Syllabus for Four-Year Undergraduate Programme in Statistics

Learning Outcomes based Curriculum Framework (LOCF)
following NEP 2020
With effect from the Academic Session 2023-2024

Department of Statistics
Siksha Bhavana (Institute of Science)
Visva-Bharati (A Central University)
Santiniketan – 731235, West Bengal, India

COURSE STRUCTURE OF FOUR-YEAR UNDERGRADUATE PROGRAMME IN STATISTICS

Sem	Major Courses	Minor Courses	Multi Courses	AECC	SEC	CVAC	Research*	Internship	Total Credits	
I	2x4cr=8	MnA 1x4cr=4	1x3cr=3	ENG/MIL1 1x2cr=2	1x3cr=3	TS 1x3cr=3	---		23	B.Sc. Certificate
II	2x4cr=8	MnB 1x4cr=4	1x3cr=3	ENG/MIL2 1x2cr=2	1x3cr=3	ES 1x3cr=3	---		23	
YEAR 1	2x8=16cr	2x4=8cr	2x3=6cr	2x2=4cr	2x3=6cr	2x3=6cr	---	Sum 4cr	46+4	
After successful completion of ONE YEAR Course (Semesters - I & II) securing 46 credits + 4 credits vocational summer internship, students may exit with B.Sc. Certificate in STATISTICS or continue further.										
III	2x4cr=8	MnA 1x4cr=4	1x3cr=3	MIL/ENG1 1x2cr=2	1x3Cr=3	---	---		20	B.Sc. Diploma
IV	4x4cr=16	MnB 1x4cr=4	---	MIL/ENG2 1x2cr=2	---	---	---		22	
YEAR 2	10x4=40cr	4x4=16cr	3x3=9cr	4x2=8cr	3x3=9cr	2x3=6cr	---	Sum 4cr	88+4	
After successful completion of TWO YEAR Course (Semesters - I to IV) securing 88 credits + 4 credits vocational summer internship, students may exit with B.Sc. Diploma in STATISTICS or continue further.										
V	3x4cr=12	MnA 1x4cr=4	---	---	---	---	---		16	B.Sc. Degree
VI	3x4cr=12	MnB 1x4cr=4	---	---	---	---	---		16	
YEAR 3	16x4=64cr	6x4=24cr	3x3=9cr	4x2=8cr	3x3=9cr	2x3=6cr	---	Sum 4cr	120+4	
After successful completion of THREE YEAR COURSE (Semesters - I to VI) securing 120 credits + 4 credits vocational summer internship, students may exit with B.Sc. Degree in STATISTICS or continue further.										
VII	4x4cr=16	MnA 1x4cr=4	---	---	---	---	---		20	B.Sc. Honours Degree
VIII	4x4cr=16	MnB 1x4cr=4	---	---	---	---	---		20	
YEAR 4	24x4=96cr	8x4=32cr	3x3=9cr	4x2=8cr	3x3=9cr	2x3=6cr	---	Sum 4cr	160+4	
After successful completion of FOUR YEAR COURSE (Semesters - I to VIII) securing 160 credits + 4 credits vocational summer internship, students may obtain B.Sc. Honours in STATISTICS.										
OR										
VII	3x4cr=12	MnA 1x4cr=4	---	---	---	---	1x4cr=4*		20	B.Sc. Honours (with Research)
VIII	2x4cr=8	MnB 1x4cr=4	---	---	---	---	2x4cr=8*		20	
YEAR 4	21x4=84cr	8x4=32cr	3x3=9cr	4x2=8cr	3x3=9cr	2x3=6cr	3x4=12cr	Sum 4cr	160+4	
After successful completion of FOUR YEAR COURSE (Semesters - I to VIII) securing 160 credits + 4 credits vocational summer internship, students may obtain B.Sc. Honours (with Research) in STATISTICS.										

