University of Pune

F.Y.B.A. (36) STATISTICS

Paper I –Descriptive Statistics

Proposed syllabus for the above mentioned course to be implemented from the Academic Year 2010-11 onwards

Note: Mathematical derivations and proofs are not expected:

Objective:

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 measurements of central tendency, dispersion, skewness and kurtosis.

(ii) To compute the correlation coefficient from ungrouped bivariate data and interpret them.

(iii) To analyze data pertaining to attributes and to interpret results.

(iv) To apply statistics in economics

(v) To analyze data pertaining to Time Series and to interpret the results.

1. Introduction to Statistics: (4)

1.1 Definitions: Webster's and Secrist's definition of Statistics.

1.2 Importance of Statistics.

1.3 Scope of Statistics: In the field of Industry, Biological Sciences, Medical Sciences, Economics Sciences, Social, Sciences, Management Sciences, Agriculture, Insurance, Actuarial Science, Education and Psychology.

1.4 Statistical organizations in India and their functions: CSO, ISI, NSS, IIPS (Devnar, Mumbai), Bureau of Economics and statistics.

2. Population and Sample (5)

2.1 Types of characteristics:

Attributes: Nominal scale, ordinal scale. Variables: Interval scale, ratio scale, discrete and continuous variables.

2.2 Types of data: Primary data, Secondary data.

2.3 Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population. Notion of sample, random sample and non-random sample.

2.4 Methods of sampling: Simple random sampling with and without replacement (SRSWR and SRWOR) stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.

3. Presentation of Data (5)

3.1 Classification: Raw data and its classification, Discrete frequency distribution, Sturge's rule, continuous frequency distribution, inclusive and exclusive methods of classification, Open end classes, cumulative frequency distribution and relative frequency distribution.

3.2 Graphical Presentation of Data: Histogram, frequency curve, frequency polygon, ogive curves, stem and leaf chart.

3.3 Check sheet, Parato diagram.

3.4 Examples and Problems.

4. Measures of Central Tendency (14)

4.1 Concept of central tendency of statistical data: Statistical average, characteristics of a good statistical average.

4.2 Arithmetic Mean (A.M.) Definition, effect of change of origin and scale, combined mean of a number of groups, merits and demerits.

4.3 Geometric Mean (G.M.) Definition, merits and demerits.

4.4 Harmonic Mean (H.M.) Definition, merits and demerits.

4.5 Weighted Mean: Weighted A.M., G.M. and H.M.

4.6 Mode: Definition, formula for computation (with derivation) graphical method of determination of mode, merits and demerits.

4.7 Median: Definition, formula for computation (with derivation) graphical method of determination of median, merits and demerits.

4.8 Empirical relation between mean, median and mode. Order relation between arithmetic mean, geometric mean, harmonic mean (proof for $n = 2$).

4.9 Partition Values: Quartiles, Deciles and Percentiles, Box Plot, Percentile ranks.

4.10 Situations where one kind of average is preferable to others.

4.11 Examples and Problems.

5. Measures of Dispersion (13)

5.1 Concept of dispersion, characteristics of good measure of dispersion.

5.2 Range: Definition, merits and demerits.

5.3 Semi-interquartile range (Quartile deviation).

5.4 Mean deviation: Definition, merits and demerits, minimality property (without proof).

5.5 Mean square definition: Definition, minimality property of mean square deviation (with proof), Variance and standard deviation: Definition, merits and demerits, effect of change of origin and scale, Combined variance (derivation for 2 groups), Combined standard deviation, generalization for n groups.

5.6 Measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation (C.V.)

5.7 Examples and Problems.

6. Moments (7)

6.1 Raw moments (m_r') for grouped and ungrouped data.

6.2 Moments about an arbitrary constant for grouped and ungrouped data $m_r(a)$.

6.3 Central moments (m_r) for grouped and ungrouped data, Effect of change of origin and scale, Sheppard's correction.

6.4 Relations between central moments and raw moments (upto 4-th order).

7. Skewness and Kurtosis (8)

7.1 Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution.

