DATABASE MANAGEMENT
WITH WEB SITE DEVELOPMENT APPLICATIONS
To Ann, Mary, Christina, and Elizabeth
Preface

Database Management with Web Site Development Applications comprehensively covers the core database concepts for the design, creation, and manipulation of relational data. Thus it is ideally suited to the core introductory database course for many students. The topics are discussed in the context of how databases are used in businesses and Web sites. The presentation includes analysis of requirements, conceptual modeling, definition of the relational model, relational database design and normalization, creation of databases, and the manipulation of relational databases in relational algebra, in Microsoft Access, and with SQL.

My vision in writing this book was twofold. First, I wanted to give students a practical way of learning the basics of how information is specified, acquired, and managed using database technology. I aimed to cover the core information that any first database course should offer:

• Determining the information requirements for a system
• Specifying those requirements
• Developing a relational database to store the information
• Using the SQL language to manipulate databases

The other part of my vision was to introduce these topics in a motivating, realistic context so that students could understand how information is used to support businesses and other organizations. I thus present the principles of database management in the context of two business-oriented examples: BigHit Video Inc., a traditional brick-and-mortar video rental business; and BigHit Online, an online video sales company. These examples are followed from the initial requirements through the data modeling and database development and finally to the development of complex working Web sites.

To further motivate students and to provide them with additional practical knowledge, I also include a detailed presentation of how to create a database-driven Web site. As the book develops the BigHit Online retail sales site, additional topics are introduced and students learn to:

• Design Web sites to interact with users
• Construct Web pages with HTML
• Design and implement their own dynamic Web applications
• Use database management systems to manage the information content of Web sites

Motivating Students to Learn

For teachers, the Web provides an opportunity to engage students in learning the fundamental principles of information management. It’s not hard to convince learners that the Web cannot exist without database systems. Anyone who looks at a Web search engine or an online retail Web site knows that vast amounts of information are stored behind the scenes. If we convince students that they can learn how information is managed in Web sites—that they can even learn to develop their own sophisticated Web sites—they will be excited. If we get across to them that they cannot understand or develop Web sites without a thorough understanding of database management, they will want to learn.

One theme of Database Management with Web Site Development Applications is that database management and the Web are inextricably linked. As we learn about the Web, we are learning about information management—about collecting, managing, and distributing information. As we learn about database management, we are learning the fundamental principles that support good Web site development.
Audience and Prerequisites

This book is designed for IT, MIS, and mixed-majors courses with no computer programming or math prerequisites. It takes on the significant challenge of presenting material whose understanding requires both technical skill and precision to students who may be unfamiliar with the need for either. Among the book’s major goals are emphasizing the need for precision in the specification of information systems and developing each student’s capability to be precise.

With this information and these skills in hand, students will be prepared for additional study in database management, information systems, computer science, and Internet technology. Additionally, the material in the book provides an excellent foundation for entry-level employment in Web site design and management.

Coverage and Organization

This book is divided into 6 parts that take the reader from an overview of information systems and Web sites, through the principles that underlie database systems, and into Web site development. Part I is an overview of all of the material of the book. Parts II, III, and IV cover data modeling, relational database design, and manipulation of relational databases. Parts V and VI present the basics of Web pages and Web sites, and a detailed look at building complex Web sites and database applications.

In Part I, before encountering the details of database system development, students are introduced to information systems with overviews of what they are, why they are important, and how people create and interact with them. Students are also shown how information system requirements, relational databases, and Web servers work together to produce dynamic Web sites. The early coverage of these topics sets the stage for the study of the principles of database management.

The presentation of the specification, design, and implementation of databases is primarily contained in Parts II, III, and IV. Students begin in Part II (Chapters 3 and 4) by learning about the importance of data modeling and then about how to develop precise specifications of information content. Part III (Chapters 5–7) shows how to transform data models into relational database schemas, create databases, and normalize database schemas. Part IV (Chapters 8 and 9) completes the traditional database material by concentrating on manipulating databases with relational algebra, Query by Example, and SQL.

The coverage of Web site design and implementation continues in Part V (Chapters 10–12). Students learn a very simple style of using HTML to present information and of using cascading style sheets (CSS) to control the look and feel of a Web site. They move on to a discussion of using Microsoft Active Server Pages (ASP) and JavaScript as a programming environment for developing Web applications.

