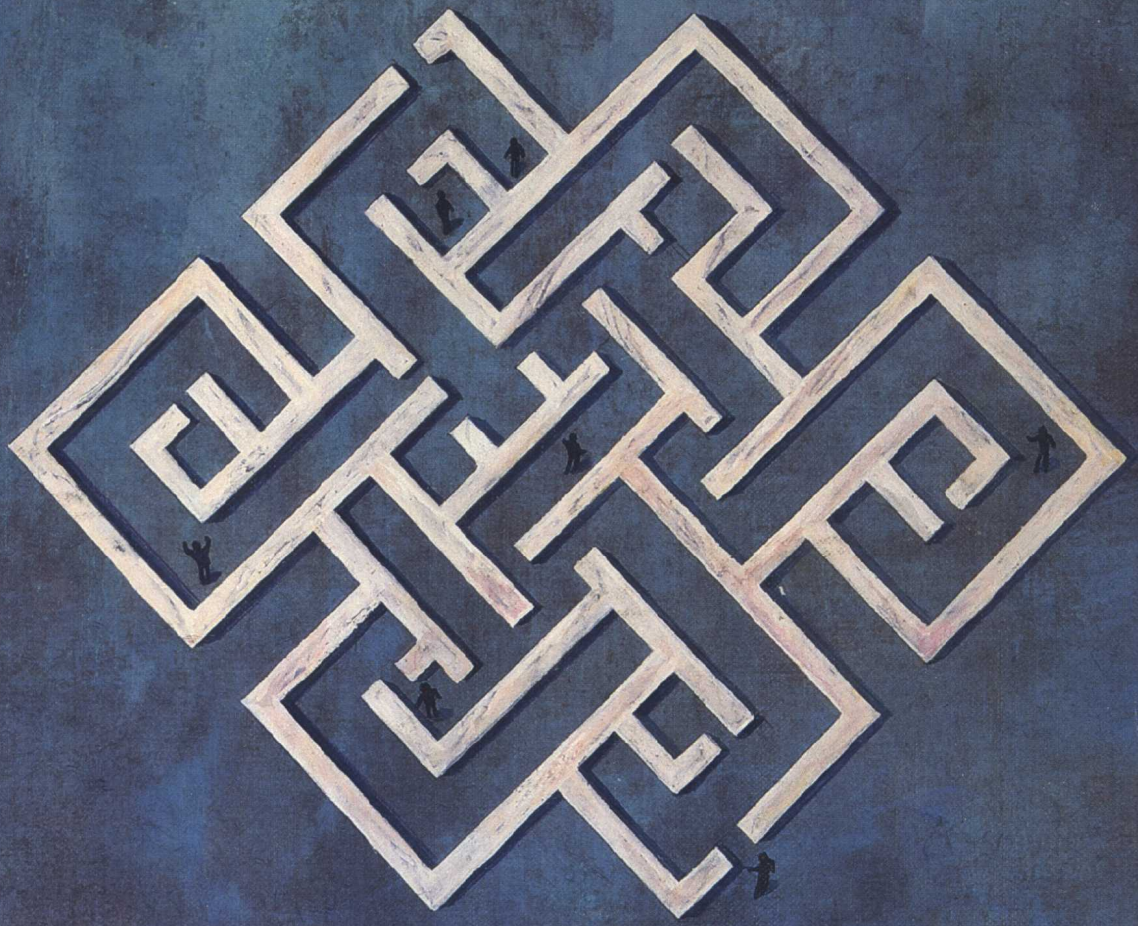
Quantitative Decision Making

Guisseppi A. Forgionne



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To my mother, Mary, and to Jesus

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Preface

This book gives an introductory survey of management science/operations research. The text provides complete coverage of today's major quantitative models and shows how they are applied to managerial problems in public and private organizations. Much effort has been spent in making each topic interesting and easy to read. The purpose is to provide the user with a sound conceptual understanding of the role of quantitative analysis in the decision-making process.

FOCUS The focus is on the practical and applied. The text explains how to formulate decision problems, how to solve them with an appropriate quantitative analysis, and how to apply the recommended solution. However, there is an emphasis on concepts rather than mechanical manipulation. Hence, a significant part of the discussion is devoted to problem formulation, technique assumptions, potentials, limitations, and interpretation of the results of the analysis from the perspective of the decision maker.