7.2 Bowley's coefficient of skewness: Proof of Bowley's coefficient of skewness lies between −1 to 1, interpretation using Box plot.

7.3 Karl Pearson's coefficient of skewness.

7.4 Measures of skewness basked on moments (β_1, γ_1).

7.5 Concepts of kurtosis, leptokurtic, mesokurtic and platykurtic frequency distributions.

7.6 Measures of kurtosis based on moments, (β_2, γ_2).

7.7 Examples and Problems.

End of First Term

8. Correlation (10)

8.1 Bivariate data, bivariate frequency distribution.

8.2 Concept of correlation between two variables, positive correlation, negative correlation.

8.3 Scatter diagram, conclusion about the type of correlation from scatter diagram.

8.4 Covariance between two variables (m_{11}): Definition, computation, effect of change of origin and scale.

8.5 Karl Pearson's coefficient of correlation (r): Definition, computation for grouped and ungrouped data and interpretation.

Properties: (i) $-1 \le r \le 1$ (with proof), (ii) Effect of change of origin and scale (with proof).

8.6 Spearman's rank correlation coefficient: Definition, computation and interpretation (without ties), Spearman's rank correlation coefficient (derivation of formula in case of without ties). In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)

8.7 Examples and Problems.

9. Regression (15)

9.1 Concept of regression, lines of regression, fitting of lines of regression by the least squares method, interpretation of slope and intercept.

9.2 Regression coefficient (b_{yx}, b_{xy}): Definition, computation, properties (with proof). (1) $b_{yx}.b_{xy} = r^2$ (2) $b_{yx}.b_{xy} \le 1$ (3) $b_{yx} = r\,\sigma_y/\sigma_x$, $b_{xy} = r\,\sigma_x/\sigma_y$, (4) Effect of change of origin and scale, (5) Angle between the two lines of regression.

9.3 Mean residual sum of squares (s.s.) = $\dfrac{\sum (y_i - \hat{y}_i)^2}{n-2}$, Residual plot and its interpretation.

9.4 Explained and unexplained variation, coefficient of determination.

9.5 Non-linear regression: (1) Second degree curve, (2) Exponential curve of type $y = ab^x$, fitting of such curves by the least square method, (3) Logistic curve $y = \dfrac{K}{1+\exp(a+bx)}$; Interpretation of $b < 0$, $b > 0$. Illustrations of logistic curve. (Fitting of logistic curve is not expected). Mean residual s.s. as a criteria to decide the best fit of the curve.

9.6 Examples and Problems.

10. Theory of Attributes (13)

10.1 Attributes: classification, notion of manifold classification, dichotomy, class-frequency, order of class, positive class-frequency, negative class frequency,

quantra class frequencies, ultimate class frequency, relationship among different class frequencies (up to three attributes), dot operator to find the relation between frequencies, fundamental set of class frequencies.

10.2 Consistency of data upto 3 attributes.

10.3 Concepts of independence and association of two attributes.

10.4 Yule's coefficient of association (Q), $-1 \leq Q \leq 1$, interpretation.

10.5 Examples and Problems.

11. Applications of Statistics in Economics (18)

11. Index Numbers

11.1 Introduction

11.2 Definition and Meaning

11.3 Points to be considered in construction of Index numbers.

11.4 Simple and weighted price index numbers.

11.5 Laspeyre's, Passche's and Fisher's Index numbers.

11.6 Description of following index numbers; CPI, BSE, SENSEX.

11.7 Examples and Problems.

Reference Books

1. Goon Gupta and Das Gupta: **Fundamentals of Statistics**, Vol. 1, The World Press Pvt. Ltd., Kolkata.

2. Miller and Fruend: **Modern Elementary Statistics**.

3. Snedecor and Cochran: **Statistical Methods,** Oxford and IBH Publishers.

4. Mukhopadhyay, P: **Mathematical Statistics** (1996), New Central Book Agency, Calcutta, **Introduction to Mathematical Statistics**, Ed. 4 (1989), MacMillan Publishing Co. New York.

