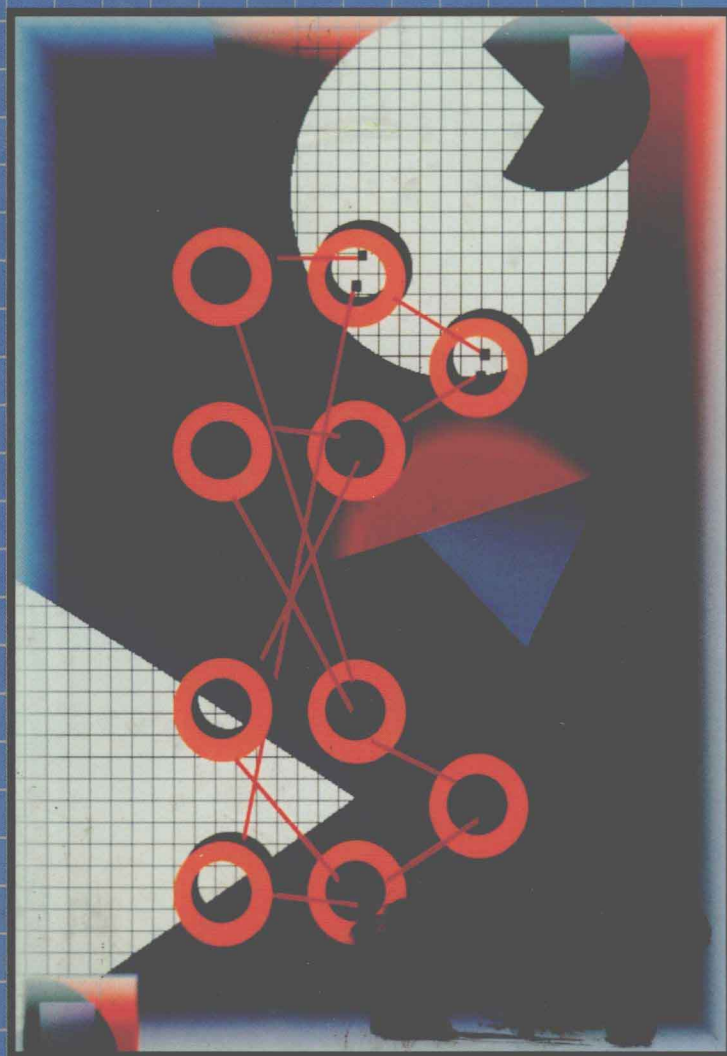


Introduction to Management Science

Sixth Edition



Bernard W. Taylor III

Introduction to Management Science

Sixth Edition

Bernard W. Taylor III

Virginia Polytechnic Institute and State University



PRENTICE HALL

Upper Saddle River, New Jersey 07458

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To Diane, Kathleen, and Lindsey

*To the memory of my grandfather,
Bernard W. Taylor, Sr.*

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A Simon & Schuster Company
Upper Saddle River, New Jersey 07458

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Library of Congress Cataloging-in-Publication Data

Taylor, Bernard W.

Introduction to management science / Bernard W. Taylor III. — 6th ed.

p. cm.

Includes bibliographical references and index.

