
Preface

Information is a valuable resource to an organization. Computer software provides an efficient means of processing information, and database systems are becoming increasingly common means by which it is possible to store and retrieve information in an effective manner. This book provides comprehensive coverage of fundamentals of database management system. This book is for those who wish a better understanding of relational data modeling, its purpose, its nature, and the standards used in creating relational data model.

Relational databases are the most popular database management systems in the world and are supported by a variety of vendor implementations. Majority of the practical tasks in industry require applying relatively not complex algorithms to huge amounts of well-structured data. The efficiency of the application depends on the quality of data organization. Advances in database technology and processing offer opportunities for using information flexibility and efficiently when data is organized and stored in relational structures. The relational DBMS is a success in the commercial market place with respect to business data processing and related applications. This success is a result of cost effective application development combined with high data consistency. The success has led to the use of relational DBMS technology in other application environments requesting its traditional virtues, while at the same time adding new requirements.

SQL is the standard computer language used to communicate with relational database management systems. Chapter 4 gives an introduction to SQL with illustrative examples. The limitations of SQL and how to overcome that limitations using PL/SQL are discussed in Chap. 5.

The current trends in hardware like RAID technology made relational DBMSs to support high transmission rates, very high availability, and a soft real-time transaction a cost effective possibility. The basics of RAID technology, different levels of RAID are discussed in this book.

Object-oriented databases are also becoming important. As object-oriented programming continues to increase in popularity, the demand for

such databases will grow. Due to this reason a separate chapter is being devoted to object-oriented DBMS and object-relational DBMS.

This text discusses a number of new technologies and challenges in database management systems like Genome Database Management System, Mobile Database Management System, Multimedia Database Management System, Spatial Database Management Systems, and XML.

Finally, there is no substitute for experience. To ensure that every student can have experience for creating data models and database design, list of projects along with codes in VB and Oracle are given. The goal in providing the list of projects is to ensure that students should have atleast one commercial product at their disposal.

About the Book

The book is meant for wide range of readers from College, University Students who wish to learn basics as well as advanced concepts in Database Management System. It can also be meant for the programmers who may be involved in the programming based on the Oracle and Visual Basic applications.

Database Management System, at present is a well-developed field, among academicians as well as between program developers. The principles of Database Management System are dealt in depth with the information and the useful knowledge available for computing processes. The various approaches to data models and the relative advantages of relational model are given in detail.

Relational databases are the most popular database management systems in the world and are supported by a variety of vendor implementations. The solutions to the problems are programmed using Oracle and the results are given. The overview of Oracle and Visual Basic is provided for easy reference to the students and professionals. This book also provides introduction to commercial DBMS, pioneers in DBMS, and dictionary of DBMS terms in appendix.

The various worked out examples and the solutions to the problems are well balanced pertinent to the RDBMS Projects, Labs, and for College and University Level Studies.

This book provides data models, database design, and application-oriented structures to help the reader to move in to the database management world. The book also presents application case studies on a wide range of connected fields to facilitate the reader for better understanding. This book can be used from Under Graduation to Post-Graduate Level. Some of the projects done are also added in the book. The book contains solved example problems, review questions, and solutions.

This book can be used as a ready reference guide for computer professionals who are working in DBMS field. Most of the concepts, solved problems and

applications for wide variety of areas covered in this book, which can fulfill as an advanced academic book.

We hope that the reader will find this book a truly helpful guide and a valuable source of information about the database management principles for their numerous practical applications.

Salient Features

The salient features of this book includes:

- Detailed description on relational database management system concepts
- Variety of solved examples
- Review questions with solutions
- Worked out results to understand the concepts of relational database management Systems using Oracle Version 8.0.
- Application case studies and projects on database management system in various fields like Transport Management, Hospital Management, and Academic Institution Management, Hospital Management, Railway Management and Election Voting System.

Organization of the Book

The book covers 14 chapters altogether. The fundamentals of relational database management systems are discussed with basic principles, advanced concepts, and recent challenges. The application case studies are also discussed.