Dissertation can be opted by students who attain at least CGPA 75% in 3 years and desire the Research degree. The students pursuing B.Sc. Honours (with Research) have to secure 12 credits (4 credits in Semester VII and 8 credits in Semester VIII). However, students pursuing only B.Sc. Honours have to study additional three Major Courses in STATISTICS securing 12 credits (4 credits in Semester VII and 8 credits in Semester VIII) in lieu of the Dissertation.

Learning Outcome based Curriculum for
FOUR-YEAR UNDERGRADUATE PROGRAMME in STATISTICS following NEP 2020

MAJOR COURSES in STATISTICS [Discipline-Specific Core Courses]

CourseCode	Course Type	Course Title	Credits	Marks	Hours
SEMESTER I					
MJST01A	Theory	Descriptive Statistics I	3	75	
MJST01B	*Practical*	Descriptive Statistics I	1	25	
MJST02	Theory	Probability and Probability Distributions I	4	100	
		Total	**8 credits**	**200**	
SEMESTER II					
MJST03A	Theory	Descriptive Statistics II	3	75	
MJST03B	*Practical*	Descriptive Statistics II	1	25	
MJST04A	Theory	Probability and Probability Distributions II	3	75	
MJST04B	*Practical*	Probability and Probability Distributions II	1	25	
		Total	**8 credits**	**200**	
ONE-YEARCERTIFICATE PROGRAMME TOTAL 4 MAJOR COURSES			**16 credits**	**400**	
SEMESTER III					
MJST05	Theory	Sampling Distributions	4	100	
MJST06A	Theory	Linear Algebra	3	75	
MJST06B	*Practical*	Linear Algebra	1	25	
		Total	**8 credits**	**200**	
SEMESTER IV					
MJST07	Theory	Mathematical Analysis and Applications	4	100	
MJST08	Theory	Statistical Inference I	4	100	
MJST09A	Theory	Time Series Analysis	3	75	
MJST09B	Practical	Time Series Analysis	1	25	
MJST10A	Theory	Demography	3	75	
MJST10B	*Practical*	Demography	1	25	
		Total	**16 credits**	**400**	
TWO-YEARDIPLOMA PROGRAMMETOTAL 10 MAJOR COURSES			**40 credits**	**1000**	
SEMESTER V					
MJST11A	Theory	Statistical Inference II	3	75	45
MJST11B	*Practical*	Statistical Inference II	1	25	30
MJST12A	Theory	Linear Models	3	75	45
MJST12B	*Practical*	Linear Models	1	25	30
MJST13A	Theory	Sample Survey and Indian Official Statistics	3	75	45
MJST13B	*Practical*	Sample Survey and Indian Official Statistics	1	25	30
		Total	**12 credits**	**300**	

SEMESTER VI					
MJST14A	Theory	Multivariate Analysis	3	75	45
MJST14B	*Practical*	Multivariate Analysis	1	25	30
MJST15A	Theory	Design of Experiments	3	75	45
MJST15B	*Practical*	Design of Experiments	1	25	30
MJST16A	Theory	Statistical Quality Control	3	75	45
MJST16B	*Practical*	Statistical Quality Control	1	25	30
		Total	**12 credits**	**300**	
THREE-YEAR DEGREE PROGRAMME 16 MAJOR COURSES			**64 credits**	**1600**	
SEMESTER VII					
MJST17A	Theory	Statistical Inference III	3	75	45
MJST17B	*Practical*	Statistical Inference III	1	25	30
MJST18	Theory	Distribution Theory	4	100	
MJST19A	Theory	Applied Multivariate Analysis	3	75	45
MJST19B	*Practical*	Applied Multivariate Analysis	1	25	30
		Total	**12 credits**	**300**	
MJST20	Theory	Research Methodology (For those who do not opt for research)	4	100	
			4 credits	**100**	
SEMESTER VIII					
MJST21	Theory	Stochastic Process	4	100	
MJST22	Theory	Statistical Inference IV	4	100	
		Total	**8 credits**	**200**	
FOUR-YEARHONOURS PROGRAMME 21 COURSES + 3 COURSES* (Optional in lieu of Dissertation for Honours students) FOUR-YEAR HONOURS with RESEARCH PROGRAMME 21 COURSES + DISSERTATION			**84 credits +12 credits**	**2100 + 300**	

