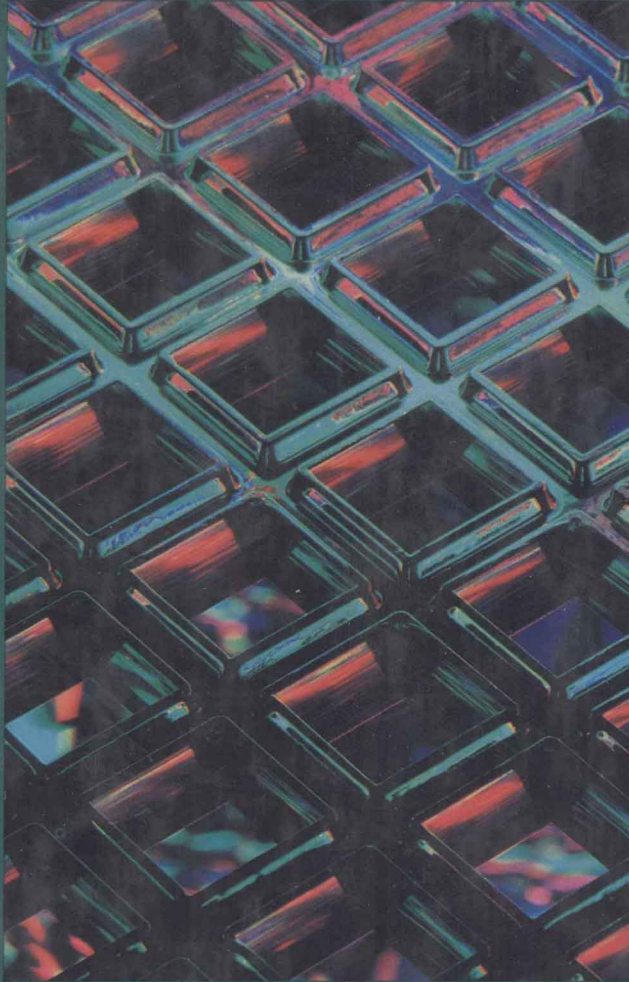


INTRODUCTION TO
MANAGEMENT
SCIENCE



BERNARD W. TAYLOR, III

THIRD EDITION

THIRD EDITION

Introduction to Management Science

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

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Preface

A Note to the Student

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, sprawling chapters that tried to explain everything about a quantitative technique without giving very many examples. Therefore, I have written short, concise chapters centered around simple, straightforward examples that demonstrate in detail the fundamentals of the 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 technique, I do not automatically assume that students understand the mathematical underpinnings. This policy is followed both in chapters on relatively easy topics and in those dealing with what are often perceived as more complex management science techniques—integer programming and dynamic programming. As you read, you should find that topics you 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 position 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. More realistic examples reflecting actual applications would be so complex that they would not help a student learn a technique. Let me assure you, though, that the techniques presented in this text are already being used extensively in the real world and their use is increasing rapidly. Therefore, the chances of using the techniques you learn from this text in a future course or job are very high. To demonstrate the usefulness of these techniques in the

real world, I have included in many chapters an “Applications” section that documents actual applications of management science.

Even if you do not use these techniques when you get a 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 you specific techniques but also provides a method for approaching problems that will be very useful in your future endeavors.

A Note to the Instructor

I had two primary objectives in mind when I originally wrote this text, neither of which has been altered during the preparation of this third edition. First, I wanted the text to be comprehensive, containing all of the topics normally considered to be part of the field of management science. Second, I wanted the text to be readable.

The first objective, comprehensiveness, was attained by including twenty-four chapters that encompass the major topics in the field of management science. This format allows the book to be employed in a variety of course structures. The organization of the various techniques presented in this text is shown on the front endpaper.

The second objective, readability, was accomplished primarily by creating succinct chapters that avoid rambling discussions of the subtleties and nuances of a technique. In each chapter I have concentrated on the fundamentals of one topic or several closely related topics, rather than combining several areas of coverage in a single chapter. 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.

