



CHRIST
(DEEMED TO BE UNIVERSITY)
BANGALORE · INDIA

DEPARTMENT - STATISTICS

Course Pack FOR STATISTICAL INFERENCE-STA331

STA331 - STATISTICAL INFERENCE

Total Teaching Hours For Semester : 90

Total Teaching Hours For Semester : 6

Max Marks : 150

Credits : 6

Course Objectives/Course Description:

This course is designed to give knowledge about estimation theory and testing of hypothesis. Parameter estimation techniques and their confidence intervals, sampling distributions like Chi-square, t, and F are introduced. This paper also deals with the concept of testing of hypothesis, testing of hypothesis for large and small samples. Data analysis using R programming is also taught in this course.

Learning Outcome

- point and interval estimation of unknown parameters and their significance using large and small samples.
- the basic concepts like hypothesis and its types, types of errors
- sampling distributions of different statistic: mean, variance, chi-square, t and F
- understand nonparametric tests for single sample and two samples
- understand how to analyze the raw data using R programming.
- perform the data manipulation techniques using R programming-analysis for parametric tests
- relation between two or more variables using R programming

Unit-1

Teaching Hours:20

Sampling distributions

Definition of random sample, parameter and statistic, Sampling distribution of a statistic, standard errors of sample mean, sample proportion and sample moments. Sampling distribution of sample mean for normal distribution. Sampling distributions of Chi-square, t and F statistics and properties.

Unit-2

Teaching Hours:15

Tests of Significance-I

Null and alternative hypotheses, level of significance and probabilities of Type I and Type II errors, critical region and power of test. Large sample test, use of CLT for testing single proportion and difference of two proportions, single mean and difference of two means. Standard deviation and difference of standard deviations.

Unit-3

Teaching Hours:15

Tests of Significance-II

Tests of significance based of Chi-square, t and F distributions. Neyman-Pearson lemma (statement only) and its applications.

Unit-4

Teaching Hours:25

Theory of Estimation

Parameter space, sample space, point estimation, requirement of a good estimator, consistency, unbiasedness, efficiency, sufficiency, Minimum variance unbiased estimators. Cramer-Rao inequality

(Statement only). Maximum likelihood, least squares and minimum variance, statement of Rao-Blackwell theorem. Properties of maximum likelihood estimators (illustration). Interval Estimation: confidence intervals for the parameters of normal distribution, confidence intervals for difference of mean and for ratio of variances.

Unit-5

Teaching Hours:15

Statistical Analysis using R

Introduction to R and its interface, entering data, data import and export, basic data manipulation techniques, graphical representation of statistical data, descriptive statistics, correlation and regression and tests of significance using parametric tests. **Practical Assignments using R**

1. Data Base Creation (including Importing test, excel, CSV files)
2. Graphical representation (Bar, Pie, Line, Histogram, Scatter)
3. Cross Tabulation and Descriptive Statistics
4. Correlation and Simple Regression
5. Tests of significance using Parametric tests

Text Books And Reference Books:

1. G. Casella and R.L. Berger, Statistical Inference, 2nd Ed., Thomson Duxbury, 2002.
2. A.M. Goon, M.K. Gupta and B. Dasgupta, An Outline of Statistical Theory (Vol. I), 4th Ed., World Press, Kolkata, 2003.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
4. V.K. Rohtagi and A.K. Md. E. Saleh, An Introduction to Probability and Statistics, 2nd Ed., John Wiley and Sons, 2009.
5. Paul Teeter, R Cookbook, O'Reilly Media, Inc., 1st ed., 2011

Essential Reading / Recommended Reading:

1. M.G. Kendall and A. Stuart, The Advanced Theory of Statistics (Vol. III), Macmillan Publishing Co., Inc., 1977
2. R.V. Hogg, A.T. Craig and J.W. McKean, Introduction to Mathematical Statistics, 6th Ed. Pearson Education, 2005.
3. E.J. Dudewicz and S.N. Mishra, Modern Mathematical Statistics, John Wiley and Sons, 1988.

Evaluation Pattern

ASSESSMENT PATTERN

Sem-Ester	CIA Marks (Max. Marks)	Attendance (Max. Marks)	ESE (Max. Marks)	Practical Marks (Max. Marks)	Total Marks
I	45	05	50	50	150
II	45	05	50	50	150
III	45	05	50	50	150
IV	45	05	50	50	150
V	45	05	50	50	150
VI	45	05	50	50	150

CIA's Evaluation Pattern:

Component	Mode of Assessment	Parameters	Points
CIA1	MCQ, Written Assignments, Quizzes, Presentations	Mastery of the core subject	10
CIA2	Mid Semester Exam	Basic, Conceptual and analytical knowledge of the subject	25
CIA3	Presentation, Seminar, Quiz, MCQ,	Presentation and analysis skills	10

	Projects using statistical software		
Attendance	Attendance	Regularity and Punctuality	5
Total			50

End Semester Exam Pattern:

Section	Total number of questions	No. of questions to be answered	Max. Marks for each question	Total Marks
A	12	10	3	30
B	6	5	6	30
C	6	4	10	40
Total	24	19		100

