SHIVAJI UNIVERSITY, KOLHAPUR.

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CHOICE BASED CREDIT SYSTEM

Syllabus For

B.Sc. Part - I

Statistics

SEMESTER I AND II

(Syllabus to be implemented from June, 2018 onwards.)

B. Sc. Part – I Semester – I DSC –

7A – STATISTICS – I

(DESCRIPTIVE STATISTICS – I)

Theory: 30 hrs. Marks -50 (Credits: 02)

OBJECTIVES:

The main objective of this course is to acquaint students with some basic concepts in Statistics. They will be introduced to some elementary statistical methods of analysis of data. By the end of this course students are expected to be able,

1) To compute various measures of central tendencies, dispersion, moments, skewness, kurtosis and to interpret them.
2) To analyze data pertaining to attributes and to interpret the results.

CONTENTS:

Unit - 1 (15 hrs.)

1.1 Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: primary and secondary data, quantitative and qualitative data, attributes, variables, discrete and continuous variables, scales of measurement - nominal, ordinal, interval and ratio scale. Presentation: tabular and graphical, including histogram and ogives.

1.2 Measures of Central Tendency: Mathematical and positional. Concept of central tendency of statistical data, statistical average, requirements of good statistical average. Arithmetic Mean (A.M): Definition, Effect of change of origin and scale, Deviation of observations from A.M., Mean of pooled data, Weighted A.M. Geometric Mean (G.M): Definition, Properties: i) G. M. of pooled data (for two groups), ii) G. M. of ratio of two series is the ratio of their G. M's. Harmonic Mean (H.M.): Definition, Relation: A.M $\geq$ G.M $\geq$ H.M (proof for n = 2 positive observations). Median: Definition, Derivation of formula for grouped frequency distribution. Mode: Definition, Derivation of formula for grouped frequency distribution. Empirical relation between mean, median and mode. Graphical method of determination of Median and Mode. Partition values: Quartiles, Deciles and Percentiles. Comparison between averages in accordance with requirements of good average. Situations where one kind of average is preferable to others. Examples to illustrate the concept.

Unit - 2 (15 hrs.)

2.1 Measures of Dispersion: Concept of dispersion, Absolute and Relative measures of dispersion, Requirements of a good measure of dispersion. Range: Definition, Coefficient of range. Quartile Deviation (Q. D. or Semi-inter quartile range): Definition, Coefficient of Q.D. Mean Deviation (M.D.): Definition, Coefficient of M.D., Minimal property of M.D. Mean Square Deviation (M.S.D.): Definition, Minimal property of M.S.D. Variance and Standard Deviation (S.D.): Definition, Effect of change of origin and scale, S.D. of pooled data (proof for two

groups). Coefficient of Variation: Definition and use. Comparison of S.D. with other measures. Examples to illustrate the concept.

2.2 Moments: Raw moments and central moments for ungrouped and grouped data. Effect of change of origin and scale on central moments, relation between central moments and raw moments (up to 4th order). Sheppard's corrections. Skewness: Concept of skewness of a frequency distribution, types of skewness. Bowley's coefficient of skewness, Karl Pearson's coefficient of skewness, measure of skewness based on moments. Kurtosis: Concept of kurtosis of a frequency distribution, Types of kurtosis. Measure of kurtosis based on moments. Illustrative examples.

2.3 Attributes: Notation, dichotomy, class frequency, order of class, positive and negative class frequency, ultimate class frequency, fundamental set of class frequency, relationships among different class frequencies (up to three attributes). Concept of consistency, conditions of consistency (up to three attributes). Concept of independence and association of two attributes. Yule's coefficient of association (Q): Definition, interpretation. Coefficient of colligation (Y): Definition, interpretation. Relation between Q and Y: $Q = 2Y/ (1+Y^2)$, $|Q| \geq |Y|$. Illustrative examples.

Books Recommended

1. Bhat B. R., Srivenkatramana T. and Madhava Rao K. S. (1996): Statistics: A Beginner's Text, Vol. 1, New Age International (P) Ltd.
2. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.
3. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta.
4. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.
5. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics.- Sultan & Chand.
6. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.
7. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
8. Dr. Kore B. G. and Dr. Dixit P. G.: "Descriptive statistics-I", Nirali Prakashan, Pune.
9. Mood A. m., Graybill F. A. and Boes D. C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
10. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Lowa State University Press.
11. Waiker and Lev.: Elementary Statistical Methods.

