

॥ मंत्राी मेरुु मरुुवते ॥
NORTH MAHARASHTRA UNIVERSITY, JALGAON.

Draft Syllabi for the Three-Year Integrated B.Sc. Degree
Course First Year B.Sc. from June, 1992.

* STATISTICAL TECHNIQUES *
--Statistical Techniques - I. -

@ SYLLABUS @

1. : Population and sample :
 - 1.1 : Notion of a Statistical population.
 - 1.2 : Types of population-finite and infinite population with illustrations.
 - 1.3 : Variable, Definition, types of variable.
2. : Classification and tabulation.
 - 2.1 : Classification by the method of attributes (only principle of dichotomy).
 - 2.2 : Classification by the method of class intervals.
 - 2.3 : Inclusive and Exclusive method of classification.
 - 2.4 : Tabulation, Definition, Parts of a table.
 - 2.5 : Type of tables one-way, two-way and Three-way.
 - 2.6 : Simple numerical problems.
3. : Diagrammatic and graphical representation.
 - 3.1 : Bar diagram Need and uses.
 - 3.2 : Subdivided and multiple bar diagrams.
 - 3.3 : Histogram, frequency polygon and frequency curve.
 - 3.4 : Ogive curves (more than and less than type)
4. : Measures of central Tendency.
 - 4.1 : Concept of central tendency of statistical data;
 - 4.2 : Arithmetic Mean (A.M.) Definition and computation.
 - 4.3 : Median Definition and Computation.
 - 4.4 : Mode : Definition and Computation.
 - 4.5 : Empirical relation between mean mode and median.
 - 4.6 : Simple numerical problems.
5. : Dispersion.
 - 5.1 : Concept of dispersion.
 - 5.2 : Range, definition and computation.
 - 5.3 : Mean Deviation about mean, definition and computation.
 - 5.4 : Standard deviation, definition and computation.
 - 5.5 : Co-efficient of variation definition and computation.
 - 5.6 : Concept of skewness.
 - 5.7 : The distributions with +ve, -ve and zero skewness.
 - 5.8 : Pearson's co-efficient of skewness and its interpretation.

@ END OF TERM @

- 6. : Correlation :
- 6.1 : Bivariate data.
- 6.2 : Concept of correlation between two variables.
- 6.3 : Types of correlations - Positive and negative.
- 6.4 : Scatter diagram, conclusion about the type of correlation from scatter diagram.
- 6.5 : Covariance between two variables, definition, computation.
- 6.6 : Karl Pearson's co-efficient of correlation (r) definition and computation for grouped and ungrouped data.
- 6.7 : Statement of the properties of co-efficient of correlation (r).
 - (i) -1 $+1$
 - Invariant to change of origin and scale.
- 6.8 : Spearman's rank correlation co-efficient : definition, computation and interpretation.
- 6.9 : Properties of spearman's rank correlation co-efficient (Statement only)
- 6.10 : Simple numerical problems.
- 7. : Regression.
- 7.1 : Lines of regression, Fitting of lines of regression by the method of least squares.
- 7.2 : Properties of regression co-efficients.
- 7.3 : Relation between correlation co-efficient & regression co-efficients.
- 7.4 : Simple numerical problems.
- 8. : Theory of attributes :
- 8.1 : Attributes and variable : Notation dichotomy, class frequency, order of a class positive class frequency, negative class frequency, ultimate class frequency, relationship among different class frequencies, method of operators.
- 8.2 : Fundamental set of class-frequencies definition. (up to two attributes)
- 8.3 : Definition of independence of two attributes.
- 8.4 : Yules co-efficient of association (Q) : Co-efficient of colligation (Y).
- 8.5 : Relationship between Q and Y (without proof)
- 8.6 : Simple numerical problems.

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BOOKS RECOMMENDED.

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@ STATISTICAL TECHNIQUES-II. @

--SYLLABUS --

1. : Probability :
- 1.1 : Experiments and random experiments.
Ideas of deterministic and non deterministic models.
- 1.2 : Definitions.
 - i) Sample space.
 - ii) Sample space (finite and infinite)
 - iii) Event.
 - iv) Elementary event.
 - v) Certain event.
 - vi) Impossible event.
- 1.3 : Probability (over finite sample space)
- 1.4 : Conditional probability and independence.
- 1.5 : Baye's theorem (without proof)
- 1.6 : Simple numerical problems.
2. : Probability distributions :
- 2.1 : Concept of random variable.
- 2.2 : Definition of probability function.
- 2.3 : Definition of Mathematical expectation and Statements of properties.
- 2.4 : Bernoulli distribution definition and properties without proof.
- 2.5 : Binomial distribution : definition, properties without proof.
- 2.6 : Poisson distribution : definition, properties without proof.
- 2.7 : Geometric Distribution & simple numerical problems.
3. : Continuous probability distribution :
- 3.1 : Definition of probability of density function of a continuous random variable.
- 3.2 : Normal distribution : definition., properties without proof.
- 3.3 : Computation of probabilities using normal probability tables.
- 3.4 : Simple problems.

