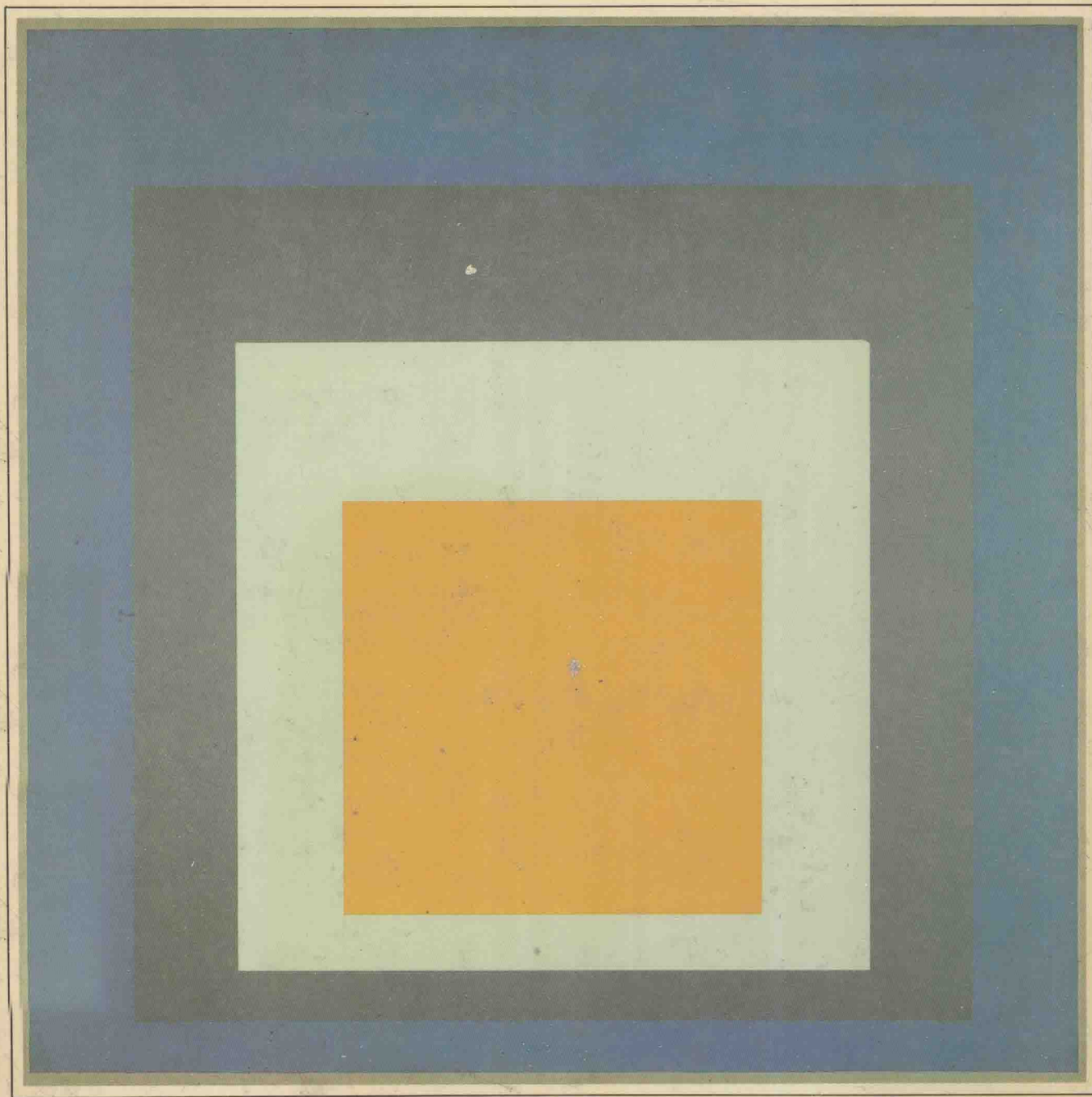


Management Science

ANDREW W. SHOGAN



MANAGEMENT SCIENCE

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PREFACE

This text is designed for a single course or a two-course sequence that introduces management science to undergraduate or graduate students studying business, economics, public policy, health care administration, or applied mathematics.

UNDERLYING PHILOSOPHY

The writing of this text was guided by the following philosophy:

- *Managerial Perspective.* A managerial perspective is maintained throughout the text. Examples are the discussion at the end of Section 4.3 of how to use a rolling planning process to implement the solution to a linear programming model of a production and inventory planning problem, the overview of inventory management in Sections 14.1–14.3, and the overview of queueing systems in Sections 16.1 and 16.2.
- *Innovative Examples.* The examples used to illustrate applications are not “toy problems” but realistic scenarios. These scenarios, many of which are simplified from recent journal articles, involve diverse applications, including applications in the public sector. Examples are Section 5.4’s scenario involving the use of goal programming to allocate the budget of a state agency, Section 9.12’s scenario involving the use of integer programming to perform cluster analysis for marketing research, and Section 17.6’s scenario involving the use of simulation to improve a city’s street-cleaning efforts.

