

PRACTICAL

Operations Management

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Philip and Natalie served as the original tutors in the NoteShaper™ video tutorials accompanying the practice problems in this book.

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TO THE INSTRUCTOR

This book differs from other OM textbooks. First, we were determined to tell the whole story of operations management, including an entire chapter on incident and disruption management, recognizing that operations don't always proceed as planned. Second, we wanted to provide this balanced story of OM at a reasonable price to students. We felt both objectives were worthy and both could be achieved, provided that we rebooted the format for this kind of text by framing concepts and analytics with a practical bent. Our aim is to provide a learning tool students will use more of—and more affordably too. In our fifteen concise chapters, we hope to convince students that operations management is action itself, meaning that they should pick up a pencil and try it. To pursue all these ambitions simultaneously, we developed several features you'll see throughout the manuscript:

- **Threaded scenarios.** Every time an analytical methodology is introduced, it is demonstrated in the context of a case study that unfolds throughout the chapter. These demonstration scenarios “thread” through the general discussion of each chapter, presenting conceptual material in action. One major objective of the threaded scenarios is to clarify how operations management is an active process, by viewing it through the eyes of one who is putting the tools to work.
- **Tiered end-of-chapter content.** To support self-guided learning, end-of-chapter content is divided into tiers of resources, each suited to a different purpose. After each summary, key word review, and discussion questions, chapter exercises begin with a set of *Minute Answer* problems, or qualitative quiz questions most appropriately answered with one or two words. Minute Answer serves as a warm-up conceptual review to the subsequent *Quick Start* problems, which are quantitative questions that require the application of a single formula or numerical principle. Quick Start is followed by *Ramp Up* questions, which are also single-answer quantitative queries, but many are quite challenging. Ramp Up questions require additional

confidence in the material, because some aspect of each problem is hidden. Chapter practice problems conclude with full-scale, multipart *Scenarios*, many of which are similar to threaded scenarios earlier in the chapter. Finally, each chapter concludes with a two-paged case study, requiring a methodology from within the chapter but also requiring some creative adaptation to address the issues posed there. Short answers to all practice problems are available in the back of the text, but case notes are available only to instructors.

- **Online support.** To keep the overall size of this book under control, we placed some problems in the book, but more problems—with answers—online at NoteShaper.com. To help with those moments when students get stuck, the NoteShaper™ site also houses a library of video tutorials providing step-by-step instruction on how to solve each of the problems in the book, accessible for a small fee.

We also controlled the size of the book by being really picky about the photographs. Honestly, this book has fewer pictures than some OM textbooks, but each of ours had to earn its space by telling some part of the OM story. We tried to use good page composition to make the book easier to use, nice to look at, and relatively lean, considering the size of that story.

SOME ROADS NOT TAKEN

No matter how we economized through page design, everything OM would not fit in this book. While we take no joy in not writing about something valuable, we had to make some hard choices about what to leave out. Here is our thinking about about three of these choices in particular:

- **History of operations management.** Operations management can be traced back thousands of years. While OM's deepest roots are rarely acknowledged, some textbooks do examine history from the Industrial Revolution through to the present day,

chronicling the names of famous contributors to the field. Instead, we wove the mention of important names into the book's content throughout, forgoing a specific historical section.

- **Linear programming.** Linear programming and related algorithms such as the transportation and assignment methods are powerful techniques in optimization. It grieved us to exclude discussion of them from the text, especially when you can see the results of their use in certain sections, such as the optimal aggregate plan for Main House Gaming in Chapter 14. But we structured this text with the principle of never introducing a technique without explaining exactly how you could put that technique to work. We hope to complete a small companion volume for this book soon, dedicated to linear programming, optimization, and other supporting topics from decision science.
- **Forecasting techniques.** Almost every OM textbook has a chapter on forecasting, including this one. We can imagine that most OM textbook authors aren't completely happy with their forecasting chapter (like us), because there is so much more that could be included. Techniques such as centered moving averages, nonlinear regression analysis, and trend-adjusted exponential smoothing are just a few of the many intriguing tools that we don't cover, simply because we couldn't find space.

ACKNOWLEDGMENTS

Like many complex creative endeavors, this book did not appear instantly, nor is it the result of a few people. What we wrote first appeared as bulky, black-and-white spiral-bound prototypes of today's book, hauled around by over 1,200 undergraduate students at the University at Buffalo (UB) and the Singapore Institute of Management (SIM). We are forever grateful to this first wave of patient contributors, as their sharp eyes corrected and refined the manuscript each semester for two years before we then submitted it for publication. Thank you also to David Wagner of Great Lakes Graphics and Printing at UB, who would marshal these rough-cut, ever-changing, course-pack versions into production on short notice, without missing a single deadline or misplacing a single page.

UB and SIM students shaped this textbook's illustrations as well, because many of the images you see now were originally captured by them. We would like to thank Fang Song in particular, for providing no less than eight

of the images of important conceptual content. In addition we thank these student photographers:

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Several colleague reviewers provided useful suggestions that we did our best to incorporate into the final version. As in any other operation, we faced conflicting requests and suggestions, which we tried to balance with our overall goals of a practical and affordable text. We are especially grateful to the following colleagues for their thoughtful investment of time and personal expertise:

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We hope all will be happy with the published result.

Copy editor Carol Rose trained the manuscript to speak out both confidently and correctly. Carol combed through each page of what you see today, although those adolescent pages didn't flow or even look nearly as nice as they do now. Our grateful thanks to Carol for her exceptional skill, and to Laurie Entringer, Kirsten Dennison, and Jan Troutt for their transformative design work.

