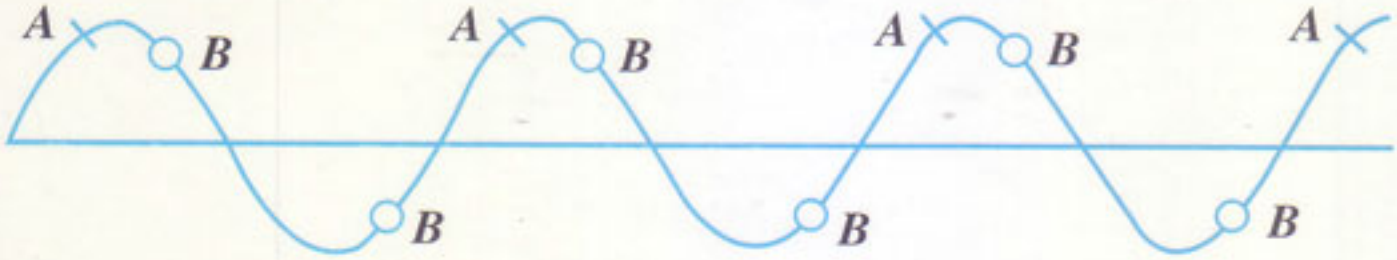
Third Edition

M. Nurul Islam

An Introduction to SAMPLING METHODS

Theory and Applications



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Chapter 1

INTRODUCTION

1.1 CONCEPT OF SAMPLING

During the past 30 years or so, the methods and techniques of sampling have reached a high level of scientific development. As a result, the uses of sampling have been extended into a wide variety of fields. From the standpoint of statistical data collection, sampling is a means for selecting a relatively small number of households, persons or other units for inclusion in a survey of some kind and inferring conclusions on the basis of these limited number of instances. This selection is done because enumeration of all units in the **target population** (population for which information is needed) is a large and complex undertaking that is almost always affected by limitations of time, budget and availability of experienced personnel. Not only that, it is unnecessary as well from the standpoint of precision and statistical reliability. Many countries have found, moreover, that sampling can play an important role in an overall census program (UN, 1997).

Let us now introduce the concept of sampling by an example.

EXAMPLE 1.1: Very frequently we talk about banning or restricting students' politics in the university campus. This is a very sensitive issue. We sometime wonder whether our views on this issue are shared by the student community, who are directly or indirectly involved in this important issue. We may want to know the actual percentage of students of Dhaka University who do not approve of banning students' politics in the campus. This percentage could be obtained by asking every student in the campus

inadequate. The works of Gosset appeared in Biometrika in 1908 under the name of 'Student', Gosset's pseudonym. (A famous story has it that Gosset was afraid to publish under his own name for fear that his employers, the Guinness Brewery, would be unhappy to discover that one of its chemists was doing research in statistics.) Today, student's t is a basic tool of statisticians and experimenters.

R. A. Fisher (1890–1962), who is known as the father of statistics, made numerous and significant contributions to statistics. He was influenced by Karl Pearson and Gosset, the two world known statisticians. His pioneering works made valuable contributions to evolve statistical procedures in many fields particularly agriculture, biology and genetics. He is known for his contribution in the field of Analysis of Variance and Experimental Design. Meanwhile, Francis Galton (1822–1921) gave the concept of **regression line** while working on heredity of men and laws governing the transmission of physical and mental characteristics from one generation to another'. His work was confirmed by his friend Karl Pearson.

The development of the theory of statistics was also effected by the pioneering works of a great number of authors, among whom Pareto, Adam, Edgeworth, Bowley, Yule, Stuart and Kendall deserve special mention.

J. Neyman (1894–1981) and E. S. Pearson (1895–1980) will remain ever known for their original contributions to the theory of testing statistical hypothesis in 1936 and 1938. This theory promoted considerable research works of practical use. Indian statistician Mahalanobis (1893–1972) contributed significantly to the field of sample survey. He is well known for his D^2 statistic. He established Indian Statistical Institute (ISI) in 1931 and founded **Sankhya**, an international journal in Statistics. Qazi Motahar Hussain (1897–1981), an authority in statistics, made significant contributions towards the development of statistics in Bangladesh. He is known worldwide for his works **'Hussain Chain'**. He was the founder of the Department of Statistics and the Institute of Statistical Research and Training at the University of Dhaka.

Deming's (1900–1993) philosophical thoughts towards improving the quality of manufactured products through statistical quality control techniques is noteworthy. Genichi Tagguci (1924–) promoted the use of experimental designs for product improvement.

CHAPTER

1

STATISTICS AND ITS ORIGIN

1.1 STATISTICS: ITS ORIGIN AND DEVELOPMENT

It is not precisely known how the word **statistics** was originated. However, most people believe that the term statistics, derived from word **state,** was used to refer to a collection of facts of interest to the state. Some believe that the word **statistic** has been originated from the Italian word **statista**, the French word **statistique** and the German word **statistik**. This background tends to suggest that the term statistics has its origin from the ancient time. At that time, the word statistics had been believed to be in use as an indicator or yardstick of a country's economic, political and social conditions. In this sense, the word statistics serves as an index of a country's overall condition. In modern days too, relevant statistical data are of immense importance to understand the level of development of a country. Presumably, all cultures that recorded history internationally also recorded statistics.

The term **statistics** is an old one. As people abandoned their nomadic way of life, and started to live in groups, they urgently felt the need to know each other's wealth, manpower, strength and position for their survival and safety. The group chiefs or rulers used to collect information on the above aspects in order to impose and levy tax to strengthen their economic condition. Caesar Augustus decreed that the entire world should be taxed.