5. Gupta and Kapoor: **Fundamentals of Mathematical Statistics**, Sultan Chand and Sons, New Delhi.

6. Neil Weiss: **Introductory Statistics**: Pearson Publishers

9. Gupta and Kapoor: **Fundamentals of Applied Statistics,** Sultan Chand

and Sons, New Delhi.

10. Amir D. Aczel and Jayael Soundarpandiyan, **Complete Business Statistics** : McGraw Hill Education (6th Edition).
11. B. L. Agarwal: **Programmed Statistics**, New Age International Publishers, New Delhi.
12. D. C. Montgomory **Introduction to Statistical Quality Control**, Wiley Eastern Publishers.
13. Sarma, K V S: **Statistics made simple, Do it Yourself on PC,** Prentice Hall, New Delhi

(37) Mathematical Statistics

Paper I-Discrete Probability and Probability Distributions

Objectives:

The main objective of this course is to introduce to the students the basic concepts of probability; axiomatic probability, concepts of random variables, probability distributions of discrete random variables, expectation and moments of a probability distribution.

By the end of the course students are expected to be able"

(i) to distinguish between random and non-random experiments.

(ii) To find the probabilities of events.

(III) to obtain a probability distribution of a random variable in the given situation and

(iv) to apply the standard discrete probability distribution to different real life situations.

Paper - I: Discrete Probability and Probability Distributions

Prerequisites: Permutation and Combination theory, Binomial theorem, Algebra of sets.

1. Sample Space and Events (8)

1.1 Experiments, Ideas of deterministic and non-deterministic models.

1.2 Definitions of (i) Sample space, (ii) Discrete sample space: finite and countably infinite, (iii) Event, (iv) Elementary event, v) Certain event,

(vi) Impossible event, (vii) Complement of an event.

1.3 Concepts of occurrence of an event.

1.4 Algebra of events and its representation in set theory notations.

Occurrence of

(i) at least one of the given events,

(ii) none of the given events,

(iii) all of the given events,

(iv) mutually exclusive events,

(v) mutually exhaustive events,

(vi) exactly one event out of the given events.

1.5 Examples and Problems.

2. Probability (for finite sample space only) (10)

2.1 Equiprobable sample space, probability of an event, classical definition of probability and its limitations, relative frequency approach.

2.2 Unequiprobable sample space, probability with reference to a finite sample space: probability assignment approach, probability of an event.

2.3 Axioms of probability.

2.4 Probability of union of two events. Theorem of total probability

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ and its generalization to three events (with proof).

2.5 To prove

(i) $P(A') = 1 - P(A)$, (ii) If $A \subset B$, $P(A) \leq P(B)$,

(ii) (iii) $P(\bigcup_{i=1}^{k} A_i) \leq \sum_{i=1}^{k} A_i$ (Boole's inequality).

2.6 Examples and Problems.

3. Conditional Probability and Independence (12)

3.1 Definition of independence of two events

$P(A \cap B) = P(A) \times P(B)$

3.2 Pairwise independence and mutual independence for three events.

3.3 Definition of conditional probability of an event.

3.4 Multiplication theorem $P(A \cap B) = P(A) \cdot P(B/A)$. Generalisation $P(A \cap B \cap C)$.

3.5 Bayes' Theorem (with proof).

3.6 Examples and Problems.

4. Univariate Probability Distributions (12)

4.1 Concept and definition of a discrete random variable.

4.2 Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), $F(\cdot)$ of discrete random variable properties of (c.d.f.).

4.3 Mode and median of a univariate discrete probability distribution.

4.4 Examples and Problems.

5. Mathematical Expectation (Univariate Random Variable) (12)

5.1 Definition of expectation of a random variable, expectation of a function of a random variable.

5.2 Definitions of mean, variance of univariate probability distribution, effect of change of origin and scale on mean and variance.

