

F.Y.BA (Statistics) Syllabus w.e.f. 2018-19

ST-101 DESCRIPTIVE STATISTICS

Total Clock Hours: 45

Credits: 03

1. INTRODUCTION TO STATISTICS (2L)

- 1.1 Meaning of Statistics: numerical information, science, decision making science, general definition of Statistics as science.
- 1.2 Scope of Statistics: In the field of Industry, Biological Sciences, Medical Sciences, Economics Sciences, Social Sciences, Management Sciences, Agriculture, Insurance, Information Technology, Education and Psychology. Importance of quantification, scope of statistical methods.
- 1.3 Statistical institutes and organizations: ISI, NSS, Bureau of Economics and Statistics in States, Indian Institute of Population Sciences(IIPS).
- 1.4 Limitations of statistics.

2. CONCEPT OF POPULATION AND SAMPLE (3L)

- 2.1 Population, statistical population, census, sample, sampling.
- 2.2 Objectives of sampling. Advantages of sampling over census.
- 2.3 Methods of sampling; Simple random sampling with and without replacement, Stratified sampling and Systematic sampling.
- 2.4 Illustrations from real life situations.

3. PRESENTATION OF DATA (5L)

- 3.1 Meaning of data, Raw data, and Qualitative and Quantitative data.
- 3.2 Attributes and Variables, continuous and discrete variables.
- 3.3 Primary data and Secondary data.
- 3.4 Sources of secondary data.
- 3.5 Measurement scales: nominal, ordinal, ratio and interval scales.
- 3.6 Illustrations from real world situations.
- 3.7 Tabular presentation of data:- Meaning of table, Parts of table and construction of table(up to three factors of classification)
- 3.8 Diagrammatic representation of data: simple, Multiple and subdivided bar diagrams, pie diagram.

- 3.9 Frequency distribution: - Meaning of frequency, class, exclusive and inclusive classes, Open-end classes, class width, mid-value, class boundaries and limit, relative frequency.
- 3.10 Cumulative frequency distribution: less than, more than type.
- 3.11 Guidelines for construction of classes, Sturges formula.
- 3.12 Graphical representation of data:-Histogram (equal and unequal classes), Frequency curve, Frequency Polygon, ogives, stem & leaf chart.
- 3.13 Check sheet and Pareto diagram.

4. MEASURES OF CENTRAL TENDENCY (LOCATION) (7L)

- 4.1 Meaning of central tendency of data, objectives, and requirements of a good measure of Central Tendency.
- 4.2 Arithmetic mean (A.M.): Definition, effect of change of origin and scale, sum of deviations from A.M., combined mean for k groups, merits and demerits.
- 4.3 Geometric mean (G.M.): Definition, merits, demerits and its uses.
- 4.4 Harmonic Mean (H.M.): Definition, merits and demerits, uses
- 4.5 Median: Definition, computation formula(without derivation), graphical method of determining median, merits and demerits,
- 4.6 Mode: Definition, computation formula(without derivation), graphical method of determining median, merits and demerits,
- 4.7 Weighted Means: A.M., G.M., H.M.
- 4.8 $A.M. > G.M. > H.M.$ (for 2 and 3 values)
- 4.9 Trimmed mean
- 4.10 Use of appropriate measure of central tendency in different situation.
- 4.11 Empirical relation among mean, median and mode.
- 4.12 Partition values:-Quartiles, deciles, & percentiles (Definition and Computation for ungrouped and grouped data). Box plot.
- 4.13 Examples and problems.

5. MEASURES OF DISPERSION (6L)

- 5.1 Meaning of Dispersion of data and objective. Requirements of a good measure of dispersion.
- 5.2 Range .Definition, Merits and Demerits, uses.
- 5.3 Quartile Deviation (Q.D.): Definition, computation, merits and demerits.