ISBN 0-13-918103-2

1. Management science. I. Title.

T56.T38 1999

658.4'03—dc21

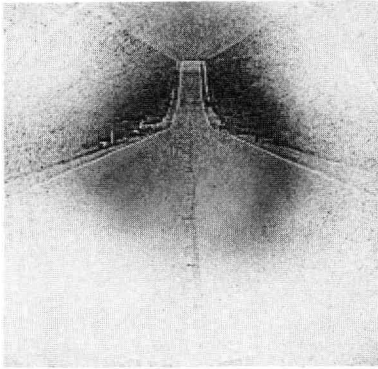
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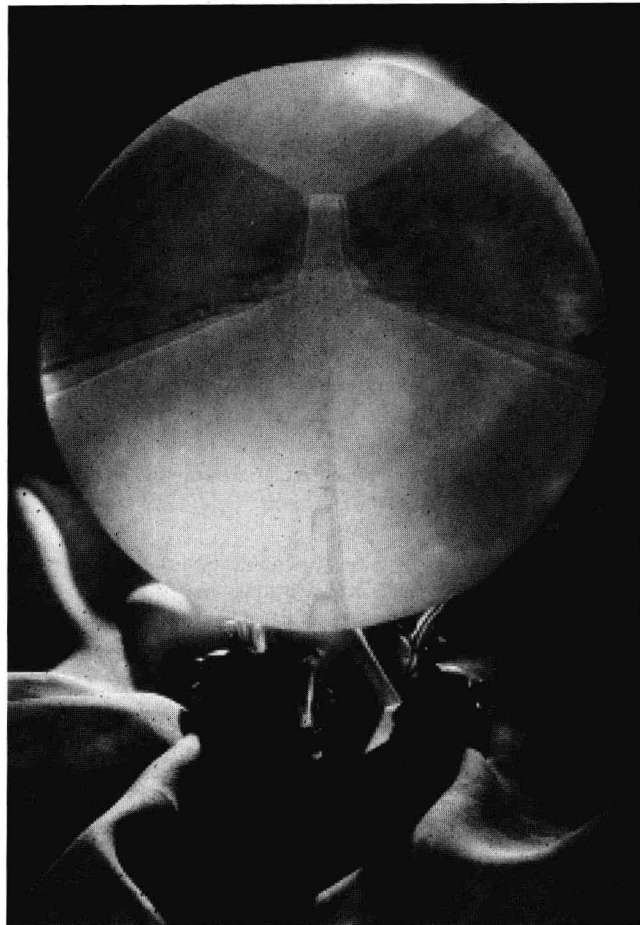
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Simon & Schuster Asia Pte. Ltd., Singapore
Editora Prentice-Hall do Brasil, Ltda., Rio de Janeiro

Printed in the United States of America

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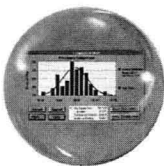
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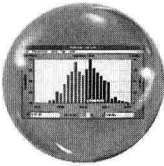


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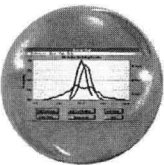
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Preface

Before writing this book, I tried to recall the reasons I did not like many of the quantitatively-oriented textbooks that I had used when I was a student. One prominent reason was that many of the texts consisted of long chapters that attempted to explain everything about a quantitative technique without giving very many examples. Therefore, I have written concise chapters centered around simple, straightforward examples that demonstrate in detail the fundamentals of the modeling techniques. I have presented these examples so that you can easily apply the same solution steps to homework and test problems.

I have attempted to write a book that can be understood by students with limited mathematical backgrounds and by those who haven't had a math course for several quarters or semesters. Thus, when I begin to cover a particular quantitative topic, I do not automatically assume that students understand the mathematical underpinnings. This philosophy is followed both in chapters on relatively easy topics and in those dealing with what are often perceived as more complex management science techniques. Students should find that the topics they thought would be very hard are presented in such a way that they are not that difficult.

Students often have difficulty perceiving the usefulness of quantitative courses in general. When I was a student, I did not foresee how I would use such material in any job that I might hold. Part of the problem is that the examples used in texts often do not appear to be realistic. However, examples must be made simple to facilitate the learning process. Larger, more realistic examples reflecting actual applications would be so complex that they would not help a student learn a technique. The techniques presented in this text are, in fact, used extensively in the real world and their use is increasing rapidly because of computer/information technology. Therefore, the chances of students using the modeling techniques that they learn from this text

in a future course or job are very high. To demonstrate their usefulness in the real world, I have included applications boxes that document actual applications of management science.

Even if these techniques are not used on the job, the logical approach to problem solving incorporated in management science or quantitative methods is valuable for all types of jobs in all types of organizations. Management science consists of more than just a collection of techniques; it embodies a philosophy of approaching a problem in a logical manner, as does any science. Thus, this text not only teaches specific techniques but also provides a method for approaching problems that is very useful.

A primary objective I have had with all revisions of this text, which I have attempted to sustain in this sixth edition, is readability. The techniques presented in each chapter are explained with straightforward examples that avoid lengthy written explanations. These examples are organized in a logical step-by-step solution approach that the student can subsequently apply to the problems. An attempt has been made to avoid complex mathematical notation and formulas wherever possible. These various factors help to ensure that students will assimilate the material.

Learning Features

This sixth edition of *Introduction to Management Science* includes many features that, hopefully, will help sustain and accelerate the students' learning of the material. Some of these features remain from the previous editions, whereas others are new to this edition. The most significant change in this edition has been the addition of Excel spreadsheet solutions in virtually every chapter and the use of several new spreadsheet add-in programs, as well as a new management science software package, *QM for Windows*. In the following sections, we will summarize these and other learning features that appear in the text.

