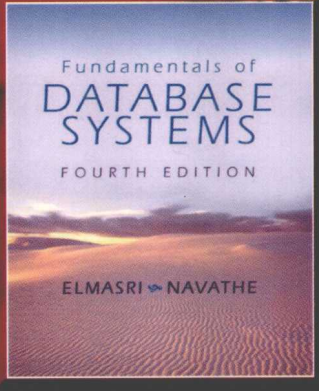
TURING 图灵原版计算机科学系列

PEARSON Addison Wesley

Fundamentals of Database Systems
Fourth Edition

数据库系统基础
高级篇
（英文注释版·第4版）

[美] Ramez Elmasri
Shamkant B. Navathe 著
孙瑜 注释



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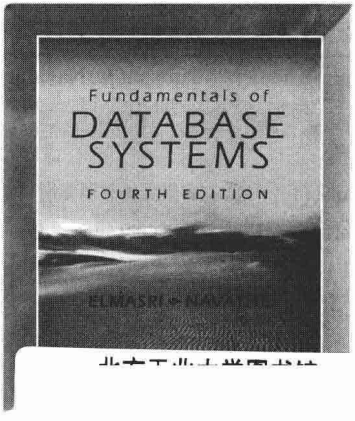

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内 容 提 要

本书是讲述数据库系统原理的经典教材。全书分为4个部分。第一部分讲述事务处理的概念、并发控制技术和数据库恢复技术，第二部分讲述面向数据库的概念、语言、设计及对象－关系和扩展－关系系统，第三部分主要描述了数据库安全和客户－服务器体系结构，第四部分简要介绍了XML、数据挖掘和数据仓库等几种新兴技术。

本书是高等院校计算机及相关专业本科生、研究生数据库系统课程的理想教材，也是对相关技术人员非常有价值的参考书。

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注释者序

为提高我国高等学校信息技术的教学水平，加快培养高水平的具有国际竞争力的信息技术人才，教育部提出，在信息科学技术领域要大力引进国外优秀的原版教材，在有条件的学校要推动开展英语授课或双语教学。一本适合双语教学的好教材是正常开展双语教学及保证教学效果的基础。

我们调研了部分高校的双语教学的开展情况，了解到大多数高校都是直接采用国外原版教材或国内影印版作为双语课教材。直接引进原版教材进行教学，有利于使学生阅读到“原汁原味”的专业英语，为学生提供一个国际化的教育环境，为今后与国外同行直接进行学术和技术交流打下坚实的基础。

但我们认为，根据中国目前的国情，使用全英文教材可能会存在以下两方面问题。

(1) 中英文术语对应问题。接受双语教学的对象是以中文为母语的学生，这些学生今后除了要参与国际交流以外，可能更多的是要与国内同行进行交流。如果学生仅仅熟悉专业词汇的英文说法，而不熟悉对应的中文术语，那么会给他们阅读其他中文专业参考书及与国内同行交流带来较大的困难。

(2) 全英文教材对部分英语基础不太好的学生难度偏大。

我们通过双语教学的实践和调研发现：不管教师采用哪种模式的双语教学，对于重要的专业术语和概念都在教案（或授课幻灯片）中用中文进行了标注，并在课堂讲授时用中文强调和解释。这就给了我们建设一种全新的双语教材的启发：在引进国外优秀原版教材的基础上添加部分中文注释，以弥补使用全英文教材的不足。

通过调研，我们选择了数据库系统方面的优秀英文原版教材*Fundamentals of Database Systems*进行注释。这本教材在内容上既包括数据库系统基本概念，又反映了数据库技术最新发展前沿，在国际上被许多著名大学采用，并多次再版。此外，这本教材在语言文字上也比较浅显，适合大学本科三年级以上学生阅读。

在注释的尺度上，我们主要为以下内容添加了注释：

- 所有的章节标题；
- 所有的图表标题；
- 原文中重要的、常用的专业术语；
- 原文中较生僻的公共英语词汇，对这些词的注释用语往往根据上下文进行了适当的调整，以更加便于理解。

