Preface

We have long been concerned that traditional management science textbooks have not taken the best approach in introducing business students to this exciting field. Our goal when initially developing this book during the late 1990s was to break out of the old mold and present new and innovative ways of teaching management science more effectively. We have been gratified by the favorable response to our efforts. Many reviewers and other users of the first four editions of the book have expressed appreciation for its various distinctive features, as well as for its clear presentation at just the right level for their business students.

Our goal for this fifth edition has been to build on the strengths of the first four editions. Co-author Mark Hillier has won several schoolwide teaching awards for his spreadsheet modeling and management science courses at the University of Washington while using the first four editions, and this experience has led to many improvements in the current edition. We also incorporated many user comments and suggestions. Throughout this process, we took painstaking care to enhance the quality of the preceding edition while maintaining the distinctive orientation of the book.

This distinctive orientation is one that closely follows the recommendations in the 1996 report of the operating subcommittee of the INFORMS Business School Education Task Force, including the following extract.

> There is clear evidence that there must be a major change in the character of the (introductory management science) course in this environment. There is little patience with courses centered on algorithms. Instead, the demand is for courses that focus on business situations, include prominent non-mathematical issues, use spreadsheets, and involve model formulation and assessment more than model structuring. Such a course requires new teaching materials.

This book is designed to provide the teaching materials for such a course.

In line with the recommendations of this task force, we believe that a modern introductory management science textbook should have three key elements. As summarized in the subtitle of this book, these elements are a *modeling* and *case studies* approach with *spreadsheets.*

SPREADSHEETS

The modern approach to the teaching of management science clearly is to use *spreadsheets* as a primary medium of instruction. Both business students and managers now live with spreadsheets, so they provide a comfortable and enjoyable learning environment. Modern spreadsheet software, including Microsoft Excel used in this book, now can be used to do real management science. For student-scale models (which include many practical real-world models), spreadsheets are a much better way of implementing management science models than traditional algebraic solvers. This means that the algebraic curtain that was so prevalent in traditional management science courses and textbooks now can be lifted.

However, with the new enthusiasm for spreadsheets, there is a danger of going overboard. Spreadsheets are not the only useful tool for performing management science analyses. Occasional modest use of algebraic and graphical analyses still have their place and we would be doing a disservice to the students by not developing their skills in these areas when appropriate. Furthermore, the book should not be mainly a spreadsheet cookbook that focuses largely on spreadsheet mechanics. Spreadsheets are a means to an end, not an end in themselves.

A MODELING APPROACH

This brings us to the second key feature of the book, a *modeling approach.* Model formulation lies at the heart of management science methodology. Therefore, we heavily emphasize the art of model formulation, the role of a model, and the analysis of model results. We primarily (but not exclusively) use a spreadsheet format rather than algebra for formulating and presenting a model.

Some instructors have many years of experience in teaching modeling in terms of formulating algebraic models (or what the INFORMS Task Force called "model structuring"). Some of these instructors feel that students should do their modeling in this way and then transfer the model to a spreadsheet simply to use the Excel Solver to solve the model. We disagree with this approach. Our experience (and the experience reported by many others) is that most business students find it more natural and comfortable to do their modeling directly in a spreadsheet. Furthermore, by using the best spreadsheet modeling techniques (as presented in this edition), formulating a spreadsheet model tends to be considerably more efficient and transparent than formulating an algebraic model. Another benefit is that the spreadsheet model includes all the relationships that can be expressed in an algebraic form and we often will summarize the model in this format as well.

Another break from tradition in this book (and several contemporary textbooks) is to virtually ignore the algorithms that are used to solve the models. We feel that there is no good reason why typical business students should learn the details of algorithms executed by computers. Within the time constraints of a one-term management science course, there are far more important lessons to be learned. Therefore, the focus in this book is on what we believe are these far more important lessons. High on this list is the art of modeling managerial problems on a spreadsheet.

Formulating a spreadsheet model of a real problem typically involves much more than designing the spreadsheet and entering the data. Therefore, we work through the process step by step: understand the unstructured problem, verbally develop some structure for the problem, gather the data, express the relationships in quantitative terms, and then lay out the spreadsheet model. The structured approach highlights the typical components of the model (the data, the decisions to be made, the constraints, and the measure of performance) and the different types of spreadsheet cells used for each. Consequently, the emphasis is on the modeling rather than spreadsheet mechanics.

A CASE STUDIES APPROACH

However, all this still would be quite sterile if we simply presented a long series of brief examples with their spreadsheet formulations. This leads to the third key feature of this book—a *case studies* approach. In addition to examples, nearly every chapter includes one or two case studies patterned after actual applications to convey the whole process of applying management science. In a few instances, the entire chapter revolves around a case study. By drawing the student into the story, we have designed each case study to bring that chapter's technique to life in a context that vividly illustrates the relevance of the technique for aiding managerial decision making. This storytelling, case-centered approach should make the material more enjoyable and stimulating while also conveying the practical considerations that are key factors in applying management science.