- 5.4 Mean deviation (M.D.), Definition, computation, merits and demerits Minimal Property of Mean Deviation without proof .
- 5.5 Mean Squared Deviation. Definition, Minimal property with proof, Variance and Standard deviation.
- 5.6 Properties of variance and Standard Deviation i) Combined Variance and Standard deviation for two groups (with proof) and its extension for k groups ii).Effect of change of origin and scale iii) $S.D. \geq M.D.$
- 5.7 Absolute and relative measures of dispersion :Coefficient of range, Coefficient of Q.D., Coefficient of M.D., Coefficient of variation (C.V.), Uses Of C.V.
- 5.8 Examples and problems.

6. MOMENTS (2L)

- 6.1 Raw & central moments with Sheppard's correction; Effect of change of origin and scale on central moments.
- 6.2 Moments about an arbitrary constant for grouped and ungrouped data.
- 6.3 Relation between central moments and raw moments (up to 4-th order).

7. SKEWNESS AND KURTOSIS (4L)

- 7.1 Concept of Skewness of a frequency distribution; Positive and negative skewness, symmetric frequency distribution
- 7.2 Bowley's coefficient of skewness, Limits of Bowley's coefficient of skewness
- 7.3 Karl Pearson's coefficient of skewness.
- 7.4 Kurtosis: Meaning, Types of Kurtosis:-leptokurtic, mesokurtic & platykurtic.
- 7.5 Measures of skewness and kurtosis based on moments.
- 7.6 Examples and Problems.

8. CORRELATION (8L)

- 8.1 Bivariate data. Ungrouped and grouped.
- 8.2 Meaning of correlation between two variables, positive & negative correlation,
- 8.3 Scatter diagram, Construction of scatter diagram and interpretation.
- 8.4 Covariance between two variables: Definition, Effect of change of origin and scale
- 8.5 Product moment correlation (Karl Pearson's correlation coefficient) and its properties, interpretation.
- 8.6 Rank correlation: Spearman's rank correlation coefficient, derivation of the formula of rank correlation coefficient (without ties).Rank correlation with ties

8.7 Simple numerical examples and problems.

9. REGRESSION

(8L)

9.1 Meaning of regression, concept of linear and non-linear regression.

9.2 Concept of method of least squares.

9.3 Linear regression: Fitting of lines of regression by method of least squares.

9.4 Regression coefficients and their properties (statement and proof).

9.5 Angle between the two lines of regression.

9.6 Standard error of regression estimate.

9.7 Explained and unexplained variation and coefficient of determination.

9.8 Non-linear regression: Fitting of non-linear curves of the following type

$$(i) y = a + bx + cx^2 \quad (ii) y = ax^b \quad (iii) y = ab^x$$

9.9 Examples and problems.

BOOKS FOR REFERENCE:

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1996): Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
3. Goon, A. M., Gupta, M. K. and Dasgupta, B. (2002). Fundamentals of Statistics, Vol. I and II, 8th Edition, the World Press Pvt. Ltd., Kolkata.
4. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
5. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
6. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
7. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
8. Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press.
9. Montgomery, D. C; Peck, E. A.; Vining, G. G. (2006). Introduction to Linear Regression Analysis, John Wiley and Sons.

ST-201 PROBABILITY AND PROBABILITY DISTRIBUTIONS

Total Clock Hours: 45

Credits: 03

1. SAMPLE SPACE AND EVENTS (6L)

- 1.1 Meaning of experiment, random experiment, deterministic and non-deterministic models.
- 1.2 Definitions of the following terms:- Outcome , sample space (finite and infinite), discrete sample space, Event, Elementary event, Compound event, Complementary event, Favorable event, Equally-likely events, Sure event, Impossible event.
- 1.3 Concept of occurrence of an event
- 1.4 Union and intersection of two or more events
- 1.5 Exhaustive events, Mutually exclusive events
- 1.6 Representation of sample space and events by Venn diagram
- 1.7 Occurrence of (i) at least one of the given events (ii) all of the given events (iii) none of the given events.
- 1.8 Examples and problem

