F O R E W O R D

Simulation is a modeling and analysis technique used to evaluate and improve dynamic systems of all types. It has grown from a relatively obscure technology used by only a few specialists to a widely accepted tool used by decision makers at all levels in an organization. Imagine being in a highly competitive industry and managing a manufacturing or service facility that is burdened by outdated technologies and inefficient management practices. In order to stay competitive, you know that changes must be made, but you are not exactly sure what changes would work best, or if certain changes will work at all. You would like to be able to try out a few different ideas, but you recognize that this would be very time-consuming, expensive, and disruptive to the current operation. Now, suppose that there was some magical way you could make a duplicate of your system and have unlimited freedom to rearrange activities, reallocate resources, or change any operating procedures. What if you could even try out completely new technologies and radical new innovations all within just a matter of minutes or hours? Suppose, further, that all of this experimentation could be done in compressed time with automatic tracking and reporting of key performance measures. Not only would you discover ways to improve your operation, but it could all be achieved risk free—without committing any capital, wasting any time, or disrupting the current system. This is precisely the kind of capability that simulation provides. Simulation lets you experiment with a computer model of your system in compressed time, giving you decision-making capability that is unattainable in any other way.

This text is geared toward simulation courses taught at either a graduate or an undergraduate level. It contains an ideal blend of theory and practice and covers the use of simulation in both manufacturing and service systems. This makes it well suited for use in courses in either an engineering or a business curriculum. It is also suitable for simulation courses taught in statistics and computer science programs. The strong focus on the practical aspects of simulation also makes it a book that any practitioner of simulation would want to have on hand.

This text is designed to be used in conjunction with ProModel simulation software, which accompanies the book. ProModel is one of the most powerful and popular simulation packages used today for its ease of use and flexibility. ProModel was the first fully commercial, Windows-based simulation package and the first to introduce simulation optimization. ProModel is already being used in thousands of organizations and taught in hundreds of universities and colleges throughout the world. While many teaching aids have been developed to train individuals in the use of ProModel, this is the first full-fledged textbook written for teaching simulation using ProModel.

Simulation is definitely a learn-by-doing activity. The goal of this text is not simply to introduce students to the topic of simulation, but to actually develop competence in the use of simulation. To this end, the book contains plenty of real-life examples, case studies, and lab exercises to give students actual experience in the use of simulation. Simulation texts often place too much emphasis on the theory behind simulation and not enough emphasis on how it is used in actual

problem-solving situations. In simulation courses we have taught over the years, the strongest feedback we have received from students is that they wish they had more hands-on time with simulation beginning from the very first week of the semester.

This text is divided into two parts: a section on the general science and practice of simulation, and a lab section to train students in the use of ProModel. While the book is intended for use with ProModel, the division of the book into two parts permits a modular use of the book, allowing either part to be used independently of any other part.

Part I consists of study chapters covering the science and technology of simulation. The first four chapters introduce the topic of simulation, its application to system design and improvement, and how simulation works. Chapters 5 through 10 present both the practical and theoretical aspects of conducting a simulation project and applying simulation optimization. Chapters 11 through 13 cover specific applications of simulation to manufacturing, material handling, and service systems.

Part II is the lab portion of the book containing exercises for developing simulation skills using ProModel. The labs are correlated with the reading chapters in Part I so that Lab 1 should be completed along with Chapter 1 and so on. There are 13 chapters and 13 labs. The labs are designed to be self-teaching. Students are walked through the steps of modeling a particular situation and then are given exercises to complete on their own.

This text focuses on the use of simulation to solve problems in the two most common types of systems today: manufacturing and service systems. Nearly 15 percent of the U.S. workforce is employed in manufacturing. In 1955, about one-half of the U.S. workforce worked in the service sector. Today nearly 80 percent of the American workforce can be found in service-related occupations. Manufacturing and service systems share much in common. They both consist of activities, resources, and controls for processing incoming entities. The performance objectives in both instances relate to quality, efficiency, cost reduction, process time reduction, and customer satisfaction. In addition to having common elements and objectives, they are also often interrelated. Manufacturing systems are supported by service activities such as product design, order management, or maintenance. Service systems receive support from production activities such as food production, check processing, or printing. Regardless of the industry in which one ends up, an understanding of the modeling issues underlying both systems will be helpful.

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In addition to the printed text, numerous supplemental materials are available on the McGraw-Hill Web site at www.mhhe.com/harrell3e. These include case studies, PowerPoint slides and ProModel software downloads. The case studies are taken mostly from actual scenarios that can be assigned as simulation projects. They are intended as capstone experiences to give students an opportunity to bring together what they have learned in the course to solve a real-life problem.

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