Note: 1. In theory examination, the weightage to the numerical problems should not exceed 40%.

2. Students can use scientific calculators in theory examination.

B. Sc. Part – I Semester – I DSC – 8A –

STATISTICS - II (ELEMENTARY

PROBABILITY THEORY) Theory: 30 hrs.

Marks -50 (Credits: 02)

OBJECTIVES:

The main objective of this course is to acquaint students with some basic concepts of probability, axiomatic theory of probability, and concept of random variable. By the end of this course students are expected to be able,

1) To distinguish between random and non-random experiments.

2) To find the probabilities of various events.

3) To understand concept of conditional probability and independence of events.

CONTENTS:

Unit – 1 (15 hrs.)

1.1 Sample space and events: Concepts of experiments and random experiments. Definitions: Sample space, Discrete sample space (finite and countably infinite), Event, Elementary event, Compound event. Favourable event. Algebra of events (Union, Intersection, Complementation). Definitions of mutually exclusive events, Exhaustive events, Impossible events, Certain event. Power set |P(Ω) (sample space consisting at most 3 sample points). Symbolic representation of given events and description of events in symbolic form. Illustrative examples.

1.2 Probability: Equally likely outcomes (events), apriori (classical) definition of probability of an event. Equiprobable sample space, simple examples of computation of probability of the events based on permutations and combinations. Axiomatic definition of probability with reference to a finite and countably infinite sample space. Proof of the results:

i) $P(\Phi) = 0$, ii) $P(A^C) = 1 - P(A)$,

iii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (with proof) and its generalization (Statement only),

iv) If $A \subseteq B$, $P(A) \leq P(B)$, v) $0 \leq P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$.

Definition of probability in terms of odd ratio. Illustrative examples.

Unit – 2 (15 hrs.)

2.1 Conditional Probability: Definition of conditional probability of an event. Multiplication theorem for two events. Examples on conditional probability. Partition of sample space. Idea of posteriori probability, statement and proof of Baye's theorem, examples on Baye's theorem. Elementary examples.

2.2 Independence of events: Concept of independence of two events. Proof of the result that if A and B are independent then,

i) A and B^C are independent, ii) A^C and B are independent, iii) A^C and B^C are independent. Pairwise and mutual Independence for three events. Elementary examples.

Books Recommended

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2. Edward P. J., Ford J. S. and Lin (1974): Probability for Statistical Decision-Making, Prentice Hall.

3. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta.

4. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics.- Sultan & Chand.

5. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.

6. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.

7. Dr. Kore B. G. and Dr. Dixit P. G.: "Elementary Probability Theory", Nirali Prakashan, Pune.

8. Meyer P.L. (1970): Introductory Probability and Statistical Applications, Addision Wesley.

9. Mukhopadhyay P. (2006): Probability. Books and Allied (P) Ltd.

10. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia).

11. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Lowa State University Press.

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B. Sc. Part – I Semester – II DSC – 7B -

STATISTICS III (DESCRIPTIVE STATISTICS – II) Theory: 30 hrs.

Marks -50 (Credits: 02)

OBJECTIVES:

The main objective of this course is to acquaint students with some basic concepts in statistics. At the end of this course students are expected to be able,

1) To compute correlation coefficient, interpret its value.

2) To compute regression coefficient, interpret its value and use in regression analysis.

3) To compute various index numbers.

CONTENTS:

Unit – 1 (15 hrs.)

1.1 Correlation: Bivariate data. Concept of correlation between two variables, Types of correlation. Scatter diagram, its utility. Covariance: Definition, effect of change of origin and scale. Karl Pearson's coefficient of correlation (r): Definition, Computation for ungrouped and grouped data, Properties : i) $-1 \leq r \leq 1$, ii) Effect of change of origin and scale.(iii) Interpretation when $r = -1, 0, 1$. Spearman's rank correlation coefficient: Definition, Computation (with and without ties). Derivation of the formula for without ties and modification of the formula for with ties. Illustrative examples.

1.2 Regression: Concept of regression, Lines of regression, Fitting of lines of regression by the least square method. Regression coefficients (b_{xy}, b_{yx}) and their geometric interpretations, Properties: i) $b_{xy} \times b_{yx} = r^2$, ii) $b_{xy} \times b_{yx} \leq 1$, iii) $(b_{xy} + b_{yx}) / 2 \geq r$, iv) Effect of change of origin and scale on regression coefficients, v) The point of intersection of two regression lines. Derivation of acute angle between the two lines of regression. Illustrative examples.

