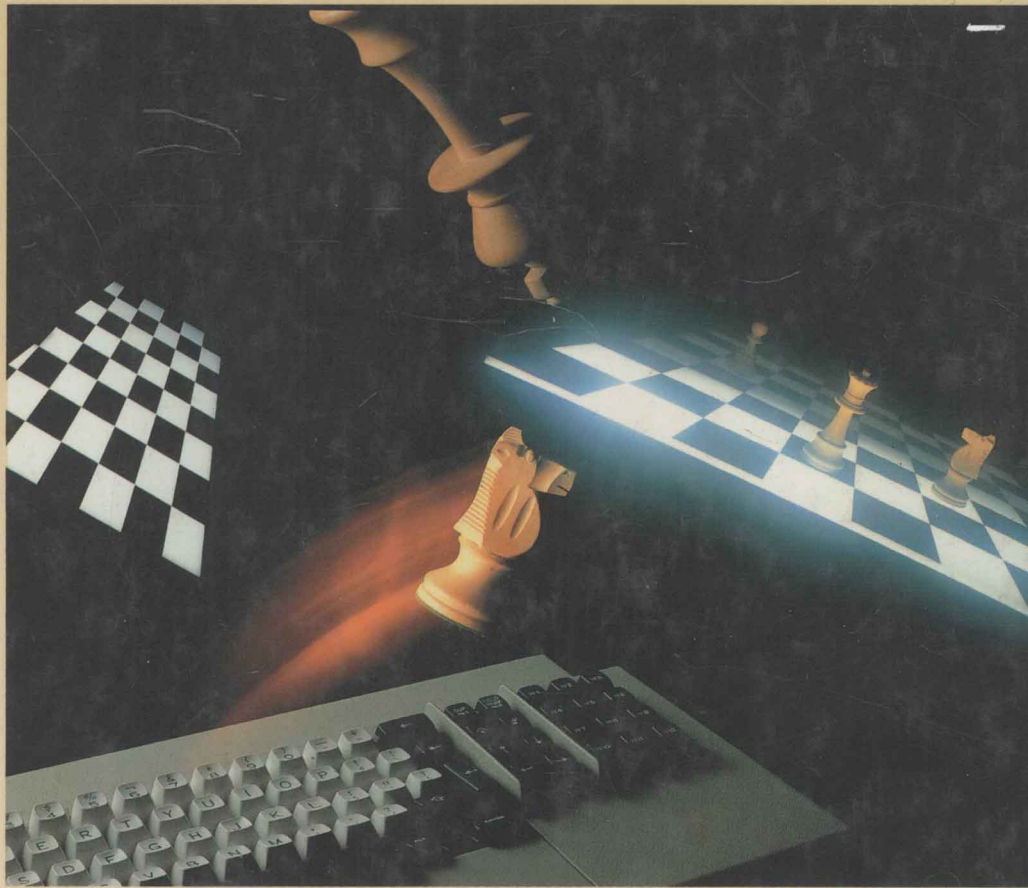


DATABASE SYSTEMS FOR MANAGEMENT



SECOND EDITION

JAMES F. COURTNEY, JR.

DAVID B. PARADICE

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**JAMES F. COURTNEY, JR.
DAVID B. PARADICE
BOTH OF TEXAS A & M UNIVERSITY
SECOND EDITION**

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DATABASE SYSTEMS FOR MANAGEMENT

PREFACE

The Intended Audience for the Book

Database Systems for Management is intended to support a management-oriented first course in database processing concepts. This course is usually taught in the junior or senior year in four-year institutions or in the second year of two-year programs. We recommend that students have taken an introductory computer concepts course, at least one high-level programming course in which basic data structures and access methods have been covered, and a course in systems analysis and design. The systems analysis and design course may be taken concurrently with the database course. Due to the managerial orientation of the book, we recommend that students have completed introductory course work in the major functional areas of business. A course in data structures is not necessary since we provide adequate coverage of this material in appendices. The book can be used for any introductory database management processing course, but is focused on the type of database processing concepts needed in a management information systems program.

