NORTH MAHARASHTRA UNIVERSITY, JALGAON.

Syllabi for the Three - year Integrated

B.Sc.Degree Course.

First year B.Sc. (With effect from June,1997)

STATISTICS.

Paper I : Descriptive Statistics.

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.

At the end of this course students are expected to be able-
(i) to compute various measures of central tendency, dispersion, skewness and kurtosis, (ii) to compute the correlation coefficient and regression coefficients from ungrouped and grouped bivariate data and interprete them, (iii) to tabulate statistical information given in discriptive form, (iv) to analyse data pertaining to attributes and to interprete the results.

1. Fundamental Concepts :-

1.1 Meaning, Scope and Limitations of Statistics.

1.2 Population, Sample, Sampling, objects of Sampling, Simple random Sampling with and without replacement.

1.3 Data, Raw data, Primary and Secondary data, Variable, Attribute, Types of variable-discrete and continuous.

2. Measures of central tendency and dispersion.

2.1 Meaning of measure of central tendency, objects of measure of central tendency, Requirements of good measure of central tendency.

2.2 Types of measure of central tendency :- Arithmetic mean, Geometric mean, Harmonic mean, median and mode (Meaning and Computational formulae), Situation where one kind of average is preferable to others. Simple theoretical and numerical problems.

2.3 Partition values :- Quartiles, Deciles and Percentiles, (Meaning and compulational formula).

2.4 Meaning of measures of dispersion, objects of measure of dispersion- Absolute and Relative measures of dispersion- Range, Quartile deviation and its coefficient, Mean deviation and its coefficient, variance, Standard deviation and its coefficient (Discussions about combined mean and standard deviation are expected). Simple theoretical and numerical problems.

3. Moments

3.1 Meaning of raw moments and central moments.

3.2 Effect of change of origin and scale on moments.

3.3 Expressing central moments in terms of raw moments about origin.

4. Skewness

4.1 Meaning of Skewness, Types of Skewness-positive skewness and negative skewness, symmetric distribution, cofficient of skewness.

4.2 Determination of coefficient of skewness by using Bowley method, Karl pearson's method and moments method. Limits for Bowley's and Karl person coffien cofficient of skewness.

4.3 Emparical relation among mean, median and mode.

4.4 Simple problems.

5. Kurtosis

5.1 Meaning of kurtosis Leptokurtic, Mesokurtic and platykurtic curves.

5.2 Measures of kurtosis based on moments.

5.3 Simple theoretical and numerical problems.

6. Correlation.

6.1 Meaning of bivariate data, construction of bivariate frecuency distribution, marginal and conditional frequency .

6.2 Meaning of correlation, Types of correlation positive, negative and perfect correlation.

6.3 Scatter diagram and its use.

6.4 Karl pearson's coefficient of correlation definition, computation for ungrouped and grouped data, Interpretation of the correlation coefficient.

6.5 Properties of correlation coefficient :-

(i) $-1 \leq r \leq +1$

(ii) Inveriant to change of origin and scale (Proofs are expected)

6.6 Rank correlation, Spearman's rank correlation coefficient. (Derivation of the formula for rank correlation coefficient is expected), computation and interpretation (with and without ties).

6.7 Simple theoretical and numerical problems.

7. Regression.

7.1 Meaning of regression, differences between correlation and regression.

7.2 Concept of linear and non-linear regression. Meaning of fitting of curve, method of least squares in fitting a curve to given data.

7.3 Linear regression- Fitting of lines of regression by the method of least squares (proof is expected).

7.4 Concept of regression coefficients, properties of regression coefficients :-

(a) $b_{yx} \cdot b_{xy} = r^2$

(b) Change of origin and scale.

(c) If one regression coefficient is greater than one, then another regression coefficient is less than one.

7.5 Angle between two lines of regression (proof is expected).

7.6 Standard error of estimate (proof is expected), coefficient of determination.

7.7 Fitting of non-linear curves of the type (a) $y = a + bx + cx^2$, (b) $y = ax^b$, (c) $y = ab^x$ by the method of least squares.

7.8 Simple numerical and theoretical problems.

8. Multiple Regression

8.1 Meaning of multiple regression, residual, Determination of multiple regression equation involving 3 variables only by the method of least squares, Meaning of partial regression coefficients, formula for variance of residual (derivation

is not expected), stabdard error of regression estimate; properties of residuals (without proof), variance of regression estimate (proof is not expected).

