

MIZRAHI & SULLIVAN

FINITE MATHEMATICS

7TH EDITION

AN
APPLIED
APPROACH



Finite Mathematics

An
Applied
Approach

Seventh Edition

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Finite Mathematics

An Applied Approach

To Our Parents With Gratitude

About the Authors

Abe Mizrahi received his doctorate in mathematics from the Illinois Institute of Technology in 1965. He is currently Professor of Mathematics at Indiana University Northwest. Dr. Mizrahi is a member of the Mathematics Association of America. Articles he has written explore topics in math education and the applications of mathematics to economics. Professor Mizrahi has served on many CUPM committees and has been a panel member on the CUPM Committee on Applied Mathematics in the Undergraduate Curriculum. Professor Mizrahi is a recipient of many NSF grants and has served as a consultant to a number of businesses and federal agencies.

Michael Sullivan received his doctorate in mathematics from the Illinois Institute of Technology in 1967. Since 1965, he has been Professor of Mathematics and Computer Science at Chicago State University. Dr. Sullivan is a member of the American Mathematical Society, the Mathematics Association of America, and the Text and Academic Authors Association. He has served on CUPM curriculum committees and is a member of the Illinois Section MAA High School Lecture Committee. Professor Sullivan has written a variety of scholarly articles and has served as a curriculum consultant to high schools, colleges, professional organizations, and government agencies.

Drs. Sullivan and Mizrahi are also the coauthors of *Mathematics: An Applied Approach*, Sixth Edition, John Wiley & Sons, Inc., 1996.

Preface

The first edition of *Finite Mathematics* was published in 1973. At that time our purpose was to present an accessible approach to the mathematics required in business and the social sciences, while giving emphasis to real-world applications from these fields. We achieved this goal of making mathematics accessible to students through clear exposition, appropriate pacing, timely suggestions for interaction, and motivating examples, exercises, and applications. In subsequent editions this has remained our purpose, and in this edition we have enlarged our range of applications to include those using a graphing calculator.

DEVELOPMENT

This edition of *Finite Mathematics: An Applied Approach* has undergone extensive development to ensure its pedagogical soundness and mathematical accuracy. Surveying users of previous editions, monitoring curriculum changes, reviewing proposed organizational changes, reviewing first-draft and final-draft manuscript, reading all phases of manuscript for accuracy, monitoring the selection of new examples and exercises, and working the answers and solutions to all exercises are some of the activities comprising the development process.

Reviewing

Current and former users, and users of other texts, reacted to critical components such as quality of examples and exercises, level, pacing, sequencing and organization, pedagogical approach, and mathematical accuracy. Based on the results of this survey and the current trends in curriculum, a reorganized table of contents was proposed. This was reviewed by professors to gain their reactions to scope, sequencing, pacing, emphasis, and new topics. Reactions were analyzed and incorporated. The first draft of the manuscript was reviewed by a group of finite mathematics professors. They provided additional reactions to pedagogical approach, accuracy, choice of examples and exercises, and organization. In turn, their suggestions were analyzed and incorporated into the next phase of the manuscript.

Accuracy Checks

Maintaining accuracy through manuscript development is an abiding concern of both authors and publisher. For this reason, each phase of the manuscript was read by yet another group of professors to ensure mathematical accuracy in features such as use of notation and computational detail of examples. Professors also monitored exercises to ensure that they gradually increased in difficulty, coordinated well with instruction, and were of interest to students. Equally important, the authors and publishers endeavored to impart to users of this edition the confidence that everything that is humanly possible has been undertaken to ensure the accuracy of answers and solutions to problems. This is evidenced by the special attention given through the working, and reworking, of every problem of this text by an experienced professor of mathematics.

Prepublication Reactions

Just prior to publication, the manuscript was reviewed by professors from a cross section of colleges and universities. These professors are familiar with previous editions of this text and profess a knowledge of competing texts. Their highly positive reaction to exposition, approach, examples, exercises, applications, reorganization, and new topics attests to the pedagogical superiority of this Seventh Edition of *Finite Mathematics: An Applied Approach*.

FEATURES FOR THE STUDENT

A variety of features work together to help students use this book.

Style and Pedagogy

The writing style is clear and concise. Students can easily follow the straightforward explanations. At the same time, the text is mathematically accurate and pedagogically sound. Topics are introduced in simple algebraic settings so that students can more easily concentrate on the underlying concepts.

Examples

An abundance of examples is used to thoroughly exemplify concepts. Some exhibit a basic idea, whereas others gradually raise the complexity of the idea. Where appropriate, examples are used to illustrate applications of the material. In all cases, sufficient detail is provided so that the mathematics is easy to follow.

Interaction

To encourage students to interact with the text, the instruction “Now Work Problem XX” appears in the margin in selected places in each section. These references direct students to problems in the exercise set at the end of the section that relate to the concepts and examples just introduced. By working a related problem in the exercises, the student is able to discover whether the idea just presented is understood, or whether it needs further study before he or she continues to the next concept.

Exercises

At the end of each section, problems are given that progress from easy (to instill confidence) to ones that are more difficult (to challenge better students). Motivation is sustained through application-type exercises that deal with business and the life and social sciences.