Web-database interaction is developed using the Microsoft Active Data Objects (ADO) library. Students “learn by doing” as they read about applications development and practice modifying existing applications and writing their own.

By the time students have studied Parts I–V, they will be capable of analyzing system requirements, designing and creating databases, and designing and implementing complex Web sites. The “Case in Point” section that ends each chapter gives students detailed examples of how to apply what they’ve learned, using the text’s BigHit Online example.

The final part of the book, Part VI (Chapters 13–15), draws from all of the principles of information systems presented in the first twelve chapters to create the BigHit Online system. Chapter 13 begins by analyzing system requirements and then develops the data models and database for the system. The Web site design is presented as an SQL application by showing exactly what SQL statements must be executed to cre-
ate and process each Web page. Chapter 14 takes a very detailed look at Web applications in JavaScript. It discusses many new programming ideas and demonstrates their usefulness. Chapter 15 addresses a number of issues that are crucial to making databases and database applications reliable and secure.

The presentation of Web development applications in the book is entirely self-contained. All necessary information is presented in the book and the book’s companion Web sites (details below). Additional materials are available through the Addison-Wesley ftp site to assist instructors in setting up the necessary Web server support for class projects and to help students install the Web server tools on their own computers.

Features of This Book

The basic premise of this book is that many students learn best when they work from the specific to the general. Chapters begin with a compelling example of the material. The example is decomposed into its basic parts and each part is explained. In this way the principles emerge from the details in a natural way.

Some special pedagogical features are built into each chapter to help to communicate, and get students involved with, the content of the basic database course—beginning with two continuing examples:

- **A running example, Big Hit Video Inc.**, shows how database principles apply to businesses. This study brings the basic concepts to life in the context of information management for a brick-and-mortar video rental company. Throughout the BigHit Video example, readers dissect an existing database to learn about database design, SQL, and the Entity-Relationship model. All of the elements of the BigHit Video information system are available online for both instructors and students—the E-R diagrams, a sample Access database, sample SQL queries, and a working Web site.

- **A second running example, BigHit Online**, investigates a retail Web site. This fictitious Internet business that sells movie videos is featured in each chapter’s concluding “Case in Point” section, and it is also the basis for the hands-on discussion in Chapters 13–15 of developing and managing Web-database interaction. This example allows students to apply database concepts by building an online video sales store one step at a time. The BigHit Online example helps students to understand how the design decisions that they make early on affect the later development process.

The entire BigHit Online system is available on the book’s Web site. Both students and instructors can see the E-R diagrams and database schemas. Each Web page on the site has a link to source code of the application that generated the page. Even the SQL statements that are used by the Web applications can be seen in Web pages. Students and instructors can download the entire Web site, including a sample SQL Server database, for local installation.

Each chapter concludes with exercises organized into questions, problems, and projects, as follows.

- **Questions** require students to read and understand the chapter and to draw conclusions. In many cases, students are asked to consult references (Web sites or books) that allow them to expand on the topics of the book.

- **Problems** are applications-oriented in that they involve design or implementation of topics from the chapter, and they generally require more time and effort than the questions do.
Projects present step-by-step information system developments that contribute to the BigHit Video, BigHit Online, or Movie Lovers information systems. Each chapter’s projects ask students to apply what they’ve learned in the chapter to create an ever larger piece of an information system.

Instructors should consider choosing one of the three information systems and assigning a project from that system for each chapter. In developing their own solutions to the projects, students will be challenged to study the principles of database systems in more detail. They will solidify their understanding of the material by applying it to real system developments.

The BigHit Video and BigHit Online systems are described in the book in ways that leave many parts incomplete or overly simplified. Projects encourage students to evaluate and extend the simple systems of the book to create their own more realistic systems.

The Movie Lovers projects encourage students to invent an information system and a Web site for movie fans. A prototype implementation of this information system is available to instructors, but is not available to students directly. The Movie Lovers projects are described in general terms in the book, and each instructor is able to tailor projects to students’ needs by providing them with more or less of the prototype implementation.

The project supplements that are available to instructors are designed to make it easy to assign and evaluate student projects. This is especially important for the Web site development projects when students will create their own Web sites using infrastructure tools that can be downloaded from the Web.