此为试读，需要完整PDF请访问：www.ertongbook.com

我们认为，通过以上的注释，可以让学生充分熟悉数据库领域重要的、常用的专业术语的中英文对照，为以后进行国内外技术交流打下语言基础，同时在一定程度上降低了学生阅读教材的难度，帮助学生对教材原文进行理解。

考虑到原版教材内容较多、篇幅巨大且知识点跨度较大，本注释版教材将其分为“初级篇”和“高级篇”两册。“初级篇”包括原书的第1章到第16章，内容主要包括数据库系统基本概念、概念建模、关系数据模型、逻辑建模、SQL语言、数据库设计理论和方法学、数据存储、索引、查询处理和数据库物理设计等，可以作为“数据库导论课程”的教科书；“高级篇”包括原书的第17章到第29章，内容主要包括事务处理、对象和对象－关系数据库、数据库安全性、增强的数据模型、分布式数据库、XML、数据仓库、数据挖掘及其他数据库新兴技术，可以作为“数据库高级课程”的教科书。另外原书还有附录、参考文献和索引三部分，感兴趣的读者可以到图灵网站www.turingbook.com本书网页免费注册下载。

需要说明的是，由于本注释版教材本质上就是国外原版教材的影印版，所以在将原书拆分成“初级篇”和“高级篇”两册时，我们保留了原书的页码、章节编号和版式。

本书的注释和审校由西南石油大学计算机科学学院孙瑜博士组织完成。参加注释的还有刘影、蒋俊、蒋萍萍、高磊等。本书注释过程中曾得到西南石油大学计算机科学学院副院长陈汶滨副教授、赵刚副教授的关心和指导，在此向他们表示衷心的感谢。

出版这种注释版双语教材在国内数据库教学领域是一种尝试，限于注释者水平和经验的不足，注释中疏漏和错误难免，欢迎读者批评指正（bobsunyu@gmail.com）。

注释者

西南石油大学计算机科学学院

2008年7月

Preface

前言

This book introduces the fundamental concepts necessary for designing, using, and implementing database systems and applications. Our presentation stresses the fundamentals of database modeling and design, the languages and facilities provided by the database management systems, and system implementation techniques. The book is meant to be used as a textbook for a one- or two-semester course in database systems at the junior, senior or graduate level, and as a reference book. We assume that the readers are familiar with elementary programming and data-structuring concepts and that they have had some exposure to basic computer organization.

实现
介绍，讲述
建模/设施
大三/大四
了解一些

We start in Part 1 with an introduction and a presentation of the basic concepts and terminology, and database conceptual modeling principles. We conclude the book in Parts 7 and 8 with an introduction to emerging technologies, such as data mining, XML, security, and Web databases. Along the way—in Parts 2 through 6—we provide an in-depth treatment of the most important aspects of database fundamentals.

术语/结束
新兴的技术
深入的讨论

The following key features are included in the fourth edition:

主要特色

- The entire book follows a self-contained, flexible organization that can be tailored to individual needs.
- Coverage of data modeling now includes both the ER model and UML.
- A new advanced SQL chapter with material on SQL programming techniques, such as JDBC and SQL/CLI.

自成体系的
论述/建模

贯穿
- Two examples running throughout the book—called COMPANY and UNIVERSITY—allow the reader to compare different approaches that use the same application.

地理信息系统
- Coverage has been updated on security, mobile databases, GIS, and Genome data management.
- A new chapter on XML and Internet databases.
- A new chapter on data mining.

教辅材料
- A significant revision of the supplements to include a robust set of materials for instructors and students, and an online case study.

与第3版的主要区别
Main Differences from the Third Edition

There are several organizational changes in the fourth edition, as well as some important new chapters. The main changes are as follows:

- The chapters on file organizations and indexing (Chapters 5 and 6 in the third edition) have been moved to Part 4, and are now Chapters 13 and 14. Part 4 also includes Chapters 15 and 16 on query processing and optimization, and physical database design and tuning (this corresponds to Chapter 18 and sections 16.3-16.4 of the third edition).