MINOR COURSES in STATISTICS [Discipline-Specific Minor Courses]

Course Code	Course Type	Course Title	Credits	Marks	Hours
SEMESTER I					
MNST01A	Theory	Statistical Methods	3	75	45
MNST01B	Practical	Statistical Methods	1	25	30
SEMESTER II					
MNST01A	Theory	Statistical Methods	3	75	45
MNST01B	Practical	Statistical Methods	1	25	30
ONE-YEAR CERTIFICATE PROGRAMME TOTAL 1 MINOR COURSE			**4**	**100**	
SEMESTER III					
MNST02A	Theory	Introductory Probability	3	75	45
MNST02B	Practical	Introductory Probability	1	25	30
SEMESTER IV					
MNST02A	Theory	Introductory Probability	3	75	45
MNST02B	Practical	Introductory Probability	1	25	30
TWO-YEAR DIPLOMA PROGRAMME TOTAL 2 MINOR COURSES			**8**	**200**	
SEMESTER V					
MNST03A	Theory	Basics of Statistical Inference	3	75	45
MNST03B	*Practical*	Basics of Statistical Inference	1	25	30
SEMESTER VI					
MNST03A	Theory	Basics of Statistical Inference	3	75	45
MNST03B	*Practical*	Basics of Statistical Inference	1	25	30
THREE-YEAR DEGREE PROGRAMME TOTAL 3 MINOR COURSES			**12**	**300**	
SEMESTER VII					
MNST04A	Theory	Applied Statistics	3	75	45
MNST04B	*Practical*	Applied Statistics	1	25	30
SEMESTER VIII					
MNST04A	Theory	Applied Statistics	3	75	45
MNST04B	*Practical*	Applied Statistics	1	25	30
FOUR-YEAR HONOURS PROGRAMME TOTAL 4 MINOR COURSES			**16**	**400**	

SKILL ENHANCEMENT COURSES in STATISTICS

Course Code	CourseType	Course title	Credits	Marks	Hours
SEMESTER I					
SECST01	Theory	Statistical Data Analysis with Excel	3	75	
SEMESTER II					
SECST02	Theory	Introduction to R	3	75	
ONE-YEAR CERTIFICATE PROGRAMME TOTAL 2 COURSES			**6 credits**	**150**	
SEMESTER III					
SECST03	Theory	Introduction to C/C++	3	75	
TWO-YEAR DIPLOMA PROGRAMME TOTAL 3 COURSES			**9 credits**	**225**	

RESEARCH/WITHOUT RESEARCH in STATISTICS

Course Code	CourseType	Course title	Credits	Marks	Hours
SEMESTER VII					
MJRST23/ MJWRST23	Theory	Dissertation(4Cr) /Regression Techniques (Th 3+Pr.1) (For those who do not opt for Research)	4	100	
SEMESTERVIII					
MJRST24/ MJWRST241 / MJWRST242 / MJWRST243 / MJWRST244 / MJWRST245	Theory	Dissertation/Any two of the following Courses – 1. Introduction to Operations Research (Th 3+ Pr. 1) 2. Introduction to Data Science with Python(Th 3+Pr. 1) 3. Categorical Data Analysis and Advanced Data Analysis Techniques(Th 3+Pr. 1) 4. Reliability /Survival Analysis (Th 3+ Pr.1) 5. Project (4)	8	200	

SEMESTER I

Major Courses in Statistics

MJST01A Descriptive Statistics I (Theory) (Credit 3)

Course Objective: *A statistical survey usually consists of collection of data, scrutiny of data and finally the analysis of data. Thus it is necessary for a student of Statistics is to be familiar with these steps at the very beginning. This particular course is designed keeping this in mind. Here the students are first introduced with the different ways of collecting data, followed by different types of data structure, their representation styles and finally different statistical tools and techniques that can be applied on a data set.*

Learning Outcomes: *After completion of this course, the students will be able to*

(1) Scrutinize an arbitrary data set.
(2) Represent the data in tabular and diagrammatic form.
(3) Prepare the frequency distribution for qualitative and quantitative data.
(4) Find the summary measures, viz. the measures of central tendency, measure of dispersion, measures of skewness and kurtosis of a univariate data.