Why We Wrote This Book

Many textbooks used in introductory database management classes for management information systems (MIS) students are deficient because of their computer science orientation. This situation occurs because most authors of database textbooks have their foundations in computer science and are currently pursuing careers in that field. Without doubt, their textbooks are excellent presentations of their material. Unfortunately, the material is not in all cases relevant to the ultimate goal of most MIS students (or MIS curricula), which is more oriented toward becoming (or producing) effective decision-making skills than

becoming (or producing) top-rate database designers and builders. Specifically:

- Many database management textbooks have a computer science orientation that stresses the “how” aspects of database design but rarely addresses the “why” aspects. When the “why” aspects are addressed in other books, it is rarely from an organizational decision-making perspective. This textbook approaches introductory database design from a distinctly MIS viewpoint. Throughout the text, we emphasize decision-making and the impact of a database environment upon the decision-making process.
- Many database management textbooks motivate examples from a conceptual basis. Our examples are motivated by realistic scenarios. Each example in this text is formulated within the context of a plausible business situation.
- Many database management textbooks provide abstract data in examples. Our examples contain data that simulates the type of data found in most corporate domains.
- Due to their computer science orientation, many books go into great detail on technical topics. Certainly MIS students need to be familiar with the technical aspects of security and transaction recovery. But they also need to understand the managerial implications of choosing one method over another, or the liability of having inadequate technical support. These aspects are unique to our book.
- Due to their computer science orientation, many books do not go into any detail on managerial issues. MIS students need a database management class that will emphasize the database function as a part of the overall information management system of the organization.

We believe you should consider this book because we have developed it with the intention of addressing the inadequacies of other books described above. More than that, however, we have incorporated a number of features in the second edition that we feel instructors of database management systems courses in MIS curricula will find attractive:

- The importance of planning for database design is emphasized. Unlike any other database textbook, we develop the concept of an organizational information systems master plan and the role of the database management system within that plan.
- We present a very thorough coverage of Entity-Relationship modeling techniques. We also demonstrate how to use data structure diagrams.
- The book has a relational model orientation, although we provide thorough coverage of the CODASYL model and provide an overview of IMS to illustrate the hierarchical model.

- The concept of *normalization* is developed early in the text in an intuitive manner without sacrificing the rigor inherent in the definition of the various normal forms. We develop an approach that demonstrates *why* non-normalized data structures are undesirable. Dependencies, presented in this way, become concepts that students are better able to recognize.
- We emphasize the role of organizational assumptions in determining dependencies, making the process practical instead of mechanical. We also emphasize that normalization is a concept to be considered in *all* database systems, not just relational systems.
- Although managerial in orientation, no major technical topic is omitted. Obviously, a manager cannot effectively manage in a database environment when he or she lacks an understanding of these technical issues. Our treatment is different from other textbooks in that, after presenting the basic technical concept, we discuss managerial issues where other textbooks discuss detailed implementation issues.
- The proliferating role of microcomputers in the organizational environment is addressed. We have a chapter devoted to microcomputer database systems issues.
- We have an entire chapter devoted to distributed database systems. All of the major issues of security, concurrency, recovery, and data partitioning are covered in this chapter. We also discuss query optimization in a distributed database environment.
- We provide a chapter that covers several topics that will be important issues in the future. This chapter includes coverage of object-oriented databases, deductive databases and Prolog, implications of computer-integrated manufacturing for database design, and the role of database processing in expert systems.
- We provide a “capstone” chapter on decision support systems. This chapter is also intended to emphasize the database processing function in the overall organizational information management system.
- Our “User’s View” section in each chapter emphasizes the view of organizational database systems users. Database users have always presented special managerial issues; as database software increases the accessibility of organizational databases, one must expect database management to become more complex. This section emphasizes user-oriented issues.
- Our “Metropolitan National Bank” scenario provides students with a comprehensive case study. Each chapter introduces new material related to this case study, providing an opportunity for students to apply the concepts of the chapter.
- We have included many, many case examples throughout the text. This is especially evident in our treatment of normalization where we give four separate scenarios. Each chapter contains approximately 20 review questions, with roughly half of these questions requiring the student to *apply* the concepts of the chapter.

- Each chapter contains a brief, annotated reading list where supplemental material may be found.

Our approach immediately reinforces *why* a particular point is being made and *how* the database is supporting the decision-making process. Our approach may be summarized as follows: MIS students are better trained if they understand the managerial impacts of decisions made in designing database systems.