约束/关系代数及关系演算
- The relational model coverage has been reorganized and updated in Part 2. Chapter 5 covers relational model concepts and constraints. The material on relational algebra and calculus is now together in Chapter 6. Relational database design using ER-to-relational and EER-to-relational mapping is in Chapter 7. SQL is covered in Chapters 8 and 9, with the new material on SQL programming techniques in sections 9.3 through 9.6.
- Part 3 covers database design theory and methodology. Chapters 10 and 11 on normalization theory correspond to Chapters 14 and 15 of the third edition. Chapter 12 on practical database design has been updated to include more UML coverage.

并发
- The chapters on transactions, concurrency control, and recovery (19, 20, 21 in the third edition) are now Chapters 17, 18, and 19 in Part 5.
- The chapters on object-oriented concepts, ODMG object model, and object-relational systems (11, 12, 13 in the third edition) are now 20, 21, and 22 in Part 6. Chapter 22 has been reorganized and updated.

略去
并入
- Chapters 10 and 17 of the third edition have been dropped. The material on client–server architectures has been merged into Chapters 2 and 25.

时态/空间
- The chapters on security, enhanced models (active, temporal, spatial, multimedia), and distributed databases (Chapters 22, 23, 24 in the third edition) are now 23, 24, and 25 in Part 7. The security chapter has been updated. Chapter 25 of the third edition on deductive databases has been merged into Chapter 24, and is now section 24.4.

演绎数据库

- Chapter 26 is a new chapter on XML (eXtended Markup Language), and how it is related to accessing relational databases over the Internet.
- The material on data mining and data warehousing (Chapter 26 of the third edition) has been separated into two chapters. Chapter 27 on data mining has been expanded and updated.

数据仓库
数据挖掘

第4版的内容
Contents of This Edition

Part 1 describes the basic concepts necessary for a good understanding of database design and implementation, as well as the conceptual modeling techniques used in database systems. Chapters 1 and 2 introduce databases, their typical users, and DBMS concepts, terminology, and architecture. In Chapter 3, the concepts of the Entity-Relationship (ER) model and ER diagrams are presented and used to illustrate conceptual database design. Chapter 4 focuses on data abstraction and semantic data modeling concepts and extends the ER model to incorporate these ideas, leading to the enhanced-ER (EER) data model and EER diagrams. The concepts presented include subclasses, specialization, generalization, and union types (categories). The notation for the class diagrams of UML are also introduced in Chapters 3 and 4.

实体－联系
说明
纳入
记号

Part 2 describes the relational data model and relational DBMSs. Chapter 5 describes the basic relational model, its integrity constraints and update operations. Chapter 6 describes the operations of the relational algebra and introduces the relational calculus. Chapter 7 discusses relational database design using ER and EER-to-relational mapping. Chapter 8 gives a detailed overview of the SQL language, covering the SQL standard, which is implemented in most relational systems. Chapter 9 covers SQL programming topics such as SQLJ, JDBC, and SQL/CLI.

完整性约束

Part 3 covers several topics related to database design. Chapters 10 and 11 cover the formalisms, theories, and algorithms developed for the relational database design by normalization. This material includes functional and other types of dependencies and normal forms of relations. Step-by-step intuitive normalization is presented in Chapter 10, and relational design algorithms are given in Chapter 11, which also defines other types of dependencies, such as multivalued and join dependencies. Chapter 12 presents an overview of the different phases of the database design process for medium-sized and large applications, using UML.

形式化
范式
直观的
中等规模的

Part 4 starts with a description of the physical file structures and access methods used in database systems. Chapter 13 describes primary methods of organizing files of records on disk, including static and dynamic hashing. Chapter 14 describes indexing techniques for files, including B-tree and B+-tree data structures and grid files. Chapter 15 introduces the basics of query processing and optimization, and Chapter 16 discusses physical database design and tuning.

散列法
网格

Part 5 discusses transaction processing, concurrency control, and recovery techniques, including discussions of how these concepts are realized in SQL.

