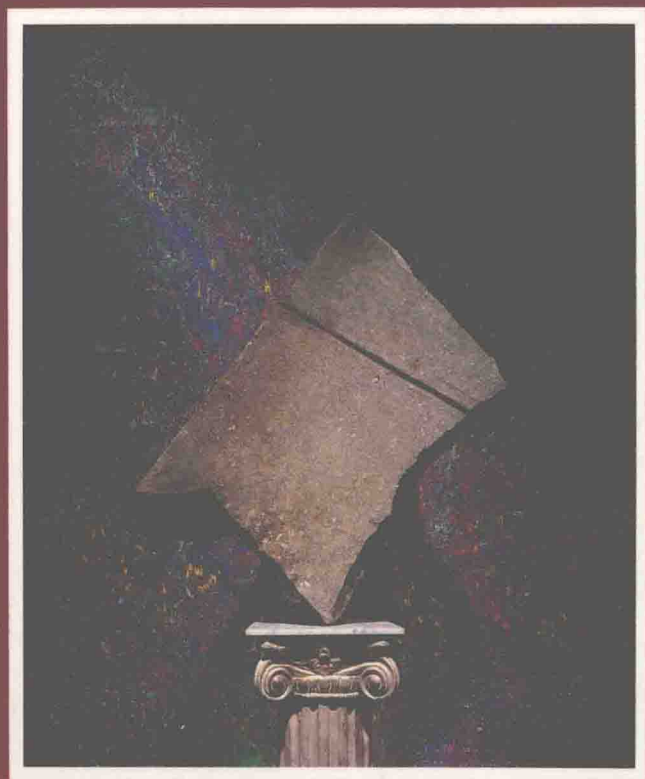


QUANTITATIVE METHODS FOR BUSINESS DECISIONS

With Cases

FIFTH EDITION



LAWRENCE L. LAPIN

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LAWRENCE L. LAPIN

San Jose State University



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Preface

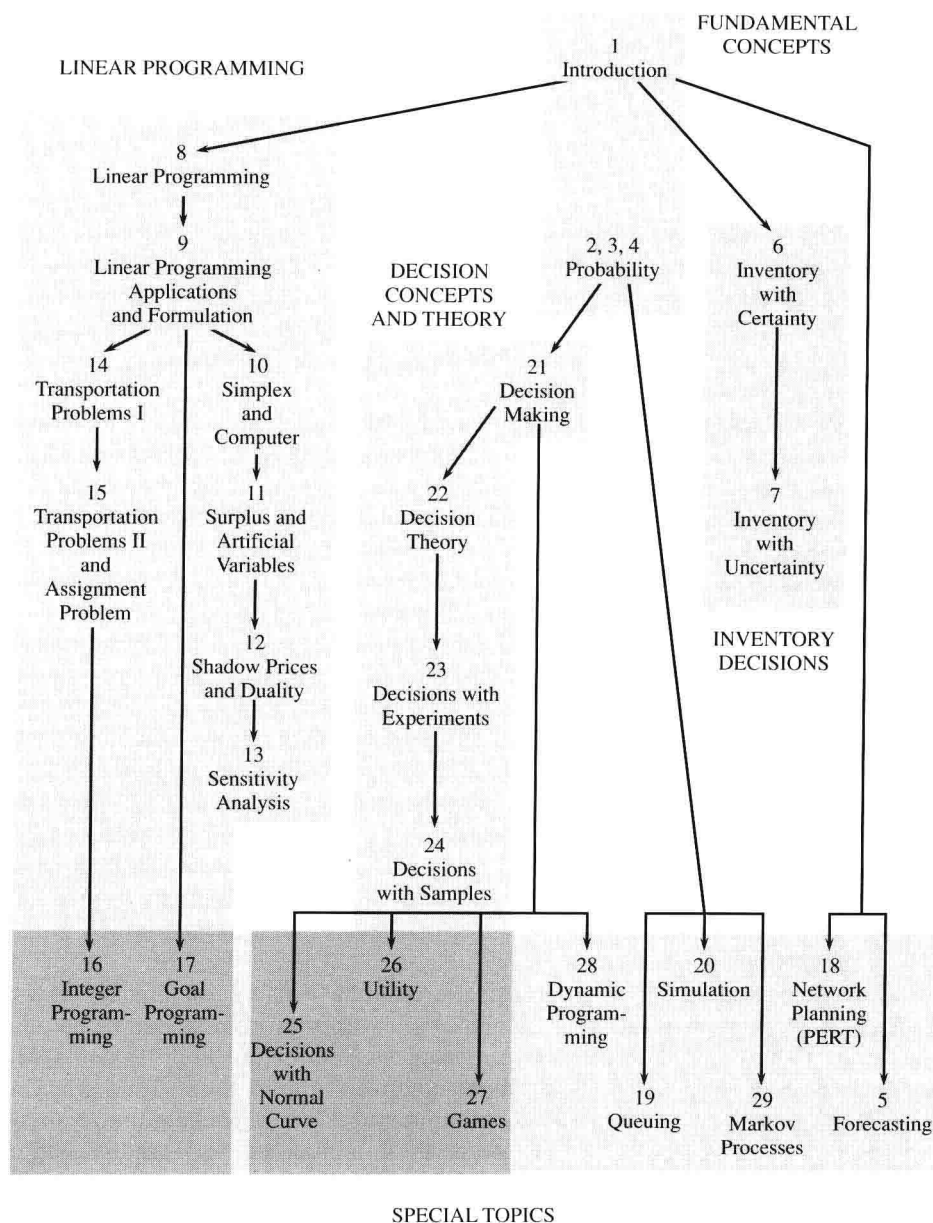
My goal in writing *Quantitative Methods for Business Decisions* has been to provide a complete and modern treatment of basic management science methodology. The book is written for college students who have only an algebra background. Even more important, it is designed to provide a feeling for the variety and power of management science tools, to alleviate apprehension of the subject, and to enable students to recognize on-the-job situations in which management science methodology can be successfully employed.