We believe that our practical experience designing and developing database management systems currently in use in businesses, our research in theoretical aspects of the field, and our academic experience teaching various aspects of MIS in colleges of business administration have provided us with some insight into the needs of the undergraduate MIS student of today. We further believe that this text specifically addresses one such need, a need for a truly management-oriented introduction to database management systems, in a rather unique fashion. We are excited about this edition. We hope the features of the book listed above will convince you to consider using our book in your course.

How to Use This Book

Database Systems for Management is presented in five parts. Part One, "Database Fundamentals," introduces the topic of database systems. We begin with an overview of the purpose of using database systems and review the major components of these systems. We also begin our focus on planning and design issues. This part of the book addresses the following questions:

- Why should an organization adopt database management concepts?
- What are the major components of a database system?
- How should the organization plan for the development of a database management system?
- What should be contained in the organization's information systems master plan?

Chapter 1 presents the fundamental concepts and major components of database management systems. Chapter 2 describes planning for database systems and emphasizes that database systems are one part of the overall organizational information management system.

Part Two of this book focuses on design issues. In Chapter 3, we provide an overview of logical design concepts. We provide extensive coverage of Entity-Relationship modeling concepts and show how to convert these to data structure diagrams. Chapter 4 presents the ANSI/X3/SPARC conceptual framework for database management systems and previews the hierarchical, network, and relational models. We feel this glimpse of the models allows students to begin designing databases with some thought of their ultimate implementation goal. But before they can get too far, Chapter 5 presents normalization. We cover the topic first by discussing modification anomalies. These problems are

symptomatic of non-normalized designs. Then, we proceed to the normal form criteria. We have found this approach to be a successful one.

- What data should be included in the database system and how is it logically structured?
- How can logical relationships be implemented in data structures?
- What are the primary means for structuring the data in a database system?
- How can one identify potential problems in various database designs?

Part Three of the book examines the relational database model in depth. Three of the four chapters in this part cover relational database issues. We also present the CODASYL model at the end of this part. We include the CODASYL model in our textbook because we believe many of today's students will be involved in conversion projects from CODASYL to relational implementations. Thus, they need a basic knowledge of the CODASYL approach. The issues addressed in this part are:

- What is the relational approach to database management and how can it be used to manipulate data?
- What do the concepts of *essentiality* and *integrity* mean?
- What distinguishes relational systems from systems that merely present data in the form of tables?
- What is SQL and how can it be used to extract data from a relational database?
- What role do microcomputers play in a database environment?
- What special considerations should management have regarding microcomputer-based database systems?
- How is database manipulation different on microcomputers?
- What is a QBE interface and how is it used to access data?
- What is the CODASYL approach to database management and how can it be used to manipulate data?
- What are currency indicators, or cursors, and how are they used to manipulate data in a CODASYL environment?

Chapter 6 reviews the relational model in depth. In Chapter 7, we examine the SQL approach to relational data manipulation. Since SQL has become the official standard in relational data manipulation, we provide extensive coverage of this topic. Chapter 8 looks at microcomputer-based database systems, which are primarily relational systems. We examine managerial issues as well as specific implementations, dBase IV, Paradox, and XQL. Chapter 9 focuses on the CODASYL model. This chapter provides a comprehensive examination of the CODASYL approach.

Part Four emphasizes physical design and implementation issues in database management. Chapter 10 reviews storage methodologies and data structure issues. Chapter 11 provides comprehensive coverage of

database issues at the transaction level. We examine the role of data repositories. We address security issues from two viewpoints: database software and managerial responsibility. We present several ways to recover from system failures including logging and memory management techniques. We also cover how problems can arise when multiple users access a data item concurrently, and how to resolve these problems. Some of the specific points covered here are:

- How are logical relationships physically implemented?
- What are the differences in alternative implementations of relationships?
- Under what circumstances is one implementation preferred to another?
- What are data repositories and how do they influence database processing?
- What are the important security considerations in a database environment?
- How does a system recover from a major system failure?
- When should a transaction's effects actually be applied to the database?
- How are problems caused by multiple users resolved?
- How are database systems physically implemented?
- What are the advantages of one physical implementation over another?
- How can the database models be represented at the physical implementation level?
- What technical aspects of database systems are particularly important from a manager's viewpoint?
- How are database transaction failures recovered?
- How can one recover a database after a major system failure?
- How does one prevent problems caused by concurrent access to data by multiple users?
- How are security issues addressed in database systems?
- How is database performance monitored?