There is a simplified, logical presentation of quantitative tools with extensive use of examples, graphs, tables, and other illustrative devices. Furthermore, each chapter has technique summaries incorporated at appropriate points within the discussion. In addition, the discussion highlights the connection between management science/operations research and computer information systems. Appropriate batch and interactive computer programs are identified. Computer data and models are presented, solution procedures are discussed, and the results are interpreted. There are also end-of-chapter glossaries for easy reference.

Quantitative decision making, like athletics and music, is best learned by doing. Beginners can facilitate their understanding by practicing the concepts in the types of situations actually encountered by decision makers. Therefore, there is an abundance of realistic examples that are scaled-down versions of problems encountered in public and private

organizations. Each chapter contains several examples in the body of the text and numerous exercises and a case at the end.

End-of-chapter exercises are divided into thought exercises (extension of basic concepts), technique exercises (practice of procedures), and applications exercises (selection of concepts and techniques, and development of solution). Each chapter concludes with a modified version of an actual private- or public-sector case. Cases require an integration and extension of text concepts, quantitative analysis, formulation of a decision recommendation, and presentation of results in a form understandable to management.

Mathematics is kept at an accessible level for the beginning user of quantitative decision making. The only prerequisites are college algebra, elementary probability, and basic statistics. Other relevant mathematics is developed as needed. The orientation should put the material within reach of a junior, senior, or beginning MBA student.

ORGANIZATION

The book is organized in a way that leads to a coherent treatment of the subject. First, major topics are divided into modules, or parts. Part I provides the foundations. It defines the nature of management science, discusses its role in the decision-making process, and identifies the steps necessary for successful implementation. The second part presents a general decision-making framework and shows how strategies can be formed in various decision environments. Part III addresses linear and other mathematical (integer, goal, heuristic, and nonlinear) programming problems and methods. The next part provides a comprehensive review of general network flow problems, including transportation, transshipment, assignment, minimal spanning trees, cycles and routes, maximal flows, and PERT/CPM. Part V considers some standard situations involving sequential decisions, queuing, and inventory problems. Simulation is the topic of the final module.

Although each module after Part I is essentially independent, the modules are arranged in a logical progression. Part II deals mainly with decisions made in an uncertain or risky environment. The mathematical programming module, Part III, extends the analysis to constrained optimization problems that involve primarily certain circumstances. In Part IV, the mathematical programming concepts are applied to network flow problems. Part V considers some standard analytical models that build on the concepts developed in preceding modules. In many cases, available analytical models are of little value because of the complex or unstructured nature of the problem. The final module presents an approach designed for these situations.

Each module, or part, is also designed to eliminate the effect of variability in student capabilities and motivation. Starting at the simplest

level, there is a gradual development of ideas and applications. Eventually, the student progresses to near the state of the art in the field. Similar independent modularity is provided within the chapters. Each chapter starts with elementary concepts, progresses through increasingly complex material, and ends with the most advanced topics.

With this arrangement, students can be assigned a continuous sequence of pages within a module. Then, when the level within the module exceeds the course objectives, students can be directed to another part of the book. In this way, the instructor can easily control the level for any particular topic. Furthermore, by directing the sequence of modules, the instructor can readily satisfy different course plans. These features provide the topical flexibility necessary for matching content with course objectives and student profiles.

The selection of topics reflects the introductory nature of the text. The book emphasizes the most popular quantitative approaches used today by public and private organizations. Unfortunately, some techniques, like nonlinear programming, require a preparatory background in management science/operations research. In these instances, the topic is merely identified and illustrated, and text notations and a bibliography refer the user to appropriate advanced treatments. However, the book provides the essential, relevant material covered in almost all one-semester/two-quarter introductory survey courses in quantitative decision making.

SUPPLEMENTARY MATERIAL

The Instructor's Manual contains fully worked-out solutions, hints in selecting problems for student assignments, and a bank of potential examination problems complete with solutions. The hints include a brief description of the problems, an assessment of their level of difficulty, and the relationships between the concepts and problems. In addition, the Manual provides sample course outlines and chapter-by-chapter ideas for presenting the material.

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