专业课课程教学大纲Syllabus

SJQU-QR-JW-033（A0）

**【数据库原理】**

**【Principles of Databases】**

一、基本信息Basic Information（必填项）

**课程代码 Course Code：【**2050217**】**

**课程学分 Course Credits：【 3 】**

**面向专业 Major：【**2019数媒体技术（双语）Bachelor in Digital Media Technology**】**

**课程性质Characteristic of the Course：【**系级必修课Department-level required courses**】**

**开课院系Department：**国际教育学院International Education College

**使用教材Teaching and Reference Materials：**

**教材Textbook**【数据库系统概念(第7版 影印版)（（美）Abraham Silberschatz等；高等教育出版社；2021.6）】

Database System Concept (Version 7 Edition) ((US) Abraham Silberschatz et al.; Higher Education Press; 2021.6)

**参考书目Bibliography：**【Database Illuminated, Catherine M. Ricardo and Susan D. Urban, 3rd Edition, Jones & Bartlett Learning】

**课程网站网址Online Learning Website URL：**http://gench.fanya.chaoxing.com/

**先修课程Preface Course:**【计算机程序设计Computer programming 、数据结构Data structure】

二、课程简介**Course Description**（必填项）

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| --- | --- |
| This module will provide a theoretical background in modelling persistent data in relational databases, it  will also develop the concepts of information security.  该模块将为关系数据库中的持久性数据建模提供理论背景，也将发展信息安全的概念。 | |
| **Learning Outcome**  **学习目标**  **The learner will**  **学生将** | **Assessment Criteria:**  **评判标准**  **The learner can:**  **学生能** |
| 1. Be able to explain key principles of database   and information security   1. 能够解释数据库的关键原理信息和信息安全 | 1.1 Identify threats to security  1.1. 识别对安全的威胁  1.2. Discuss techniques to secure data  1.2. 讨论保护数据安全的技术  1.3. Evaluate different security techniques  1.3. 评估不同的安全技术 |
| 1. Be able to explain and provide a rationale for   relational, semi-structured and alternative data  model concepts  2.能够解释并提供以下方面的基本原理：  关系型、半结构化和可选数据模型概念 | 2.1. Understand the benefits of different general  database models  2.1. 了解不同数据库模型的好处  2.2. Explain the design of relations and entities  2.2. 解释关系和实体的设计  2.3. Discuss domains, relations and tuples  2.3. 能讨论域、关系和元组 |
| 1. Be able to design and implement a database   justifying design decisions  3.能够设计和实现数据库  证明设计决策的合理性 | 3.1. Evaluate constraints and built in functions  3.1. 评估约束和内置函数  3.2. 识别并实现嵌套和存储程序  3.2. Identify and implement nested and stored  procedures  3.3. Assess and discuss table and database  Constraints  3.3. 评估和讨论表格和数据库约束条件 |
| 1. Be able to implement a database design and a   range of complex queries using relational  database management systems  4.能够实现数据库设计和进行关系数据库管理系统的复杂查询 | 4.1. Evaluate transactions and database rollbacks  4.1. 评估事务和数据库回滚  4.2. Identify and implement built in functions  4.2. 识别并实现内置功能  4.3. Discuss and implement queries and views  4.3. 讨论并实现查询和视图 |

三、选课建议**Suggestion for Selection of Course**（必填项）

This course as the professional elective courses fits for the advanced level students for more knowledge of computer database and preparation for the advanced courses.

本课程为专业基础课程，适合高年级学生选择, 以获得计算机数据库知识为高级课程做预备。

四、课程与专业毕业要求的关联性**The Correlation between Curriculum and Graduation Requirements**（必填项）

