Syllabus for Integrated Master Degree Programme

STATISTICS

UNDER NATIONAL EDUCATION POLICY 2020

TRIPURA UNIVERSITY
(A Central University)
Suryamaninagar, Tripura – 799022, India.

(Effective from Academic Session 2023-24)

Statistics (Minor) Syllabus

1st Year: 1st Semester [Credit 4 Th]

Paper: IST 101

Unit I (Measures of Central Tendency and Dispersion)

Introduction to Statistics: Definition, scope and Limitations of statistics, Use of statistics. Collection and classification of data: Primary data and secondary data, methods of collection of data, Scrutiny of data. Classification, principles of classification, types of classification.

Tabular presentations of data. Diagrammatic representation of data. Frequency distribution and its constructions. Graphical presentations of frequency distribution.

Concept of central tendency, Different measures of central tendencies. Empirical relationships between different measures.

Concept of dispersion, Different measures of dispersion and their properties. Different types of moments, relationships between raw and central moments. Sheppard's corrections for moments (without proof). Skewness and Kurtosis.

Unit II (Probability)

Random experiment, Sample point, Sample space, different types of Events, Meaning of Probability, Classical, Statistical and Axiomatic definitions of Probability. Limitation of classical definition of Probability, Theorem on the Probability of union of Events. Conditional Probability, Theorem on conditional Probability, Statistical independence of Events, Bayes' theorem and its application.

Unit III (Random Variable and Expectation)

Definition of discrete and continuous random variables. Probability mass function (p.m.f.). Probability density function (p.d.f.). Cumulative distribution function (c.d.f.) and its properties. Expectation and moments, Theorem on sum and product of expectations of variables. Bi-variate frequency distribution. The p.m.f., p.d.f. and c.d.f. in the bivariate case. Marginal and conditional distributions. Independence, conditional expectation and conditional variance. Cauchy-Schwarz inequality. Tchebycheff's Inequality. Moment generating function (m.g.f.).

Unit IV (Correlation and Regression)

Bivariate data, Scatter diagram, Pearson Correlation coefficient and its properties. Spearman's Rank correlation.

Principle of Least squares. Concept of regressions, fitting of regression lines, Important results relating to regression lines. Fitting of Polynomial, Exponential and Growth curve.

Multiple linear regression. Multiple and partial correlation coefficient and their properties.

Suggested Reading:

[1]   Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics (Vol-I), World Press, Kolkata.
[2]   Goon A.M., Gupta M.K. and Dasgupta B. (1994): An Outline of Statistical Theory (Vol-I), World Press, Kolkata.
[3]   Gupta S. C., Kapoor V. K.: Fundamentals of Mathematical Statistics, Sultan Chand and Sons..
[4]   Mukhopadhyay P. (1999): Applied Statistics. New Central Book Agency Pvt. Ltd
[5]   Rohatgi V.K. (1984): An Introduction to Probability Theory and Mathematical Statistics, John Wiley.

1st Year: 2nd Semester [Credit 4 Th]
Paper: IST 201

Unit I (Probability Distributions)

Uniform, Bernoulli, Binomial, Poisson, Negative Binomial and Geometric distributions. Uniform, Exponential, Normal, Gamma and Beta distributions.

Unit II (Sampling Distributions)

Concepts of Random sampling, statistic and parameter. Sampling distribution of statistic and its Standard Error. Definition, properties and applications of Chi-square, t, F and Z statistics. Contingency table and frequency chi-square. Distributions of sample mean and variance in case of sampling from normal population.

Unit III (Index Numbers and Time Series Analysis)

Definition, construction and use of price index numbers. Laspeyres', Passache's, Fisher's and Edgeworth-Marshall's index numbers. Time and factor reversal tests. Chain index number, wholesale and consumer price index numbers.

Different components of a time series. Determination of trend by free hand smoothing, Method of moving average and by fitting of a mathematical curve. Determination of seasonal indices by simple average method, method of trend ratios and ratios to moving averages.

