STUDY MATERIAL

Prepared for

II B.Com (III Semester)

Subject

Business Statistics

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BUSINESS STATISTICS SMC032

- UNIT I Introduction Definition of statistics Importance Application Limitations – Statistical survey – Planning and design of survey – Collection of Data – Sources - Primary and secondary data – Techniques – Census method and sampling method–Methods of sampling. Classification and tabulation of data – Diagrammatic and graphic presentation of data.
- **UNIT II** Measures of Central Tendency Mean Median Mode Geometric Mean Harmonic Mean.
- UNIT III Measures of Dispersion-Range Quartile Deviation Mean Deviation Standard Deviation – Co-efficient of Variation. Skewness – methods of studying Skewness – Karl Pearson's Co-efficient of Skewness – Bowley's co-efficient of Skewness.
- UNIT IV Correlation meaning types-scatter diagram Karl Pearson's Coefficient of Correlation – Rank correlation – Concurrent deviation method. Regression analysis – uses- Regression line – Regression equations – least square method – deviations taken from actual mean and assumed mean method.
- UNIT V Index numbers meaning types its problems Methods of constructing index numbers unweighted and weighted indices Index number tests Consumer price index numbers. Analysis of time series Meaning Importance Components of time series Secular trend, seasonal, cyclical and irregular variations Measurement of trend Graphic method-Semi average method Moving average method Method of least square.

UNIT - I

INTRODUCTION

MEANING OF STATISTICS

The word 'Statistics' is derived from the Latin word 'Status' Italian word 'Statista', German word 'Statistik' or French word Statistique' which means a political state.

STATISTICS AS DATA

Statistics is aggregates of facts, numerically expressed, collected, in systematic manner for a predetermined purpose and placed in relation to each other.

FEATURES

- i) Statistics are aggregate of facts.
- ii) Statistics are affected to a market extend by multiplicity of causes.

IMPORTANCE OF STATISTICS

- i) Statistics in States
- ii) Statistics in Business
- iii) Statistics in Economics
- iv) Statistics and Natural Sciences
- v) Statistics and Research
- vi) Statistics and Other Uses

LIMITATIONS OF STATISTICS

- 1) Statistics does not deal with individual items
- 2) Statistics deals with quantitative characteristics only
- 3) Statistical laws are true only on averages
- 4) Statistics does not reveal the entire story
- 5) Statistics can be misused
- 6) Statistical data should be uniform

FUNCTIONS OF STATISTICS

- 1) Presents the general statements in a precise and a definite form.
- 2) Simplifies the complexity of data.
- 3) Classifies the data.
- 4) Provides techniques for comparisons.
- 5) Enlarges individual experiences. In the words of Bowley,"The proper function of statistics, indeed is to enlarge individual experiences".
- 6) Formulates policies in different fields.
- 7) Tests hypothesis.
- 8) Studies relationship between different phenomena.
- 9) Indicates trend behaviour.
- 10) Measures uncertainty.
- 11)Helps the Government.
- 12) Draw inferences.

SOURCES OF DATA

i) Primary data ii) Secondary data

Primary data refers to those data which are gathered by actual observation, measurement and count during the course of investigation. Example: Population census conducted by Government of India such data are original in character and are generated through various surveys.

Secondary data refer to those data which have already been collected and used by some agency for some purpose.

TECHNIQUES OF DATA COLLECTION

i) Census Method

It is also known complete enumeration. A census is a complete enumeration of each and every unit of the universe that is, all the units of the universe under study are considered. In the case of census method or enquiry, data relating to every item of the population will be collected. That is, all the units of the population or universe are studied. *Example: population census*.

ii) Sample Method

It is also known as partial enumeration. Under the sample method, only a part of the universe is studied and conclusions about the entire universe are drawn on that basis. That is, only a representative part of the universe is studied. In the case of sample enquiry, only a part of the whole group of population will be studied. The Law of Statistical Regularity states that, 'a small group chosen at random from large group will have much the same characteristic as the larger group'.

SOURCES OF COLLECTION OF DATA

1) PRIMARY DATA

Primary Data refer to those data which are gathered by actual observation, measurement and count during the course of investigation. Data are collected by the investigators or enumerators. Primary data are those which are collected for the first time and they are original in character. Primary Data are also known as first-hand information. It is a Time consuming method. It is an expensive one. *Example: Population census*.

Methods of collecting Primary Data

- i) Direct personal interview
- ii) Indirect oral investigation
- iii) Information from correspondents
- iv) Mailed questionnaire method
- v) Schedules sent through enumerators

2) SECONDARY DATA

Secondary data refer to those data which have already collected and been used by some agency for some purpose and are avail- able for the study. Example: The records and publications of population census are illustration of primary data. The data from other source by the Government of India, and used by some other persons, then that data are known as secondary data.

