QUANTITATIVE TECHNIQUES

(As per UGC Model Curriculum for the MBA and PGDBA students of all Indian Universities)

Dr. C. SATYADEVI

S. CHAND

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DEDICATION

I dedicate this book

To

My beloved husband

Sri. Surisetti .V. Sivaprasad

C. Satyadevi

PREFACE TO THE REVISED EDITION

Business exectives, administrative heads, Managers and policy makers need the support of Quantitative Techniques. It is a great tool in making efficient decisions. The tools of Quantitative Techniques are essential for every Commerce and Management student of the modern business world.

This book is designed according to the syllabus of MBA course structure of all the Universities in India. This book serves as a standard text book for MBA students. The book contains a large variety of methods of solving problems along with clear explanation. For every model a detailed explanation with sufficient number of examples are given. The peculiar feature of this book is that a large variety of illustrations are given under every heading. Sufficient number of problems and theory questions are given for students to practice. The book will be a great help to the students who wish to appear for competitive examinations. The book covers theory part and the subject is presented in such a way that the students can understand the concepts through self study.

On this occassion I would like to express my gratitude to St. Theresa's College, its Management and Principal for providing me the academic environment to complete this work. I would like to make a special mention of the help given by my husband, Sri. S.V. Siva Prasad and my son, Mr. Aditya and I thanks them profoundly. I thanks my parents and family members for their continuous support. I thanks Dr. Ms. D.K. Durga, Mrs. Umadevi and Mr. V. Gopinath lecturer in maths for their help in completing this book.

I thanks S. Chand & Company Pvt. Ltd. who had taken up the responsibility of releasing the book in time.

C. SATYADEVI

CONTENTS

PART – A

PART – B

PART – C

PART – A

UNIT I

CHAPTER

1 Introduction to Quantitative Techniques

Socio-economic life of man became increasingly complex with the fast changing technologies and life styles. 'Severe competition', the by-product of globalisation became an unavoidable component in every segment of the economy, especially in administration and business. Decision-making, the core responsibility of policy makers and top managers was once based on subjective matter such as observation, experience and intelligent guess of the decision maker. Now it is shifted to database, which provides accurate base. In today's world of business management a minor mistake in decision-making leads to a heavy loss or complete closure of the business. Such conditions diverted the attention of planners towards quantitative techniques, making it an important tool in decision-making, goal programming and policy framing. Knowledge of quantitative analysis and quantitative techniques is essential to those who wish to develop their career in any economic activity, where competition is a threat.

Concept of Quantitative Techniques

"Quantity" is the root from which the concept 'quantitative techniques' is developed. The term "quantity" literally means the ability to be measured through measurable units in numbers or symbols, such as weight, length etc. The word "quantity" is derived from the Latin term 'Quantum Libet' which means 'as much as you please'. Thus quantity is something measurable with definiteness. Quantitative is concerned with quantity. It can be explained as the numerical expression of information or fact against qualitative expression, which is a non-numerical statement of a fact. Thus quantitative techniques involve introduction of the element of quantities such as numbers, symbols and other mathematical expressions.

Example of Qualitative Statement

- You must show good progress in sales in the next month.
- He is expecting 'big amount' for advertising the product

These two are qualitative expressions.

Example of Quantitative Expression

- You must improve sales by 12% by next month.
- He is expecting Rs. 25,000/- for advertising the product.

Examples show that qualitative expression lacks measuring units in numerical form. Quantitative expressions require units of measurement, in numbers, which can also be called data.

Definition of Quantitative Techniques

As the name indicates plural form, it contains more than one technique or tool. Thus the term can be defined as:

1. "Quantitative Techniques may be defined as those techniques which provide the decision maker with a systematic and powerful means of analysis and help, based on quantitative, in exploring policies for achieving pre-determined goals." – C.R. Kothari.
2. Quantitative Techniques are the devices developed on the basis of mathematical and statistical principles and formulae.
3. Quantitative Techniques refer to a group of data based tools designed with mathematical and statistical models.
4. "Quantitative techniques are the methods that provide systematic base in the form of numbers, mathematical formulae, symbols etc., for analytical study of the problem under consideration and for achieving predetermined goals."