Unit IV (Vital Statistics)

Introduction and sources of demographic data, measurement of population, rates and ratios of vital events. Measurement of mortality: CDR, SDR (w.r.t. Age and sex), IMR, Standardized death rates. Complete Life (mortality) tables: definition of its main functions and uses. Measurement of fertility and reproduction: CBR, GFR, and TFR. Measurement of population growth: GRR, NRR.

Suggested Reading

[1] Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics (Vol-I), World Press, Kolkata.
[2] Goon A.M., Gupta M.K. and Dasgupta B. (1994): An Outline of Statistical Theory (Vol-I), World Press, Kolkata.
[3] Rohatgi V.K. (1984): An Introduction to Probability Theory and Mathematical Statistics, John Wiley.
[4] Kendall M.G. and Stuart A. (1966): Advanced Theory of Statistics (Vol-I and II).
[5] Gupta S. C., Kapoor V. K.: Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
[6] Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics (Vol-II), World Press, Kolkata.
[7] Gupta S.C., Kapoor V. K.: Fundamentals of Applied Statistics, Sultan Chand and Sons.
[8] Mukhopadhyay P. (1999): Applied Statistics. New Central Book Agency Pvt. Ltd.

2nd Year: 3rd Semester [Credit 4 Th]
Paper: IST 301

Unit I (Estimation)

Concepts of estimation. Point estimation. Requirement of a good estimator: unbiasedness, sufficiency, consistency and efficiency. Different problems related to unbiasedness, consistency and efficiency. Minimum variance unbiased estimator (MVUE). Best Linear Unbiased Estimator (BLUE). Maximum Likelihood method of Estimation (MLE). Properties of MLE and related problems.

Concepts of confidence interval and confidence coefficient, Method of Construction of confidence interval, Exact confidence intervals under normal set-up for a single mean, single variance, difference of two means and ratio of two variances.

Unit II (Test of Significance)

Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, power of a test. Concept of P value. Exact tests of hypotheses under normal set-up for a single mean, the equality of two means, a single variance and the ratio of two variances. Tests of significance for correlation coefficient (null case) and regression coefficients of a bivariate normal distribution.

Unit III (ANOVA and Design of Experiments)

Analysis of Variance (ANOVA). Linear hypothesis. Basic concepts of fixed, random and mixed effect model. Analysis of variances for one-way and two-way classified data under fixed effect model.

Basic principles of experimental Design: randomization, replication and local control. Uniformity trials. Shapes and sizes of plots and blocks. Completely Randomized design (CRD), Randomized Block design (RBD) and Latin Square design (LSD). Missing plot techniques in a RBD and in a LSD.

Unit IV (Sampling Technique and Statistical Quality Control)

Concepts of a finite population and of a sample. Need for sampling. Complete enumeration and sample surveys.

Planning and execution of sample survey. Biases and Errors. Judgment and probability samplings. Tables of random numbers and their uses.

Simple random sampling with and without replacement. Associated unbiased estimators of population total, mean and proportion. Their variances and unbiased estimators of variances. Concept of Systematic and Stratified sampling.

Concepts of quality and quality control. Process control and product control. Chance and assignable Causes of quality variation. Construction and Statistical basis of 3-σ Control charts, Rational Sub-grouping. Construction and use of control charts for mean, range, number of defectives (including the case of varying sub-group size), fraction defective and number of defects.

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[1] Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics (Vol-I), World Press, Kolkata.
[2] Rohatgi V.K. (1984): An Introduction to Probability Theory and Mathematical Statistics, John Wiley.
[3] Kendall M.G. and Stuart A. (1966): Advanced Theory of Statistics (Vol-I and II).
[4] Gupta S. C., Kapoor V. K.: Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
[5] Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics (Vol-II), World Press, Kolkata.
[6] Gupta S.C., Kapoor V. K.: Fundamentals of Applied Statistics, Sultan Chand and Sons.
[7] Mukhopadhyay P. (1999): Applied Statistics. New Central Book Agency Pvt. Ltd.