The chapters are organized as follows:

- Chapter 1 gives an overview of database management system, Evolution of Database Management System, ANSI/SPARK data model, Two-tier, Three-tier and Multi-tier database architecture.
- The preliminaries of the Entity Relation (ER) data model are described in Chap. 2. Different types of entities, attributes and relations are discussed with examples. Mapping from ER model to relational model, Enhanced ER model, which includes generalization, specialization, are given with relevant examples.
- Chapter 3 deals with relational data model. In this chapter E.F. Codd rule, basic definition of relation, cardinality of the relation, arity of the relation, constraints in relation are given with suitable examples. Relational algebra, tuple relational calculus, domain relational calculus and different operations involved are explained with lucid examples. This chapter also discusses the features of QBE with examples.
- Chapter 4 exclusively deals with Structured Query Language. The data definition language, data manipulation language and the data control language were explained with suitable examples. Views, imposition of constraints in a relation are discussed with examples.

- Chapter 5 deals with PL/SQL. The shortcomings of SQL and how they are overcome in PL/SQL, the structure of PL/SQL are given in detail. The iterative control like FOR loop, WHILE loop are explained with examples. The concept of CURSOR and the types of CURSORS are explained with suitable examples. The concept of PROCEDURE, FUNCTION, and PACKAGE are explained in detail. The concept of EXCEPTION HANDLING and the different types of EXCEPTION HANDLING are given with suitable examples. This chapter also gives an introduction to database triggers and the different types of triggers.
- Chapter 6 deals with various phases in database design. The concept of database design tools and the different types of database design tools are given in this chapter. Functional dependency, normalization are also discussed in this chapter. Different types of functional dependency, normal forms, conversion from one normal form to the other are explained with examples. The idea of denormalization is also introduced in this chapter.
- Chapter 7 gives details on transaction processing. Detailed description about deadlock condition and two phase locking are given through examples. This chapter also discusses the concept of query optimization, architecture of query optimizer and query optimization through Genetic Algorithm.
- Chapter 8 deals with database security and recovery. The need for database security, different types of database security is explained in detail. The different types of database failures and the method to recover the database is given in this chapter. ARIES recovery algorithm is explained in a simple manner in this chapter.
- Chapter 9 discusses the physical database design. The different types of File organization like Heap file, sequential file, and indexed file are explained in this chapter. The concept of B tree and B⁺ tree are explained with suitable example. The different types of data storage devices are discussed in this chapter. Advanced data storage concept like RAID, different levels of RAID, hardware and software RAID are explained in detail.
- Advanced concepts like data mining, data warehousing, and spatial database management system are discussed in Chap. 10. The data mining concept and different types of data mining systems are given in this chapter. The performance issues, data integration, data mining rules are explained in this chapter.
- Chapter 11 throws light on the concept of object-oriented and object Relational DBMS. The benefits of object-oriented programming, object-oriented programming languages, characteristics of object-oriented database, application of OODBMS are discussed in detail. This chapter also discusses the features of ORDBMS, comparison of ORDBMS with OODBMS.
- Chapter 12 deals with distributed and parallel database management system. The features of distributed database, distributed DBMS architecture, distributed database design, distributed concurrency control are discussed

- in depth. This chapter also discusses the basics of parallel database management, parallel database architecture, parallel query optimization.
- Recent challenges in DBMS are given in Chap. 13 which includes genome database management, mobile database management, spatial database management system and XML. In genome database management, the concept of genome, genetic code, genome directory system project is discussed. In mobile database, mobile database center, mobile database architecture, mobile transaction processing, distributed database for mobile are discussed in detail. In spatial database, spatial data types, spatial database modeling, querying spatial data, spatial DBMS implementation are analyzed. In XML, the origin of XML, XML family, XSL, XML, and database applications are discussed.
 - Few projects related to bus transport management system, hospital management, course administration system, Election voting system, library management system and railway management system are implemented using Oracle as front end and Visual Basic as back end are discussed in Chap. 14. This chapter also gives an idea of how to do successful projects in DBMS.
 - Four appendices given in this book includes dictionary of DBMS terms, overview of commands in SQL, pioneers in DBMS, commercial DBMS. Dictionary of DBMS terms gives the definition of commonly used terms in DBMS. Overview of commands in SQL gives the commonly used commands and their function. Pioneers in DBMS introduce great people like E.F. Codd, Peter Chen who have contributed for the development of database management system. Commercial DBMS introduces some of the popular commercial DBMS like System R, DB2 and Informix.
 - The bibliography is given at the end after the appendix chapter.