Sources of secondary data

a) Published Sources b) Unpublished Sources

SAMPLING

MEANING

Sampling is the process of learning about the universe (population) on the basis of representative items (samples) drawn from the universe. When we collect data from representative items of the universe, this is called as a sampling method.

BASIC PRINCIPLES OF SAMPLING

- i) Law of statistical Regularity
- ii) Law of Large numbers

METHODS OF SAMPLING

- I. Random Sampling Methods
 - i) Simple Random Sampling
 - ii) Restricted Random Sampling
 - a) Stratified Sampling
 - b) Systematic Sampling
 - c) Cluster Sampling
- II. Non-random Sampling Methods
 - i) Purposive Sampling
 - ii) Quota Sampling
 - iii) Convenient Sampling

CLASSIFICATION

MEANING

Classification is the process of arranging the related facts into homogeneous groups according to the resemblances and similarities. The process of division of data, into homogeneous groups according to their characteristics is known as Classification.

METHODS / TYPES OF CLASSIFICATION

- 1) Geographical Classification
- 2) Chronological Classification
- 3) Qualitative Classification
- 4) Quantitative Classification

TYPES OF STATISTICAL SERIES

- 1) Individual Observations
- 2) Discrete Series
- 3) Continuous Series

TABULATION

MEANING

A table is a logical and systematic arrangement of statistical data in columns and rows. Rows are horizontal arrangement whereas columns are vertical arrangement. In other words, Tabulation is the process of presenting data in tables.

The main purpose of tabulation is to simplify the presentation and to facilitate comparisons.

PARTS OF TABLE OR ESSENTIALS OF A TABLE

The number of parts of table depend upon the given data. A good table should contain all that is required in as small a space as possible without loss of clarity. Different parts of a Table are given below:

- 1. Table Number5. Body of the table2. Title of the table6. Head Note3. Caption7. Foot Note
- 4. Stub

DIAGRAMS

Diagrams refer to those types of devices (Bars, Circles, Maps, etc) which are drawn from the tabulated statistical data.

Diagrams can take many attractive forms. Diagrams are drawn from the statistical data in order to exhibit the data in a good manner.

TYPES

1. Bar Diagrams 2. Pie Diagrams 3. Pictograms

BAR DIAGRAMS MAY BE SUBDIVIDED INTO FIVE GROUPS

- i) Simple Bar Diagrams
- ii) Component Bar Diagrams
- iii) Multiple Bar Diagrams
- iv) Percentage bar Diagrams
- v) Deviation Bars.

KINDS OF GRAPHS OF TIME SERIES

- 1) Graph of one variable
- 2) Graph of more than one variables
- 3) Range Chart
- 4) Band Graphs

While drawing Graph of Time Series, variables are plotted on X axis and Time (Number of years) is plotted on Y axis.

KINDS OF GRAPHS OF FREQUENCY DISTRIBUTION

- 1) Lina Graphs
- 2) Histogram
- 3) Frequency polygon
- 4) Smoothed frequency curve
- 5) Cumulative frequency curve

UNIT - II

MEASURES OF CENTRAL TENDENCY

CENTRAL VALUE

A central value is a single value that describes the characteristics of the entire mass of urwidely data. Such a value is called the "Central value or an average". An Average stands for the whole group of which it forms a part yet represents the whole. An average is a representative figure. It summarises the characteristics of the whole data.

TYPES OF AVERAGES

- 1. Arithmetic Mean
- 2. Median
- 3. Mode
- 4. Geometric Mean
- 5. Harmonic Mean

1. Arithmetic Mean

The most widely used measures for representing the entire data by one value is known as an average and the statisticians call it as Arithmetic Mean. It is also called as Mean.

Types of Arithmetic average

- 1. Simple arithmetic Mean
- 2. Weighted arithmetic Mean

2. Median

Median is the middle value in a distribution. It is also known as positional average. Median is the central value which divides the distribution in to two equal parts. Median is that value which divides the group in to two equal parts. One part comprising all values greater and the other all values less than median.

Graphical Method

- 1. An Ogive curve method
- 2. Two Ogives curve method

3. Mode

Mode is the most fashionable or typical value of a distribution because it is repeated to the highest number of times in the series. The mode refers to that value in a distribution which occurs most frequently in a distribution. Mode is the value which occurs most frequently in a frequency distribution. It is that item around which there is a maximum concentration.

4. Geometric Mean

Geometric Mean is defined as the root of the product of N items of series. It is obtained by multiplying together all the values of the series and the calculating the root of their product corresponding to the number of items in the group.