Technology

At the end of most sections, Technology Exercises have been included that demonstrate the usefulness of a graphing utility for solving certain types of exercises. These are used as an instructional tool in order to facilitate the crucial combination of graphical, numerical, and algebraic viewpoints. These exercises, which require a programmable and/or graphing calculator or graphing software, have been placed in appropriate exercise sets.

Appendix B, new to this edition, contains examples of solving linear programming problems using the LINDO software package.

Chapter Review

Each chapter concludes with a summary of important terms and formulas, followed by their page reference. A variety of problems affords another check as to whether the material of the chapter has been mastered.

Professional Exams

When appropriate, mathematical questions from CPA, CMA, and Actuary exams are given. This feature adds to the realism of the text by providing students with a preview of those questions that might appear on professional exams.

Functional Appendix

Prerequisite material from algebra, including exercise sets, is presented in Appendix A. This review focuses precisely on topics from earlier courses that are used and needed in this course. Timely references to Appendix A appear at appropriate places in the text.

Purposeful Design

Important terms are given in boldface type when first introduced. Those requiring more emphasis are set off with their definitions in boldface type. Formulas and properties are enclosed in boxes and highlighted with color. Procedures are also highlighted in boxes. Numerous illustrations have been used, each utilizing a second color for clarity and emphasis.

Answers

A section of Answers to Odd-Numbered Problems appears at the end of the book.

CHANGES AND IMPROVEMENTS TO THIS EDITION

Much of the narrative has been rewritten to improve clarity and to heighten understanding. New examples have been added where appropriate. The exercise sets have been improved so that the early problems help build student confidence, while later problems challenge the better student. Many new applied problems have been added for student motivation, and technology exercises have been added at the ends of appropriate sections. All the exercises have been reworked to ensure accuracy in the answer section and in the solutions manuals.

Organizational and Content Changes

Chapter 1 has been streamlined to improve its usefulness as a review chapter. The simple interest application has been removed since it is covered in Chapter 5, Finance. Several new applied problems have been added.

Chapter 2 includes many new applied examples, especially to motivate systems of equations and matrix multiplication. Geometry motivation for analyzing systems of equations appears earlier (Section 2.1). Steps to use for solving systems of equations by elimination have been added. The method of least squares appears as an optional subsection at the end of Section 2.5. More exercises involving using the inverse to solve systems of equations have been added to Section 2.6. New technology exercises also appear here. Section 2.7 has added applications to accounting.

In Chapter 3, Section 3.1 has been rewritten to improve clarity. New examples providing motivation for graphing systems of inequalities and visualization-type exercises have been added.

Chapter 4 has been completely rewritten to modernize the approach. Steps for pivoting are explained in terms of row operations, with proper warnings now given. The concepts of basic variable, entering variable, and leaving variable are explained in more detail than before. Current values of the objective function and corresponding variables are provided after each pivot. A brief discussion of some recent advances in linear programming methods is given. The solution of the minimum problem, mixed constraints, and equality constraints are handled using phase I/phase II techniques.

In Chapter 5, Sections 5.1–5.4 have been rewritten to improve clarity. A new example involving doubling time of an investment has been added to Section 5.2, with reference to the new Appendix A.2, Exponents and Logarithms. In Section 5.3, use of calculators is more pronounced. New examples involving time required for an annuity, with reference to Appendix A.2, Exponents and Logarithms, and sinking funds have been added. Section 5.4 includes a new section on applications: leasing, capital expenditure, and bonds.

In Chapter 6, Section 6.4 now introduces combinations with two examples that provide the basis for the derivation of the formula.

In Chapter 7, Sections 7.1–7.5 have been virtually rewritten and reorganized to improve the presentation. Many of the proofs now appear as exercises with ample hints as to their derivation. As a result, the material now flows better. Equally likely outcomes appears much earlier, with additional new examples to help clarify and explain the concept. The exercises have been redone to improve their readability and relationship to the examples. Conditional probability and independent events now appear in this introductory chapter on probability. A new example has been included in the discussion of conditional probability to help the student use the formulas correctly. The use of Venn diagrams is more extensive than before. Tree diagrams are used early and extensively to solve product rule problems. The exercises have been expanded to include problems involving Venn diagrams and tree diagrams. Eleven new applied exercises have been added for independent events.

Chapter 8 now uses tree diagrams to motivate Bayes' formula as well as to provide an alternative technique of solution. This serves to simplify the explanations, while utilizing previous experience. Expected value has been moved to an earlier position in the chapter and no longer requires random variables for its coverage.

Chapter 9 now takes into account organization methods to improve the discussion of grouped data.

Chapter 10 is a combined, more streamlined, version of the old Chapters 10 and 11; that is, games and Markov chains now appear together. This should help make these topics more accessible.

Chapters 11–13 have been refined and updated.