Thus quantitative techniques are numerical descriptions of quantitative process and analysis extensively applied in the study of problems and process of decision-making.

Classification

The term Quantitative Techniques is defined as a group of devices. It implies that different tools or models constitute the branch of quantitative technique. On the basis of the principles applied in the models, the quantitative technique can be broadly classified under three heads.

1. Statistical Quantitative Techniques.
2. Mathematical Quantitative Techniques.
3. Programming or Operations Research Quantitative Techniques.

Statistical Quantitative Techniques

The technique in which the principles, procedures and the formulae of statistics are used, are classified under the statistical quantitative techniques. The techniques are built on statistics, which is the science of quantitative data.

Concept of Statistics

Statistics is a term with multifarious meanings and interpretations. Broadly, the concept is defined by the statisticians either as data called descriptive statistics or as procedure which deals with methods of statistics. The term can be described in the following way.

- In the view of common man statistics is 'data'.
- Some statisticians called it as science of counting, averages and estimations (Bowley), Science of numerical data (Ya-Lun-Chou) etc.
- As a method statistics may be defined as a process of collection of data and analysis for drawing conclusions.

In this context F.E. Croxton & D J. Cowden say, " Statistics is collection, presentation, analysis and interpretation of numerical data".

From the above statements it can be concluded that statistics is systematic collection, analysis and interpretation of quantitative data. Thus the statistical quantitative techniques consist of the following tools:

- **Collection of Data:** Data is the base on which quantitative analysis is built. Data can be collected in a scientific way from primary sources or secondary sources; according to the needs of the problem. Data collection is a multistage process that requires time and money of the investigator.

- **Classification and Tabulation:** If the data collected is mass and complex, it cannot help the user unless it is classified and tabulated. It is a process of arranging data in different groups on the basis of similarities. If they are organized in rows and columns with captions, it is called tabulation. Tabulated data is suitable for quantitative processing and analysis.
- **Measures of averages:** Average is the most widely applied quantitative technique to reduce mass data into a single figure and to study the general characteristics of the total data. There are different types of averages such as Arithmetic mean, Geometric mean, Harmonic mean, Median and Mode. Averages are also popular as "measures of central tendency" because core features are concentrated around the central value, called average.
- **Measures of variation:** Some times it is necessary to know the scatter of values in the distribution to measure the rate of variation in two groups. To know the consistency and variation in the data of two or more groups, measures of variations are applied. Measures of variation include the Range, Mean Deviation, Quartile Deviation and Standard Deviation.
- **Measures of Relation:** In business it is essential to find out the degree of relationship existing between two groups of variables and also the extent of influence of one on the other variable to forecast the probable developments. Ex. Advertisement and sales, rainfall and agricultural production. There are two standard and popular techniques called: Correlation and Regression to study the degree, extent and cause of relation between two sets of values.
- **Analysis of Time Series:** Quantitative variables over certain points of time are called time series. Analysis of time series is a part of business and economic studies. Time series consists of four different components: - the secular trend, cyclical variations, irregular changes and seasonal variations. Analysis of time series depicts past behaviour and future trends of the problem under study.
- **Index Numbers:** Index numbers are special type of averages popular in the study of cost of living, changes in general price level etc. Index numbers are constructed primarily to understand the changing pattern of prices of different goods and to estimate purchasing power, changing value of money etc.
- **Skewness, Moments & Kurtosis:** Skewness gives the detailed features of normality in the distribution by measuring how far the variables in the series are skewed from normal state. Moments and kurtosis study the deviations of variables from arithmetic mean.
- **Diagrammatic and Graphic Presentation:** This is another technique of presentation and interpretation of data where problem can be analysed by drawing curves, lines and bars.
- **Interpolation and Extrapolation:** It is a statistical technique of estimating the future trends under certain assumptions. Extrapolation provides figures outside the given data. This technique helps in obtaining probable changes in prices, demand, production etc.
- **Statistical Quality Control:** It is used in manufacturing industries. Under this method quality is regulated and ensured by applying the theory of Probability etc.