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement, nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis.

SUGGESTED READING:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

MJST01B Descriptive Statistics I (PRACTICAL/LAB. WORK) (Credit 1)

List of Practical

1. Graphical representation of data.
2. Problems based on measures of central tendency.
3. Problems based on measures of dispersion.
4. Problems based on combined mean and variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.

MJST02 Probability and Probability Distributions I (Credit 4)

Course Objective: *This is a fundamental course on probability theory. Students must have the knowledge of probability theory, random variables and their distributions to make further progress on statistical analysis.*

Learning Outcomes: *After completion of this course, the students will be able to*

(1) Understand the random experiment, sample space and probability theory.
(2) Know the one / two dimensional random variables and their properties in discrete / continuous framework.

Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, lawsof addition and multiplication, independent events, theorem of total probability, Bayes'theorem and its applications.

Random variables: discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Mathematical Expectation, Properties and uses of generating Functions.

SUGGESTED READING:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi

Minor Courses in Statistics

MNST01A Statistical Methods (Theory)Credit 3

Course Objectives: *A statistical survey usually consists of collection of data, scrutiny of data and finally the analysis of data. Thus it is necessary for a student of Statistics is to be familiar with these steps at the very beginning. This particular course is designed keeping this in mind. Here the students are first introduced with the different ways of collecting data, followed by different types of data structure, their representation styles and finally different statistical tools and techniques that can be applied on a data set.*

Learning Outcomes: *After completion of this course, the students will be able to*

(1) Scrutinize an arbitrary data set.
(2) Represent the data in tabular and diagrammatic form.
(3) Prepare the frequency distribution for qualitative and quantitative data.
(4) Find the summary measures, viz. the measures of central tendency, measure of dispersion, measures of skewness and kurtosis of a univariate data.

(5) *Find the degree of association/correlation between the two concerned variables in case of a bivariate data.*
(6) *Fit linear and non-linear curves for predicting the value of one variable, given the value of another, in case of bivariate data.*

Introduction: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives.

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

SUGGESTED READING:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

MNST01B Statistical Methods (Practical) Credit 1

PRACTICAL/ LAB WORK

List of Practical

1. Graphical representation of data
2. Problems based on measures of central tendency
3. Problems based on measures of dispersion
4. Problems based on combined mean and variance and coefficient of variation
5. Problems based on moments, skewness and kurtosis
6. Fitting of polynomials, exponential curves
7. Karl Pearson correlation coefficient
8. Partial and multiple correlations
9. Spearman rank correlation with and without ties.
10. Correlation coefficient for a bivariate frequency distribution
11. Lines of regression, angle between lines and estimated values of variables.
12. Checking consistency of data and finding association among attributes.

Skill Enhancement Courses in Statistics

SECST01: Statistical data analysis with EXCEL (Credit 3)

Course Objectives:

- *To build a strong understanding on the Basics of Microsoft Excel*
- *To understand data crunching and data presentation*

Learning Outcomes: *After completion of this course, the students will be able to create dynamic reports by mastering some of the most popular tools in excel.*

Introduction to Excel: About Excel & Microsoft, Uses of Excel, Excel software, Spreadsheet window pane, Title Bar, Menu Bar, Standard Toolbar, Formatting Toolbar, the Ribbon, File Tab and Backstage View, Formula Bar, Workbook Window, Status Bar, Task Pane, Workbook & sheets

Columns & Rows: Selecting Columns & Rows, Changing Column Width & Row Height, Autofitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Addressof a cell, Components of a cell – Format, value, formula, Use of paste and paste special

Creating Formulas: Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper,Lower, Using AutoSum etc.

