

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula Artificial Intelligence & Data Science, VII-Semester Open Elective-703 (C) Advanced Statistical Analytics

Course Objective:

1. To provide a comprehensive understanding of sampling techniques and sampling distributions.
2. To develop skills in correlation and regression analysis for analyzing relationships between variables.
3. To introduce hypothesis testing and provide knowledge of various tests for means, proportions, and variances.
4. To explore the concept of point estimation and develop an understanding of different estimation methods.
5. To introduce Bayesian statistics and its applications in data analysis.

Course Outcomes:

After completion of this course student will be able to:

1. Understand the concepts of population, sample, and different sampling techniques.
2. Apply various statistical methods to analyze relationships between variables using correlation and regression analysis.
3. Conduct hypothesis tests for means, proportions, variances, and correlation coefficients.
4. Estimate population parameters using different estimation methods and determine the quality of estimators.
5. Apply Bayesian statistics for parameter estimation and understand the concepts of hierarchical modeling and survival analysis in Bayesian inference.

Syllabus

UNIT 1

Introduction: Population and Sample, Random Sampling from finite population (SRSWR and SRSWOR), Parameter and Statistic, Sampling distribution of a statistic in the context of a finite population, Sampling distribution of sample mean and sample proportion while sampling from a finite population. Random sampling from an infinite population, Sampling Distribution of sample mean and sample variance when the sample is drawn from a Normal distribution, Problems on sampling distributions of statistics from finite and infinite populations. Statement of Lyndeberg-Levy Central Limit Theorem (CLT) and its applications.

UNIT 2

Correlation, Regression Analysis and ANOVA: Correlation, Scatter diagram, Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient, Methods of least square, Simple linear Regression model, SLR assumptions and prediction Multiple linear Regression, MLR assumption and prediction, Polynomial Regression, Logistics Regression, Poisson Regression, Non-Linear Regression Analysis of Variance (One way & Two Way). Analysis of Covariance, Multivariate Analysis of Variance

UNIT 3

Testing of Hypothesis:

Testing of Hypotheses: Null and Alternative Hypothesis, Testing Procedure (Critical region), Type I and Type II errors, Level of significance & Power of atest, p-value for symmetric null distribution. Tests for me an and proportion (single sample, two sample; exact & large sample)

Tests for variance (single sample and two samples), Tests for me an and correlation coefficient for paired sample (Exact & Large sample), Analysis of Variance (one way).

UNIT 4

Parametric Point Estimation: Problem of point estimation, Criteria of a good Estimator, Unbiasedness, Consistency, Efficiency, Sufficiency Minimum Variance and Unbiasedness (Small sample) Method of moments, Method of Maximum Likelihood, Consistency & Efficiency (Large sample), Interval Estimation: Confidence Intervals of mean and proportion in large samples.

UNIT 5

Bayesian Statistics: Introduction to Bayesian inference, Bayesian parameter estimation, Markov Chain Monte Carlo (MCMC) methods, Bayesian hierarchical models, Survival analysis, Causal inference, High-dimensional data analysis.

Text Books:

1. Statistical Methods by SP Gupta : 31st Edition: Sultan Chand and sons
2. Mathematical Statistics by S.C Gupta and VK Kapoor (10th Edition) : Sultan Chand and sons

Reference Books:

1. Understanding and using Advance Statistics by Jeremy Foster Emma Barkus Christian Yavorsay, Sage Publication.
2. Understanding Advanced Statistical Methods (Chapman & Hall/CRC Texts in Statistical Science), by Peter Westfall, Kevin S. S. Henning ,2013