@ END OF THE FIRST TERM @

- 4. : Sampling Distribution :
- 4.1 : Definition of a random sample, statistics.
- 4.2 : Definition of sampling distribution of a statistics.
Standard error of a statistics.
- 4.3 : Notion of hypothesis, Types of hypothesis, critical region
- 5. : Tests of Significance I.
- 5.1 : Concept of a test of significance, level of significance.
Idea of two tailed and one tailed tests of significance.
- 5.2 : Idea of large sample tests of significance.
- 5.3 : Large sample tests for
 - i) $H_0 : \mu = \mu_0$ $H_1 : \mu \neq \mu_0$
 - ii) $H_0 : \mu_1 = \mu_2$ $H_1 : \mu_1 \neq \mu_2$
- 5.4 : Numerical problems.
- 6. : Test of significance II
- 6.1 : Idea of small sample tests of significance.
- 6.2 : t - test for testing.
 - i) $H_0 : \mu = \mu_0$ $H_1 : \mu \neq \mu_0$
 - ii) $H_0 : \mu_1 = \mu_2$ $H_1 : \mu_1 \neq \mu_2$
- 6.3 : χ^2 - test of goodness of fit.
- 6.4 : χ^2 - test for independence of attributes.
- 6.5 : χ^2 - test for testing population variance
 - $H_0 : \sigma^2 = \sigma_0^2$ $H_1 : \sigma^2 \neq \sigma_0^2$ where is know
- 6.6 : F test for testing $H_0 : \sigma_1^2 = \sigma_2^2$ $H_1 : \sigma_1^2 \neq \sigma_2^2$
- 6.7 : Numerical problems.
- 7. : Sampling methods.
- 7.1 : Simple random sampling (SRSWOR AND SRSWR)
- 7.2 : Writing down all possible samples of given size drawn by SRSWR and SRSWOR for a given finite population.
- 7.3 : Statements regarding estimates of population mean, population total, their standard errors, estimates of standard errors, verification of unbiasedness through simple numerical problems.
- 7.4 : Stratified random sampling, real life situations where stratification is appropriate.
- 7.5 : Statements regarding estimates of population mean and population total, their standard errors in case of SRSWOR only
- 7.6 : Statement of proportional allocation, optimum allocation.
- 7.7 : Simple numerical problems.

- 7.7 Definitions of covariance and correlation coefficient (r) in bivariate distribution. Does $r=0$ imply independence of variables?
- 7.8 Definition of raw and central moments of Univariate probability distributions and their interrelations.
- 7.9 Definitions of raw and central moments of bivariate distribution.
- 7.10 Examples and Problems.
8. Some Standard Discrete Probability Distributions
- 8.1 Bernoulli Distribution p.m.f. mean, variance, moments, distribution of sum of independent identically distributed Bernoulli variates.
- 8.2 Uniform discrete distribution on integers 1 to n ; p.m.f., mean, variance, Situations where this distribution arises.
- 8.3 Statement of binomial theorem, Binomial distribution p.m.f. $b(x, n, p) = \binom{n}{x} p^x (1-p)^{n-x}$ recurrence relation for successive probabilities, computation of probabilities of different events, mode of the distribution, mean, variance, moment skewness (comment when $p=0.5$, $p > 0.5$, $p < 0.5$, recurrence relations for raw and central moments, additive property of binomial variates, distribution of X , given $X+Y=n$, where X and Y are independent $B(n_1, p)$ and $B(n_2, p)$ variates.
- 8.4 Examples and Problems.

BOOKS RECOMMENDED

1. Hoel, P.G. Introduction to Mathematical Statistics.
2. Gupta & Kapoor : Fundamentals of Mathematical Statistics.
3. B.D. Gupta & O.P. Gupta Mathematical Stat.

PAPER III PRACTICALS.

Prerequisites: Knowledge of the topic in the theory papers.
Objectives: 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 correlation coefficient, (iii) to fit binomial distribution.

Title of Experiment.

1. Computation of raw and central moments from ungrouped and grouped data.
2. Computation of measure of central tendency I.
3. Computation of measures of central tendency II (use of an appropriate measure of central tendency. Interpretation of results.)
4. Computation of measures of dispersion.
5. Computation of measures of skewness and kurtosis.
6. Use of random number tables.
7. Scatter diagram, fitting of Lines of regression and computation of correlation coefficient (un grouped and grouped data)
8. Computation of Spearman's correlation coefficient.
9. Fitting Lines of regression and computation of correlation
10. Fitting of second degree curves, fitting of exponential curve.
11. Association of attributes.
12. Fitting of binomial distribution.
13. Application of the binomial distribution and computation of probabilities.

Note:- Practicals 1 to 6 are to be taken in the first term and 7 to 13 in the second term.

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Syllabi for the Three-year Integrated B.Sc. Degree Course.
First year B.Sc. (with effect from June, 1992)

STATISTICS (Principal)

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 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 interpret them. (iii) to tabulate statistical information given in descriptive form (iv) to analyse data pertaining to attributes and to interpret the results.