- *Comprehensiveness.* Each topic is covered thoroughly, thereby eliminating the need for an instructor to supplement a topic with extra readings or notes. Within the coverage of each topic, there is an attention to detail that goes beyond that in other texts. This detail is not in the form of mathematical rigor but rather careful and patient explanations. While this approach demands more effort by the reader, it also leads to a greater understanding and appreciation of the topic.
- *Flexibility.* Despite their comprehensiveness, the chapters have been organized to provide maximum flexibility. Advanced material has been placed in separate chapters or in sections near the ends of chapters and can be omitted without loss of continuity. For example, a one-quarter survey course can omit the advanced topics in linear programming formulation in Chapter 5, the advanced topics in project management in Chapter 11, the advanced topics in decision analysis in Chapter 13, the coverage of material requirements planning in Section 14.7, and the coverage of the newsboy problem in Sections 15.8–15.12. Also, a course emphasizing modeling instead of solution techniques can omit the simplex method in Chapters 6 and 7 and the branch-and-bound method in Section 9.14. Additional flexibility is provided by the ability to cover the chapters in a sequence different from the order in which they appear. For more details on the text's flexibility, consult the accompanying Instructor's Manual.
- *Limited Prerequisites.* Despite its comprehensiveness, this text has as a prerequisite only a basic understanding of college algebra and elementary probability theory. Before a probability concept is used in the text, it is briefly reviewed. Statistics and calculus are not prerequisites.

PEDAGOGICAL CHOICES

In writing an introductory text, numerous choices must be made about the pedagogical approaches taken. Below is a summary of the most important choices made in this text.

- *Use of Computer Software Packages.* Because of the diversity of the software available and because of the lack of standardization, this text is not integrated with any particular software. However, in discussing linear programming and network optimization, two hypothetical software packages are used to introduce the reader to typical formats for input and output.
- *The Details of the Simplex Method.* This text accommodates both those instructors who do not wish to cover the simplex method and those who do. The former should omit Chapters 6 and 7, whereas the latter should cover at least Chapter 6 and possibly Chapter 7. In presenting the simplex method, these two chapters assume the reader does not want a “cookbook” approach and hence stress the relationship between geometry and algebra.
- *The Presentation of Goal Programming.* Instead of being treated as an isolated topic, goal programming is presented in Chapter 5 (along with piecewise linear programming and maximin or minimax objective functions) as one of several “tricks” for transforming an apparently nonlinear problem into a linear program.
- *Presentation of Network Optimization.* The topic of network optimization is presented under the unifying “umbrella” of the minimum cost network flow problem. This problem is introduced at the chapter's outset and other models are shown to be special cases.

- *Use of AOA or AON Project Networks.* Instead of using activity-on-arc project networks, this text uses activity-on-node project networks (the choice of almost every personal computer software package).
- *The Use of Bayes' Theorem in Decision Analysis.* A student's understanding of the value of imperfect information is greatly affected by his or her understanding of Bayes' Theorem. Instead of providing a direct statement and proof of Bayes' Theorem, this text uses a three-stage tabular approach that requires only an elementary knowledge of probability theory.

STUDENT LEARNING AIDS

The text has several learning aids that students will find useful as they read and then review a chapter. The most important learning aid is the summaries that are interspersed throughout every chapter. To facilitate quick identification, each summary is highlighted by a vertical line in color in the left margin. Besides the highlighted summaries, every chapter contains two other learning aids: a Checklist of important concepts and techniques and a Glossary of important terminology. For each item in the Checklist and Glossary, a reference to a specific section of the chapter indicates where the student can find more detail.

END-OF-CHAPTER EXERCISES

The text contains over 400 exercises. Several aspects of these exercises merit discussion:

- To ensure a student knows the purpose of each exercise, every exercise or set of similar exercises is introduced by a short learning objective. As examples of how useful the learning objectives can be, examine those that are interspersed throughout the exercises in Chapters 4 and 10. (Instructors will also find these learning objectives useful when they decide which exercises to assign to their students.)
- Each chapter's exercises have varying degrees of difficulty, ranging from requiring students simply to mimic similar examples in the chapter to requiring students to consider a concept or technique mentioned only briefly (if at all) in the chapter. For examples of the latter type of exercise, see Exercises 3.8–3.9, 6.20, 9.9, 10.11–10.12, 13.18–13.20, and 17.19.
- In the back of the text are abbreviated solutions to those exercises marked with an “*” in the left margin (approximately 30% of the exercises). Complete solutions to all exercises are in the Instructor's Manual described below.

SUPPLEMENTS

Accompanying this text are the following supplements:

- *Supplementary Chapters on Dynamic Programming and Heuristics.* Upon request, Prentice Hall will supply free to adopters of the text copies of chapters with comprehensive coverage of two topics excluded from the text: Supplementary Chapter A is on dynamic programming, and Supplementary Chapter B is on heuristics. These supplementary chapters may be duplicated and distributed to students. (Besides introducing an increasingly important topic, the chapter on

heuristics has the added benefit of introducing an important class of decision problems—a routing problem involving several capacitated vehicles rendering service to several geographically dispersed locations.)

- *The Instructor's Manual.* The Instructor's Manual contains specific course outlines illustrating the text's flexibility, enlargements of selected artwork for use in making transparencies, and the complete solution (not just the final answer) to every exercise in every chapter. The manual also contains an appendix to Chapter 8 covering the solution of a transportation problem using the stepping-stone method.
- *Student's Solutions Manual.* Students may purchase a separate manual that provides the complete solutions to those exercises with abbreviated solutions in the back of the text.
- *Computer Software.* Prentice Hall will grant adopters of this text a free site license to the personal computer software package *Quantitative Systems for Business* (QSB), written by Y. Chang and R. S. Sullivan. Although QSB is not designed specifically for this text, it has modules that correspond to almost all the text's chapters. Students may purchase their own copies of QSB and its documentation.

For additional information on these supplements, contact your Prentice Hall representative.

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January 1988

Andrew W. Shogan

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