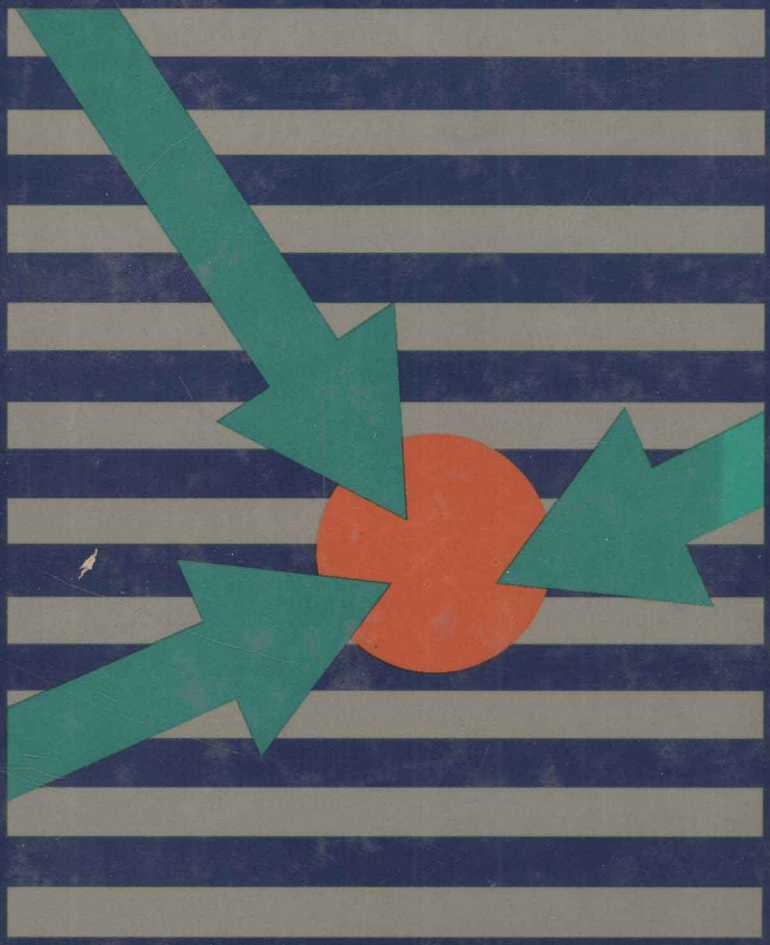
# Management Science

## An Introduction



Davis/McKeown/Rakes

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# Management Science

## An Introduction

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To

Halaine, Kevin, and Kimberly
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P.G.M.

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# Preface

Since the emergence of management science/operations research (MS/OR) as a discipline in the 1940s, the application of these techniques has spread to encompass almost every facet of modern business management and decision making. The inevitable impact of this on business education is that management science has become an integral part of business curricula, and a host of textbooks dealing with the subject have been written.

We wrote this text because we felt that we could, in many respects, improve upon what has been written in the past. Three major pedagogical issues that have influenced the writing of this text are: (1) the role of the computer in teaching management science, (2) the matching of presentation style to the audience of the text, and (3) the necessary content to accommodate a variety of instructor styles and syllabi.

Every instructor who has ever taught an introductory course on management science has been asked, Why are we spending time to learn about management science when the computer can do all of this for us? How well the instructor fields this question may determine whether the class becomes a motivated learning group or a disinterested mass. The answer to this question lies in the fact that every decision problem involves three stages of effort: (1) problem formulation (or model development), (2) solution of the problem, and (3) interpretation and testing of the solution results. While current computer software and computer-based decision support systems are very useful for mathematical computation and problem solution, few are able to provide much assistance in either the formulation of the problem or the interpretation of the results. The computer generates solutions for a wide variety of input parameters, but lacks interpretive judgment about these solutions. In effect, the computer still plays the same role as a calculator or a paper and pencil; it is a tool in the decision-making cycle. We are not trying to downplay the importance of the computer, since most contemporary management science problems could not be solved without one. However, we do not think that the role of the trained decision-maker should be downplayed, since his or her role is just as crucial. The bottom line is that an individual who is well-trained in management science techniques can very quickly adapt to user-friendly management-science computer software, while the best software available cannot help a decision-maker who does not understand these techniques.