全面的

Part 6 gives a comprehensive introduction to object databases and object-relational systems. Chapter 20 introduces object-oriented concepts. Chapter 21 gives a detailed overview of the ODMG object model and its associated ODL and OQL languages. Chapter 22 describes how relational databases are being extended to include object-oriented concepts and presents the features of object-relational systems, as well as giving an overview of some of the features of the SQL3 standard, and the nested relational data model.

特权

Parts 7 and 8 cover a number of advanced topics. Chapter 23 gives an overview of database security and authorization, including the SQL commands to GRANT and REVOKE privileges, and expanded coverage on security concepts such as encryption, roles, and flow control. Chapter 24 introduces several enhanced database models for advanced applications. These include active databases and triggers, temporal, spatial, multimedia, and deductive databases. Chapter 25 gives an introduction to distributed databases and the three-tier client–server architecture. Chapter 26 is a new chapter on XML (eXtended Markup Language). It first discusses the differences between structured, semi-structured, and unstructured models, then presents XML concepts, and finally compares the XML model to traditional database models. Chapter 27 on data mining has been expanded and updated. Chapter 28 introduces data warehousing concepts. Finally, Chapter 29 gives introductions to the topics of mobile databases, multimedia databases, GIS (Geographic Information Systems), and Genome data management in bioinformatics.

三层
半结构化的
生物信息学

其他的
模式

Appendix A gives a number of alternative diagrammatic notations for displaying a conceptual ER or EER schema. These may be substituted for the notation we use, if the instructor so wishes. Appendix C gives some important physical parameters of disks. Appendixes B, E, and F are on the web site. Appendix B is a new case study that follows the design and implementation of a bookstore's database. Appendixes E and F cover legacy database systems, based on the network and hierarchical database models. These have been used for over thirty years as a basis for many existing commercial database applications and transaction-processing systems and will take decades to replace completely. We consider it important to expose students of database management to these long-standing approaches. Full chapters from the third edition can be found on the web site for this edition.

遗留的

长期存在的

如何使用本书
Guidelines for Using This Book

There are many different ways to teach a database course. The chapters in Parts 1 through 5 can be used in an introductory course on database systems in the order that they are given or in the preferred order of each individual instructor. Selected chapters and sections may be left out, and the instructor can add other chapters from the rest of the book, depending on the emphasis of the course. At the end of each chapter's opening section, we list sections that are candidates for being left out whenever a less detailed discussion of the topic in a particular chapter is desired. We suggest covering up to Chapter 14 in an introductory database course and including selected parts of other chapters, depending on the background of the students and the desired coverage. For an emphasis on system implementation techniques, chapters from Parts 4 and 5 can be included.

