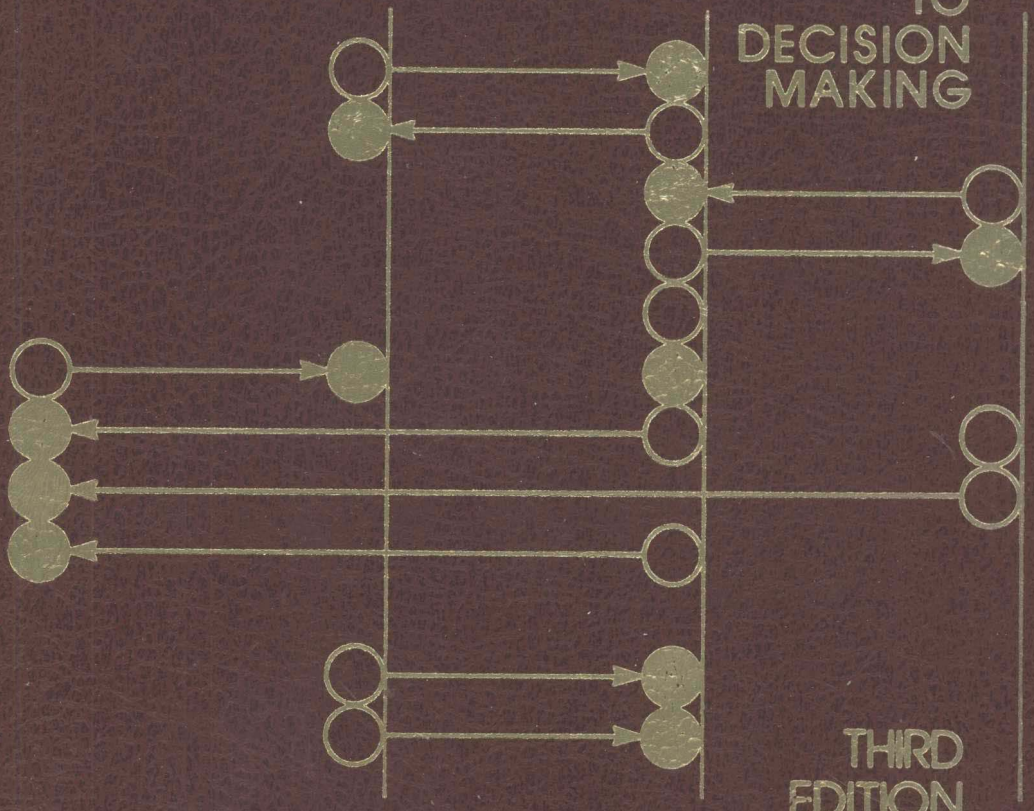
AN INTRODUCTION TO

MANAGEMENT SCIENCE

QUANTITATIVE APPROACHES TO DECISION MAKING



THIRD EDITION

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Third Edition

An Introduction to Management Science

Quantitative Approaches to Decision Making

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A study guide has been developed to assist you in mastering concepts presented in this text. The study guide reinforces concepts by presenting them in condensed concise form. Additional illustrations and examples are also included. The study guide is available from your local bookstore under the title, *Study Guide to Accompany An Introduction to Management Science: Quantitative Approaches to Decision Making,* third edition, prepared by John A. Lawrence, Jr. and Barry Alan Pasternack.

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To Our Parents

Preface

As with the previous editions, the purpose of this text is to provide students, primarily in the fields of administration and economics, with a sound conceptual understanding of the role management science plays in the decision-making process. Specifically, the text is concerned with that part of management science referred to as quantitative approaches to decision making. Emphasis is placed not only on how the quantitative approaches work but also on 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 situation is described in conjunction with the quantitative procedure being introduced. The development of the quantitative technique or model includes applying it to the problem situation in order to generate a solution or recommended decision. We believe that this approach helps to motivate the student by demonstrating not only how the procedure works, but also how it can be applied and how it contributes to the decision-making process.

We have been pleased with the positive response and wide usage of the previous editions of our text. In preparing this third edition, we have been careful to maintain the format and approach of the previous edition while making selected additions and changes designed to enhance the content and readability of the text. The new features in this edition are:

1. To further emphasize the applications of management science, nine cases supplied by practitioners from business and industry have been added at the end of selected chapters. Each case describes an actual company and its current usage of the management science technique introduced in the chapter. Cases appear at the end of the following chapters: Introduction, Linear Programming Applications, Assignment Problem, Integer Linear Programming, PERT/CPM, Inventory Models, Simulation, Waiting Line Models, and Management Science and Decision Support Systems.
2. The material on linear programming has been repackaged so that all topics involving graphical methods are treated in Chapter 2. Chapter 2 now includes a new section on graphical sensitivity analysis as well as a discussion of infeasibility and unboundedness. The discussion of the Simplex method, including sensitivity analysis and duality, is contained in Chapters 3 and 4. Instructors wishing to cover only the graphical method may cover Chapter 2 and then move on to the linear programming applications of Chapter 5.