8.2 Simple theoretical problems.

9. Multiple correlation and Portial correlation

9.1 Meaning of multiple correlation and partial correlation, Definition of multiple and portial correlation coefficients in terms of simple correlation coefficients (proof, are not expected), limits for multiple and partial correlation coefficients.

9.2 Simple theoretical and numerical problems.

10. Theory of Attributes.

10.1 Notation, dichotomy, class frequency, Order of class, positive class frequency, negative class frequcney, contra class frequency, ultimate class frequency, relationships among different class frequency method of operators upto three attributes).

10.2 Fundamental set of class frequencies : definition, to determine whether a given set of frequencies is a fundamental set or not (up to three attributes).

10.3 Concept of independence and association of two attributes.

10.4 Yule's coefficient of association (Q)

10.5 Simple theoretical and numerical problems.

Books Recommended.

1) Fundamentals of Mathematical Statistics by S.C. Gupta and V.K.Kapoor.

2) Statistical Methods by S.P.Gupta.

3) Fundamentals of Statistics volume One by A.M.Goon, M.K.Gupta and B.Dasgupta.

4) Descriptive Statistics for F.Y.B.Sc. Statistics by North Maharashtra University, Jalgaon.

Paper - II

PROBABILITY AND PROBABILITY DISTRIBUTIONS

Prerequisites :- Knowledge of following concepts are expected

i) Sets and set operations such as union, Intersection, complementation.

ii) Permutations and combinations.

iii) Probability of an event.

iv) conditional probability.

v) Independence of events.

vi) Binomial Theorem.

Objectives :- The main objective of this course is to introduce to the students the axiomatic approach to probability; concepts of Random Variable, study of Discrete (univariate and Bivariate) random variable, Expectation, Moments, moment generating function, cummulant generating function of probability distribution. Some Standard Discrete Distributions.

By the end of course students are expected to be able followings :-

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

ii) To identify discrete random variable.

iii) To obtain a probability distribution of random variable one or two imensional) in the given situation.

iv) To apply the standard discrete probability distributions to different situations.

FIRST TERM.

CONTENTS

Concepts of probability and random variable

1.1 Experiments and Random Experiments, Ideas of deterministics and nondeterministics models.

1.2 Definitions of -i)Sample Space, ii)Discrete and continous sample space, iii)Event, iv)Elementary event, v)Certain event, vi)Impossible event.

1.3 Concept of occurance of an event.

1.4 Axioms of probability.

1.5 Concepts of random variable, Discrete and continuous random variable.

1.6 Examples and Problems.

UNIVARIATE DISCRETE PROBABILIRY DISTRIBUTIONS

2.1 Univeriate probability mass function f(x).

2.2 Cummulative probability distribution function.

2.3 Properties of probability mass function & cumulative distribution function of random variable.

2.4 Mode and median of a univeriate discrete probability distribution .

2.5 Exam les and problems.

BIVARIATE DISCRETE PROBABILITY DISTRIBUTIONS

3.1 Definition of two-dimensional Discrete random variable & its probability mass function.

3.2 Joint probability mass function & joint distribution function & .. their properties.

3.3 Computation of probabilities of events in bivariate probability distribution.

3.4 Concepts of marginal & conditional probability distributions.

3.5 Independence of two discrete random variable. Distribution function of two functions of jointly distributed random variables.

3.6 Examples & Problems.

MATHEMATICAL EXPECTATION

4.1 Definition of expectation of random variable & function of random variable.

4.2 Definition of expectation in bi-variate distribution.

4.3 Laws of Expectation. (With proof)

4.4 Conditional Expectation.

4.5 Examples & Problems.

VARIANCE, CO-VARIANCE & CORRELATION

5.1 Definition of variance.

5.2 Properties of variance & conditional variance.

5.3 Definition of co-variance.

5.4 Properties of co-variance.

5.5 Definition of correlation coefficients.

5.6 Properties of correlation coefficients.

5.7 Examples & Problems.

MOMENTS, SKEWNESS & KURTOSIS

6.1 Definition of raw moments & central moments.

6.2 Relations between raw moments & central moments.

6.3 Coefficient of skewness & kurtosis.

6.4 Moment Generating Function.

Moment generating function of AX, AX+B & X+Y.
Where X & Y are independent. Uniqueness (with proof)
property of moment generating function. (With proof)