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| --- | --- |
| **专业毕业要求**  **Graduation Requirements** | **关联Relation** |
| LO1 表达沟通  Expressing communication  理解他人的观点，尊重他人的价值观，能在不同场合用书面或口头形式进行有效沟通。  Understand the views of others, respect their values, and communicate effectively in writing or orally on different occasions |  |
| LO2自主学习  Self-learning  能根据需要确定学习目标，并通过搜集信息，分析信息，讨论，实践，质疑，创造等方法来实现学习目标。  Be able tOidentify learning goals as needed and achieve them by gathering information, analyzing information, discussing, practicing, questioning, |  |
| LO3 专业能力  Professional ability |  |
| LO 4 尽责抗压  Due diligence and pressure resistance  遵守纪律，守信守则，具有耐挫折，抗压力的能力。  Discipline, abide by the rules, with resistance to setbacks, the ability to resist pressure. |  |
| LO 5 协同创新  Collaborative innovation  同团队保持良好的合作关系，做集团中的积极成员；勇于从不同的角度思考问题，勇于提出新设想。  Keep good cooperation with the team, be an active member of the group, be brave to think from different perspectives and put forward new ideas. |  |
| LO6信息应用  Information application  能在学习，工作中应用信息技术解决问题，具有运用计算机处理工作领域中的信息和技术交流的能力。  Can apply information technology tOsolve problems in study and work, and have the ability tOuse computers tOprocess information and technology exchanges in the field of work. |  |
| LO 7 服务关爱  Service care  愿意服务他人，服务企业，服务社会；为人热忱，富于爱心，痛得感恩（感恩， 回报， 爱心为我校校训内容之一）  Willing to serve others, enterprises and society; being enthusiastic, loving and grateful (gratitude, return, love is one of the contents of our school motto) |  |
| LO 8 国际视野  International Perspective  具有基本的外语表达沟通能力与跨文化理解能力，能够阅读专业外文资料，有国际竞争与合作意识。  With basic foreign language communication skills and cross-cultural understanding ability, able to read professional foreign language materials, with international competition and cooperation awareness. |  |

备注：LO=learning outcomes（学习成果）

五、课程目标/课程预期学习成果**Course Objectives / Course Expected Learning Outcomes**（必填项）（预期学习成果要可测量/能够证明）

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| --- | --- | --- | --- | --- |
| 序号  No. | 课程预期  学习成果  Course Expected Learning Outcomes | 课程目标  （细化的预期学习成果）  Course Objectives  （Detailed Expected Learning Outcomes） | 教与学方式  Teaching and Learning Methods | 评价方式  Assessment Methods |
| 1 | LO2 | Be able to explain key principles of database  and information security  能够解释数据库的关键原理信息和信息安全 | Lecture and Discussion and Individual Presentation  授课与讨论及个人演示 | Multiple Questions, Quiz, Case Study, and Team Work  各类问题，章节测验，案例学习，和团队项目 |
| 2 | LO3 | Be able to explain and provide a rationale for  relational, semi-structured and alternative data  model concepts  能够解释并提供以下方面的基本原理：  关系型、半结构化和可选数据模型概念 | Lecture and Discussion  授课与讨论 | Multiple Questions, Quiz, Case Study, and Team Work  各类问题，章节测验，案例学习，和团队项目 |
| 3 | LO5 | Be able to design and implement a database  justifying design decisions能够设计和实现数据库  证明设计决策的合理性 | Lecture, Discussion, Case Study and Team Work  授课、讨论、案例分析和团队项目 | Multiple Questions, Quiz, Case Study, and Team Work  各类问题，章节测验，案例学习，和团队项目 |
| 4 | LO6 | Be able to implement a database design and a  range of complex queries using relational  database management systems  能够实现数据库设计和  进行关系数据库管理系统的复杂查询 | Lecture, Discussion, Case Study and Team Work  授课、讨论、案例分析和团队项目 | Multiple Questions, Quiz, Case Study, and Team Work  各类问题，章节测验，案例学习，和团队项目 |

六、课程内容**Course Contents**（必填项）

**Chapter 1 Introduction 第一章 概论 理论课时Hours 2/实践课时Actual Hours 0**

教学内容 Teaching Content:

* 1. Database-System Applications

1 1数据库系统的应用

* 1. Purpose of Database Systems

1 2数据库系统的目标

* 1. View of Data

1 3数据视图

* 1. Database Languages

1 4数据库语言

* 1. Database Design

1.5 数据库设计

1.6 Database Engine

1.6 数据库引擎

1.7 Database and Application Architecture

1.7 数据库体系结构

1.8 Database Users and Administrators

1.8 数据库用户和管理员

1.9 History of Database Systems

1.9 数据库系统的历史

知识要求Knowledge Requirements：

1. To know DBMS：A database-management system (DBMS) is a collection of interrelated data and a set of programs to access those data. The collection of data, usually referred to as the database, contains information relevant to an enterprise. The primary goal of a DBMS is to provide a way to store and retrieve database information that is both convenient and efficient.

知道数据库管理系统：数据库管理系统（DBMS）是一组相互关联的数据和一组访问这些数据的程序。数据的收集，通常称为数据库，包含与企业相关的信息。DBMS的主要目标是提供一种既方便又高效的存储和检索数据库信息的方法。

1. To understand Dtabase system: Database systems are designed to manage large bodies of information. Management of data involves both defining structures for storage of information and providing mechanisms for the manipulation of information. In addition, the database system must ensure the safety of the information stored, despite system crashes or attempts at unauthorized access. If data are to be shared among several users, the system must avoid possible anomalous results.

理解数据库系统： 数据库系统旨在管理大量信息。数据管理包括定义信息存储结构和提供信息操作机制。此外，尽管系统崩溃或试图进行未经授权的访问，数据库系统必须确保存储信息的安全。如果要在多个用户之间共享数据，系统必须避免可能的异常结果。

1. To grasp the basic concept and terms: Because information is so important in most organizations, computer scientists have developed a large body of concepts and techniques for managing data. These concepts and techniques form the focus of this book. This chapter briefly introduces the principles of database systems.

掌握基本的概念和术语：由于信息在大多数组织中都非常重要，计算机科学家已经开发了大量用于管理数据的概念和技术。这些概念和技术构成了本书的重点。本章简要介绍数据库系统的原理。

能力要求Capability Requirements：

1. Understanding: basic terms commonly used in database, including database, database management system, instance, mode, physical mode, logical mode, sub mode, physical data independence, database language, database user and DBA.

理解：数据库常用的基本术语，包括数据库、数据库管理系统、实例、模式、物理模式、逻辑模式、子模式、物理数据独立性、数据库语言、数据库用户和DBA。

1. Understand: the advantages of database system.

理解：数据库系统的优点。

1. Understanding: the three-tier structure of data view and data abstraction.

理解：数据视图和数据抽象的三层结构。

1. Understanding: data model, including entity relation model and relational model.

理解：数据模型，包括实体-联系模型和关系模型。

1. Understanding: transaction management.

理解：事务管理。

1. Understand: the basic structure of database system and the role of storage manager and query processor.

理解：数据库系统的基本组成结构及存储管理器和查询处理器的作用。

1. Know: the development of database system.

了解：数据库系统的发展历程。

教学难点 Difficulties in Teaching：

1. The Need for Databases

1对数据库的需求

1. View of Data

2数据视图

1. Data Models

3.数据模型

1. Database Languages

4数据库语言

1. Database Design

5数据库设计

1. Storage Manager

6存储管理器

1. Query Processing

7查询处理

1. Transaction Manager

8事务管理器

1. History of Database Systems

9数据库系统的历史

**Chapter 2 Introduction to the Relational Model 第2章关系模型介绍 理论课时Hours 6/实践课时Actual Hours 3**

教学内容 Teaching Content:

2.1 Structure of Relational Databases

2.1关系数据库的结构

2.2 Database Schema

2.2数据库模式

2.3 Keys

2.3键

2.4 Schema Diagrams

2.4模式图

2.5 Relational Query Languages

2.5关系查询语言

2.6 The Relational Algebra

2.6关系代数

知识要求Knowledge Requirements：

1. To know data model：A data model is a collection of conceptual tools for describing data, data relationships, data semantics, and consistency constraints. In this part, we focus on the relational model.

