

GLOBAL
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Business Intelligence and Analytics

Systems for Decision Support

TENTH EDITION

Ramesh Sharda • Dursun Delen • Efraim Turban

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TENTH EDITION

BUSINESS INTELLIGENCE AND ANALYTICS:

SYSTEMS FOR DECISION SUPPORT

Global Edition

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PREFACE

Analytics has become the technology driver of this decade. Companies such as IBM, Oracle, Microsoft, and others are creating new organizational units focused on analytics that help businesses become more effective and efficient in their operations. Decision makers are using more computerized tools to support their work. Even consumers are using analytics tools directly or indirectly to make decisions on routine activities such as shopping, healthcare, and entertainment. The field of decision support systems (DSS)/business intelligence (BI) is evolving rapidly to become more focused on innovative applications of data streams that were not even captured some time back, much less analyzed in any significant way. New applications turn up daily in healthcare, sports, entertainment, supply chain management, utilities, and virtually every industry imaginable.

The theme of this revised edition is BI and analytics for enterprise decision support. In addition to traditional decision support applications, this edition expands the reader's understanding of the various types of analytics by providing examples, products, services, and exercises by discussing Web-related issues throughout the text. We highlight Web intelligence/Web analytics, which parallel BI/business analytics (BA) for e-commerce and other Web applications. The book is supported by a Web site (pearsonglobaleditions.com/sharda) and also by an independent site at dssbibook.com. We will also provide links to software tutorials through a special section of the Web site.

The purpose of this book is to introduce the reader to these technologies that are generally called *analytics* but have been known by other names. The core technology consists of DSS, BI, and various decision-making techniques. We use these terms interchangeably. This book presents the fundamentals of the techniques and the manner in which these systems are constructed and used. We follow an EEE approach to introducing these topics: **Exposure**, **Experience**, and **Explore**. The book primarily provides **exposure** to various analytics techniques and their applications. The idea is that a student will be inspired to learn from how other organizations have employed analytics to make decisions or to gain a competitive edge. We believe that such **exposure** to what is being done with analytics and how it can be achieved is the key component of learning about analytics. In describing the techniques, we also introduce specific software tools that can be used for developing such applications. The book is not limited to any one software tool, so the students can **experience** these techniques using any number of available software tools. Specific suggestions are given in each chapter, but the student and the professor are able to use this book with many different software tools. Our book's companion Web site will include specific software guides, but students can gain **experience** with these techniques in many different ways. Finally, we hope that this **exposure** and **experience** enable and motivate readers to **explore** the potential of these techniques in their own domain. To facilitate such **exploration**, we include exercises that direct them to Teradata University Network and other sites as well that include team-oriented exercises where appropriate. We will also highlight new and innovative applications that we learn about on the book's companion Web sites.

Most of the specific improvements made in this tenth edition concentrate on three areas: reorganization, content update, and a sharper focus. Despite the many changes, we have preserved the comprehensiveness and user friendliness that have made the text a market leader. We have also reduced the book's size by eliminating older and redundant material and by combining material that was not used by a majority of professors. At the same time, we have kept several of the classical references intact. Finally, we present accurate and updated material that is not available in any other text. We next describe the changes in the tenth edition.

WHAT'S NEW IN THE TENTH EDITION?

With the goal of improving the text, this edition marks a major reorganization of the text to reflect the focus on analytics. The last two editions transformed the book from the traditional DSS to BI and fostered a tight linkage with the Teradata University Network (TUN). This edition is now organized around three major types of analytics. The new edition has many timely additions, and the dated content has been deleted. The following major specific changes have been made:

- ***New organization.*** The book is now organized around three types of analytics: descriptive, predictive, and prescriptive, a classification promoted by INFORMS. After introducing the topics of DSS/BI and analytics in Chapter 1 and covering the foundations of decision making and decision support in Chapter 2, the book begins with an overview of data warehousing and data foundations in Chapter 3. This part then covers descriptive or reporting analytics, specifically, visualization and business performance measurement. Chapters 5–8 cover predictive analytics. Chapters 9–12 cover prescriptive and decision analytics as well as other decision support systems topics. Some of the coverage from Chapter 3–4 in previous editions will now be found in the new Chapters 9 and 10. Chapter 11 covers expert systems as well as the new rule-based systems that are commonly built for implementing analytics. Chapter 12 combines two topics that were key chapters in earlier editions—knowledge management and collaborative systems. Chapter 13 is a new chapter that introduces big data and analytics. Chapter 14 concludes the book with discussion of emerging trends and topics in business analytics, including location intelligence, mobile computing, cloud-based analytics, and privacy/ethical considerations in analytics. This chapter also includes an overview of the analytics ecosystem to help the user explore all of the different ways one can participate and grow in the analytics environment. Thus, the book marks a significant departure from the earlier editions in organization. Of course, it is still possible to teach a course with a traditional DSS focus with this book by covering Chapters 1–4, Chapters 9–12, and possibly Chapter 14.
- ***New chapters.*** The following chapters have been added:
 - Chapter 8, “Web Analytics, Web Mining, and Social Analytics.”** This chapter covers the popular topics of Web analytics and social media analytics. It is an almost entirely new chapter (95% new material).
 - Chapter 13, “Big Data and Analytics.”** This chapter introduces the hot topics of Big Data and analytics. It covers the basics of major components of Big Data techniques and characteristics. It is also a new chapter (99% new material).
 - Chapter 14, “Business Analytics: Emerging Trends and Future Impacts.”** This chapter examines several new phenomena that are already changing or are likely to change analytics. It includes coverage of geospatial in analytics, location-based analytics applications, consumer-oriented analytical applications, mobile platforms, and cloud-based analytics. It also updates some coverage from the previous edition on ethical and privacy considerations. It concludes with a major discussion of the analytics ecosystem (90% new material).
- ***Streamlined coverage.*** We have made the book shorter by keeping the most commonly used content. We also mostly eliminated the preformatted online content. Instead, we will use a Web site to provide updated content and links on a regular basis. We also reduced the number of references in each chapter.
- ***Revamped author team.*** Building upon the excellent content that has been prepared by the authors of the previous editions (Turban, Aronson, Liang, King, Sharda, and Delen), this edition was revised by Ramesh Sharda and Dursun Delen.

Both Ramesh and Dursun have worked extensively in DSS and analytics and have industry as well as research experience.

- ***A live-update Web site.*** Adopters of the textbook will have access to a Web site that will include links to news stories, software, tutorials, and even YouTube videos related to topics covered in the book. This site will be accessible at <http://dssbibook.com>.
- ***Revised and updated content.*** Almost all of the chapters have new opening vignettes and closing cases that are based on recent stories and events. In addition, application cases throughout the book have been updated to include recent examples of applications of a specific technique/model. These application case stories now include suggested questions for discussion to encourage class discussion as well as further exploration of the specific case and related materials. New Web site links have been added throughout the book. We also deleted many older product links and references. Finally, most chapters have new exercises, Internet assignments, and discussion questions throughout.

Specific changes made in chapters that have been retained from the previous editions are summarized next:

Chapter 1, “An Overview of Business Intelligence, Analytics, and Decision Support,” introduces the three types of analytics as proposed by INFORMS: descriptive, predictive, and prescriptive analytics. A noted earlier, this classification is used in guiding the complete reorganization of the book itself. It includes about 50 percent new material. All of the case stories are new.

Chapter 2, “Foundations and Technologies for Decision Making,” combines material from earlier Chapters 1, 2, and 3 to provide a basic foundation for decision making in general and computer-supported decision making in particular. It eliminates some duplication that was present in Chapters 1–3 of the previous editions. It includes 35 percent new material. Most of the cases are new.