2. PROBABILITY (For finite sample space only) (10L)

- 2.1 Theory of Permutation and Combinations
- 2.2 Equiprobable sample space, probability of an event, certain event, impossible event, classical definition of probability and its limitations, relative frequency approach.
- 2.3 Non-equiprobable sample space, probability with reference to a finite sample space: probability assignment approach, probability of an event.
- 2.4 Axioms of probability
- 2.5 Probability of union of two events, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ and its generalization to three events (with proof).
- 2.6 Following results with proof
 - (i) $P(A') = 1 - P(A)$
 - (ii) If $A \subseteq B$, then $P(A) \leq P(B)$
 - (iii) $P(\cup_{i=1}^n A_i) \leq \sum_{i=1}^n P(A_i)$
- 2.7 Examples and problems.

3. CONDITIONAL PROBABILITY AND INDEPENDENCE

(6L)

- 3.1 Independence of events, pair wise and mutual independence for three events.
- 3.2 Conditional probability of an event
- 3.3 Multiplication theorem of probability (with proof)
- 3.4 Partition of sample space.
- 3.5 Theorem of total probability with proof.
- 3.6 Bayes' theorem (with proof)
- 3.7 Examples and problems.

4. UNIVARIATE PROBABILITY DISTRIBUTION

(8L)

- 4.1 Concepts and definition of discrete random variable.
- 4.2 Probability mass function of a discrete random variable.
- 4.3 Distribution functions of a discrete random variable.
- 4.4 Statement of properties of a distribution function.
- 4.5 Concept of symmetric random variable.
- 4.6 Median and mode of a discrete random variable.
- 4.7 Definition of Expectation of discrete random variable.
- 4.8 Function of random variable.
- 4.9 Examples and problems.

5. SOME STANDARD DISCRETE PROBABILITY DISTRIBUTIONS

(15L)

- 5.1 Discrete Uniform distribution on integers 1 to n : p.m.f., c.d.f., mean, variance of Uniform distribution, real life situations, comment of mode and median.
- 5.2 Bernoulli distribution, Its p.m.f., mean, variance, moments, distribution of sum of independent and identically distributed Bernoulli variables.
- 5.3 Binomial Distribution : Its p.m.f.,

$$P(X = x) = \begin{cases} \binom{n}{x} p^x q^{n-x} ; & x = 0, 1, 2, \dots, n. \quad p \in (0,1) \text{ and } q = 1 - p \\ 0 ; & \text{otherwise} \end{cases}$$

Notation $X \sim B(n, p)$

Recurrence relation for successive probabilities, computation of probabilities of different events, computation of median for given parameters, mode of the distribution.

- 5.4 Mean, variance, moments, skewness (comments when $p = 0.5, p > 0.5, p < 0.5$), p.g.f., additive property of binomial variables, conditional distribution of X given $X + Y$, where X and Y are independent, $B(n_1, p)$ and $B(n_2, p)$ variables.

5.5 Hypergeometric Distribution: Its p.m.f.,

$$P(X = x) = \begin{cases} \frac{\binom{M}{x} \binom{N-M}{n-x}}{\binom{N}{n}} & ; x = a, a + 1, \dots, b \\ 0 & ; \text{ otherwise} \end{cases}$$

Where, $a = \max(0, n - N + M)$ and $b = \min(n, M)$

Computation of probability, situations where this distribution is applicable, binomial approximation to hypergeometric probabilities, mean and variance of the distribution.

5.6 Poisson Distribution: Its p.m.f., $P(X = x) = \begin{cases} \frac{e^{-\lambda} \lambda^x}{x!} & ; x = 0, 1, 2, \dots \quad \lambda > 0. \\ 0 & ; \text{ otherwise} \end{cases}$

Statement of Mean, Variance and additive Property (without derivation). Derivation of Poisson distribution as a limiting case of binomial distribution.

5.7 Examples and problems.

BOOKS FOR REFERENCE:

1. Agarwal B. L. (2003). Programmed Statistics, 2nd edition, New Age International Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Hogg, R. V. and Craig R. G. (1989). Introduction to Mathematical Statistics, Ed. 4. MacMillan Publishing Co., New York.
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6. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing, Inc.
7. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
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