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3. A new section has been added in order to amplify the important role the computer plays in solving linear programming problems. The computer software package discussed is IBM's MPSX/370 system, which is one of the most widely used linear programming packages available today. Whether or not the instructor chooses to use a linear programming computer package as part of the course, this new section (Section 4.6) will give the student an understanding of the valuable information computer packages can provide. The section is written so that instructors choosing to skip treatment of the Simplex method may cover it after Chapter 2.
4. The simulation chapter (Chapter 14) has been substantially revised and now includes simulation applications for both waiting line and inventory systems. The waiting line application is used to introduce the simulation methodology. However, the waiting line example is developed in such a fashion that the instructor can introduce simulation and waiting lines simultaneously without first treating analytical waiting line or queueing models (i.e., it is not necessary to cover the chapter on waiting lines prior to simulation).
5. A new concluding chapter has been written in order to provide an overview of the interaction between management science models and decision support systems.
6. Answers to the even-numbered problems are now included at the back of the text.

We have also refined and modified other sections of the text in order to enhance the readibility and pedagogical effectiveness of the material. These changes include new surveys cited in Chapter 1 in order to reflect current usage of the various quantitative techniques and the incorporation of higher inventory costs to reflect inflationary trends. Finally, approximately 100 new and/or revised problems have been included in this edition.

The problems at the end of each chapter have been expanded and continue to be an important part of the book. In addition to reinforcing the material in the chapters, the problems are suggestive of the types of situations in which the methods can be applied. A good number of the examples are actually scaled down versions of problems that have been encountered in practice.

The mathematical prerequisite for this text is a course in college algebra. However, an introductory knowledge of probability and statistics should precede a study of the chapter on decision theory. Such a background would be desirable, but not necessary, for Chapters 9, 13, 14, 15, and 17. Only Chapter 18, which discusses calculus-based solution procedures, requires mathematical skills beyond college algebra and basic probability; this chapter, which we consider optional, requires a knowledge of differential calculus.

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

The text has been designed such that the instructor has substantial flexibility in terms of selecting topics to meet specific course needs. While many

variations are possible, the following one-quarter and one-semester courses are illustrative of the options available.

Possible Course Outlines

One-Quarter	One-Semester
Introduction (Chapter 1)	Introduction (Chapter 1)
Introduction to Linear Programming and Selected Applications (Chapter 2, Section 4.6 and Chapter 5)	Linear Programming and Selected Applications (Chapters 2–5)
Assignment Problems (Sections 6.1–6.3)	Assignment Problem (Sections 6.1–6.3)
Transportation Problem (Chapter 7)	Transportation Problem (Chapter 7)
PERT/CPM (Chapter 9)	Integer Linear Programming (Sections 8.1–8.3)
Inventory Models (Sections 12.1 and 12.2)	PERT/CPM (Chapter 9)
Computer Simulation (Chapter 14)	Inventory Models (Sections 12.1–12.2)
	Computer Simulation (Chapter 14)
	Waiting Line Models (Chapter 15)

Many other possibilities exist for such a course, dependent upon the time available and the background of the students. However, it is probably not possible to cover all the material in a one-term course, unless some of the topics have been previously studied.

Accompanying the text is a complete package of support materials, including a statement of learning objectives for each chapter, solutions for all problems, and a revised student study guide with self-correcting exercises. The study guide was coauthored by John Lawrence and Barry Pasternack (California State University at Fullerton). In addition, adopters will be provided with a new bank of questions and problems specifically designed for examination purposes. The test bank was prepared by Fabienna Godlewski at the University of Cincinnati. We believe that the applications orientation of the text combined with this package of support materials provides an ideal basis for introducing students to management science.

We would again like to express our appreciation to individuals who made significant contributions to the earlier edition of our text including Stanley A. Brooking (University of Southern Mississippi), John L. Eatman (University of North Carolina at Greensboro), Ronald Ebert (University of Missouri at Columbia), Lawrence P. Ettkin (University of Tennessee at Chattanooga), Jack Goodwin, Raymond Jackson (Southeastern Massachusetts University), Phillip E. Lowery, Richard R. McCready, Patrick McKeown (University of Georgia), Richard E. Rosenthal (University of Tennessee at Knoxville), William Truscott (McMaster University) and Ed Winkofsky (Mead Corporation).

In addition, we would like to express our appreciation to the practitioners from business and industry who provided the application cases for this edition. These individuals are: Jerry T. Ranney and Keith R. Weiss (Marathon Oil), James R. Evans (American League), John Tomlin (Ketron, Inc.), Lee Mairose and Debbie Schoening (Seasongood & Mayer), Walt Fenske (Goodyear Tire &

Rubber Company), Carol Hays (Informatics, Inc.), Bill Griggs and Walter Foody (Champion International), and Richard Murphy (Optimal Decision Systems).

We are also indebted to Norman Baker (University of Cincinnati) for providing suggestions for the revision of the simulation chapter and to our editor, Mary Schiller, and others at West Publishing Company for their editorial counsel and support during the preparation of this text. Finally, we would again like to express our appreciation to Linda Leininger and Phyllis Trosper for their continued typing support.

David R. Anderson
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