Revised Text Organization

An important objective is to have a well-organized text that flows smoothly and follows a logical progression of topics that places the different management science modeling techniques in their proper perspective. To achieve this objective, this new edition has been substantially reorganized. The first nine chapters group together those chapters related to mathematical programming, including linear, integer, nonlinear, and goal programming. Within these mathematical programming chapters, the traditional simplex procedure for solving linear programming problems manually is now located in one chapter (5), which can be covered as part of linear programming or excluded without leaving a “hole” in the presentation of this topic. The next two chapters, 10 and 11, cover network flow models and project networks, which can also be solved with linear programming as well as traditional model-specific solution procedures. Chapters 12 through 16 include topics generally thought of as being probabilistic, including probability and statistics, decision analysis, Markov analysis, queuing, and simulation. Forecasting in chapter 17 and inventory in chapter 18 are both unique topics related to operations management.

New Topics in This Edition

In an effort to keep the book current and abreast of contemporary trends in management science, several chapters have been altered to include new topics. Chapter 8, which focused exclusively on goal programming in the previous edition, has been expanded to include the analytical hierarchy process (AHP) and has been renamed “Multicriteria Decision Making” to reflect this change. Chapter 17 on forecasting has been expanded to include multiple regression.

Excel Spreadsheets

The most pervasive and significant change in this edition has been the addition of Excel spreadsheet solutions of problems. Spreadsheet solutions are demonstrated in 16 of the 19 chapters in the text for virtually every management science modeling technique presented. These spreadsheet solutions are presented in optional sub-sections, allowing the instructor the flexibility of covering them or not. The text includes over 150 Excel spreadsheet screens, many of which include reference boxes that describe the solution steps within the spreadsheet. In addition, appendix B at the end of the text provides a tutorial on how to set up and edit spreadsheets for problem solution.

The only chapters that do not include spreadsheet coverage are chapter 2 on the graphical analysis of linear programming, chapter 5 on simplex, and chapter 19, the final chapter in the text, on DSS.

Free Spreadsheet “Add-Ins”

Several spreadsheet add-in packages are provided free on the CD-ROM which is packaged with every copy of this text.

Excel QM

For some management science topics, the Excel formulas that are required for solution are lengthy and complex and, thus, are very tedious and time-consuming to type into a spreadsheet. In several of these instances in the book, including chapter 6 on transportation and assignment problems, chapter 13 on decision analysis, chapter 15 on queuing, chapter 17 on forecasting, and chapter 18 on inventory control, a spreadsheet “add-in” called Excel QM is demonstrated. These add-ins provide a generic spreadsheet set-up with easy-to-use dialog boxes and all of the formulas already typed in for specific problem types. Unlike other “black box” software, these add-ins allow users to see the formulas used in each cell. The input, results, and the graphics are easily seen and can be easily changed, making this software ideal for classroom demonstrations and student explorations. This software is provided free on the accompanying CD-ROM.

TreePlan

Another spreadsheet add-in program that is demonstrated in the text is *TreePlan*, a program that will set up a generic spreadsheet for the solution of decision-tree problems in chapter 13 on decision analysis. This too is provided free on the accompanying CD-ROM.

Crystal Ball

Still another spreadsheet add-in program that is included on the accompanying CD-ROM and demonstrated in the book is *Crystal Ball*. Crystal Ball is demonstrated in chapter 16 on simulation and shows how to perform simulation analysis for certain types of risk analysis and forecasting problems.

OPTIONAL Software Package: QM FOR WINDOWS

The computer package that many students and instructors will prefer to use with this text is *QM for Windows*. This software is very user-friendly, requir-

ing virtually no preliminary instruction except for the “help” screens that can be accessed directly from the program. It is demonstrated throughout the text in conjunction with virtually every management science modeling technique, except simulation. Thus, for most topics problem solution is demonstrated via both Excel spreadsheets and QM for Windows. QM for Windows can be packaged with this text for a reasonable additional price. To order this software packaged with the text, please use ISBN 0-13-989799-2.

New Problems and Cases

Previous editions of the text always provided a substantial number of homework questions, problems, and cases to offer students practice. This edition includes over 660 homework problems, 150 of which are new, and over 40 end-of-chapter cases, 10 of which are new. In addition, four additional spreadsheet modeling cases are provided on this text's web page, which can be accessed at <http://www.prenhall.com/taylor>.

Management Science Applications Boxes

These boxes are located in every chapter in the text. They describe how a company, organization, or agency uses the particular management science technique being presented and demonstrated in the chapter to compete in a global environment. There are more than 60 of these boxes throughout the text and they encompass a broad range of service and manufacturing operations, foreign and domestic.