About the Authors

S. Sumathi, B.E. in Electronics and Communication Engineering and Masters degree in Applied Electronics, Government College of Technology, Coimbatore, TamilNadu and Ph.D. in the area of Data Mining, is currently working as Assistant Professor in the Department of Electrical and Electronics Engineering, PSG College of Technology, Coimbatore with teaching and research experience of 16 years. She received the prestigious Gold Medal from the Institution of Engineers Journal Computer Engineering Division, for the research paper titled, “Development of New Soft Computing Models for Data Mining” and also Best project award for UG Technical Report, “Self-Organized Neural Network Schemes: As a Data mining tool”. She received Dr. R. Sundramoorthy award for Outstanding Academic of PSG College of Technology in the year 2006. She has guided a project which received Best M.Tech Thesis award from Indian Society for Technical Education, New Delhi. In appreciation of publishing various technical articles she has received

National and International Journal Publication Awards. She has also prepared manuals for Electronics and Instrumentation Laboratory and Electrical and Electronics Laboratory of EEE Department, PSG College of Technology, Coimbatore, has organized second National Conference on Intelligent and Efficient Electrical Systems and has conducted short-term courses on “Neuro Fuzzy System Principles and Data Mining Applications.” She has published several research articles in National and International Journals/Conferences and guided many UG and PG projects. She has also reviewed papers in National/International Journals and Conferences. She has published three books on “Introduction to Neural Networks with Matlab,” “Introduction to Fuzzy Systems with Matlab,” and “Introduction to Data Mining and its Applications.” The research interests include neural networks, fuzzy systems and genetic algorithms, pattern recognition and classification, data warehousing and data mining, operating systems and parallel computing, etc.

S. Esakkirajan has a B.Tech Degree from Cochin University of Science and Technology, Cochin and M.E. Degree from PSG College of Technology, Coimbatore, with a Rank in M.E. He has received Alumni Award in his M.E. He has presented papers in International and National Conferences. His research areas include database management system, neural network, genetic algorithm, and digital image processing.

Acknowledgment

The authors are always thankful to the Almighty for perseverance and achievements.

Sumathi and Esakkirajan wish to thank Mr. Rangaswamy, Managing Trustee, PSG Institutions, Mr. C.R. Swaminathan, Chief Executive, and Dr. R. Rudramoorthy, Principal, PSG College of Technology, Coimbatore, for their whole-hearted cooperation and great encouragement given in this successful endeavor. The authors appreciate and acknowledge Mr. Karthikeyan, Mr. Ponson, Mr. Manoj Kumar, Mr. Afsar Ahmed, Mr. Harikumar, Mr. Abdus Samad, Mr. Antony and Mr. Balumahendran who have been with them in their endeavors with their excellent, unforgettable help, and assistance in the successful execution of the work.

Dr. Sumathi owe much to her daughter Priyanka, who has helped her and to the support rendered by her husband, brother, and family. Mr. Esakkirajan like to thank his wife Akila, who shouldered a lot of extra responsibilities and did this with the long-term vision, depth of character, and positive outlook that are truly befitting of her name. He like to thank his father Sankaralingam for providing moral support and constant encouragement.

DEDICATED TO ALMIGHTY



<http://www.springer.com/978-3-540-48397-7>

Fundamentals of Relational Database Management
Systems

Sumathi, S.; Esakkirajan, S.

2007, XXVII, 776 p., Hardcover

ISBN: 978-3-540-48397-7