STAT 311 Basic and Applied Agricultural Statistics 3(2+1)

Objectives

This course is meant to expose the students to various concepts of descriptive statistical methods and statistical inferential procedures which would help them in understanding the concepts involved in data collection, its presentation, analysis and interpretation. This course will also provide them with the understanding of the early development of statistics in ancient India.

Theory

Statistics as a method of learning from experience and decision making under uncertainty were practiced from the beginning of human civilization. Here the ancient foundations of statistical practices in Indian civilization with a focus on agriculture, population and economic census in villages and towns will be explored. Data collection systems found in ancient texts like Vyasa's Mahabarata, Kautilya's (321-296 BC) Arthashastra, Abul Fazal's Ain-i-Akbari (1596-1597 AD) and others which documented methods of estimation, land classification and resource planning will be discussed. A brief discussion will be made on the first use of arithmetic mean as the best representative value for a set of observations in statistical sense which can be found in ancient India's texts (Brahamagupta, 628 AD). How population data and vital statistics were maintained in ancient India as seen in Manusmriti and the administrative practices of the Chola dynasty will also be explained.

Introduction to Statistics and its Applications in Agriculture. Types of Data. Scales of measurements of Data. Summarization of Data. Classification of Data. Frequency Distribution. Methods of Classification. Definition of Grouped and Ungrouped Data. Definition of Class Interval (formula for determining the no. of class interval), Width of CI, Class Limits (Boundaries), Mid Points. Types of Frequency Distribution. Diagrammatic Presentation of Data. Bar Diagrams – Simple, Multiple, Sub-divided and Percentage Bar Diagrams. Pie-diagram. Graphical Presentation of Data – Histogram, Frequency Polygon and Ogives, Stem and leaf plot. Measures of Central Tendency. Requisites for an Ideal Measure of Central Tendency. Different Types of Measure. Arithmetic Mean– Definition, Properties, Merits, Demerits and Uses. A.M. (examples) for Grouped and Ungrouped Data. Outlier observations. Trimmed Mean. Step-deviation Method. Weighted Mean. Definition of Geometric Mean and Harmonic Mean. Relationship between A.M., G.M. and H.M. Median Definition, Merits, Demerits and Uses. Graphical Location of Median. Mode-Definition, Merits, Demerits and Uses. Graphical Location of Mode. Relationship between Mean, Median and Mode.

Measures of Dispersion. Characteristics for an Ideal Measure of Dispersion. Different Types of Measures of Dispersions. Definition of Range, Interquartile Range, Quartile

Deviation and Mean Deviation. Standard Deviation- Definition, Properties. S.D. and Variance for Grouped and Ungrouped Data. Variance of Combined Series. Co-efficient of Dispersions. Co-efficient of Variation. Box plot and five-number summary statistics.

Measures of Skewness and Kurtosis. Definition of Symmetrical Distribution. Definition of Skewness, Measures of Skewness. Definition of Kurtosis. Measure of Kurtosis. Relationship between Mean, Median and Mode for Symmetrical and Skewed Distribution.

Correlation and Regression. Definition of Correlation. Scatter Diagram. Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient. Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients.

Introduction to Probability. Basic Terminology. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability. Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability.

Definition of Random Variable. Discrete and Continuous Random Variable. Introduction of Binomial and Poisson distributions with basic properties. Normal Distribution- Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve.

Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic. Sampling Vs Complete Enumeration. Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.

Tests of Significance. Null and Alternative Hypothesis. Type I and Type II Errors. Critical Region and Level of Significance. One Tailed and Two Tailed Tests. Test Statistic. One Sample (Z and t), Two Sample independent and dependent (Z and t) test with Examples. F-test for Variance.

ANOVA and Experimental Designs. Assumptions of ANOVA. Assignable and Non assignable Factors. Analysis of One-way Classified Data. Basic Examples of Experimental Designs. Terminologies. Completely Randomized Design (CRD).

Practical

Diagrammatic and Graphical representation of data. Calculation of A.M., Median and Mode (Ungrouped and Grouped data). Calculation of S.D. and C.V. (Ungrouped and Grouped data). Correlation and Regression analysis. Application of Z and t-test (one sample, two sample independent and dependent). Analysis of variance one-way

classification. CRD. Selection of random sample using simple random sampling.

Learning Outcome:

It is expected that the students will be equipped with basic statistical tools used for analyzing data sets and will be able to draw valid conclusion supported by statistical philosophy.

Suggested readings

- Agriculture and Applied Statistics-I by P.K. Sahu, Kalyani Publishers.
- Agriculture and Applied Statistics-II by P. K. Sahu and A. K. Das, Kalyani Publishers.
- Agricultural Statistics by S.P. Singh and R.P.S. Verma, Rama Publishing House.
- Basic Statistics by B. L. Agarwal, New Age International Publishers.
- Fundamentals of Applied Statistics by S.C. Gupta and V. K. Kapoor, Sultan Chand and Sons.
- Fundamentals of Statistics by D. N. Elhance, Kitab Mahal Publishers.
- Probability and Statistical Inference by D. Bhattacharya and S. Roychowdhury, 3rd ed. U.N. Dhur and Sons
- Statistics: Theory and Practice by D. Bhattacharya and S. Roychowdhury, 4th ed. U.N. Dhur and Sons

STAT 312 Statistical Technique 3(2+1)

Objective

This course is meant for students who have some knowledge of Statistics. It would help them in understanding the concepts involved in data presentation, their analysis and interpretation. The students would also get to know about how to describe and present data, various probability distributions, concept of drawing a good sample from the population.

Theory

Random Variable, Probability mass function. Probability density function. Mathematical Expectation, Moment generating function. Cumulant generating function. Probability Distributing: Negative Binomial, geometric, Uniform, Normal, Exponential, Gamma and Beta; Sampling Distributions: Chi-square, t and F test.

Concept of sampling; Sampling versus complete enumeration, Sample random sampling: SRSWAR and SRSWOR; Estimation of population proportion; Inverse sampling; Stratified Random Sampling; Concept of Systematic Sampling; Cluster Sampling; Sampling with varying probabilities.

Practical

Fitting of Binomial, Poisson, Normal distributions; Selection of a random sample, estimation using simple random sampling, drawing a PPS with replacement sample, Exercises on inverse sampling; Stratified Sampling; Cluster Sampling and Systematic Sampling.

Learning Outcome:

It is expected that the students will be equipped with basic statistical tools used for analysing data sets and will be able to draw valid conclusion supported by statistical mechanism.

STAT 321 Design in Agricultural Experiment 3(2+1)

Objective

This course is designed to give a comprehensive knowledge on how to design a study or experiment so that the results of the experiments are free from errors or biases, and then how to draw a valid conclusion using the results so obtained. In this context, laying out of different agricultural field experiments will also be covered. Designing an experiment is an integrated component of research in almost all sciences

Theory

Basic principles of design of experiments; Uniformity trials; Basic of design; Basic concepts of factorial experiments: Simple factorial with concept of confounding; Split plot and Strip plot designs, Analysis of covariance (CRD & RCBD); Missing plot techniques.

Practical

Analysis of data obtained from CRD, RBD, LSD; Analysis of factorial experiments (2^3 and 2^4 experiments). Analysis of Split plot and Strip plot experiment in RBD; Analysis with missing plot data in RBD and LSD; Analysis of covariance (RBD)

Learning Outcome

The students would be exposed to various concepts of designing an experiments so as to enable them understand the science involved in planning, designing their research experiments and how to make analysis of different experimental data.