认识数据模型：数据模型是用于描述数据、数据关系、数据语义和一致性约束的概念工具的集合。在这一部分中，我们主要关注关系模型。

1. To grasp the relational model: The relational model, which is covered in Chapter 2, uses a collection of tables to represent both data and the relationships among those data. Its conceptual simplicity has led to its widespread adoption; today a vast majority of database products are based on the relational model. The relational model describes data at the logical and view levels, abstracting away low-level details of data storage. The entity-relationship model, discussed later in Chapter 7 (in Part 2), is a higher-level data model which is widely used for database design.

掌握关系模型：第2章介绍的关系模型使用一组表来表示数据以及这些数据之间的关系。其概念上的简单性导致了它的广泛采用；今天，绝大多数数据库产品都基于关系模型。关系模型在逻辑和视图级别描述数据，抽象出数据存储的低级细节。第7章（第2部分）后面讨论的实体关系模型是一种更高级别的数据模型，广泛用于数据库设计。

1. To understand the importance of relational models: The relational model is today the primary data model for commercial data processing applications. It attained its primary position because of its simplicity, which eases the job of the programmer, compared to earlier data models such as the network model or the hierarchical model.

了解关系模型的重要地位：关系模型是当今商业数据处理应用程序的主要数据模型。与早期的数据模型（如网络模型或层次模型）相比，它的简单性使程序员的工作更轻松，从而获得了它的主要地位。

1. To know the fundamentals of the relational model.: In this chapter, we first study the fundamentals of the relational model. A substantial theory exists for relational databases. We study the part of this theory dealing with queries in Chapter 6. In Chapters 7 through 8, we shall examine aspects of database theory that help in the design of relational database schema, while in Chapters 12 and 13we discuss aspects of the theory dealing with efficient processing of queries..

知道关系数据库的基本原理：在本章中，我们首先研究关系模型的基本原理。对于关系数据库，存在一个实质性的理论。我们将在第6章研究该理论中处理查询的部分。在第7章到第8章中，我们将研究有助于关系数据库模式设计的数据库理论的各个方面，而在第12章和第13章中，我们将讨论处理查询的有效处理的理论方面。

能力要求Capability Requirements：

1. Understanding: basic concepts of relational model (including attribute, domain, relation, tuple, tuple variable; database schema, database instance, relational schema, relational instance; super code, candidate code, main code, external code, etc.) and relational database structure.

理解：关系模型的基本概念（包括属性、域、关系、元组、元组变量；数据库模式、数据库实例、关系模式、关系实例；超码、候选码、主码、外码等）和关系数据库结构。

1. Proficiency: draw the database mode diagram according to the main code and external code.

熟练掌握：根据主码、外码画出数据库模式图。

1. Understanding: relational query language, understanding relational operations.

理解：关系查询语言，理解关系操作。

1. Master: Express query requirements with relational algebra.

掌握：用关系代数表达查询要求。

教学难点 Difficulties in Teaching：

1. Structure of Relational Databases

关系数据库的结构

1. Keys, Foreign Key, Referential integrity constraints

主键、外键、引用完整性约束

1. Schema Diagram

模式图

1. Relational Query Languages

关系查询语言

1. Relational Operations

关系操作

1. Relational Algebra

关系代数

**Chapter 3 Introduction to SQL 第三章 SQL简介 理论课时Hours 6/实践课时Actual Hours6**

教学内容 Teaching Content:

3.1 Overview of the SQL Query Language

3.1 SQL查询语言概述

3.2 SQL Data Definition

3.2 SQL数据定义

3.3 Basic Structure of SQL Queries

3.3 SQL查询的基本结构

3.4 Additional Basic Operations

3.4其他基本操作

3.5 Set Operations

3.5集合操作

3.6 Null Values

3.6空值

3.7 Aggregate Functions

3.7聚合函数

3.8 Nested Sub-queries

3.8嵌套子查询

3.9 Modification of the Database

3.9修改数据库

3.10 Summary

3.10总结

知识要求Knowledge Requirements：

1. There are a number of database query languages in use, either commercially or experimentally. In this chapter, as well as in Chapters 4 and 5, we study the most widely used query language, SQL.