Mathematical Quantitative Techniques

Quantitative techniques in which algebraic, arithmetic, geometric and calculus approaches, concepts and methods are used, are called mathematical quantitative techniques.

Mathematics and logic are like flower and fragrance. They are inseparable. Different techniques are used in the tracing of things to their source and resolving of knowledge into its original principles. Also these techniques are used in resolving the problems by reducing the conditions that are in them into equations or mathematical concepts.

Significance of Mathematics

Mathematics is the logical development and application of abstract forms and systems arising from natural phenomena, human activities and ideas. The importance of mathematics in the modern world is very significant, because the application is not only restricted to the scientific, business and management issues but also personal and social problems.

Salient Features of Mathematical Quantitative Techniques

- Mathematics shapes and sharpens the rational capabilities of mind.
- It improves and enlarges the critical thinking skills.
- Develops ability in analytical thinking combined with an appropriate concentration of applications.
- Develops ability to reason with quantitative information to be successful in the rapidly changing work environment.
- Uncovers the structures and relationships that help us to understand the nature and problems of the world around us.
- The mode of mathematical thinking empowers an individual to absorb new ideas, adopt to rapid changes, cope up with ambiguity, recognize patterns, solve non-conventional problems, analyse complexities, work with abstract concepts and relations, detect bias, assess risks and suggest alternatives.
- Mathematics expresses its concepts in symbols and graphic representations with in a framework of logical inference which has become the universal language for communicating technical knowledge.

Some Important Techniques in Mathematics

Algebra: Algebraic Concepts and Sets, Relations, Functions etc. are abstract in nature. These are used to identify the objects and their characteristics. The relation between the objects and the scope or extent of relation with reference to the context is useful in quantitative analysis of different problems.

Arithmetic: Indices, Progressions, Series, Logarithms etc. come under Arithmetic. Logarithms and Indices are used in simplification of mathematical calculations. In a series if some of the values are given we can estimate or expect the required values in the later point of the series. Using progressions we can find the sum, mean and the required term in a given series.

Geometry: We can find the areas or volumes of the regions using analytical geometry. Using plane geometry we can express regions in a pictorial manner.

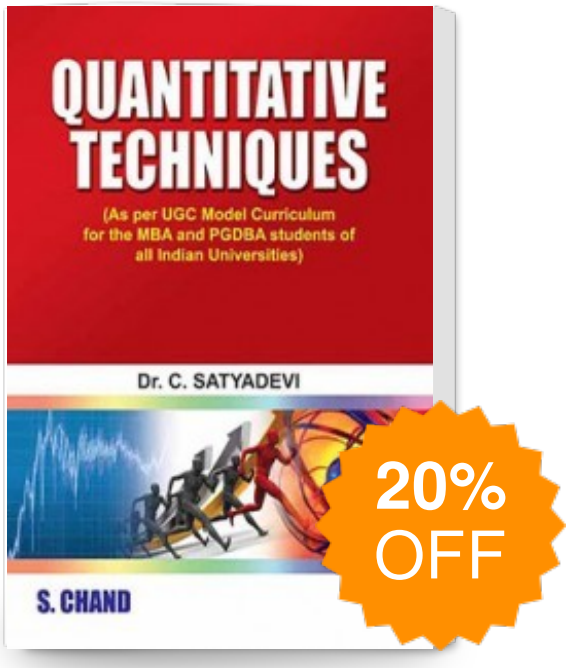
Calculus: Limits and Continuity, Differentiation, Integration, Differential Equations etc. are calculus concepts on the given functions.

Matrices: Matrices are used to solve systems of Linear Equations. A graphical data (Pictorial representation) can be converted to numerical data in the form of a matrix.

III. Programming Quantitative Techniques

Programming quantitative techniques are also known as operations research models or model building techniques. They provide support in building different models essential for gathering information, goal programming and decision-making. Programming techniques are in usage for more than half century at the primary level. The basic principles of programming were applied in certain military operations under the title “Operations Research”. Now these techniques are widely used in more advanced stage in every administrative system - government, business, defence or non-business.

Quantitative Technique



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