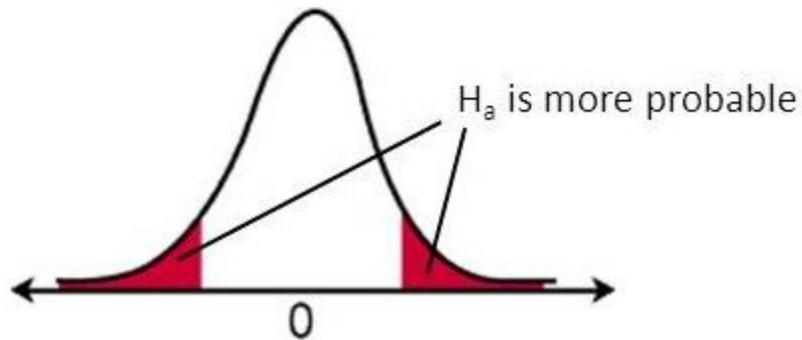
Right-tail test

$$H_a: \mu > \text{value}$$



Left-tail test

$$H_a: \mu < \text{value}$$



Two-tail test

$$H_a: \mu \neq \text{value}$$

Level of significance(l.o.s):

- The probability of committing type I error
- Denoted by α
- L.o.s of 0.05% means \rightarrow risk of making wrong decisions only is 5 out of 100 cases i.e 95% confident

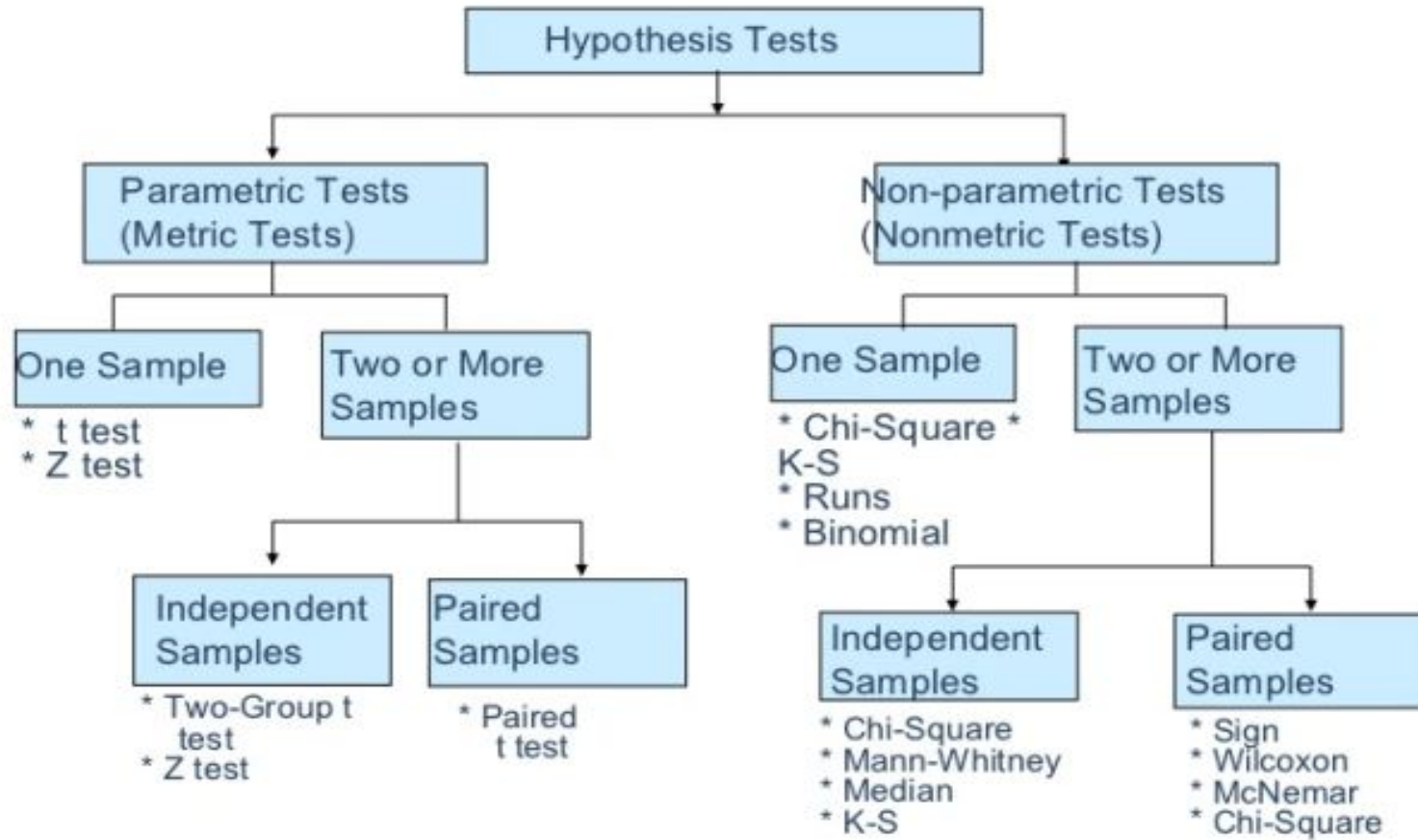
Power of the test:

- It is probability of committing type II error
- Denoted by β and $1 - \beta$ is power of the test
- Power is probability of rejecting H_0 when H_0 is false i.e correct decision.

DIFFERENCE BETWEEN LARGE SAMPLE TEST AND SMALL SAMPLE TEST

- The test is based on sample size more than or equal to 30 is called large sample test
- For large samples the sampling distributions of statistic are normal(Z test)
- The value of a statistic obtain from the sample can be taken as an estimate of the population parameter
- If the test is based on sample size below 30 is called as small sample test
- For small samples the sampling distributions are t, F and χ^2 distribution.
- The value of a statistic obtain from the sample cannot be taken as an estimate of the population parameter

A Classification of Hypothesis Testing Procedures for Examining Differences



Difference between parametric and Non parametric

Parametric

Non Parametric

Information about population is completely known

No information about the population is available

Specific assumptions are made regarding the population

No assumptions are made regarding the population

Null hypothesis is made on parameters of the population distribution

The null hypothesis is free from parameters

Difference between parametric and Non parametric

Parametric

Non Parametric

Test statistic is based on the distribution

Test statistic is arbitrary

Parametric tests are applicable only for variable

It is applied both variable and attributes

No parametric test exist for Norminal scale data

Non parametric test do exist for nominal and ordinal scale data

Parametric test is powerful, if it exist

It is not so powerful like parametric test

Why test of significance?

- Testing SAMPLE and commenting on POPULATION.
- Two different SAMPLES (group means) from same or different POPULATIONS (from which the samples were drawn)?
- Is the difference obtained TRUE or by chance alone?
- Will another set of samples be also different?
- Significance Testing - Deals with answer to above Questions.



Tests of significance

- ✓ Are mathematical methods by which the probability (P) or relative frequency of an observed difference, occurring by chance is found
- ✓ Steps & procedure of test of significance –
 1. *State null hypothesis H_0*
 2. *State alternate hypothesis H_1*
 3. *Selection of the appropriate test to be utilized & calculation of test criterion based on type of test*



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4. *Fixation of level of significance*
 5. *Select the table & compare the calculated value with the critical value of the table*
 6. *If calculated value is $>$ table value, H_0 is rejected*
 7. *If calculated value is $<$ table value, H_0 is accepted*
 8. *Draw conclusions*

THANK
YOU

you are Statistically
Significant