Unit – 2 (15 hrs.)

2.1 Index Numbers: Meaning and utility of index numbers, problems in construction of index numbers. Types of index numbers: price, quantity and value. Unweighted and weighted index numbers using (i)aggregate method, (ii) average of price or quantity relative method (A.M. or G.M. is to be used as an average). Index numbers using; Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's formula.

2.2 Tests of index numbers: Unit test, time reversal test and factor reversal tests. Cost of living index number: definition, construction by using (i) Family Budget and (ii) Aggregate expenditure method. Shifting of base and purchasing power of money. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.

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2. Croxton F. E., Cowden D.J. and Kelin S. (1973): Applied General Statistics, Prentice Hall of India.

3. Goon A. M., Gupta M. K., Das Gupta B. (1999): Fundamentals of Statistics, Vol.I and II, World Press, Calcutta.

4. Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.

5. Gupta V.K. & Kapoor S.C. Fundamentals of Mathematical Statistics.- Sultan & Chand

6. Gupta V.K. & Kapoor S.C. Fundamentals of Applied Statistics.- Sultan & Chand

7. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.

8. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.

9. Kapur, J. N and Gupta, H. C, : Fundamentals of Mathematical Statistics, S. Chand and sons, New Delhi.

10. Dr. Kore B. G. and Dr. Dixit P. G.: "Descriptive Statistics-II", Nirali Prakashan, Pune.

11. Mood A. M., Graybill F. A. and Boes D. C. (1974): Introduction to the Theory of Statistics, McGraw Hill.

12. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Iowa State University Press.

13. Waiker and Lev.: Elementary Statistical Methods.

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B. Sc. Part – I Semester – II

DSC – 8B - STATISTICS IV (DISCRETE PROBABILITY DISTRIBUTIONS) Theory: 30 hrs. Marks -50 (Credits: 02)

OBJECTIVES:

The main objective of this course is to acquaint students with concept of random variable and discrete probability distribution. At the end of this course students are expected to be able,

1) To apply discrete probability distributions studied in this course in different situations.

2) Distinguish between discrete variables and study of their distributions.

3) Know some standard discrete probability distributions with real life situations.

4) Understand concept of bivariate distributions and computation of related probabilities.

CONTENTS:

Unit – 1 (15 hrs.)

1.1 Univariate Probability Distributions (finite sample space): Definition of discrete random variable. Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.) of a discrete random variable, Properties of c.d.f. (statements only). Probability distribution of function of random variable. Median and mode of a univariate discrete probability distribution. Examples.

1.2 Mathematical expectation (Univariate random variable): Definition of expectation of a random variable, expectation of a function of a random variable. Results on expectation, i) E (c) = c, where c is a constant, ii) E (aX + b) = a E (X) + b, where a and b are constants. Definitions of mean, variance of univariate distribution. Effect of change of origin and scale on mean and variance. Definition of raw, central moments. Pearson's coefficient of skewness, kurtosis. Definition of probability generating function (p.g.f.) of a random variable. Effect of change of origin and scale on p.g.f. Definition of mean and variance by using p.g.f. Examples.

Unit – 2 (15 hrs.)

2.1 Some Standard Discrete Probability Distributions: (Finite sample space): Idea of one point, two point distributions and their mean and variances. Bernoulli Distribution: p.m.f., mean, variance, distribution of sum of independent and identically distributed Bernoulli variables. Discrete Uniform Distribution: p.m.f., mean and variance. Binomial Distribution: Binomial random variable, p.m.f. with parameters (n, p), Recurrence relation for successive probabilities, Computation of probabilities of different events, mean and variance, mode, skewness, p.g.f., Additive property of binomial variates. Examples. Hyper geometric Distribution: p.m.f. with parameters (N, M, n), Computation of probability of different events, Recurrence relation for successive probabilities, mean and variance of distribution assuming $n \leq N - M \leq M$, approximation of Hypergeometric to Binomial distribution. Examples.