We have been pleased to have several reviewers of the first four editions express particular appreciation for our case study approach. Even though this approach has received little use in other management science textbooks, we feel that it is a real key to preparing students for the practical application of management science in all its aspects. Some of the reviewers have highlighted the effectiveness of the dialogue/scenario enactment approach used in some of the case studies. Although unconventional, this approach provides a way of demonstrating the process of managerial decision making with the help of management science. It also enables previewing some key concepts in the language of management.

Every chapter also contains full-fledged cases following the problems at the end of the chapter. These cases usually continue to employ a stimulating storytelling approach, so they can be assigned as interesting and challenging projects. Most of these cases were developed jointly by two talented case writers, Karl Schmedders (a faculty member at the University of Zurich in Switzerland) and Molly Stephens (formerly a management science consultant with Andersen Consulting). The authors also have added some cases, including several shorter ones. In addition, the University of Western Ontario Ivey School of Business (the second-largest producer of teaching cases in the world) has specially selected cases from their case collection that match the chapters in this textbook. These cases are available on

the Ivey website, **cases.ivey.uwo.ca/cases**, in the segment of the CaseMate area designated for this book. This website address is provided at the end of each chapter as well.

We are, of course, not the first to incorporate any of these key features into a management science textbook. However, we believe that the book currently is unique in the way that it fully incorporates all three key features together.

OTHER SPECIAL FEATURES

We also should mention some additional special features of the book that are continued from the fourth edition.

- Diverse examples, problems, and cases convey the pervasive relevance of management science.
- A strong managerial perspective.
- Learning objectives at the beginning of each chapter.
- Numerous margin notes that clarify and highlight key points.
- Excel tips interspersed among the margin notes.
- Review questions at the end of each section.
- A glossary at the end of each chapter.
- Partial answers to selected problems in the back of the book.
- Supplementary text material on the CD-ROM (as identified in the table of contents).
- An Excel-based software package (MS Courseware) on the CD-ROM and website that includes many add-ins, templates, and files (described below).
- Other helpful supplements on the CD-ROM and website (described later).

A NEW SOFTWARE PACKAGE

This edition continues to integrate Excel 2010 and its Solver (a product of Frontline Systems) throughout the book. However, we are excited to also add to this edition an impressive more recent product of Frontline Systems called **Risk Solver Platform for Education** (or **RSPE** for short). RSPE also is an Excel add-in and its Solver shares some of the features of the Excel Solver. However, in addition to providing all the key capabilities of the Excel Solver, RSPE adds some major new functionalities as outlined below:

- A more interactive user interface, with the model parameters always visible alongside the main spreadsheet, rather than only in the Solver dialog box.
- Parameter analysis reports that provide an easy way to see the effect of varying data in a model in a systematic way.
- A model analysis tool that reveals the characteristics of a model (e.g., whether it is linear or nonlinear, smooth or nonsmooth).
- Tools to build and solve decision trees within a spreadsheet.
- The ability to build and run sophisticated Monte Carlo simulation models.
- An interactive simulation mode that allows simulation results to be shown instantly whenever a change is made to a simulation model.
- The RSPE Solver can be used in combination with computer simulation to perform simulation optimization.

A CONTINUING FOCUS ON EXCEL AND ITS SOLVER

As with all the preceding editions, this edition continues to focus on spreadsheet modeling in an Excel format. Although it lacks some of the functionalities of RSPE, the Excel Solver continues to provide a completely satisfactory way of solving most of the spreadsheet models encountered in this book. This edition continues to feature this use of the Excel Solver whenever either it or the RSPE Solver could be used.

Many instructors prefer this focus because it avoids introducing other complications that might confuse their students. We agree.

However, the key advantage of introducing RSPE in this edition is that it provides an all-in-one complement to the Excel Solver. There are some important topics in the book (including decision analysis and computer simulation) where the Excel Solver lacks the functionalities needed to deal with these kinds of problems. Multiple Excel add-ins—Solver Table, TreePlan, SensIt, RiskSim, Crystal Ball, and OptQuest (a module of Crystal Ball)—were introduced in previous editions to provide the needed functionalities. RSPE alone now replaces all of these add-ins.

OTHER SOFTWARE

Each edition of this book has provided a comprehensive Excel-based software package called *MS Courseware* on the CD-ROM and website. RSPE replaces various Excel add-ins in this package. Otherwise, the remainder of this package is being provided again with the current edition.

This package includes Excel files that provide the live spreadsheets for all the various examples and case studies throughout the book. In addition to further investigating the examples and case studies, these spreadsheets can be used by either the student or instructor as templates to formulate and solve similar problems. The package also includes dozens of Excel templates for solving various models in the book.

MS Courseware includes additional software as well.

- **Interactive Management Science Modules** for interactively exploring certain management science techniques in depth (including techniques presented in Chapters 1, 2, 5, 10, 11, 12, and 18).
- **Queueing Simulator** for performing computer simulations of queueing systems (used in Chapter 12).

NEW FEATURES IN THIS EDITION

We have made some important enhancements to the fifth edition.