6.5 Cumulant generating function & its property.

6.6 Examples & Problems.

SOME STANDARD DISCRETE DISTRIBUTION

UNIFORM DISTRIBUTION

7.1 Probability mass function, Mean, Variance, Distribution function.

7.2 Situation where this distribution is applicable.

7.3 Examples & Problems.

BERNOULLI & BINOMIAL DISTRIBUTIONS

8.1 Probability mass function, mean, variance, moments.

8.2 Distribution of sum of independent & identically distributed bernoulli variates.

8.3 Recurrence relation for successive probabilities of binomial distribution.

8.4 Moment generating function & cumulant generating function of binomial distribution.

8.5 Additive property of binomial variates. (using M.G.F.)

8.6 Computation of probabilities of different events.

8.7 Examples & Problems.

POISSON DISTRIBUTION

9.1 Probability mass function, Mean, Variance.

9.2 Moment generating function, cumulant generating function.

9.3 Additive property for two independent variables.

9.4 Recurrence relation for Probabilities.

9.5 Real life situation.

9.6 Examples & Problems.

GEOMETRIC DISTRIBUTION

10.1 Probability mass function of the form

$$p(x) = \theta^x p \quad : \quad x=0,1,2\ldots$$
$$= 0 \quad \text{otherwise}$$

distribution function.

10.2 Mean, Variance, moment generating function, cumulant generating function & hence moments.

10.3 Geometric distribution as a waiting time distribution.

10.4 Luck of memory property.

10.5 Examples & Problems.

REFERENCE BOOKS

1) TEXT BOOKS BY N.M.U.

2) FUNDAMENTALS OF MATHEMATICAL STATISTICS BY S.C.GUPTA & V.K.KAPOOR.

3) INTRODUCTION TO MATHEMATICAL STATISTICS BY P.G.HOEL.

4) MATHEMATICAL STATISTICS BY B.D. GUPTA & O.P.GUPTA.

5) MATHEMATICAL STATISTICS BY S.N.SHARMA & J.K.GOEL.

PAPER - III

PRACTICALS

Prerequisites :- Knowledge of topic in the theory papers

Objectives :- At the end of this course students are expected to be able - (i) to form frequency distribution from raw data, (ii) to compute various measures of central tendency, dispersion, skewness and kurtosis, (iii) to compute simple, partial & multiple correlation coefficients and regression coefficients (Simple and partial), (iv) to fit Binomial and Poisson distributions.

Note :-

1) Students must complete all the practicals to the satisfaction of teacher concerned.

2) Students must produce at the time of the practical examination the laboratory journal alongwith the completion certificate signed by the Head of the Department.

3) Of the 100 marks for the practical examination 10 marks shall be reserved for viva-voce and 10 marks for journal. Thus the practical paper shall actually cary 80 marks.

4) The duration of practical exam. will be 3(three) hours.

Title of the experiments :-

(1) Computation of measure of central tendency I.

(2) Computation of measure of central tendency II.

(3) Computation of measure of dispersion.

(4) Raw and centre moments for ungrouped data.

(5) Moments, Skewness and Kurtosis for grouped data.

(6) Use of random number tables.

(7) Scatter diagram, fitting of lines of regression and computation of correlation coefficient (ungrouped data).

(8) Computation of correlation coefficient.(Grouped data)

(9) Computation of spearman's rank correlation coefficient. (With and without ties)

(10) Fitting of second degree curve, fitting of an exponential curve ($Y=a\ e^{bx}$).

(11) Association of attributes.

(12) Multiple Regression : i)Fitting regression planes for trivariate data given the sample means, variances and correlation matrix. (Computations of means, variances, correlations from raw data are not expected). (ii) Fitting regression planes for trivariate data given the sum, sum of squares and sum of products.

(13) Computation of multiple and partial correlations from the sample correlation matrix.

(14) Fitting of Binomial distribution.

(15) Fitting of Poisson distribution.

(16) Model sampling from Binomial and Poisson distributions.

(17) Applications of Binomial, Poisson and geometric distribution for computation of probabilities.

Note :- Practicals 1 to 9 are to be taken in the first term and 10 to 17 in the second term.

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