5. Harmonic Mean (H.M)

Harmonic Mean is defined as the reciprocal of the Arithmetic Mean of the reciprocal of the individual observations. It is based on the reciprocals of the numbers averaged.

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UNIT - III

MEASURES OF DISPERSION

MEANING

The measurement of the scatterness of the mass of figures in a series about an average is called a measure of variation or dispersion. Measures of dispersion are also called "average of the second order".

METHODS OF STUDYING VARIATION

1) Range

- 2) Semi Inter Quartile Range
- 3) Mean Deviation
- 4) Standard Deviation
- 5) Lorenz curve

1) Range

It is the difference between the value of the smallest item and the value of the largest item of a distribution.

2. Semi -Inter Quartile Range (Quartile Deviation)

Inter Quartile Range is the difference between upper and lower Quartiles divided by two. It is a measure of dispersion based on the upper Quartiles (Q) and the lower Quartile (Q). It is also called as semi-inter Quartile range.

3. The Average Deviation or Mean Deviation

It is the average amount of scatter of the items in a distribution from either mean or the Median, ignoring the sign of the deviation.

4. Standard Deviation

Standard Deviation may be defined as the positive square root of the arithmetic mean of the squares of deviations of given observations from their arithmetic mean. It was first suggested by Karl Pearson in 1893. It is also known as Root - Mean square Deviation or Mean error or Mean square error. In short, Standard Deviation is the square root of the mean of the squared deviations from the arithmetic mean. It is denoted by the small Greek letter a (read as sigma).

5. Graphic Method of Dispersion:(Lorenz Curve)

This method was devised by Dr. Max O. Lorenz. This technique is used to measure the distribution of wealth and income.

Lorenz curve is a graphical method of showing deviation from the average of group of data. This technique is used to present production against number of producing units.

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MEASURES OF DISPERSION
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 Methods of measuring Dispersion
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       * Range
                                               co-efficient of Range = L-S
      * Inter- quartile Range (or)
                                                                          L+5
      * Mean - Deviation Quartile Deviation
                                                                       = 43-27
       * Standard Deviation
                                                                           43+27
       * Lorenz Curve
                                                                           16
                                                                           70
   RANGE
                                                                       = 0.228
   Range = Largest Value - Smallest Value
                                               Co-efficient of Range
                                                                        = 0.23
* Co-efficient of Range = 1-5
                                                     INTER QUARTILE RANGE (OR)
                                                        QUARTILE DEVIATION
        = Largest Value - Imailest Value
         Largest Value + Smallest Value
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27, 30, 35, 36, 38, 40, 43
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Soln :-
     Largest Value = 43
     Smallest Value = 27
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P11810 $40 + \frac{11.5}{22} \times 20$ - 40 + 10.45 = 50.45Q3 class = size of 3(N) the item = Size of 3x 26.5 th item = Sile of 79.5th item Q2 class = 80-100 $= L + \frac{3(n)}{4} - cf \times c$ Q3 $= 80 + \frac{79.5 - 62}{19} \times 20$ $= 80 + \frac{17.5}{19} \times 20$ = 80 + 18 - 42 Q3 = 98.42 Quartile Deviation = 03-01 = 98.42-50.45 $Q \cdot D = 23.985$ Corefficent of Q. DIE Q3-Q1 Q3 + Q1 = 98.42 - 50.45 121 - 21 - 21 110 98-42+ 50.45 = 47.94 = 0-322 Co-efficient of Quartle Deviation: 0.32

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	Cor	ntinuc	our so	eries	-			
Variable	0-5	5-10	10-15	15-20	20-25	20-30	30-35	35-40
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Standard Dervation.

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Mode class = Ed. 100 - 125 Mode = L + M A, XC FC-REES - Ed. dima . A, 122 $\Delta_1 = f_1 - f_0$ 1 = 15-10 $\Delta_1 = 5$ $\Delta_2 = f_1 - f_2$ = 15 - 7 $\Delta_2 = 8$ $z = 100 + \frac{5}{5+8} \times 25$ $= 100 + 5 \times 25$ z = 109.62Skp 3 x-z - 95-28 - 109.62 301 20 00 01 25 05 03 32.84 = - 14-34 32-84 Skp = -0.4367

Bowley's Co-efficient of Skewness BKB = Q3 + Q1 - 2 median Q3 - Q1 Find the co-efficient of skewness bare on quartile from the following data × 35 45 50 55 60 65 70 f 17 19 19 22 20 19 15 alculation of Median 10 2 f C.P 35 17 17 36 45 01 19 55 50 19 55 Median 77 22 97 20 60 19 116 65 23 15 131 70 N= 131 Median = Size of (N+1) to them = Size of 182 00 2 = Size of 66 th item Median = 55 Andrea Atta $a_1 = Sile of \frac{N+1}{4}$ item Size of = Size of 33th item Q1 = 45 = Size of 3 23 10 X 201