Given this belief, there are two approaches that could be taken. The first is to use computer output liberally in the text and attempt to integrate the presentation of

formulation and interpretation with commercial computer codes for solving the problems. The problem here is that there is little standardization of computer hardware and software at colleges and universities. This makes this approach completely useful only at those schools that have hardware that can run the code used in the text. The other approach is to concentrate in the text on the management-science issues and defer the computer integration to the instructor, who can choose computer software that is compatible with available hardware and with syllabus design. We have chosen the latter approach.

The second issue of presentation style and audience is highly related to the first issue of the role of the computer. Since the computer will continue to be the prime method of problem solution, it is our belief that the vast majority of future managers and engineers will be involved in the formulation and interpretation stages, with the solution stage left to the computer and individuals who have specialized in MS/OR. Since this is an introductory text that will be used by business students in general, we have stressed the formulaic and interpretive aspects, and have used small cases at the beginning of all chapters except the review chapters to help illustrate these aspects.

Our emphasis on formulation and interpretation does not mean that we have ignored the problem-solution stage. If the text is to be used in an upper-level course involving those students majoring in MS/OR, the solution methodologies will be an important part of the coverage. We have attempted to provide the maximum flexibility by presenting the solution methodologies in such a way that the instructor may, if he or she so chooses, exclude them without detracting from the presentation of the other two decision stages.

The third issue is that of content. In an effort to make the text useful to as wide an audience as possible, we have included chapters on most topics normally considered to fall within the area of MS/OR. In order to keep the presentation simple and make the text readable, we have tried to keep the chapters short and make the presentation concise. Consequently, the text should be appropriate for a variety of different syllabi.

In terms of organization, the book begins with an introduction to management science, and then illustrates the concept of modeling using chapters on breakeven analysis and forecasting. While a college algebra course and a probability course would be the expected prerequisites for a course using this text, we have included a review chapter on mathematics early in the text, and review chapters on probability and calculus in later chapters, in order to help those who did not retain all that they should from those courses, and to make the text a single-source reference for those students.

Chapters 5 through 8 introduce the foundations of deterministic models through the topics of linear programming formulation, the simplex solution method, and sensitivity and duality. Chapters 9 through 14 explore other deterministic models, and include PERT/CPM, transportation and assignment models, other network models, goal programming, integer programming, and inventory models. Chapters 15 through 19 deal with probability models and, after a review of probability, cover the areas of decision analysis, Markov processes, and game theory. Chapters 20 and 21 discuss additional probabilistic models, and present queueing theory and simula-

tion. Chapters 22 through 24 discuss more advanced models in terms of mathematical and computational complexity, and consist of dynamic programming, a calculus review, and a discussion of nonlinear models. The final chapter concerns model utilization, and deals with implementation issues and cautions.

In terms of order of coverage, it would be possible to cover either deterministic models or probabilistic models first. However, Chapters 5 through 8 must come before Chapters 9 through 14, Chapters 15 through 19 must come before Chapters 20 and 21, and the final chapters should be covered last. Because of the possible combinations of chapter coverage, the text could be used at several levels. While the text has been designed for the introductory undergraduate course (or two-course sequence), the inclusion of advanced concepts at the discretion of the instructor would also make the text appropriate for a course for management science majors, and possibly for the introductory MBA course as well.

This text could not have been completed without the assistance of a great many people. We wish to thank Kathy Fitzpatrick, David Pentico, Ray Souder who reviewed earlier drafts of the manuscript and made many useful suggestions. We also want to thank our Senior Editor at Kent Publishing Company, Jack McHugh, who kept us moving along, and Linda Belamarich, our Production Editor. Finally, we want to thank our families who endured many lost weekends and provided unending support during the writing of this book.

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