Spreadsheet Charts: Constructing various Line, Bar and Pie charts. Using the Pivot chart features of Excel. Understanding and constructing Histograms and Scatterplots, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table

Data Analysis: Sorting, Filter, Text to Column, Data Validation.

References:

1. Jain . R. (2021): A to Z of MS EXCEL: A Book for Learners and Trainers, Amazon Digital Services LLC - KDP Print US
2. Minhas, D.S. (2023): All you wanted to know about: creating worksheets with MS-EXCEL, New Dawn publishing
3. Aggarwal, V.B, Sood, A. and Gupta, S. (2000): A Tutorial on MS-Excel, Pitambar Publishing Company Private Limited.

SEMESTER II

Major Courses in Statistics

MJST03A Descriptive Statistics II (Theory) (Credit 3)

Course Objective: *This course is designed for finding relationship between two or more interdependent variables with changes in one variable being associated with the changes in other. It enables the students to estimate or predict the unknown value of one variable from the known value of the other variable. The course also contains meaning, importance and method of constructing Index numbers, which is a device for measuring changes in a variable or a group of related variables. The index number of industrial activity enables us to study the progress of industrialization in the country.*

Learning Outcomes: *After completion of this course, the students will be able to*

1. *Find the degree of association/correlation between the two concerned variables in case of a bivariate data.*
2. *Fit linear and non-linear curves for predicting the value of one variable, given the value of another, in case of bivariate data.*
3. *Calculate price and quantity index numbers using simple and weighted average of price relatives, the Chain Base index numbers and consumer price index number.*

Bivariate data: Definition, scatter diagram, simple correlation, Simple linear regression, principle of least squares and fitting of polynomials and exponential curves, Correlation index and Correlation ratio, Rank correlation and Intra-class correlation.

Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain base index numbers and vice-versa. Consumer price index numbers. Income distribution, Lorenz curve and Gini's coefficient.

SUGGESTED READING:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

MJST03B Descriptive Statistics II (PRACTICAL/LAB. WORK) (Credit 1)

List of Practical

1. Fitting of polynomials, exponential curves.
2. Karl Pearson correlation coefficient.
3. Correlation coefficient for a bivariate frequency distribution.
4. Lines of regression, angle between lines and estimated values of variables.
5. Spearman rank correlation with and without ties.

6. Planes of regression and variances of residuals for given simple correlations.
7. Planes of regression and variances of residuals for raw data.
8. Intra-class Correlation.
9. To calculate price and quantity index numbers using simple and weighted average of price relatives.
10. To calculate chain-base index numbers.
11. To calculate consumer price index numbers
12. To calculate Gini's coefficient

.

MJST04A Probability and Probability Distributions II (Theory) (Credit 3)

Course Objective: *In this course, students will have a nice idea about several univariate and bivariate discrete and continuous distributions. The notions of different modes of convergence of a sequence of random variables are also introduced.*

Learning Outcomes: *After completion of this course, the students will be able to*

(1) Recognize various discrete as well as continuous distributions, their properties and applications.
(2) Understand the concepts of law of large numbers and the central limit theorem.

Standard probability distributions: binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, Cauchy, beta and gamma along with their properties and limiting/approximation cases.

Bivariate Normal Distribution (BVN): p.d.f. of BVN, properties of BVN, marginal and conditional distribution.

Limit laws: convergence in probability and convergence in distribution and their inter relations, Chebyshev's inequality, Weak Law of Large Numbers (W.L.L.N) and its applications, De-Moivre Laplace theorem, Central Limit Theorem (C.L.T.) for i.i.d. variables, applications of C.L.T. and Liapunov Theorem (without proof).

SUGGESTED READING:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
IBH Publishing, New Delhi

MJST04B Probability and Probability Distributions II (PRACTICAL/LAB. WORK (Credit 1)

List of Practical

1. Fitting of binomial distributions for n and p = q = ½.
2. Fitting of binomial distributions for given n and p.
3. Fitting of binomial distributions after computing mean and variance.
4. Fitting of Poisson distributions for given value of lambda.
5. Fitting of Poisson distributions after computing mean.
6. Fitting of negative binomial.
7. Application problems based on binomial distribution.
8. Application problems based on Poisson distribution.
9. Application problems based on negative binomial distribution.
10. Problems based on area property of normal distribution.
11. To find the ordinate for a given area for normal distribution.
12. Application based problems using normal distribution.
13. Fitting of normal distribution when parameters are given.
14. Fitting of normal distribution when parameters are not given.