Course Plan

Class Name : 3CMS

Subject Name : STATISTICAL INFERENCE

Subject Code : STA331

Teacher Name : AZARUDHEEN.S,

NAGARAJA.MS. AZARUDHEEN.S. AZARUDHEEN.S. NIMITHA.JOHN. AZARUDHEEN.S. AZARUDHEEN.S. AZARUDHEEN.S

Planned Date	No of Hours	Unit	Heading	Details	Method	Reading/Ref
04/06/2018 09/06/2018	6.00	Unit-1	Sampling distributions	Definition of sample, population, random sample, parameter, statistic, sampling distribution of a statistic, Standard Errors of sample mean, Sampling distribution of sample mean for normal distributions.	Discussion	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
11/06/2018 16/06/2018	6.00	Unit-1	Sampling distributions	Problems for sample mean for normal distributions, Sampling distribution of Chi square and its properties, Applications of Chi square distributions with numerical problems.	Discussion	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
18/06/2018 23/06/2018	6.00	Unit-1	Sampling distributions	Sampling distribution of Student t and its applications, Sampling distribution of F and its applications. Sampling distribution of sample proportion and sample moments	Discussion/Assignment	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
25/06/2018 30/06/2018	6.00	Unit-2	Tests of Significance-I	Testing of hypothesis (introduction), Null and alternative hypothesis, simple and composite hypothesis, level of significance, probabilities of type 1 and type 2 errors and Critical region and power of test	Discussion	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
02/07/2018 07/07/2018	6.00	Unit-2	Tests of Significance-I	Numerical problems, Large sample test, use of CLT for testing single proportion and difference of two proportions.	Discussion	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
09/07/2018 14/07/2018	6.00	Unit-2	Tests of Significance-I	Use of CLT for testing single mean and difference of two means. Standard deviation and difference of standard deviations. Tests of	Discussion/Assignment	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.

				significance based of Chi-square		
16/07/2018 21/07/2018		Unit-3	Tests of Significance-II	Tests of significance based of t and F distributions. Neyman-Pearson lemma (statement only) and its applications. Introduction to R	Discussion	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
23/07/2018 28/07/2018	6.00	Unit-3	Tests of Significance-II	Neyman-Pearson lemma (statement only) and its applications.manipulation techniques, graphical representation of statistical data, descriptive statistics, generation of random samples, sampling distribution of means, Chi square goodness of fit test.	Discussion/Assignment	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
30/07/2018 04/08/2018	6.00	Unit-4	Theory of Estimation	Parameter space, sample space, point estimation, requirement of a good estimator, consistency, unbiasedness, efficiency.	Discussion	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
06/08/2018 11/08/2018	6.00	Unit-4	Theory of Estimation	sufficiency, Minimum variance unbiased estimators	Discussion	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
13/08/2018 18/08/2018	6.00	Unit-4	Theory of Estimation	Cramer-Rao inequality (Statement only). Maximum likelihood, least squares and minimum variance, statement of Rao-Blackwell theorem, Properties of maximum likelihood estimators (illustration).	Discussion	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
20/08/2018 25/08/2018	6.00	Unit-4	Theory of Estimation	Interval Estimation: confidence intervals for the parameters of normal distribution, confidence intervals for difference of mean and for ratio of variances.	Discussion/Assignment	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.
27/08/2018 01/09/2018	6.00	Unit-5	Statistical Analysis using R	Introduction to R and its interface, entering data, data import and export, basic data manipulation techniques, generation of random samples.	Practical	Michael J. Crawley, The R Book, Imperial College London at Silwood Park, UK.
03/09/2018 08/09/2018	6.00	Unit-5	Statistical Analysis using R	graphical representation of statistical data, descriptive statistics, correlation and regression	Practical	Michael J. Crawley, The R Book, Imperial College London at Silwood Park, UK.
10/09/2018 15/09/2018	6.00	Unit-5	Statistical Analysis using R	tests of significance using parametric tests, Chi square goodness of fit test	Practical/Assignments	Michael J. Crawley, The R Book, Imperial College London at Silwood Park, UK.
17/09/2018 22/09/2018	6.00	Unit-5	Statistical Analysis using R	Practical Aspects	Practical/Assignments	Michael J. Crawley, The R Book, Imperial College London at Silwood Park, UK.

CIA 1

Component/Task 1

CIA Details

Statistical inference- Problems based on first module1. Each student has to do the assignment individually.2.It should be in a hand written format3.Students should prepare to present the assignment in class.4. Submit the assignment by July 1 st week (as per schedule).

CIA Details will display from 14/06/2018

Learning Objective

Assignment Learning Objectives: By the end of this Assignment, students will be able to calculate the probability of sample means that differ, exceeds, or smaller by a particular value, when the samples are taken from a normal population.

Assessment Strategies aligned to LO: Class testTechnology Tools used along with their Purpose:

Whiteboard - For demonstration of calculation

Assignment Learning Objectives: By the end of this Assignment, students will be able to calculate the probability of sample means that differ, exceeds, or smaller by a particular value, when the samples are taken from a normal population.

Assessment Strategies aligned to LO: Class test **Technology Tools used along with their Purpose:**

Whiteboard - For demonstration of calculation

Evaluation Rubrics

1. Identify the distribution of sample means, when the samples are from a normal population-22. Identify its mean and variance-23. Correct identification of the probability statement from the question-24. Correct solution of the problem-4 Total marks-10

CIA 3

Component/Task 1

Learning Objective

Assignment Learning Objectives: By the end of this Assignment, you will be able to study some of the basic practical aspects of data analysis using R **Assessment Strategies aligned to LO:** Presentations **Technology Tools**

used along with their Purpose: Moodle-Assignment Submission

Assignment Learning Objectives: By the end of this Assignment, you will be able to study some of the basic practical aspects of data analysis using R **Assessment Strategies aligned to LO:** Presentations **Technology Tools**

used along with their Purpose: Moodle-Assignment Submission

Evaluation Rubrics

1. Creation of data base -22. Graphical Representation-33. Descriptive measures calculation-14. Calculation of Correlation and regression -4