UNIVERSITY OF PUNE

Syllabus for F.Y.B.A.

(With effect from Academic Year 2008-2009)

(36) Statistics

Paper - Descriptive Statistics

Note : Students should be introduced to MSEXCEL/Spreadsheet.

Objective : The main objective of this course is to acquaint students with some basic concepts in statistics. They will be introdeuced 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 measures of central tendency, dispersion, skewness and kurtosis.

(ii) to compute the correlation coefficient for ungrouped bivariate data and interpret it.

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

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

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(36) Statistics

1. Introduction to Statistics (4)

1.1 Meaning of Statistics as a Science.

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, Information Technology, 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, difference between linear scale and circular scale, discrete and continuous variables, raw data.

2.2 Types of data : (a) Primary data, Secondary data.

(b) Cross-sectional data, time series data, failure data, industrial data, directional 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 (Description only) : 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

3.3 Example 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 two groups, merits and demerits

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

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

4.5 Empirical relation between mean, median and mode.

4.6 Partition Values : Quartiles, Deciles and Percentiles, Box Plot, Percentile ranks. Order relation between arithmetic mean, geometric mean, harmonic mean (proof for $n = 2$).

Means of Transformed Data :

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

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

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

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 deviation : 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, Effects of change of origin and scale, Sheppard's correction.

6.4 Relations between central moments and raw moments upto order four.

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 based 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.

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8. Correlation (10)

8.1 Bivariate data, bivariate frequency distribution.

8.2 Concepts of correlation between two variables, positive correlation, negative correlation, zero 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) $-1 \leq r \leq 1$ (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, linear 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) $b_{yx} \cdot b_{xy} = r^2$, (2) $b_{yx} \cdot b_{xy} \leq 1$, (3) $b_{yx} = r\frac{\sigma_y}{\sigma_z}, b_{xy} = r\frac{\sigma_z}{\sigma_y}$, (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.) $\frac{1}{n-2}\Sigma(y_i - \hat{y}_i)^2$, residual plot and its interpretation.

9.4 Explained and unexplained variation, coefficient of determination.

9.5 Nonlinear regression : (1) Second degree curve, (2) Exponential curve of type $y = ab^x$, fitting of such curves by the least square method after logarithmic transformation, (3) Logistic curve $y = \frac{k}{1+e^{a+bz}}$, Interpretation of $b < 0, b > 0$. Illustrations of logistic curve. (Fitting of logistic curve 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 frequences.

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. Application of Statistics in Economics **(18)**

A. 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 Paasche's and Fisher's index numbers

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

11.7 Examples and Problems.

11. B. Demand and Supply Analysis

11.8 Introduction to Economics

Positive and Normative Economics, meaning, importance of the concept from statistical point of view.

Statistical tools of economic data analysis (Mean, variance, correlation etc.)

11.9 Demand and Supply Analysis.

Demand : Meaning, statement of law, assumptions, expectations and determinants of demand, Individual and market demand.

Supply : Meaning, statement of law, assumptions, expectations and determinants of supply, Individual and market supply.

11.10 Elasticity of Demand

Definition : Types : (i) Price elasticity of demand, (ii) Income elasticity of demand, (iii) Cross elasticity of demand

Methods of measuring elasticity of demand : (i) percentage method, (ii) point method, (iii) total outlay method, (iv) ARC method.

Importance of concept of elasticity in reality and its interpretations.

11.11 Demand forecasting : Meaning, need and methods of forecasting.

11.12 Examples and problems.

Note : In theory examination, the weightage for numerical problems should not exceed 40%.

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
7. Richard G. Lipscy : An Introduction to Positive Economics : English Language Book Society.
8. Edword T. Dowling : Introduction to Mathematical Economics, Schanm's Series.

9. Gupta and Kapoor : Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.

10. Amir D. Aczel and Jayael Soundarpandiyan, Complete Business Statistic : McGraw Hill Education (6th Edition).

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

12. D. C. Montgomery : Introduction to Statistical Quality Control, Wiley Eastern Publishers.

13. K. V. S. Sarma : Statistics Made Simple : Do it yourslef on PC : Prentice Hall of India Pvt. Ltd., New Delhi.

14. Varshney, R. L. and Maheshwari, K.L. : Managerial Economics, Sultan Chand and Sons, Delhi.