Minor Courses in Statistics

MNST02A Statistical Methods (Theory)Credit 3

Course Objectives: *A statistical survey usually consists of collection of data, scrutiny of data and finally the analysis of data. Thus it is necessary for a student of Statistics is to be familiar with these steps at the very beginning. This particular course is designed keeping this in mind. Here the students are first introduced with the different ways of collecting data, followed by different types of data structure, their representation styles and finally different statistical tools and techniques that can be applied on a data set.*

Learning Outcomes: *After completion of this course, the students will be able to*

(7) Scrutinize an arbitrary data set.
(8) Represent the data in tabular and diagrammatic form.
(9) Prepare the frequency distribution for qualitative and quantitative data.
(10) Find the summary measures, viz. the measures of central tendency, measure of dispersion, measures of skewness and kurtosis of a univariate data.
(11) Find the degree of association/correlation between the two concerned variables in case of a bivariate data.
(12) Fit linear and non-linear curves for predicting the value of one variable, given the value of another, in case of bivariate data.

Introduction: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives.

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

SUGGESTED READING:

4. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
5. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
6. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

MNST02B Statistical Methods (Practical) Credit 1

PRACTICAL/ LAB WORK

List of Practical

13. Graphical representation of data
14. Problems based on measures of central tendency
15. Problems based on measures of dispersion
16. Problems based on combined mean and variance and coefficient of variation
17. Problems based on moments, skewness and kurtosis
18. Fitting of polynomials, exponential curves
19. Karl Pearson correlation coefficient
20. Partial and multiple correlations
21. Spearman rank correlation with and without ties.
22. Correlation coefficient for a bivariate frequency distribution
23. Lines of regression, angle between lines and estimated values of variables.
24. Checking consistency of data and finding association among attributes.

Skill Enhancement Courses in Statistics

SECST02 Introduction to R (Credit 3)

Course Objectives: *1. Explaining the idea and advantages of open-source software*
2. Introducing R as an open-source software
3. Developing the idea of programming and syntaxes of R programming, especially for mathematical computations
4. Demonstrating applications of R in performing fundamental statistical analysis and visualizations.

Learning Outcomes: *After completion of this course, the students will be able to*

1. Understand the cons and advantages of open-source software.
2. Installing and start working in R in different environments
3. Basic programming and solving mathematical problems using R
4. Feeding a dataset in an R environment and carrying out different fundamental statistical analyses and plots in R

Open source software and its advantages, a Very brief history of R, installing R in computers, Different R environments (e.g. Posit, Anaconda etc.), Use of R as a calculator and built-in functions in R, Objects (variables) and their types (scalar, vector, matrix, List, Data Frame etc.) in R, performing different mathematical operations using objects e.g. vectors, matrix etc., Control statement and loop in R, Functions in R and example of their use. Coding examples for solving various mathematical problems (Finding Fibonacci sequence, mean, median, mode, variance, skewness, kurtosis of a set of numbers etc.)

Data input in R environment for statistical analysis and examining different characteristics (dimension, variable names, missing values, no. of missing values, variables nature etc.) of the dataset. Data visualizations (pie-chart, bar-plot, histogram, density plot, box-plot etc.) for variables of a dataset in R, Constructing frequency table and finding descriptive statistics measures of a dataset.

References:

1. https://www.r-project.org/other-docs.html
2. Robert L. Kabacoff: R in Action, 2nd Edition.
3. Norman Matloff: The Art of R Programming: A Tour of Statistical Software Design
4. Roger D. Peng: R Programming for Data Science
5. Roger D. Peng: Exploratory Data Analysis with R