5.3 Probability generating function (PGF), Simple properties, mean and variance using PGF.

5.4 Definition of raw, central and factorial moments of univariate probability distributions and their interrelations.

5.5 Examples and Problems.

End of Term

6. Bivariate Probability Distribution (defined on Finite Sample Space) (14)

6.1 Definition of two-dimensional discrete random variable, its joint p.m.f. and its distribution function and their properties.

6.2 Computation of probabilities of events in bivariate probability distribution.

6.3 Concepts of marginal and conditional probability distributions.

6.4 Independence of two discrete random variables.

6.5 Examples and Problems.

7. Mathematical Expectation (Bivariate Random Variable) (14)

7.1 Theorems on expectations of sum and product of two jointly distributed random variables.

7.2 Conditional expectation.

7.3 Definitions of conditional mean and conditional variance.

7.4 Definition of covariance, correlation of coefficient (ρ), independence and uncorrelatedness of two variables.

7.5 Variance of linear combination of variables.

7.6 Examples and Problems.

8. Some Standard Discrete Probability Distribution (28)

8.1 Uniform discrete distribution on integers 1 to n: - p.m.f., mean, variance, real life situations. **(3)**

8.2 Bernoulli distribution: p. m. f., mean variance, moments distribution of sum of independent identically distributed Bernoulli variables. **(3)**

8.3 Binomial distribution: Notation: $X \sim B(n, p)$. **(10)**

p. m. f: $P(x) = {}^{n}C_{x}\, p^{x} q^{n-x}$; for $x = 0, 1 \cdot \cdot \cdot, n, 0 \le p \le 1, q = 1 - p$

$= 0$ otherwise

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

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.

8.4 Hypergeometric Distribution: p. m. f., **(6)**

$p(x) = {}^{M}C_{x}\,{}^{N-M}C_{n-x} / {}^{N}C_{n}$ for , x= a, a+1, …, min(n ,M), where a = max(0, n – N+M),

= 0, otherwise

Notation: $X \sim H(N, M, n)$.

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

8.5 Poisson Distribution: p.m.f. $p(x) = \frac{e^{-m}m^{x}}{x!}$, $x = 0, 1, 2, \cdots; m > 0$. **(6)**

State the mean, variance, additive property (no derivation); derivation of Poisson distribution as a limiting case of binomial distribution.

8.6 Example and Problems.

Reference Books

1. Hogg, R. V. and Craig R. G.: **Introduction to Mathematical Statistics,** Ed. 4. (1989), MacMillan Publishing Co., New York.

2. Hoel, P. G.: **Introduction to Mathematical Statistics** (1962), John Wiley and Sons, New York.

3. Feller, W.: **Introduction to Probability Theory and Its Applications,** Vol.I , (1963), Asian Publishing House, Bombay.

4. Mood, A. M. and Graybill, F. A. and Boes D.C. E.: **Introduction to Theory of Statistics**, Ed. 3 (1974), McGraw Hill and Kagakusha Ltd. London.

5. Mayer, P. N.: **Introduction to Probability and Statistical Applications,** Addison Wesley Publishing Co., Massachusetts).16

6. Gupta and Kapoor: **Fundamentals of Mathematical Statistics,** Sultan Chand and Sons, New Delhi.

7. Sheldon Ross: **Probability theory,** Pearson Publishers.

8. M. B. Kulkarni and S. B. Ghatpande: **Discrete Probability and Probability Distributions**, SIPF Academy, Nashik.

9. B. L. Agarwal: **Programmed Statistics**, New Age International Publishers, New Delhi.

On line List of References of Websites:

1. www.stats.unipune.ernet.in **100 Data sets for Statistics Education** by Dr Anil P. Gore, Dr. Mrs. S. A. Paranjpe and Madhav B. Kulkarni available in ISPS folder).
2. www.freestatistics.tk
3. www.psychstat.smsu.edu/sbk00.htm
4. www.bmj.bmjournals.com/collections/statsbk/index.shtml
5. www.statweb.calpoly.edu/bchance/stat-stuff.html
6. www.amstat.org/publications/jse/jse-data-archive.html
7. www.statpages.org (Webpages that perform statistical calculations)
8. www.amstat.org/publications/chance (Chance magazine)
9. www.statsci.org/datasets.html (Data sets)
10. www.math.uah.edu/stat (Virtual laboratories in Statistics)
11. www.amstat.org/publications/stats (STATS: the magazine for students of Statistics)
12. www.stat.ucla.edu/cases (Case studies in Statistics)

University of Pune

F.Y.B.A.