- **A Substantial Revision of Chapter 1.** In addition to some updates and a new end-of-chapter case, the example at the heart of the chapter has been modernized to better attract the interest of the students. The example now deals with iWatches instead of grandfather clocks.
- **A New Section Introduces Risk Solver Platform for Education (RSPE).** Section 2.6 presents the basics of how to use RSPE. It is placed near the end of Chapter 2 to avoid disrupting the flow of the chapter, including the introduction of the Excel Solver.
- **Parameter Analysis Reports Are Introduced and Widely Used.** Parameter analysis reports are introduced in Chapter 5 for performing sensitivity analysis systematically. This key tool of RSPE also receives important use in Chapters 7, 8, and 13.
- **Chapter 8 Is Revised to Better Identify the Available Solving Methods for Nonlinear Programming.** The Excel Solver and the RSPE Solver share some solving methods for nonlinear programming and then the RSPE Solver adds another one. These solving methods and when each one should be used are better identified now.
- **A New Section on Using RSPE to Analyze a Model and Choose a Solving Method.** A new Section 8.6 describes a key tool of RSPE for analyzing a model and choosing the best solving method.
- **A Substantial Revision of Chapter 9 (Decision Analysis).** RSPE has outstanding functionality for constructing and analyzing decision trees. This functionality is thoroughly exploited in the revised Chapter 9.
- **A Key Revision of the First Computer Simulation Chapter.** Computer simulation commonly is used to analyze complicated queueing systems, so it is natural for Chapter 12 (Computer Simulation: Basic Concepts) to refer back to Chapter 11 (Queueing Models) occasionally. However, some instructors cover Chapter 12 but skip over Chapter 11. Therefore, we have revised Chapter 12 to make it as independent of Chapter 11 as possible while still covering this important kind of application of computer simulation.

- **A Major Revision of the Second Computer Simulation Chapter.** Although the examples remain the same, the old Chapter 13 (Computer Simulation with Crystal Ball) has been thoroughly revised to replace Crystal Ball by Risk Solver Platform for Education (RSPE). Most students already will be familiar with RSPE from preceding chapters, which should provide a gentler entry into this chapter. More importantly, this impressive, relatively new software package has some significant advantages over Crystal Ball for performing and analyzing computer simulations. However, an updated version of the old Chapter 13 still will be available on the CD-ROM (now Chapter 20) for instructors who wish to stick with Crystal Ball for the time being.
- **A New Section on Decision Making with Computer Simulations.** A key tool of RSPE is its use of multiple simulation runs to generate parameter analysis reports and trend charts that can provide an important guide to managerial decision making. Section 13.8 describes this approach to decision making.
- **A New Section on Optimizing with Computer Simulations.** Another key tool of RSPE is that its Solver can use multiple simulation runs to automatically search for an optimal solution for simulation models with any number of decision variables. Section 13.9 describes this approach.
- **Additional Links to Articles that Describe Dramatic Real Applications.** The fourth edition includes 23 application vignettes that describe in a few paragraphs how an actual application of management science had a powerful effect on a company or organization by using techniques like those being studied in that portion of the book. The current edition adds seven more vignettes based on recent applications (while deleting two old ones). We also continue the practice of adding a link to the journal articles that fully describe these applications, through a special arrangement with the Institute for Operations Research and the Management Sciences (INFORMS®). Thus, the instructor now can motivate his or her lectures by having the students delve into real applications that dramatically demonstrate the relevance of the material being covered in the lectures. The end-of-chapter problems also include an assignment after reading each of these articles.

  We continue to be excited about this partnership with INFORMS, our field's preeminent professional society, to provide a link to these 28 articles describing spectacular applications of management science. INFORMS is a learned professional society for students, academics, and practitioners in quantitative and analytical fields. Information about INFORMS journals, meetings, job bank, scholarships, awards, and teaching materials is available at **www.informs.org**.
- **Refinements in Each Chapter.** Each chapter in the fourth edition has been carefully examined and revised as needed to update and clarify the material after also taking into account the input provided by reviewers and others.

OTHER SUPPLEMENTS

The Instructor's Edition of this book's Online Learning Center, **www.mhhe.com/hillier5e**, is password-protected and a convenient place for instructors to access course supplements. Resources for professors include the complete solutions to all problems and cases, a test bank with hundreds of multiple-choice and true-false questions, and PowerPoint Presentation. The PowerPoint slides include both lecture materials for nearly every chapter and nearly all the figures (including all the spreadsheets) in the book.

The student's CD-ROM bundled with the book provides most of the MS Courseware package. It also includes a tutorial with sample test questions (different from those in the instructor's test bank) for self-testing quizzes on the various chapters.

The materials on the student CD-ROM can also be accessed on the Student's Edition of the Online Learning Center, **www.mhhe.com/hillier5e**. The website also provides the remainder of the MS Courseware package, as well as access to the INFORMS articles cited in the application vignettes and updates about the book, including errata. In addition, the publisher's operations management supersite at **www.mhhe.com/pom/** links to many resources on the Internet that you might find pertinent to this book.

We invite your comments, suggestions, and errata. You can contact either one of us at the e-mail addresses given below. While giving these addresses, let us also assure instructors that *we will continue our policy of not providing solutions to problems and cases in the book to anyone* (including your students) who contacts us. We hope that you enjoy the book.

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