FIRST TERM

Contents:

1. Fundamental concepts.
 - 1.1 Meaning, Scope & Limitations of Statistics.
 - 1.2 Variables - discrete and continuous, Attributes.
 - 1.3 Population, Sample, Raw data, Primary and Secondary data
2. Frequency distribution.
 - 2.1 Frequency, Cumulative frequencies, Class, Class-limits, Class boundaries, Class width, mid point
 - 2.2 Types of classes- exclusive classes, inclusive classes, open and classes.
 - 2.3 Formation of ungrouped and grouped frequency distributions from raw data. Cumulative frequency distributions.
 - 2.4 Graphical Representation, Histogram for equal class intervals, Frequency Polygon, Frequency curve, Ogives
3. Measures of central Tendency:
 - 3.1 Concept of central tendency of statistical data, Statistical average, Requirements of a good statistical average.
 - 3.2 Arithmetic Mean (A.M.) : definition, change of origin and scale, combined Mean of a number of groups, merits and demerits.
 - 3.3 Geometric Mean (G.M.) : definition, merits and demerits.
 - 3.4 Harmonic Mean (H.M.) : definition, merits and demerits
 - 3.5 Mode : definition, formula for computation (without derivation), graphical method of determination of mode, merits and demerits.
 - 3.6 Median : Definition, formula for computation (without derivation), graphical method of determination of median, merits and demerits.

- 3.7 Quartiles and Deciles.
- 3.8 Weighted Means Weighted A.M., G.M., H.M.
- 3.9 Situation where one kind of average is preferable to others.
- 3.10 Examples and Problems.
- 4. Measures of Dispersion
 - 4.1 Concept of dispersion, Requirements of a good measure of dispersion.
 - 4.2 Range, definition, merits and demerits.
 - 4.3 The semi interquartile range (quartile deviation).
 - 4.4 Mean deviation: definition, merits and demerits, minimal property (with proof)
 - 4.5 Mean square deviation: Definition. Variance and standard deviation: definition merits and demerits, change of origin and scale, Combined variance for two groups.
 - 4.6 Absolute and relative measures of dispersion, coefficient of quartile deviation, coefficient of variation.
 - 4.7 Examples and Problems.
- 5. Moments:
 - 5.1 Raw moments for ungrouped and grouped data.
 - 5.2 Central moments for ungrouped and grouped data. Effect of change of origin and scale.
 - 5.3 Relation between central moments and raw moments.
 - 5.4 Examples and Problems.
- 6. Skewness:
 - 6.1 Concept of skewness of a frequency distribution, positive skewness, negative skewness, symmetric frequency distributions.
 - 6.2 Bowley's coefficient of skewness, Karl Persion's coefficient of skewness, Measures of skewness based on moments.
 - 6.3 Empirical relation among mean, median, mode.
 - 6.4 Examples and Problems.
- 7. Kurtosis:
 - 7.1 Concept of kurtosis in a frequency distribution. Leptokurtic, Mesokurtic and Platykurtic frequency distributions.
 - 7.2 Measures of kurtosis based on moments.
 - 7.3 Examples and Problems.

SECOND TERM

- 8. Correlation:
 - 8.1 Bivariate data.
 - 8.2 Concept of correlation between two variables, positive correlation, negative correlation.
 - 8.3 Scatter diagram, and its interpretation.

- 8.4 Covariance between two variables; definition computation. Effect of change of origin and scale.
- 8.5 Karl Person's coefficient of correlation (r) : definition, computation for ungrouped and grouped data and interpretation.
Property (i) $-1 \leq r \leq 1$
(ii) invariant to change of origin and scale (proofs expected.)
- 8.6 Spearman's rank correlation coefficient, definition, computation and interpretation. (with and without ties).
- 8.7 Examples and Problems.
9. Regression:
- 9.1 Lines of regression. Fitting Lines of regression by the Least squares method.
- 9.2 Regression coefficients (b, b^1)
Properties (i) $b \times b^1 = r^2$
(ii) $b, b^1 \leq 1$
(iii) $b = r \frac{\sum y}{\sum x}$; $b^1 = r \frac{\sum x}{\sum y}$
(iv) change of origin and scale
(v) slope of the lines of regression
(vi) Angle between the two lines of regression.
- 9.3 Explained and unexplained variation, coefficient of determination, Standard error of estimate.
- 9.4 Nonlinear regression second degree and exponential ($Y=e^{ax}$) curves, fitting of such curves by Least Squares method.
- 9.5 Examples and Problems.
- 10- Theory of Attributes:
- 10.1 Notation, dichotomy, class frequency, order of class, positive class frequency, negative class frequency, 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. (upto three attributes.)
- 10.3 Concept of independence and association of two attributes.
- 10.4 Yule's coefficient of association (Q)
- 10.5 Example and Problems.

BOOKS RECOMMENDED

- 1) Croxton F.M. and Cowden D.J. : Applied General Statistics.
- 2) Goon, Gupta and Dasgupta: Fundamentals of Statistics, Vol. I
- 3) Gupta S.P. Statistical Methods.
- 4) Jon E. Freund. : Modern Elementary Statistics.
- 5) S.C. Gupta : Fundamentals of Statistics.