Each chapter includes additional features aimed at providing real-world applications of the text concepts and additional details on core database theory.

• **Key Concept** boxes call attention to essential information and emphasize important principles. Some Key Concept boxes go beyond the scope of the core course to provide more information on the underlying theory. Topics highlighted in the Key Concept boxes include the Hypertext Transfer Protocol (HTTP), storing information in memory and disk, and naming foreign key attributes.

• **General interest sections** cover topics that enhance chapter material by taking readers beyond the main narrative. Examples include discussions of the history of the Internet and the World Wide Web, and the evolution of database systems.

• **Interviews** with working professionals give insight into the future of information systems and into the realities of working in the field. Each chapter includes an interview with an information professional. The interviews focus on the importance of fundamental database concepts and on-the-job learning to successful careers in information systems.

• **Key terms** emphasize the importance of using proper terminology. Each key term is shown in boldface when it is introduced in the text. A precise definition of each new term appears at the end of the chapter in which the term is introduced.

### Possible Course Outlines

*Database Management with Web Site Development Applications* will support a variety of one-semester courses for students from any discipline who are interested in information management and the World Wide Web. No computer programming background is assumed.

The audience for the book includes students in both two-year and four-year colleges and universities. This book can be used for required database courses for students in majors that rely on information management and is also suitable for elective courses taken by students looking for an interesting way to learn about the Web and to fulfill computer competency requirements.
Instructors can use the book as the foundation for several possible courses:

- **A traditional database course** that covers chapters 1–9. These chapters contain plenty of material for a one-semester course, including details about how to use Microsoft Access as a database applications programming environment. Students could use Access or any relational database to create databases and develop their skills in SQL programming.

- **An applications-oriented database course** that covers the material in Chapters 1–9 in about one-half or two-thirds of a semester. The remainder of the course would be an in-depth study of Web pages and Web application design and implementation. Student projects would typically involve designing and implementing a database in the first part of the course, and using JavaScript to develop Web applications in the second part.

- **An applications-oriented database course with integrated Web development** that covers Chapters 3–7, which address conceptual modeling and relational databases, in parallel with Chapters 10 and 11, which address basic Web pages and Web server programming. Students could begin using HTML for developing Web sites early in the course and experiment with ASP and JavaScript while learning the traditional database material. The treatment of database applications and SQL in Chapters 8 and 9 could be combined with the database programming of Chapter 12. Students could write Web applications with database interaction during this part of the course. The final part of the book could be covered while students were finishing their semester projects.

- **A Web development applications course** that quickly covers parts of Chapters 3–9 and spends the bulk of the semester on the database and Web applications of Chapters 10–15. This course would be particularly important for students who know about databases and want to learn about dynamic Web sites.

In addition, this book potentially can be used for other courses, including an introductory course on information technology or information studies, or a liberal studies elective or computer literacy course for general interest students.

### Supplementary Resources

This book comes with companion Web sites (http://www.aw.com/riccardi and http://www.web4data.com) offering a variety of supplementary materials online.

**For students and instructors:**
- Sample databases for experimenting with Access and SQL.
- Detailed instructions for installing the book’s companion Web sites on student and instructor computers.
- BigHit Video and BigHit Online examples, fully functioning Web sites with all source code. The code can be used and viewed on the Web site or downloaded for local installation.

**For instructors only:**
- Solutions to text exercises
- PowerPoint lecture notes
- All of the text illustrations
- A test bank of sample exam questions
- Access to all software required to install and administer the example Web sites and databases, and detailed instructions about installing and using the sites.
• Resources for the Movie Lovers information system. The full implementation includes E-R diagrams, sample databases in Access and SQL Server, a fully functioning Web site, and all source code.

The Movie Lovers Web site gives film fans opportunities to view information about movies, to record their opinions of movies and movie people, and to keep track of their own movie experiences. This site has been implemented in full detail with E-R diagrams, relational models, sample databases in Access and SQL Server, and complete Web applications. This site is not available to students directly. Instructors are free to create student projects by providing as much detail as is appropriate for their students. Students could begin with the simplest sketch of the Web site, or a detailed description, or could even begin each piece of the project with the implementation of the previous project that can be found on the book’s instructor-only Web site.

Instructors should contact their local Addison-Wesley representative for access to the instructor-only materials.

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