按书中的顺序
省略
开篇部分

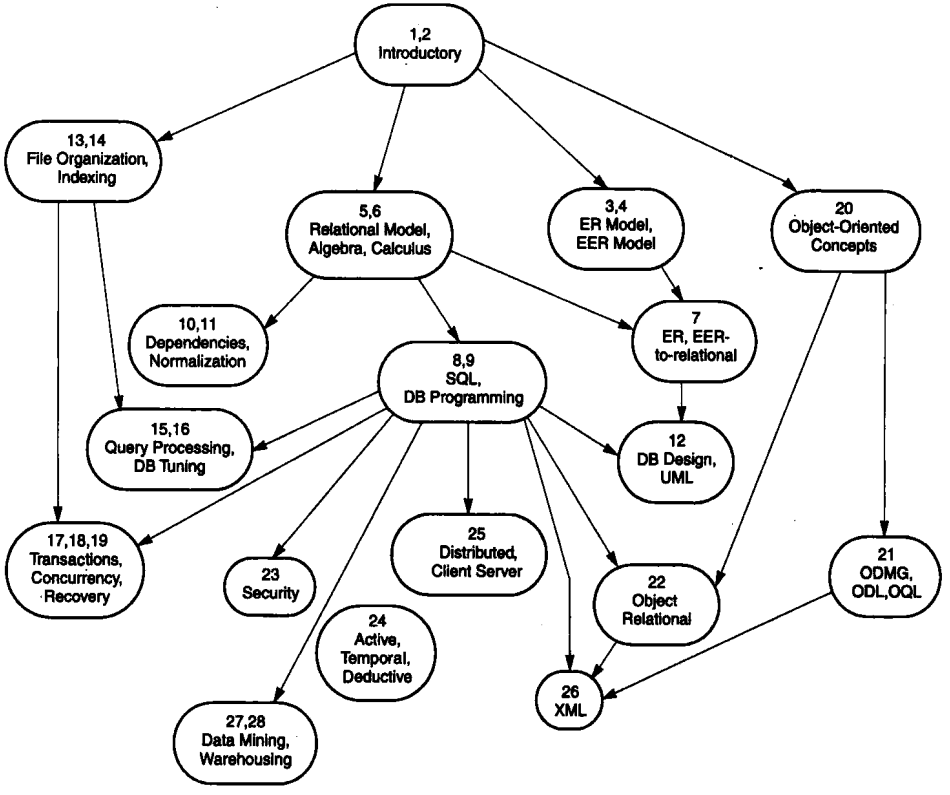
讲到

Chapters 3 and 4, which cover conceptual modeling using the ER and EER models, are important for a good conceptual understanding of databases. However, they may be par-

tially covered, covered later in a course, or even left out if the emphasis is on DBMS implementation. Chapters 13 and 14 on file organizations and indexing may also be covered early on, later, or even left out if the emphasis is on database models and languages. For students who have already taken a course on file organization, parts of these chapters could be assigned as reading material or some exercises may be assigned to review the concepts. 布置

A total life-cycle database design and implementation project covers conceptual design (Chapters 3 and 4), data model mapping (Chapter 7), normalization (Chapter 10), and implementation in SQL (Chapter 9). Additional documentation on the specific RDBMS would be required. 生命周期 文献，文档

The book has been written so that it is possible to cover topics in a variety of orders. The chart included here shows the major dependencies between chapters. As the diagram illustrates, it is possible to start with several different topics following the first two introductory chapters. Although the chart may seem complex, it is important to note that if the chapters are covered in order, the dependencies are not lost. The chart can be consulted by instructors wishing to use an alternative order of presentation. 依赖关系 按顺序/参考



For a single-semester course based on this book, some chapters can be assigned as reading material. Parts 4, 7, and 8 can be considered for such an assignment. The book can also

此为试读，需要完整PDF请访问：www.ertongbook.com

be used for a two-semester sequence. The first course, "Introduction to Database Design/Systems," at the sophomore, junior, or senior level, could cover most of Chapters 1 to 14. The second course, "Database Design and Implementation Techniques," at the senior or first-year graduate level, can cover Chapters 15 to 28. Chapters from Parts 7 and 8 can be used selectively in either semester, and material describing the DBMS available to the students at the local institution can be covered in addition to the material in the book.

大二

本地学院

教学辅助材料
Supplemental Materials

The supplements to this book have been significantly revised. With Addison-Wesley's Database Place there is a robust set of interactive reference materials to help students with their study of modeling, normalization, and SQL. Each tutorial asks students to solve problems (such as writing an SQL query, drawing an ER diagram or normalizing a relation), and then provides useful feedback based on the student's solution. Addison-Wesley's Database Place helps students master the key concepts of all database courses. For more information visit aw.com/databaseplace.

In addition the following supplements are available to all readers of this book at www.aw.com/cssupport.

- Additional content: This includes a new Case Study on the design and implementation of a bookstore's database as well as chapters from previous editions that are not included in the fourth edition.
- A set of PowerPoint lecture notes

A solutions manual is also available to qualified instructors. Please contact your local Addison-Wesley sales representative, or send e-mail to aw.cse@aw.com, for information on how to access it.

符合要求的

获取

致谢
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指写作此书

联络人

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再次表示

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最后（并非最不重要）

R.E.
S.B.N.

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