# 19MAT202 - STATISTICS AND NUMERICAL METHODS

## Unit-I Testing of Hypothesis

Sampling distributions - Statistical hypothesis - Tests for Single mean and Difference of means (large and small samples) Tests for single variance and equality of variances - chi square test for goodness of fit - Independance of attributes

## Unit-II Designs of Experiments

Completely randomized design - Randomized block design - Latin square design - Applications of ANOVA.

## Unit-III Solutions of Equations

Newton Raphson method - Pivoting Gauss Jordan methods - Iterative methods of Gauss-Seidal - Matrix Inversion by Gauss-Jordan method.

## Unit-IV Interpolation, Numerical Differentiation and Numerical Integration

Lagrange's Interpolation - Newton's forward and backward difference Interpolation - Approximation of derivatives using Interpolation Polynomials - Numerical Integration using Trapezoidal and Simpson's 1/3 rd rule.

## Unit-V Numerical Solution of ordinary Differential Equations

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step Methods: Milne's Predictor-Corrector methods for solving first order equations.

# Unit-I

## Testing of Hypothesis

### Basic Definitions:

**Population:**

A population is used to refer any collection of individual it may be finite or infinite.

**Sample:**

A sample is a small portion selected from the population and the process of drawing (drawn) a sample from a population is called sampling.

**Sample size:**

The number of individual in a selected sample is called the sample size.

**Parameter and Statistics:**

Any statistical method computed from population data is known as parameter and any statistical method computed from sample data is known as statistics

**Notations:**

| Measure | Population | sample |
|---|---|---|
| size | $N$ | $n$ |
| Mean | $\mu$ | $\bar{x}$ |
| Standard deviation | $\sigma$ | $s$ |
| Proportion | $P$ | $p'$ |
| Variance | $\sigma^2$ | $s^2$ |

## Sampling Distribution:

The various value of statistics so obtained may be arranged as a frequency distribution which is known as sampling distributions.

## Standard Error:

The standard deviation of sampling distribution of a statistic is known as its standard error, abbreviated as S.E (ie average amount of variability from the observation of a sampling distribution)

## Statistical Hypothesis:

In attempting to reach decision about population on the basis of sample observations, we make assumptions about population, which are not necessarily true, are called statistical hypothesis.

## Null Hypothesis:

Null Hypothesis is the hypothesis which is tested for possible rejection under the assumption that it is true and is denoted by $H_0$.

## Alternative Hypothesis:

A Hypothesis that is complementary to Null hypothesis is called Alternative Hypothesis and is denoted by $H_1$.

A procedure for deciding whether to accept or reject the null hypothesis is called the test of hypothesis.

## Level of Significance:

It is the probability level below which the null hypothesis is rejected. Generally 5% and 1% level of significance are used.

## Critical region (or) Region of rejection:

The critical region of a test of statistical hypothesis is that region of which leads to the rejection of null hypothesis $H_0$. Those region which leads to the acceptance of $H_0$ is called acceptance region.

## Error in Sampling:

Errors are Type I, Type II errors.

Type I error: Reject $H_0$ when it is true.

Type II error: Accept $H_0$ when it is false.

$P(\text{Type I error}) = \alpha$ & $P(\text{Type II error}) = \beta$

## One tail & two tail test:

If $\mu_0$ is population parameter & $\mu$ is the sample statistics, then the null hypothesis is given by $\mu_0 : \mu = \mu_0$.