The book has been thoroughly class-tested many times in a variety of different courses, which has resulted in the culling, revising, and grading of the problem material. In general, the problems are broken into several distinct parts to make the student's job easier and to permit the instructor added flexibility in making assignments. As an added bonus, brief answers to selected problems are provided in the back of the book, so that students can check their own work. Questions for each end-of-chapter case appear with the case, and the cases themselves have been upgraded for this edition.

The Fifth Edition provides a streamlined topical sequence that minimizes jumping back and forth. This revision has several major improvements in topical coverage that make the book easier to use, more flexible, more comprehensive, and more relevant than previous editions. As the tinted areas in the diagram on the next page indicate, the overall design of the book is modular to provide maximum flexibility for adaptation to the requirements of a particular course. All or portions of any part of these subject groupings may be used in constructing a one- or two-quarter or a one- or two-semester quantitative methods course. For example, Chapters 2–4 may be bypassed by students who have had a prior course in statistics or by instructors who teach a purely deterministic course (a viable possibility with this book). The specific sequencing constraints to be followed are also shown in the diagram.

In today's computerized environment, the optimal focus in teaching quantitative methods places less emphasis on hand computations with algorithms and more emphasis on concepts. To this end, the Fifth Edition includes several major improvements. Most chapters now end with sections describing computer applications. That placement eliminates any dependency on a particular computer or software package (and computer details may be easily skipped). The tilt toward the computer is a very gradual one, and this new edition will remain familiar to and comfortable for instructors who have taught out of prior ones.

The book's companion software package, *QuickQuant*, has also been improved. This program is now available in two editions. PC Version 2.0 for the IBM PC works on all compatible computers that have the MS-DOS capability. The new MacIntosh Version 2.0 duplicates the program features for MacIntosh Pluses, SEs, and IIs. This totally *optional* package is available to all users of this textbook. Menu-driven and user-friendly,



QuickQuant will do the messy computations for most procedures described in the book, giving instructors and students added freedom to explore new topics and applications. A detailed description of the new features of *QuickQuant* Version 2.0 is given in the Guide to *QuickQuant* at the end of this book.

A thorough discussion of the many changes made in the Fifth Edition is contained in the Synopsis in the following section. Some changes were motivated by my desire to improve the rigor of the book, while at the same time reducing hand-computational demands and giving better explanations in those areas where my own students had difficulties. My actual experience as owner of retail stores motivated certain changes to the presentation of inventory analysis. The availability of *QuickQuant* has freed me from previous computational constraints that had limited this book's scope. This increased freedom is reflected in new topical coverage and in improved presentations of original topics. Many new problems have been added to this edition, with some new cases and improvements to the existing ones.