有许多数据库查询语言在使用，无论是商业上还是实验上。在本章以及第4章和第5章中，我们研究了使用最广泛的查询语言SQL。

1. Although we refer to the SQL language as a “query language,” it can do much more than just query a database. It can define the structure of the data, modify data in the database, and specify security constraints.

尽管我们将SQL语言称为“查询语言”，但它可以做的远不止查询数据库。它可以定义数据的结构，修改数据库中的数据，并指定安全约束。

1. It is not our intention to provide a complete users’ guide for SQL. Rather, we present SQL’s fundamental constructs and concepts. Individual implementations of SQL may differ in details, or may support only a subset of the full language.。

我们无意为SQL提供完整的用户指南。相反，我们介绍SQL的基本构造和概念。SQL的各个实现可能在细节上有所不同，或者可能只支持完整语言的一个子集。

能力要求Capability Requirements：

1. Master: define the basic table.

熟练掌握：定义基本表。

1. Master: Express single table query and connection query with SQL statement.

熟练掌握：用SQL语句表达单表查询、连接查询。

1. Proficiency: express queries involving query result sorting and grouping with SQL statements.

熟练掌握：用SQL语句表达涉及查询结果排序、分组处理的查询。

1. Master: express the update of data with SQL statement.

熟练掌握：用SQL语句表达数据的更新。

1. Basic Mastery: Express nested queries with SQL statements.

基本掌握：用SQL语句表达嵌套查询。

1. Understand the concept of null value.

理解：空值的概念。

教学难点 Difficulties in Teaching：

1. SQL Data Definition

SQL数据定义

1. SQL Query Structure

SQL查询结构

1. Natural join operation

自然连接操作

1. Correlation name (Correlation variable, tuple variable)

相关名称（相关变量、元组变量）

1. Set operations

集合运算

1. Null Values

空值

1. Aggregation functions

聚合函数

1. Nested Sub-queries

嵌套子查询

1. Scalar Sub-queries

标量子查询

1. Database Modification

数据库修改

**Chapter 4 Intermediate SQL 第四章 中级SQL 理论课时Hours 3/实践课时Actual Hours3**

教学内容 Teaching Content:

4.1 Join Expressions

4 1连接表达式

4.2 Views

4 2视图

4.3 Transactions

4 3事务

4.4 Integrity Constraints

4 4完整性约束

4.5 SQL Data Types and Sachems

4 5 SQL的数据类型与模式

4.6 Authorization

4 6授权

4.7 Summary

4 7总结

知识要求Knowledge Requirements：

In this chapter, we continue our study of SQL. We consider more complex forms of SQL queries, view definition, transactions, integrity constraints, more details regarding SQL data definition, and authorization.

在本章中，我们将继续学习SQL。我们考虑更复杂的SQL查询形式、视图定义、事务、完整性约束、关于SQL数据定义和授权的更多细节。

能力要求Capability Requirements：

1. Proficiency: outreach query.

熟练掌握：外联查询。

1. Master: view definition and query.

熟练掌握：视图定义和查询。

1. Proficiency: definition of integrity limits.

熟练掌握：完整性限制定义。

1. Proficiency: authorization and recycling.

熟练掌握：授权和回收

1. Basic Mastery: View update.

基本掌握：视图更新。

教学难点 Difficulties in Teaching：

1. Join types

连接类型

1. View definition

视图定义

1. View update

视图更新

1. Integrity Constraints

完整性约束

1. Authorization

授权

**Chapter 5 Advanced SQL 第五章 高级SQL 理论课时Hours 3/实践课时Actual Hours 3**

教学内容 Teaching Content:

5.1 Accessing SQL From a Programming Language

5 1使用程序设计语言访问数据库

5.2 Functions and Procedures

5 2函数和过程

5.3 Triggers

5 3触发器

5.4 Recursive Queries\*\*

5 4递归查询\*\*

5.5 Advanced Aggregation Features\*\*

5 5高级聚集特性\*\*

5.6 OLAP\*\*

5 6OLAP\*\*

5.7 Summary

5 7总结

知识要求Knowledge Requirements：

In Chapters 3 and 4, we provided detailed coverage of the basic structure of SQL. In this chapter, we cover some of the more advanced features of SQL.1 We address the issue of how to access SQL from a general-purpose programming language, which is very important for building applications that use a database to store and retrieve data. We describe how procedural code can be executed within the database, either by extending the SQL language to support procedural actions, or by allowing functions defined in procedural languages to be executed within the database. We describe triggers, which can be used to specify actions that are to be carried out automatically on certain events such as insertion, deletion, or update of duple in a specified relation. We discuss recursive queries and advanced aggregation features supported by SQL. Finally, we describe online analytic processing (OLAP) systems, which support interactive analysis of very large data-sets.

在第3章和第4章中，我们详细介绍了SQL的基本结构。在本章中，我们将介绍SQL的一些更高级的功能。我们将讨论如何从通用编程语言访问SQL，这对于构建使用数据库存储和检索数据的应用程序非常重要。我们描述了如何在数据库中执行过程代码，可以通过扩展SQL语言来支持过程操作，也可以通过允许在数据库中执行过程语言中定义的函数。我们描述了触发器，它可用于指定在特定事件上自动执行的操作，例如在指定关系中插入、删除或更新双工。我们将讨论SQL支持的递归查询和高级聚合特性。最后，我们描述了在线分析处理（OLAP）系统，它支持对非常大的数据集进行交互式分析。

能力要求Capability Requirements：

1. Master: embedded SQL statements.

掌握：嵌入式SQL语句。

1. Understanding: dynamic SQL statements.

理解：动态SQL语句。

1. Basic Mastery: function and process.

基本掌握：函数和过程。

1. Basic Mastery: trigger.

基本掌握：触发器。

教学难点 Difficulties in Teaching：

1. Embedded SQL

嵌入式SQL

1. Dynamic SQL

动态SQL

1. SQL functions

SQL函数

1. Stored procedures

存储过程

1. Triggers

触发器

**Chapter 6 Formal Relational Query Languages 第六章 形式化关系查询语言 理论课时Hours 3/实践课时Actual Hours 3**

教学内容 Teaching Content:

6.1 The Relational Algebra

6 1关系代数

6.2 The Tuple Relational Calculus

6 2元组关系演算

6.3 The Domain Relational

6 3域关系演算

6.4 Summary

6 4总结

知识要求Knowledge Requirements：

In Chapters 2 through 5 we introduced the relational model and covered SQL in great detail. In this chapter we present the formal model upon which SQL as well as other relational query languages are based.

We cover three formal languages. We start by presenting the relational algebra, which forms the basis of the widely used SQL query language. We then cover the tuple relational calculus and the domain relational calculus, which are declarative query languages based on mathematical logic.

在第2章到第5章中，我们介绍了关系模型并详细介绍了SQL。在本章中，我们将介绍SQL以及其他关系查询语言所基于的形式化模型。

我们涵盖三种正式语言。我们首先介绍关系代数，它是广泛使用的SQL查询语言的基础。然后介绍元组关系演算和域关系演算，它们是基于数学逻辑的声明式查询语言。

能力要求Capability Requirements：

1. Proficiency: Express query with relational algebra.

熟练掌握：用关系代数表达查询。

1. Basic Mastery: Express query with tuple relation calculus.

基本掌握：用元组关系演算表达查询。

教学难点 Difficulties in Teaching：

1. Relational Algebra operations

关系代数运算

1. Outer join

外接

1. Grouping

分组

1. Tuple Relational Calculus

元组关系演算

1. Domain Relational

域关系

1. Division operations

除法操作

**Chapter 7 Database Design and the E-R Model 第七章 数据库设计和E-R模型 理论课时Hours 6/实践课时Actual Hours 6**

教学内容 Teaching Content:

7.1 Overview of the Design Process

7 1设计过程概览

7.2 The Entity-Relationship Model

7 2实体-联系模型

7.3 Constraints

7 3约束

7.4 Removing Redundant Attributes in Entity Sets

7 4从实体集中删除冗余属性

7.5 Entity-Relationship Diagrams

7 5实体－联系图

7.6 Reduction to Relational Schema

7 6转换为关系模式

7.7 Entity-Relationship Design Issues

7 7实体-联系设计问题

7.8 Extended E-R Features

7 8扩展的E-R特性

7.9 Alternative Notations for Modeling Data

7 9数据建模的其他表示法

7.10 Other Aspects of Database Design

7 10数据库设计的其他方面

7.11 Summary

7 11总结

知识要求Knowledge Requirements：

Up to this point in the text, we have assumed a given database schema and studied how queries and updates are expressed. We now consider how to design a database schema in the first place. In this chapter, we focus on the entity relationship data model (E-R), which provides a means of identifying entities to be represented in the database and how those entities are related. Ultimately, the database design will be expressed in terms of a relational database design and an associated set of constraints. We show in this chapter how an E-R design can be transformed into a set of relation sachems and how some of the constraints can be captured in that design. Then, in Chapter 8, we consider in detail whether a set of relation schemes is a good or bad database design and study the process of creating good designs using a broader set of constraints. These two chapters cover the fundamental concepts of database design.

到目前为止，我们假设了一个给定的数据库模式，并研究了查询和更新是如何表达的。现在，我们首先考虑如何设计数据库模式。在本章中，我们将重点介绍实体关系数据模型（E-R），该模型提供了一种识别要在数据库中表示的实体以及这些实体之间的关系的方法。最终，数据库设计将以关系数据库设计和相关约束集的形式表示。在本章中，我们将展示如何将E-R设计转换为一组关系模式，以及如何在该设计中捕获一些约束。然后，在第8章中，我们详细地考虑了一组关系方案是否是一个好的或坏的数据库设计，并研究使用一组更广泛的约束来创建良好设计的过程。这两章涵盖了数据库设计的基本概念。

能力要求Capability Requirements：

1. Understanding: the basic concept of entity relation model.

理解：实体-联系模型的基本概念。

1. Master: entity relation model (representation method of E-R diagram).

熟练掌握：实体-联系模型（E-R图的表示方法）。

1. Understanding: standard modeling language UML.

了解：标准建模语言UML。

教学难点 Difficulties in Teaching：

1. Entity and entity sets

实体和实体集

1. Relationship and Relationship Sets

关系和关系集

1. E-R Diagram

E-R图

1. Mapping Cardinality

映射基数

1. UNL

UNL

**Chapter 8 Relational Database Design 第八章 关系数据库设计 理论课时Hours 3/实践课时Actual Hours 3**

教学内容 Teaching Content:

8.1 Features of Good Relational Designs

8 1好的关系设计的特点

8.2 Atomic Domains and First Normal Form

8 2原子域和第一范式

8.3 Decomposition Using Functional Dependencies

8 3使用函数依赖进行分解

8.4 Functional-Dependency Theory

8 4函数依赖理论

8.5 Algorithms for Decomposition

8 5分解算法

8.6 Decomposition Using Multivariate Dependencies

8 6使用多值依赖的分解

8.7 More Normal Forms

8 7更多的范式

8.8 Database-Design Process

8 8数据库设计过程

8.9 Modeling Temporal Data

8 9时态数据建模

8.10 Summary

8 10总结

知识要求Knowledge Requirements：

In this chapter, we consider the problem of designing a schema for a relational database. Many of the issues in doing so are similar to design issues we considered in Chapter 7 using the E-R model.

In general, the goal of relational database design is to generate a set of relation sachems that allows us to store information without unnecessary redundancy, yet also allows us to retrieve information easily. This is accomplished by designing sachems that are in an appropriate normal form. To determine whether a relation schema is in one of the desirable normal forms, we need information about the real-world enterprise that we are modeling with the database. Some of this information exists in a well-designed E-R diagram, but additional information about the enterprise may be needed as well.