Alternative hypothesis is given by,

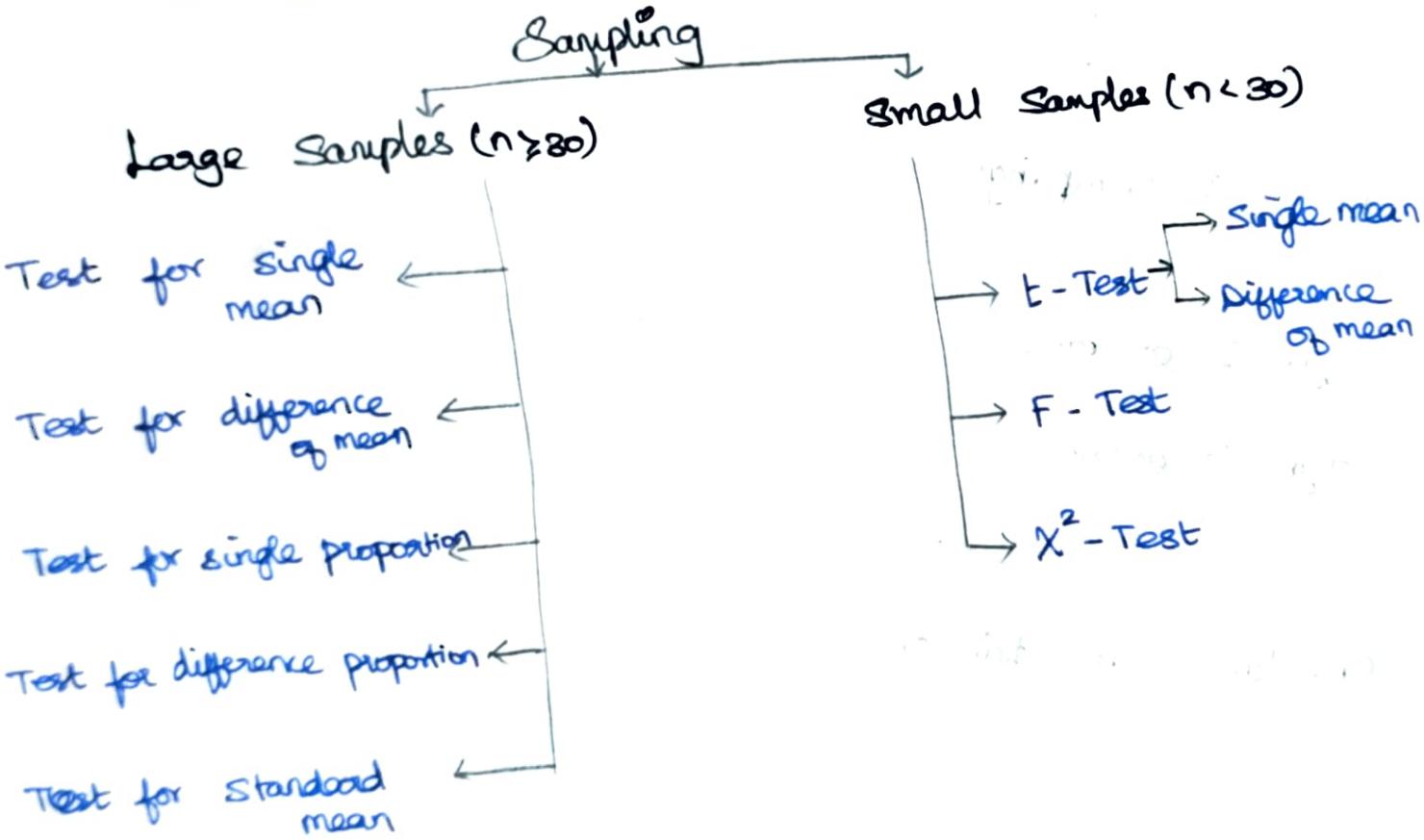
$H_1 : \mu \neq \mu_0$ (two-tailed)

$H_1 : \mu > \mu_0$ (Right tailed)(one tail)

$H_1 : \mu < \mu_0$ (Left tailed) (one tail)

Procedure for testing a hypothesis:

1. Formulate $H_0$ and $H_1$
2. Choose the level of significance $\alpha$.
3. Compute the test statistic using the data available.
4. Pick out the critical value from the tabulation.
5. Conclusion: Compare the computed value of the test statistic with the critical value at the given level of significance.




Large Samples ($n \geq 30$)

Critical Values (or) significant values:

The sample values of the statistics beyond which the null hypothesis will be rejected are called critical values or significant values.