

QUANTITATIVE METHODS FOR BUSINESS

Fourth Edition

Anderson • Sweeney • Williams



QUANTITATIVE METHODS FOR BUSINESS

FOURTH EDITION

David R. Anderson

UNIVERSITY OF CINCINNATI

Dennis J. Sweeney

UNIVERSITY OF CINCINNATI

Thomas A. Williams

ROCHESTER INSTITUTE OF TECHNOLOGY

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TO:

Krista and Mark

Mark, Linda, Brad, Tim, Scott, and Lisa

Cathy, David, and Kristin

Preface

The purpose of this fourth edition, as with previous editions, is to provide students with a sound conceptual understanding of the role that quantitative methods play in the decision-making process. The text describes the many quantitative methods that have been developed over the years, explains how they work, and shows how they can be applied and interpreted by the decision maker.

We have written this book with the needs of the nonmathematician in mind; it is applications oriented. In each chapter a problem is described in conjunction with the quantitative procedure being introduced. The development of the quantitative technique or model includes applying it to the problem in order to generate a solution or recommendation. We have found that this approach helps to motivate the student by demonstrating not only how the procedure works, but also how it can contribute to the decision-making process.

CHANGES IN THE FOURTH EDITION

In preparing the fourth edition we have been careful to maintain the overall format and approach of the previous editions. However, based on our own classroom experience and suggestions from users of previous editions, a number of significant changes have been made to enhance the content, organization, and readability of the text.

Complete Revision of Linear Programming

Chapters 7–9 now provide an earlier focus on problem formulation, sensitivity analysis, and the use of computer software in solving linear programming problems. Chapter 7 introduces the graphical method for solving linear programming problems; a new Chapter 8 provides a complete integration of modeling, computer solution, sensitivity analysis, and the interpretation of computer output; and Chapter 9 describes how selected decision-making problems can be formulated and solved as linear programs. Chapter 10 then shows how the simplex method is used to solve linear programs and to develop the standard sensitivity analysis. This new organization provides greater flexibility for instructors who do not want to teach the simplex method, since Chapters 7–9 now provide a complete introduction to linear programming without discussing the simplex solution procedure.

On the other hand, those who want to include the simplex method have a chapter devoted to this topic.

Transportation, Assignment, and Transshipment Problems

In this edition the material on the transportation, assignment, and transshipment problems has been combined into one chapter. For each problem, the discussion begins by showing how to develop a linear programming model. Special-purpose solution procedures are then presented for the transportation and assignment problems to demonstrate the streamlined solution process that is possible because of the special problem structure. Users who want simply to treat these problems as special cases of the general linear programming approach can do so by skipping the sections on the special-purpose algorithms.

Case Problems

Another significant new feature of this edition is the addition of case problems to 11 of the chapters. These case problems provide the student with the opportunity to attempt a larger-scale problem for which a computer solution is generally required. A managerial report is required, and questions at the end of each of the cases suggest important issues to be addressed in the student's analysis and recommendations.

Decision Analysis and Utility

This edition of the text further expands on the importance of decision analysis. A section discussing sensitivity analysis with respect to state-of-nature probabilities has been added, as well as a section describing marginal analysis for problems involving many decision alternatives and many states of nature. The material on the analytic hierarchy process has been combined with the goal programming material in a new chapter entitled "Multi-criteria Decision Problems" (Chapter 17).

Other Major Changes

Many of the other chapters in the text have been carefully revised in order to take advantage of the input we have had from users of previous editions. Some of the specific changes are as follows:

1. The presentation of computer output has been expanded. LINDO/PC is used to solve linear and integer programming problems. Output from *The Management Scientist* software package is presented in the other chapters. A section has been added to Chapter 1 describing the use of *The Management Scientist*.
2. A new section has been added to Chapter 1 describing mathematical models of cost, volume, and profit.
3. A new section has been added to Chapter 13 to introduce the student to the critical path procedure without the complication of probabilistic activity times.
4. Chapter 16 has been revised to explain in more detail the difference between single-channel and multiple-channel waiting lines.
5. New problems have been added and existing ones revised. As was true in previous editions, the problems are suggestive of the types of situations in which the methods can be applied. Many are scaled-down versions of real-life problems.

PREREQUISITE

The mathematical prerequisite for this text is a course in algebra. Two chapters on probability and probability distributions have been included to provide the necessary background for the use of probability in the later chapters.

Throughout the text we have utilized generally accepted notation for the topic being covered. In this regard students who pursue study beyond the level of this text will find the difficulties of reading more advanced material minimized. To assist in further study, a bibliography is included in the backmatter of the book.

COURSE OUTLINE FLEXIBILITY

The text has been designed so that the instructor has substantial flexibility in terms of selecting topics to meet specific course needs. While many variations are possible, the single-quarter and single-semester outlines that follow are illustrative of the options available.

Possible One-Quarter Outline

- Introduction (Chapter 1)
- Decision Analysis (Chapters 4 and 5)
- Forecasting (Chapter 6)
- Linear Programming (Chapters 7, 8, and 9)
- PERT/CPM (Chapter 13)
- Inventory Models (Chapter 14)
- Computer Simulation (Chapter 15)

Possible One-Semester Outline

- Introduction (Chapter 1)
- Probability Concepts (Chapters 2 and 3)
- Decision Analysis (Chapters 4 and 5)
- Forecasting (Chapter 6)
- Linear Programming (Chapters 7, 8, and 9)
- Transportation, Assignment, and Transshipment Problems (Chapter 11)
- Integer Linear Programming (Chapter 12)
- Computer Simulation (Chapter 15)
- Waiting-Line Models (Chapter 16)

Many other possibilities exist for such a course, depending on course objectives and the background of the students.

ANCILLARIES

A complete package of support materials accompanies the text: an Instructor's Manual; a Study Guide, coauthored by John A. Lawrence and Barry Alan Pasternack, California State University at Fullerton; a Test Bank, prepared by Constance McClaren, Indiana State University; transparency masters; and *The Management Scientist*, an IBM-compatible software package, capable of solving a variety of problems. This menu-driven software package is new to the fourth edition and has been designed to provide a high degree of user flexibility, including the ability to easily save and modify problems. For a small extra charge, a copy of the software may be ordered shrinkwrapped with the text.

We believe that the applications orientation of the text, combined with this package of support materials, provides a solid framework for introducing students to quantitative methods and their application.

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Our associates from organizations who supplied the Quantitative Methods in Practice applications made a major contribution to the text. These individuals are cited in a credit line on the first page of each application.

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David R. Anderson
Dennis J. Sweeney
Thomas A. Williams

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