Finally, like anything new, this book needed a champion. Thank you, Dick Hercher, for stepping into that role and bringing all of us together.

Natalie C. Simpson
Philip G. Hancock

TO THE STUDENT

Begin, be bold and venture to be wise.

—Horace

Operations management is ultimately about human endeavor, so it applies to any industry and any organization, be it a global supply chain for consumer goods, a local nonprofit agency, or an individual entrepreneur's latest project. While you may have been unaware of its formal terminology, you've been observing and participating in operations for years before you opened this book. Perhaps you felt a distinct frustration when you couldn't locate the back of a long waiting line, so you weren't sure where you should stand. In that case, the phrase "queue discipline" probably wasn't floating through your thoughts, but you were annoyed with this concept nonetheless. You may have once considered packing two of something because it was especially important to have at least one, such as bringing two calculators to an exam. You aren't likely to have thought explicitly of the role of redundancy in strengthening reliability, but that is the principle you were considering. Thus, the purpose of this introductory book is really to reintroduce you to a topic you began many years ago, this time empowering your senses with new language and analytics.

This book differs from other OM textbooks. First, we were determined to tell you the whole story of OM, including an entire chapter on incident and disruption management, recognizing that your endeavors won't always proceed smoothly, but that is no reason to be either fearful or unprepared. And yet, we wanted to create an affordable textbook, plus we hoped to convince you that operations management is action itself, meaning that you should pick up a pencil and try it for yourself, to make it your own. To pursue all these ambitions simultaneously, we developed several features you will see throughout the upcoming pages:

- **Threaded scenarios.** Operational analysis is an active process, one that you can—and in the future, probably will—participate in. We want you to see operations management as both an exciting and a hands-on undertaking that you can be involved in. To start you in that direction, each chapter features threaded scenarios in which each technique discussed in general is then put to work immediately in the setting of a certain organization. Within the scenario, you see the problem through the analyst's eyes, unfolding in the analyst's own handwriting. In this first phase of learning, you are looking over someone else's shoulder, watching this person tackle the situation, and seeing what insight they draw from it.
- **Tiered chapter problems.** When you arrive at the end of a chapter, you naturally look for similar problems to practice. To support your learning, practice problems here are divided into four distinct tiers, each with a different suggested purpose. To begin, *Minute Answer* questions are short, qualitative queries that can be answered with a word or two, quizzing you on conceptual terms and relationships. Minute Answer questions are suggested as a warm-up to computational practice. To start working with numbers, try *Quick Start* problems: these are always single-answer queries, requiring the direct application of a single equation or method from the chapter. Once your confidence begins to build, try that chapter's *Ramp Up* problems next, although please don't discourage too quickly. Like Quick Start, *Ramp Up* problems are short, single-answer questions, but unlike Quick Start many of these questions are rather difficult. *Ramp Up* problems are puzzles, where something is missing or disguised, requiring use of the same material as from Quick Start, but more creative thinking. Finally, the problem sets end in *Scenarios*, inviting you to work as the analyst. These are the more comprehensive problems, providing an extended description of some situation and multipart questions to solve. Here you won't be using a single equation, but you will be working through many of the same analytical steps you first saw unfolding in the threaded scenarios earlier.
- **Online support.** Analysis takes practice, and sometimes you get stuck. To help with practice but keep the size of this book under control, we placed some problems in the book, but more problems—with

answers—online at NoteShaper.com. To help with those moments in which you sometimes get stuck, the NoteShaper™ site also houses a library of video tutorials providing step-by-step instruction on how to solve each of the problems in the book, accessible for a small fee.

While we don't know if you are considering a supply chain major or if you consider yourself an artist (or both), what we do know is that there's something, somewhere in the story of OM that is of value to you. Keeping this

in mind, we've set out to weave this story from as many different endeavors as possible, including agile manufacturing, health care, disaster relief, airline logistics, and event management. We hope you'll see something in that rich landscape that fits your ambitions.

Thank you for your interest in operations management. We wish you the best of luck, wherever you may venture.

Natalie C. Simpson
Philip G. Hancock

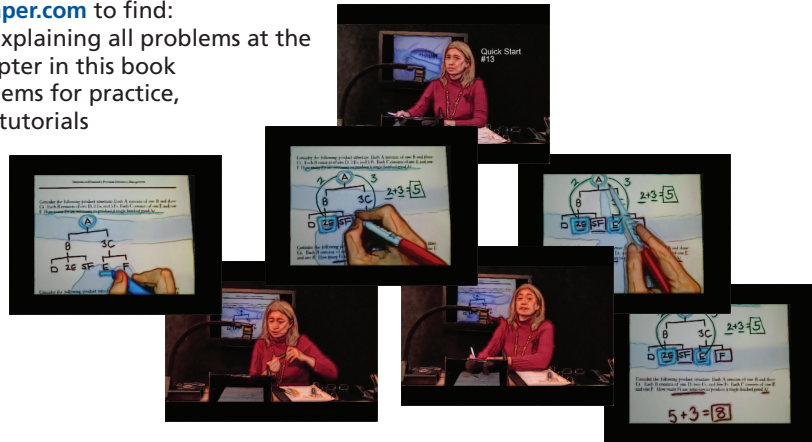
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Having difficulty with a practice problem?

Then visit noteshaper.com to find:

- video tutorials explaining all problems at the end of each chapter in this book
 - additional problems for practice, including video tutorials
- Happy studying!



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