 $= 8i2e \text{ of } 8 \times 133 \text{ to item}$ = 8i2e of 99th item $\alpha_{8} = 65$ $8K_{B} = 0.3 + 0.1 - 2 \text{ median}$ $\overline{\alpha_{8}} - 0.1$ = 65 + 45 - 2(55) = 65 - 45 = -110 - 2(55) = 1165 - 110 = 0 20 = 20 = 20 = 20

UNIT - IV CORRELATION

SKEWNESS

Skewness refers to 'lack of symmetry'. When a distribution is not symmetrical, then it is called a skewed distribution. The measures of a symmetry are called Measures of Skewness. Measures of Skewness indicate not only the extent of Skewness but also the direction. The absolute measures are known as measures of Skew- ness. The relative measures are known as the Co-efficient of Skew- ness. Absolute measure of Skewness may be Positive or Negative.

Absolute Skewness = Mean – Mode

Relative Measure of Skewness or $Co - efficient of Skewness = \frac{Mean - Mode}{Standard Deviatin}$

MEASURES OF SKEWNESS

- 1. The Karl Pearson's Co-efficient of Skewness
- 2. The Bowley's Co-efficient of Skewness
- 3. The Kelly's Co-efficient of Skewness
- 4. Measure of Skewness based on moments

CORRELATION ANALYSIS

DEFINITION

"Correlation Analysis attempts to determine the degree of relationship between variables- Ya Lun Chou.

"The relationship of Quantitative nature, the appropriate statistical tool for discovering and measuring the relationship and expressing it in brief formula is known as Correlation". - Croxto and Cowden.

TYPES OF CORRELATION

- 1. Positive and Negative
- 2. Simple and Multiple
- 3. Partial and Total
- 4. Linear and Non linear

REGRESSION

DEFINITION

In the words of M. M. Blair, "Regression is the measure of the average relationship between two or more variables in terms of the original units of the data". According to Taro Yamane, "One of the most frequently used techniques in economics and business research, to find a relation between two or more variables that are related casually. is Regression analysis".

TYPE OF REGRESSION

- 1. Simple and Multiple
- 2. Linear and Non linear
- 3. Total and Partial

VARIABLES

- Dependent Variables is one whose value is influenced or is to be predicted. Dependent variable is also known as Regressed, Predicted or Explained Variable.
- 2. Independent Variable is one which influences the values or is used for prediction. Independent variable is also known as Regressor or Predictor or Explainator.

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Calculate the co-efficient of the lines of obtain and Correlation following date Regression 108 the 7 6 5 3 4 x 2 14 13 W 12 11 8 y estimate of y which Obtain an should correspond to the average 2= 6.2 The following table gives the 2) various values of two variables 98 66 55 89 58 42 44 n 58 65 58 76 56 49 53 4 Calculation of Regression in Actual Mean D χ^2 y(y-y) 3 n (n-n) n 6 9 -2 9 4 -3 8 9 6 -3 1 10 -1 2 1 0 12 1 0 0 1 11 0 0 0 2 13 4 2 4 3 9 9 3 9 14 ∑n=28 ∑n=0 Zn2=28 Zy=77 Zy=0 Zy=28 Zny=26

Norkings	9	Regression Equation of y on x
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$\overline{x} = 4$		8 5y = Zny
		$\sigma n = \Sigma n^2$
$\overline{y} = \Sigma y / n$		= 24/28
> 77/7		- 0.93
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· · · · · · · · · · · · · · · · · · ·		4 - 11 = 0.93 (n - 4)
Regression Equation of x on y		N-11 = 0.93x - 3.72
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UNIT - V

INDEX NUMBERS

DEFINITION

According to B. L. Bowley, Index Number is defined as follows; "A series of Index Numbers is a series which reflects in its trend and fluctuations the movements of some quantity to which it is related"

"An Index Number is a statistical measure of fluctuations in a variable, arranged in the form of a series, and using a base period for making comparisons"- Lawrence J. Kaplan.

TYPES OF INDEX NUMBERS

1) Price Index	4) Diffusion Index
2) Quantity Index	5) Profit Index
3) Value Index	6) Yield Index

METHODS OF CONSTRUCTING INDEX NUMBERS

- 1. Simple (Unweighted)
 - a) Simple Aggregative
 - b) Simple Average of Relative
- 2. Weighted
 - a) Weighted Aggregative
 - i) Laspeyres
 - ii) Paasche Method
 - iii) Bowley Method
 - iv) Fisher's Ideal Method
 - v) Marshal Edge Worth Method
 - vi) Kelly's Method
 - b) Weighted Average of Relative

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