Part Five covers advanced database issues. Chapter 12 provides an overview of distributed database management systems. Chapter 13 presents several topics that we feel are the emerging areas for students to learn: database issues in computer-integrated manufacturing systems, object-oriented systems and object-oriented design, deductive database systems and Prolog, and natural language processing. Chapter 14 concludes our coverage of management-oriented database systems by presenting database concepts in a decision support role. Our objective in this part of the book is to answer the following questions.

- What are distributed database systems?
- How is data distributed?
- What are the special issues related to concurrent access, security, and database recovery in a distributed database environment?

- What are the future trends in database systems?
- What are the issues in computer integrated manufacturing that impact database design and implementation?
- What is the object-oriented paradigm?
- What are object-oriented databases and why are they important?
- What is a deductive database?
- How are deductive databases implemented?
- What is the role of natural language processing in a database environment?
- What problems exist in natural language processing?
- What are decision support systems and how do database systems support semi-structured decision-making processes?

Providing a sequencing of chapters that will meet every instructor's needs is difficult at best. The following strategies may be helpful given certain class characteristics and the goals of the instructor:

- Students with strong technical backgrounds may skip Chapter 10 without loss of continuity.
- Students with prior instruction in systems analysis and design may be able to move through Chapter 2 without significant in-class discussion.
- Instructors that wish to get into the relational model quickly may want to give light emphasis to Chapter 1 and skip Chapter 4, thus getting to Chapters 6 and 7 sooner.
- Instructors may wish to substitute coverage of a database package available at their institution for the coverage of SQL in Chapter 7.

Our experience in class testing the book indicates that one must move rather quickly in order to cover all of the topics presented in the text. We have yet to get through an entire semester without feeling that some topic somewhere along the way received a little less attention than we would have liked.

Instructor's Manual

The *Instructor's Manual for Database Systems for Management* has been developed to do what few other instructor's guides do: **guide** the instructor! Of course, we have included an outline of the chapter contents, answers to the review questions that appear at the end of each chapter, over 100 transparency masters, and sample test questions. The test questions will also be available in a computerized test bank (free to adopters). Also included in the instructor's manual are several examples of solutions to the Metropolitan National Bank case. These features are, we think, expected in an instructor's guide. A separate case book with five additional cases is also available.

We have extended the instructor's manual concept, however, in two ways. Since the "cost" of preparation in a course such as this is large,

we have included annotated excerpts from our lectures based on the material in the text. These excerpts include emphasis of the major topics in the chapter, suggestions for anticipating students' reactions and pitfalls, and cross references to other textbooks frequently used in this course. We think you'll agree that with this help the transition to our textbook will be much smoother than is typically the case.

Our second extension to the traditional instructor's guide format is the inclusion of small chapter-by-chapter "minicases." These cases are designed to provide instructors with a small amount of extra material that some students need to completely grasp a concept. Additionally, instructors can modify the contents of these minicases to develop a basis for small student projects. These cases also provide an excellent source for comprehensive test questions. We also provide the kernel for another major case study.

We hope you'll agree that our *Instructor's Manual for Database Systems for Management* is a valuable addition to your planning and preparation tools for this class.

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Additionally, several persons contributed to the book's development in other ways. Our section on database issues in computer integrated manufacturing environments was drawn from the research of Gabriela Marin. We greatly appreciate her efforts to make that material available to us. Karen Silvermintz worked on initial versions of the Metropolitan National Bank case and helped us refine it. Karen's design work appears in the Instructor's Manual. We would also like to thank Paul Maddock and Josie Ceccoli for contributing design work on this case, which also appears in the Instructor's Manual.

At Irwin, Becky Johnson, Lena Buonanno, and Larry Alexander have worked very hard to bring this edition to the market. We appreciate their efforts to keep our philosophy of teaching database concepts in managerial environments alive.

At home, we must thank our families for their patience and understanding as we tackled the chore of a major revision. As always, their support has been most generous.

Everyone involved tried to find and correct errors, but we as authors must take responsibility for any that managed to get into the final product. As before, any comments, criticisms, suggestions, or improvements are welcomed and appreciated. Write to us in care of Irwin.

Jim Courtney
David Paradice

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