To facilitate the learning process and to update the text, I have made two major additions to this edition. First, I have added an “Example Problem Solution” immediately before the problems section in most of the chapters in the text. I hope that it will help students in working the problems. Second, I have demonstrated the use of computer software packages for most of the techniques in these chapters and have increased the emphasis in the text on computerized solutions. The text now contains computer output from LINDO, QSB+, Super LINDO/PC, GINO, and Minitab. In addition to these packages, the text also demonstrates and features output from

Render and Stair's Microcomputer Software for Management Science, 2nd edition, and Lee and Shim's Micro Manager. Several software packages are available for purchase with this textbook, to provide instructors and students with an easy-to-use integrated textbook and software package.

Introduction to Management Science provides many pedagogical aids for the student. Each chapter begins with a *chapter outline* that gives a brief overview of topics covered in the chapter. *Marginal notes* help the student quickly locate specific topics, and a complete *glossary* of all the key terms is included at the end of the text. In addition, the *solutions* to all of the odd-numbered problems appear at the end of the text.

Many quantitative methods or management science texts are criticized because they contain a limited number of problems. In this third edition, the number of problems has been increased by more than 10 percent. There are now over 600 end-of-chapter problems, many with multiple parts. These problems are organized to coincide with the way the material is presented in the chapter. The problems range from very easy to very challenging. The Instructor's Manual that accompanies this text contains detailed solutions to all problems, as well as over 100 transparency masters of figures and tables from the text.

Also available is a revised Study Guide (authored by Michael Klein of Loyola University of New Orleans) that has a chapter corresponding to each chapter in the text. Each chapter consists of an outline of the text chapter, quizzes (answers are given in the back of the Study Guide), additional problems that are solved in detail, and cases whose solutions are contained in a separate Case Solutions Manual. A separate Test Bank contains over 800 short-answer questions, true/false questions, multiple-choice questions, and problems, as well as their solutions.

The text and its associated materials comprise a comprehensive package that is flexible enough to accommodate a broad range of management science course structures. The material in this package should provide the student with a thorough understanding of the individual management science techniques and an overall comprehension of the management science process.

Acknowledgments

Like any large project, the revision of a textbook is not accomplished without the help of many people. The third 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 thank my colleagues at Virginia Tech, Loren Rees, Ernie Houck, and Robin Russell, for their valued assistance and many helpful suggestions. I also thank the reviewers of this third edition: William R. Brown, Towson State University; Kenneth Darby-Dowman, Polytechnic of Central London; Ed Fisher, Central Michigan State University; Ronald E. Jablonski, University of Illinois; Frank Kokotajlo, University of Nebraska, Omaha; Patrick Lee, Penn State University; and Jay Varzandeh, Arizona State University. I remain indebted to the reviewers of the first and second editions: James C. Goodwin, Jr., Richard Gunther, Robert L. Ludke, Robert D. Lynch, Mildred Massey, and Lisa Sokol. I am also very grateful to Gerry Chenault at Virginia Tech for her typing and editorial assistance. Finally, I would like to thank Kelley Saunders-Butcher and Carolyn Harris at Allyn and Bacon and Sally Lifland and Quica Ostrander at Lifland et al., whose patience and encouragement, as well as the organization they lent to the project, are greatly appreciated.

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Management science is the application of a scientific approach to solving management problems in order to help managers make better decisions. As implied by this definition, management science encompasses a number of mathematically oriented techniques that have either been developed within the field of management science or been adapted from other disciplines, such as the natural sciences, mathematics, statistics, and engineering. This text provides an introduction to the techniques comprising management science and demonstrates their applications to management problems.

Management science, although rather young, is a recognized and established discipline in the field of business administration. The applications of management science techniques are widespread, and they have been frequently credited with increasing the efficiency and productivity of business firms. In a 1975 survey responded to by 275 firms, approximately 50% indicated that they

A scientific
approach to
management