(38) Applied Statistics

Paper I: Descriptive Statistics

Proposed syllabus for the above mentioned course to be implemented from the Academic

Year with effect from 2008-09

Note: Mathematical derivations and proofs are not expected:

Objective:

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 measurements of central tendency, dispersion, skewness and kurtosis.

ii) to compute the correlation coefficient from ungrouped bivariate data and interpret them.

iii) to analyze data pertaining to attributes and to interpret results.

iv) to analyze data pertaining to Time Series and to interpret the results.

Revised Syllabus for F.Y.B.A.

(38) Applied Statistics

Paper I: Descriptive Statistics

First Term

1. Population and Sample: (6)
   1.1 Types of characteristics
   Attributes: Nominal scale and ordinal scale
   Variable: Interval scale, ratio scale. Discrete and continuous variables, raw data
   1.2 Types of data – primary data and secondary data
   1.3 Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population. Notion of a sample, random sample and non-random sample.
   1.4 Methods of sampling: Simple random sampling with and without replacement (SRSWR & SRSWOR), Stratified random sampling.
2. Presentation of Data: (14)
   2.1 Classification: Discrete frequency distribution, Inclusive and Exclusive methods of classification, open-end classes, Cumulative frequency distributions and Relative frequency distribution.
   2.2 Graphical presentation of data, Histogram, frequency curve, Ogive curves, Stem and leaf chart.

2.3 Diagramatic presentation:
Bar diagram, Percentage Bar diagram, Multiple Bar-diagram, Subdivided Bar-diagram, Pie-diagram

2.4 Simple numerical problems.

3. Measures of Central Tendency (18)

3.1 Concepts of central tendency of statistical data, statistical average, characteristics of a good statistical average.

3.2 Arithmetic Mean (A.M.) Definition, Effects of change of origin and scale, Combined mean of two 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 Weighted Mean: Weighted A.M.

3.6 Mode: Definition, formula for computation, graphical method of determination of mode, Merits and Demerits.

3.7 Median: Definition, formula for computation, graphical method of determination of median, Merits and Demerits.

3.8 Partition values: Quartiles, Deciles and percentile, graphical method of determination of quatiles, deciles and percentiles for grouped frequency distibutions.

3.9 Simple numerical problems.

4. Measures of Dispersion (12)

4.1 Concepts of dispersion, characteristics of good measure of dispersion

4.2 Range: definition, Merits and Demerits

4.3 Semi-interquartile range (Quartile deviation), Merits and Demerits

4.4 Mean deviation: definition, Merits and demerits

4.5 Mean square deviation: Definition,
Variance and Standard deviation (S.D.): Definition,
Merits and Demerits

4.6 Absolute and Relative measures of dispersion,

Coefficient of variation (C.V.)

4.7 Simple numerical problems.

5. Moments: (6)

5.1 Raw moments (m_r') for ungrouped and grouped data upto order 4

5.2 Central moments(m_r) for ungrouped and grouped data upto order 4, Effects of change of origin and scale.

5.3 Relation between central and raw moments upto order 4.

5.4 Simple numerical problems.

End of First Term

6.Skewness and Kurtosis (12)

6.1 Concept of skewness of frequency distribution, postive skewness, negative skewness, symmeric frequency distribution.

6.2 Bowley's coefficient of skewness, interpretation using Box Plot.

6.3 Karl Pearson's coefficient of skewness

6.4 Measures of skewness based on moments

6.5 Concepts of Kurtosis, Leptokurtic, Mesokurtic and Platykurtic frequency distribution

6.6 Obtaining measures of Kurtosis based on moments

6.7 Simple numerical problems

7. Correlation (14)

7.1 Bivariate data

7.2 Concepts of correlation between two variables, positive correlation, negative correlation

7.3 Scatter diagram, conclusion about the type of correlation from scatter diagram

7.4 Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped data and interpretation. Statement of properties:

(i) $-1 \leq r \leq +1$; (ii) Effects of change of origin and scale

7.5 Spearman's rank correlation coefficient: Definition, computation and

interpretation (without ties)

7.6 Simple numerical problems

8. Regression (10)

8.1 Concept of regression, linear of regression, interpretation of slope and i Intercept

8.2Regression coefficient (b_{yx} , b_{xy}): Definition, computation, statement of properties: (i) $b_{yx} . b_{xy} = r^2$; (ii) $b_{yx} . b_{xy} \leq 1$ (iii) Effect of change of origin and scale

8.3 Simple numerical problems

9. Theory of Attributes (10)

9.1 Attributes: Classification, Notion of dichotomy and manifold classification, class-frequency, order of class, positive class-frequency, negative class-frequency, ultimate class-frequency, relationship among class-fequencies of different order (upto three attributes), dot operator, Fundamental set of class frequencies.

9.2 Consistency of data upto 3 attributes

9.3 Concepts of independence and association of two attribtes

9.4 Yule's coefficient of association (Q)

9.5 Simple numerical problems.

10. Time Series (10)

10.1 Meaning of Time Series

10.2 Various components of a time series (Explanation and illustrations of each component)

10.3 Additive and Multiplicative methods for analysis of a time series

10.4 Methods of estimating trends

(i) Freehand or Graphical method

(ii) Method of least square

(iii) Method of semi-averages

(iv) Method of moving averages

10.5 Simple numerical problems.

##########

University of Pune

F.Y.B.A.

(40) STATISTICAL PRE-REQUISITES

Proposed syllabus for the above mentioned course to be implemented from the Academic Year 2008-09 onwards

The course in 'Statistical Pre-requisites' may be offered only by candidates, offering one of the Social Sciences as their Special subject at the B.A. Degree Examination.

The Course in 'Statistical Pre-requisites' cannot be offered by those who offer any of the Course in Statistics Group for their B.A Examination.

Note: Mathematical derivations and proofs are not expected:

Objective:

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 measurements of central tendency, dispersion, skewness and kurtosis.

(ii) To compute the correlation coefficient from ungrouped bivariate data and interpret them.

(iii) To analyze data pertaining to attributes and to interpret results.

(iv) To analyze data pertaining to Index Numbers and to interpret the results.

Revised Syllabus for F.Y.B.A.

(40) STATISTICAL PRE-REQUISITES

First Term

1 Population and Sample: (8)

1.1 Types of characteristics

Attributes: Nominal scale and ordinal scale

Variable: Interval scale, ratio scale. Discrete and continuous variables, raw data

1.2 Types of data – primary data and secondary data

1.3 Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population. Notion of a sample, random sample and non-random sample.

1.4 Methods of sampling: Simple random sampling with and without replacement (SRSWR & SRSWOR), Stratified random sampling.

2 Presentation of Data: (12)

2.1 Classification: Discrete frequency distribution, Inclusive and Exclusive methods of classification, Open-end classes, Cumulative frequency distributions and Relative frequency distribution.

2.2 Graphical presentation of data, Histogram, frequency curve, Ogive curves, Stem and leaf chart.

2.3 Simple numerical problems.

3. Measures of Central Tendency (16)

3.1 Concepts of central tendency of statistical data, statistical average, characteristics of a good statistical average.

3.2 Arithmetic Mean (A.M.) Definition, Effects of change of origin and scale, Combined mean of two 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 Weighted Mean: Weighted A.M.

3.6 Mode: Definition, formula for computation, graphical method of determination of mode, Merits and Demerits.

3.7 Median: Definition, formula for computation, graphical method of determination of median, Merits and Demerits.

3.8 Partition values: Quartiles, Deciles and percentile, graphical method of determination of quatiles, deciles and percentiles for grouped frequency distibutions.