Chapter 3, “Data Warehousing”

- 30 percent new material, including the cases
- New opening case
- Mostly new cases throughout
- NEW: A historic perspective to data warehousing—how did we get here?
- Better coverage of multidimensional modeling (star schema and snowflake schema)
- An updated coverage on the future of data warehousing

Chapter 4, “Business Reporting, Visual Analytics, and Business Performance Management”

- 60 percent of the material is new—especially in visual analytics and reporting
- Most of the cases are new

Chapter 5, “Data Mining”

- 25 percent of the material is new
- Most of the cases are new

Chapter 6, “Techniques for Predictive Modeling”

- 55 percent of the material is new
- Most of the cases are new
- New sections on SVM and k NN

Chapter 7, “Text Analytics, Text Mining, and Sentiment Analysis”

- 50 percent of the material is new
- Most of the cases are new
- New section (1/3 of the chapter) on sentiment analysis

Chapter 8, “Web Analytics, Web Mining, and Social Analytics” (New Chapter)

- 95 percent of the material is new

Chapter 9, “Model-Based Decision Making: Optimization and Multi-Criteria Systems”

- All new cases
- Expanded coverage of analytic hierarchy process
- New examples of mixed-integer programming applications and exercises
- About 50 percent new material

In addition, all the Microsoft Excel–related coverage has been updated to work with Microsoft Excel 2010.

Chapter 10, “Modeling and Analysis: Heuristic Search Methods and Simulation”

- This chapter now introduces genetic algorithms and various types of simulation models
- It includes new coverage of other types of simulation modeling such as agent-based modeling and system dynamics modeling
- New cases throughout
- About 60 percent new material

Chapter 11, “Automated Decision Systems and Expert Systems”

- Expanded coverage of automated decision systems including examples from the airline industry
- New examples of expert systems
- New cases
- About 50 percent new material

Chapter 12, “Knowledge Management and Collaborative Systems”

- Significantly condensed coverage of these two topics combined into one chapter
- New examples of KM applications
- About 25 percent new material

Chapters 13 and 14 are mostly new chapters, as described earlier.

We have retained many of the enhancements made in the last editions and updated the content. These are summarized next:

- **Links to Teradata University Network (TUN).** Most chapters include new links to TUN (teradatauniversitynetwork.com). We encourage the instructors to register and join teradatauniversitynetwork.com and explore various content available through the site. The cases, white papers, and software exercises available through TUN will keep your class fresh and timely.
- **Book title.** As is already evident, the book’s title and focus have changed substantially.
- **Software support.** The TUN Web site provides software support at no charge. It also provides links to free data mining and other software. In addition, the site provides exercises in the use of such software.

THE SUPPLEMENT PACKAGE: PEARSONGLOBALEDITIONS.COM/SHARDA

A comprehensive and flexible technology-support package is available to enhance the teaching and learning experience. The following instructor and student supplements are available on the book’s Web site, pearsonglobaleditions.com/sharda:

- **Instructor’s Manual.** The Instructor’s Manual includes learning objectives for the entire course and for each chapter, answers to the questions and exercises at the end of each chapter, and teaching suggestions (including instructions for projects). The Instructor’s Manual is available on the secure faculty section of pearsonglobaleditions.com/sharda.

- **Test Item File and TestGen Software.** The Test Item File is a comprehensive collection of true/false, multiple-choice, fill-in-the-blank, and essay questions. The questions are rated by difficulty level, and the answers are referenced by book page number. The Test Item File is available in Microsoft Word and in TestGen. Pearson Education's test-generating software is available from www.pearsonglobaleditions.com/irc. The software is PC/MAC compatible and preloaded with all of the Test Item File questions. You can manually or randomly view test questions and drag-and-drop to create a test. You can add or modify test-bank questions as needed. Our TestGens are converted for use in BlackBoard, WebCT, Moodle, D2L, and Angel. These conversions can be found on www.pearsonglobaleditions.com/sharda. The TestGen is also available in Respondus and can be found on www.respondus.com.
- **PowerPoint slides.** PowerPoint slides are available that illuminate and build on key concepts in the text. Faculty can download the PowerPoint slides from www.pearsonglobaleditions.com/sharda.

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R.S.

D.D.

E.T.

Note that Web site URLs are dynamic. As this book went to press, we verified that all the cited Web sites were active and valid. Web sites to which we refer in the text sometimes change or are discontinued because companies change names, are bought or sold, merge, or fail. Sometimes Web sites are down for maintenance, repair, or redesign. Most organizations have dropped the initial “www” designation for their sites, but some still use it. If you have a problem connecting to a Web site that we mention, please be patient and simply run a Web search to try to identify the new site. Most times, the new site can be found quickly. Some sites also require a free registration before allowing you to see the content. We apologize in advance for this inconvenience.

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