Marginal Notes

Notes are included in the margins that serve the same basic function as notes that students themselves might write in the margin. They highlight certain topics to make it easier for the student to locate them, they summarize topics and important points, and they provide brief definitions of key terms and concepts.

Examples

The primary means of “teaching” the various quantitative modeling techniques presented in this text is through examples. Thus, examples are liberally inserted throughout the text, primarily to demonstrate how problems are solved with the different quantitative techniques and to make them easier to under-

stand. These examples are organized in a logical step-by-step solution approach that the student can subsequently apply to the homework problems.

Solved Example Problems

At the end of each chapter, just prior to the homework questions and problems, there is a section with solved examples to serve as a guide for doing the homework problems. These examples are solved in a detailed, step-by-step fashion.

Instructors' and Students' Supplements

For the Instructor:

- Electronic Transparencies—figures, tables, and main points from the text are provided electronically as Adobe Acrobat files. These can be viewed with the free Adobe Acrobat Reader, which can be downloaded from Adobe's Web site, <http://www.adobe.com>. These transparencies are available on the instructor's part of the text Web site and on a separate Instructor's CD-ROM.
- Instructor's Solutions Manual (0-13-975087-8)—detailed solutions for all end-of-chapter exercises and cases. In addition to a printed solutions manual, these solutions are provided electronically on the text's Web site and on a separate Instructor's CD-ROM, allowing instructors to electronically post individual solutions on their own course Web site.
- Test Item File—available on both hard copy (0-13-975095-9) and on disk, with Prentice Hall's Custom Test (0-13-975103-3).
- Instructor's CD-ROM (0-13-975111-4)—this separate CD-ROM, for instructors only, contains all of the above supplements, as well as the author's Excel, Crystal Ball, and TreePlan files (with solutions) used in the examples in the text. The only item not included on the CD-ROM is the Prentice Hall Custom Test. The individual test questions, however, are included.
- Text Web Page (<http://www.prenhall.com/taylor>)—the Web site for this text has a password-protected Web site to protect the instructors' material. Included are the Excel QM, instructor's solutions, the electronic transparencies, test questions, and four extra spreadsheet modeling cases with their Excel workbooks. Please contact your local Prentice Hall sales representative for the password.

For the Student:

- **FREE CD-ROM**—A CD-ROM is packaged with every copy of this book. This CD-ROM contains free software (Excel QM, a student version of Crystal Ball, and TreePlan), and Excel, Crystal Ball, and TreePlan files for the examples in the text.
- **Text Web Page** (<http://www.prenhall.com/taylor>)—the Web site for this text contains the Excel, Crystal Ball, and TreePlan files used in the text's examples, as well as four extra cases.

Acknowledgments

As with any large project, the revision of a textbook is not accomplished without the help of many people. The sixth edition of this book is no exception, and I would like to take this opportunity to thank those who have contributed to its preparation. First, I would like to thank my friend and colleague, Larry Moore, for his help in developing the organization and approach of the original edition of this book and for his many suggestions during its revisions. We spent many hours discussing what an introductory text in management science should contain, and his ideas appear in these pages. Larry also served as a sounding board for many ideas regarding content, design, and preparation, and he read and edited

many portions of the text, for which I am very grateful. I also thank the reviewers of this edition:

Nagraj Balakrishnan, Clemson University
 Edward M. Barrow, Keller Graduate School of Management
 Warren W. Fisher, Stephen F. Austin University
 Charles H. Smith, Virginia Commonwealth University
 Richard Gunther, California State University, Northridge

I remain indebted to the reviewers of the previous editions: Ali Behnezhad, Weldon J. Bowling, Rod Carlson, Petros Christofi, Yar M. Ebadi, Richard Ehrhardt, James Flynn, Wade Furgeson, Soumen Ghosh, James C. Goodwin, Jr., Richard Gunther, Ann Hughes, Shivaji Khade, Shao-ju Lee, Robert L. Ludke, Peter A. Lyew, Robert D. Lynch, Dinesh Manocha, Mildred Massey, Abdel-Aziz Mohamed, Thomas J. Nolan, Susan W. Palocsay, David W. Pentico, Cindy Randall, Roger Schoenfeldt, Lisa Sokol, John Wang, and Barry Wray.

I am also very grateful to Tracy McCoy at Virginia Tech for her typing and editorial assistance. I would like to thank Cynthia Regan, my production editor at Prentice Hall, for her valuable assistance and patience. Finally, I would like to thank my editor, Tom Tucker at Prentice Hall for his continual help, patience, and prodding.

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