3.9 Simple numerical problems.

4. Measures of Dispersion (!4)

4.1 Concepts of dispersion, characteristics of good measure of dispersion

4.2 Range: definition, Merits and Demerits

4.3 Semi-interquartile range (Quartile deviation), Merits and Demerits

4.4 Mean deviation: definition, Merits and demerits

4.5 Mean square deviation: Definition,
Variance and Standard deviation (S.D.): Definition,
Merits and Demerits

4.6 Measures of dispersion for comparison of two distributions.
Coefficient of variation (C.V.)

4.7 Simple numerical problems.

5. Moments: (6)

5.1 Raw moments ($m_r^{/}$) for ungrouped and grouped data upto order 4

5.2 Central moments(m_r) for ungrouped and grouped data upto order 4, Effects of change of origin and scale.

5.3 Relation between central and raw moments upto order 4.

5.4 Simple numerical problems.

End of First Term

6.Skewness and Kurtosis (12)

6.1 Concept of skewness of frequency distribution, postive skewness, negative skewness, symmeric frequency distribution.

6.2 Bowley's coefficient of skewness, it's interpretation using Box Plot.

6.3 Karl Pearson's coefficient of skewness

6.4 Measures of skewness based on moments

6.5 Concepts of Kurtosis, Leptokurtic, Mesokurtic and Platykurtic frequency distribution

6.6 Obtaining measures of Kurtosis based on moments

6.7 Simple numerical problems

7. Correlation (14)

7.1 Bivariate data

7.2 Concepts of correlation between two variables, positive correlation, negative correlation

7.3 Scatter diagram, conclusion about the type of correlation from scatter diagram

7.4 Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped data and interpretation. Statement of properties:

(I) $-1 \leq r \leq +1$ (ii) Effects of change of origin and scale

7.5 Spearman's rank correlation coefficient: Definition, computation and interpretation (without ties)

7.6 Simple numerical problems

8. Regression (14)

8.1 Concept of regression, linear of regression, interpretation of slope and intercept

8.2 Regression coefficients: Definition, computation, statement of properties:

(i) $b_{yx} . b_{xy} = r^2$; (ii) $b_{yx} . b_{xy} \leq 1$ (iii) Effect of change of origin and scale

8.3 Simple numerical problems

9. Theory of Attributes (8)

9.1 Attributes: Classification, Notion of dichotomy and manifold classification, class-frequency, order of class, positive class-frequency, negative class frequency,

ultimate class-frequency, relationship among class-frequencies of different order (upto three attributes), dot operator, Fundamental set of class frequencies.

9.2 Consistency of data upto 3 attributes

9.3 Concepts of independence and association of two attributes

9.4 Yule's coefficient of association (Q)

9.5 Simple numerical problems.

10. Index Numbers (8)

10.1 Meaning of Index Numbers

10.2 Problems in constructions of index numbers

10.3 Price Index numbers

10.4 Methods of construction of index numbers (unweighted and weighted) Laspeyre's, Paasche's and Fisher's index numbers

10.5 Simple numerical problems.

Books Recommended

1. Yule G.U and Kendall M.G: **An Introduction to Theory of Statistics, Vol 1** .
2. Goon Gupta and Dasgupta: **Fundametal of Statistics** Vol.1.Ed.5. World Press,Calcutta 1986
3. Gupta S.P. **Statistical Methods**,Ed 12,Sultan Chand and sons,New Delhi
4. Gupta S.C. **Fundamentals of Statistics,** Himalaya Publishing House
5. Nabendu Pal and Sahadeb Sarkar: **Statistics Concepts and Applications,** Eastern Economy Edition,Prentice-Hall of India Pvt.Ltd., New Delhi
6. Walpole R..:**Introduction to Statistics**: Macmilan Co.New York
7. Gupta S.C. and Kapoor V.K. **Fundamental of Applied Statistics**, Ed 3,Sultan Chand and Sons,New Delhi-1987
8. Goon Gupta and Dasgupta: **Fundametal of Statistics** Vol.II.Ed.6. World Press,Calcutta 1986

***