This book is more intuitive than most. Discussions devoted to difficult topics therefore may be longer than those in some other books. Explanations are richly illustrated with relevant and interesting examples to provide more meaningful and *easier* learning experiences than those of briefer books. Chapter 10 thoroughly describes in nonmathematical terms the underlying rationale of the simplex method, so that the student can learn why—as well as how—this method works. More advanced concepts, such as artificial variables, are grouped in a second chapter (Chapter 11). Chapter 18 discusses network planning (PERT or CPM) in a broad context, including management implications, milestone and activity scheduling, time–cost trade-off, and (in an appendix to the chapter) probabilistic aspects. Chapter 20 introduces Monte Carlo simulation as a simple substitute for the stopwatch observation of an actual system operation. Highly intuitive decision trees are used extensively throughout to explain a variety of concepts.

The book also highlights the limitations and pitfalls associated with various mathematical models and algorithms. For example, some basic models, such as the EOQ model used in inventory decisions and the simple queuing formulas, are based on assumptions that rarely apply in real life. Wherever practical, alternative approaches such as Monte Carlo simulation are indicated and fully described. Traditional probabilistic PERT assumptions are accompanied by a critical analysis of their applicability. The severe limitations on the use of Markovian decision models are also noted.

The Instructor's Manual contains specific recommendations for various course designs, teaching suggestions, and detailed solutions to the nearly 600 problems and the end-of-chapter cases in the text. Also available is a testbook which contains a set of about 200 solved problems of slight to moderate difficulty. A comprehensive bibliography is included in the back of the book for students who wish to pursue a particular topic in greater detail.

I wish to thank my colleagues who were instrumental in helping me shape the manuscript: Gerry Gunn, Central Washington University; Ke T. Hsia, California State University, Los Angeles; and James E. Storbeck, Ohio State University. I also wish to acknowledge the valuable assistance of my students, and to extend special mention to Janet Anaya, who helped find errors and assisted in preparing the Instructor's Manual.

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streamlines the later simplex discussions in Chapters 10 and 11, where greater prominence has been given to computerized evaluations. The presentation of the simplex algorithm has been improved by adding a new section that explains the meaning of the exchange coefficients and other elements of the simplex tableau. Chapter 10 has a new short symbolic section showing all simplex steps, where z_j and $c_j - z_j$ are introduced as alternative labels for sacrifice and improvement values. Chapter 11 now contains a section on alternative solution methods that includes a brief discussion of Karmarker's algorithm. The presentation of the dual linear program in Chapter 12 has been made more realistic through the inclusion of unrestricted dual variables. Complete rules are given for passing from a non-standard primal to its dual.

Modified LP Extensions The presentation of special transportation method applications in Chapter 15 has been simplified and resequenced, with bounded cells, sources, and destinations placed at the chapter's end. The discussion of integer programming in Chapter 16 has been streamlined by eliminating redundant coverage of the assignment problem (retained as a transportation method application) and by simplifying the presentation of the branch-and-bound method. A graphical problem has been added to introduce this method. Coverage of goal programming in Chapter 17 has been simplified and strengthened. The simpler presentation begins with a graphical portrayal of multiple goals. The omnibus objective function is made more intuitive through the use of natural coefficients as a substitute for arbitrary weights. New to this edition is an alternative procedure, pre-emptive goal programming, which avoids entirely the omnibus objective by instead solving a succession of linear programs—each incorporating higher priority goals as constraints.

Improved Decision Analysis Many improvements have been made to the decision analysis chapter group. A more general and systematic treatment is given in Chapter 22 to risk premiums and certainty equivalents. The discussion of decision making with experimental information is now enriched in Chapter 23 with the introduction of EVEI and ENGE concepts. That change helps students digest the Bayesian statistics in Chapter 24, where EVSI and ENGS are introduced. Chapter 24 has been totally rewritten in an attempt to sort out these concepts, to improve the discussion of the economic issues in sampling, and to integrate computer evaluations. A brief segment has been added to Chapter 26 graphically showing the relationships among attitude toward risk, expected values, certainty equivalents, and risk premiums. The notion of negative risk premium is also discussed in this chapter in conjunction with risk seeking attitude.

Greater Computer Thrust The still optional use of the computer has been expanded to virtually every computationally intensive topic in this book. Many of the above changes are reflected in the *QuickQuant* package. A detailed summary of new features in Version 2.0 can be found in the Guide to *QuickQuant* at the back of this book. Every major *QuickQuant* application is illustrated within the related chapters. A substantial number of computer exercises have been added to the problems and cases.



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