2.2 Bivariate Discrete Distribution: Definition of bivariate discrete random variable (X, Y) on finite sample space, Joint p.m.f., and c.d.f., Properties of c.d.f. (without proof). Computation of probabilities of events in bivariate probability distribution, concept of marginal and conditional probability distribution, independence of two discrete r.v.s, Examples. Mathematical Expectation: Definition of expectation of function of r.v. in bivariate distribution, Theorems on expectations: (i) $E(X+Y) = E(X) + E(Y)$, (ii) $E(XY) = E(X)\cdot E(Y)$ when X and Y are independent, expectation and variance of linear combination of two discrete r.v.s., definition of conditional mean, conditional variance, covariance and correlation coefficient, $Cov(aX+bY,cX+dY)$, distinction between uncorrelated and independent variables, joint p.g.f, proof of the p.g.f. of sum of two independent r.v.as the product of their p.g.f. Examples.

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2. Edward P. J., Ford J. S. and Lin (1974): Probability for Statistical Decision-Making, Prentice Hall.
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Equivalence for Theory Papers

Old Syllabus		Revised Syllabus	
Semester No. Paper No.	Title of the Paper	Semester No. Paper No.	Title of the Paper
Sem. I / Paper I	Descriptive Statistics -I	Sem. I DSC – 7A STATISTICS - I	Descriptive Statistics -I
Sem. I / Paper II	Elementary Probability Theory	Sem. I DSC – 8A STATISTICS - II	Elementary Probability Theory
Sem. II / Paper III	Descriptive Statistics -II	Sem. II DSC – 7B STATISTICS - III	Descriptive Statistics -II
Sem. II / Paper IV	Discrete Probability Distributions	Sem. I DSC – 8B STATISTICS - IV	Discrete Probability Distributions

Practical Paper-I (Credit 2+2) Pre requisites: Knowledge of the topics in the theory papers. Objectives:

At the end of this course students are expected to be able-

1. To represent statistical data diagrammatically and graphically.
2. To compute various measures of central tendency, dispersion, moments, skewness and kurtosis.
3. To compute correlation coefficient, regression coefficients.
4. To understand Consistency, Association and Independence of Attributes.
5. To interpret summary Statistics of computer output.
6. To know applications of some standard discrete probability distributions.
7. To compute the index numbers.

List of Practicals:

1. Graphical presentation of the frequency distribution (Histogram, frequency polygon, frequency curve, Location of Mode, Ogive curves, Location of Partition values).
2. Measures of Central Tendency I (ungrouped data).
3. Measures of Central Tendency II (grouped data).
4. Measures of the Dispersion I (ungrouped data).
5. Measures of the Dispersion II (grouped data).
6. Moments, Skewness and Kurtosis I (ungrouped data).
7. Moments, Skewness and Kurtosis II (grouped data).
8. Correlation coefficient and Spearman's rank correlation coefficient (ungrouped data)
9. Correlation coefficient (grouped data)
10. Regression I (ungrouped data).
11. Regression II (grouped data).
12. Attributes I (Missing frequencies and consistency).

13. Attributes II (Association and independence).

14. Applications of Binomial and Hypergeometric Distribution.

15. Index Numbers-I. (Computations of index numbers)

16. Index Numbers-II (Tests of adequacy, Shifting of base, cost of living index number)

17. Bivariate Discrete distribution I. (Marginal and conditional distribution, computation of probabilities of events).

18. Bivariate Discrete distribution II (Expectations /conditional expectations / variances / conditional variance /covariance / correlation coefficient)

19. Using MS-EXCEL: Diagrammatic and Graphical presentation, Compute A.M., G.M., H.M., Variance, C.V., M.D.

20. Using MS-EXCEL: Moments, Correlation and Regression (ungrouped data).

Notes:

i) Elementary statistical analysis using MS-Excel: Numerical computations and computations using library functions.

ii) Knowledge of MS-EXCEL Spreadsheet should be tested on computers at the time of Viva-Voce.

iii) Student must complete the entire practical to the satisfaction of the teacher concerned.

iv) Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with sufficient number of electronic calculators and computers along with necessary Software's, UPS and Printers.

Nature of Practical Question Paper:

a) In the practical question paper there shall be four questions each of twenty marks, a student has to attempt any two questions. In only one of the four questions there shall be a sub-question of about 5 marks based on MS-EXCEL.

b) Evaluation of the MS-EXCEL based questions will be online and should be demonstrated to examiner.

c) 5 marks are reserved for the journal and 5 marks for the oral examination.

d) Practical examination is of four hours duration which includes viva examination and on line demonstration.