Indira Gandhi
National Open University
School of Sciences

MST-002
DESCRIPTIVE STATISTICS

Block

1

ANALYSIS OF QUANTITATIVE DATA

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Curriculum and Course Design Committee

Prof. K. R. Srivathasan
Pro-Vice Chancellor
IGNOU, New Delhi

Prof. Parvin Sinclair
Pro-Vice Chancellor
IGNOU, New Delhi

Prof. Geeta Kaicker
Director, School of Sciences
IGNOU, New Delhi

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Mathematics
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Prof. Sujatha Varma
Dr. S. Venkataraman

Block Preparation Team

Content Editor
Dr. Rajesh Tailor
School of Studies in Statistics
Vikram University, Ujjain (MP)

Language Editor
Dr. Nandini Sahu
School of Humanities, IGNOU

Secretarial Support
Mr. Deepak Singh

Course Writers
Dr. Soubhik Chakraborti (Unit 1& 2)
Department of Applied Mathematics
B. I. T. Mesra, Ranchi (JH)

Dr. Manish Trivedi (Unit 3 & 4)
School of Sciences, IGNOU

Formatted By
Dr. Manish Trivedi
Mr. Prabhat Kumar Sangal
School of Sciences, IGNOU

Programme and Course Coordinator: Dr. Manish Trivedi

Block Production

Mr. Y. N. Sharma, SO (P.)
School of Sciences, IGNOU

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DESCRIPTIVE STATISTICS

In MST-001, we have discussed some mathematical techniques to make the learners able to cope up with the derivational and numerical part of some statistical techniques which are discussed in this course and other core and elective courses of this programme. We also discussed some basic methods of collection, organization and representation of data in that course.

After collection and organization, the next step is to proceed for data analysis to explore the properties of the data. The statistical tools which describe the properties of the data are known as descriptive statistics. The techniques of the descriptive statistics are frequently used for analysing the data in various fields. The purpose of discussing those techniques is to make you aware of the three major properties that describe the data. These properties are:

1. The numerical value of an observation (commonly referred as central value) around which most of the other numerical values show a tendency to concentrate or group, called central tendency.
2. The degree to which numerical values are scattered or dispersed around the central value, called dispersion.
3. The extent of departure of numerical values from symmetrical distribution (taken as normal distribution) around the central value, called skewness.

In Block 1, we have discussed the measures based on the above three properties. These measures can also be used to compare two distributions. The development of such types of measures was based on univariate distributions.

The next step in this direction is to study simultaneously two or more variables on the same unit of the population. This kind of analysis is important for drawing inferences from the co-variation between variables in a given data. In this regard the concept of statistical relationship between two variables is introduced in Block 2 and quantitative measures of relationship between two variables for analysing the strength of relationship are developed.

As a sequel of Block 2, the average relationship between two variables in terms of regression analysis is elaborated in Block 3. In Block 3, (i) the quantitative measure of the degree of association between a dependent variable and two or more independent variables taken together in a group, known as multiple correlation coefficient; (ii) the quantitative measure of the degree of association between a dependent variable and any one of the independent variables included in the analysis, while the effect of other independent variables included in the analysis is held constant, known as partial correlation coefficient, have also been discussed.

The Block 4 is mainly concerned with the qualitative characteristics and analysis of qualitative data. Such type of data arises when a sample from some population is classified with respect to two or more qualitative variables.

Notations and Symbols

x_i	:	Value of i^{th} observation of variable X
f_i	:	Frequency of i^{th} class
$\overline{X}$	:	Arithmetic mean
A	:	Assumed mean
$\sum$	:	Sum of observations
W_i	:	Weight of i^{th} observation
$\overline{X}_w$	:	Weighted mean
$N=\sum_{i=1}^{k} f_i$	:	Total number of observations in data
GM	:	Geometric Mean
HM	:	Harmonic Mean
Q_i	:	i^{th} Quartile
D_i	:	i^{th} Decile
P_i	:	i^{th} Percentile
QD	:	Quartile Deviation
MD	:	Mean Deviation
$Var(X)=\sigma_x^2$	:	Variance of X
SD = σ	:	Standard Deviation
RMSD	:	Root Mean Square Deviation
μ_r'	:	r^{th} Moment about arbitrary point
μ_r	:	r^{th} Central moment
S_k	:	Coefficient of skewness
β_1	:	Measures of skewness
β_2	:	Measures of kurtosis
γ_1	:	Derivative of β_1
γ_2	:	Derivative of β_2

ANALYSIS OF QUANTITATIVE DATA

A raw data after collection are not suitable to draw conclusions about the mass or population from which it has been collected. Some inferences about the mass can be drawn from the frequency distribution which condenses and reduces the bulk of data. In general, a distribution can be categorized by two parameters, i.e., (i) Measures of location and (ii) Measures of dispersion.

Generally, the data are condensed into a single value around which the most of values tend to cluster in finding central value. Such a value lies in the center of the data and is known as central tendency. A central value explores an idea of whole mass. But the information so obtained is neither exhaustive nor compressive as the measure of central tendency does not provide the information about the scatterness of the observations. This leads us to conclude that a measure of central tendency alone is not enough to have a clear picture of data, one need to have a measure of dispersion or variation.

Moments are statistical measures that describe certain characteristics of the distribution. Measures of Skewness and Kurtosis give us the direction and the magnitude of the lack of symmetry and peakedness or flatness of data.

In this block, we shall discuss some statistical tools which are used to analyse the quantitative data. In Unit 1, a detailed idea has been explored about the measures of Central Tendency. In Unit 2, we have discussed about the variation of data and some useful measures of dispersion. Then, in Unit 3 we have described various types of moments and their uses. In Unit 4, we have discussed the Skewness and Kurtosis and their coefficients.

References:

- Agrawal, B. L.; Basic Statistics, New Age International (P) Ltd. Publishers, New Delhi, 3rd edn., 1996
- Goon, A. M., Gupta, M. K. and Das Gupta, B.; Fundamentals of Statistics Vol-I; World Press Culcutta.
- Gupta, M. P. and Gupta, S. P.; Business Statistics; Sultan Chand & Sons Publications.
- Gupta S. C. and Kapoor, V. K.; Fundamentals of Mathematical Statistics, Sultan Chand & Sons Publications.
- Mukhopadhayaya, P.; Mathematical Statistics, Books & Allied (p) Ltd., Kolkata
- Hoel, P. G.; Introduction to Mathematical Statistics, Wiley Series in Probability and Statistics.