TEACHING OPTIONS

Based on an extensive survey of what topics are actually taught, this edition was reorganized to meet the varied needs of different curricular requirements. In this edition, you may now teach any of the following clusters of material in any order you wish:

Systems of Equations, Matrices

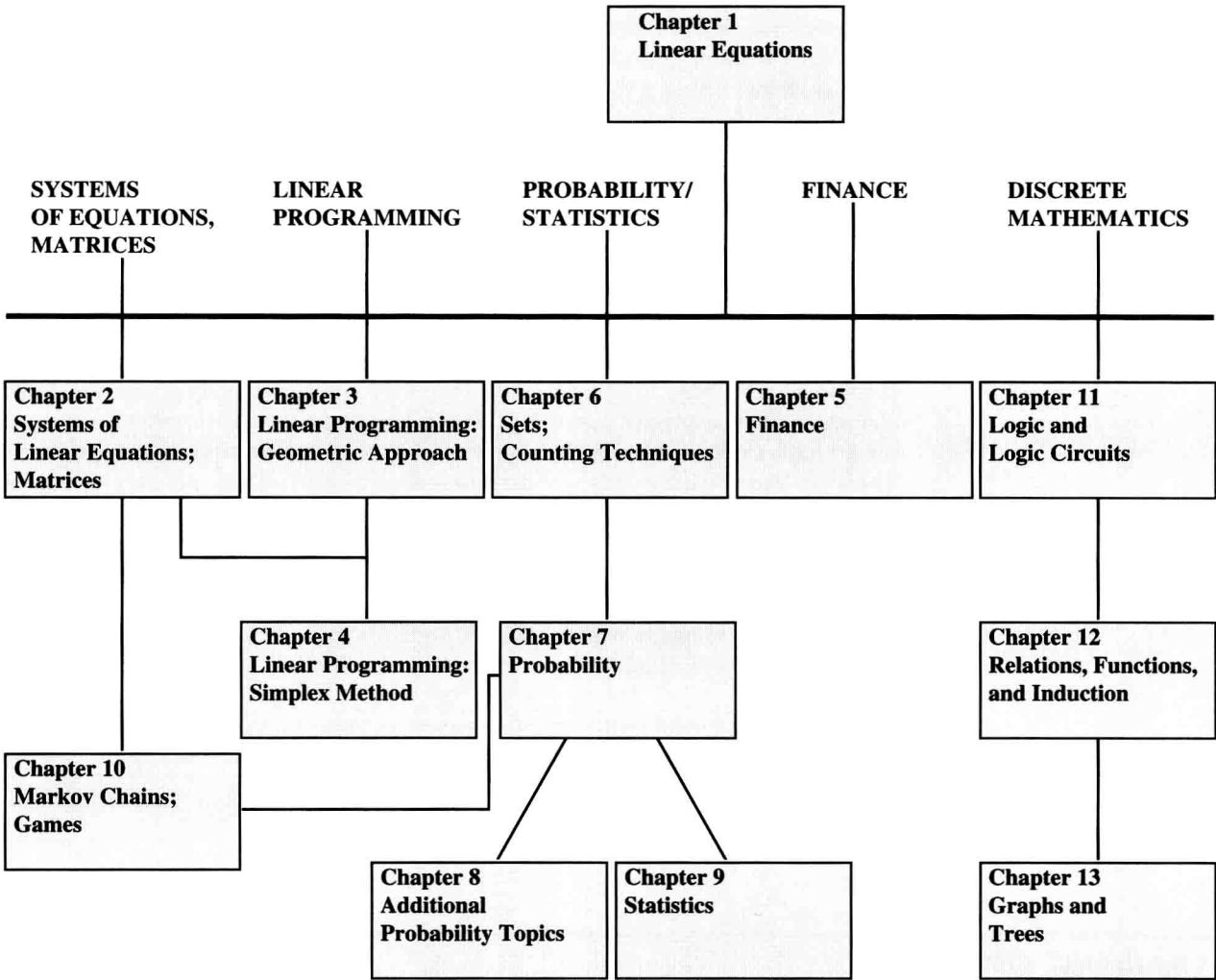
Linear Programming

Finance

Probability/Statistics

Discrete Mathematics

The flowchart that follows shows how the various chapters can be selected and sequenced to meet your specific requirements.



Supplements

Discovering Finite Mathematics and Calculus: A Laboratory Approach with examples on the TI-82 and TI-85 to Accompany *Finite Mathematics: An Applied Approach*, Seventh Edition.

Prepared by Donna Pirich and Patricia Bigliani

0-471-14264-6

Computerized Testbank Macintosh 3½ to Accompany *Finite Mathematics: An Applied Approach*, Seventh Edition.

0-471-13675-1

Computerized Testbank IBM 3½ to Accompany *Finite Mathematics: An Applied Approach*, Seventh Edition.

0-471-13674-3

Testbank to Accompany *Finite Mathematics: An Applied Approach*, Seventh Edition (print version).

Prepared by Deborah Betthauser Britt

0-471-13673-5

Instructor's Solutions Manual to Accompany *Finite Mathematics: An Applied Approach*, Seventh Edition.

Prepared by Stephen L. Davis

0-471-13671-9

Student Solutions Manual to Accompany *Finite Mathematics: An Applied Approach*, Seventh Edition.

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Abe Mizrahi

Michael Sullivan



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