In this chapter, we introduce a formal approach to relational database design based on the notion of functional dependencies. We then define normal forms in terms of functional dependencies and other types of data dependencies. First, however, we view the problem of relational design from the standpoint of the sachems derived from a given entity-relationship design.

在本章中，我们考虑设计关系数据库的模式的问题。这样做的许多问题类似于我们在第7章中使用E-R模型考虑的设计问题。

一般来说，关系数据库设计的目标是生成一组关系数据库，它允许我们存储信息而不需要不必要的冗余，同时也允许我们轻松地检索信息。这是通过设计合适的正常形式的气囊来实现的。要确定关系模式是否符合所需的标准形式，我们需要有关使用数据库建模的真实企业的信息。其中一些信息存在于精心设计的E-R图中，但也可能需要有关企业的其他信息。

在本章中，我们将介绍一种基于函数依赖概念的关系数据库设计的形式化方法。然后，我们根据函数依赖和其他类型的数据依赖定义范式。然而，首先，我们从从一个给定的实体-关系设计衍生出的概念的角度来看待关系设计的问题。

能力要求Capability Requirements：

1. Understanding: concepts of 1NF paradigm, 3NF paradigm, BCNF paradigm and 4NF paradigm; The concepts of functional dependency, trivial functional dependency and multivalued functional dependency; Functional dependent closures; Armstrong axiom; The concepts of relationship decomposition, lossless connection decomposition and functional dependency preserving decomposition.

理解：1NF范式、3NF范式、BCNF范式、4NF范式的概念；函数依赖、平凡函数依赖、多值函数依赖的概念；函数依赖的闭包；Armstrong公理；关系分解、无损连接分解、函数依赖保持分解的概念。

1. Master: BCNF decomposition algorithm and 3NF decomposition algorithm.

熟练掌握：BCNF分解算法、3NF分解算法。

1. Master: the solution algorithm of attribute set closure, the solution method of relationship candidate code and the solution method of minimum functional cover.

熟练掌握：属性集闭包的求解算法、关系候选码的求解方法、最小函数依赖（canonical cover）的求解方法。

1. Master: the whole process of database design.

掌握：数据库设计的全过程。

教学难点 Difficulties in Teaching：

1. Normalization

规范化

1. Decomposition

分解

1. Functional dependencies

函数依赖关系

1. Lossless decomposition

无损分解

1. First Normal Form (1NF)

第一范式（1NF）

1. Second Normal Form (2NF)

第二范式（2NF）

1. Third Normal Form (3NF)

第三范式（3NF）

1. Boyce-Codd Normal Form (BCNF)

Boyce Codd范式（BCNF）

1. Dependency preservation

依赖项保存

1. Closure of a set of functional dependencies

函数依赖集的闭包

1. Armstrong’s axioms

阿姆斯特朗公理

1. Closure of attribute sets

属性集的闭包

**Chapter 12 Transactions 第十二章 事务管理 理论课时Hours 6/实践课时Actual Hours 3**

教学内容 Teaching Content:

12.1 Transaction Concept

12 1事务概念

12.2 A Simple Transaction Model

12.2简单的事务模型

12.3 Storage Structure

12.3存储结构

12.4 Transaction Atomicity and Durability

12.4事务原子性和持久性

12.5 Transaction Isolation

12 5事务隔离性

12.6 Serializability

12 6可串行化

12.7 Transaction Isolation and Atomicity

12.7事务隔离和原子性

12.8 Transaction Isolation Levels

12.8 事务隔离级别

12.9 Implementation of Isolation Levels

12.9 隔离等级的实施

12.10 Transactions as SQL Statements

12.10 作为SQL语句的事务

12.11 Summary

12.11 总结

知识要求Knowledge Requirements：

Often, a collection of several operations on the database appears to be a single unit from the point of view of the database user. For example, a transfer of funds from a checking account to a savings account is a single operation from the customer’s standpoint; within the database system, however, it consists of several operations. Clearly, it is essential that all these operations occur, or that, in case of a failure, none occur. It would be unacceptable if the checking account were debited but the savings account not credited.

Collections of operations that form a single logical unit of work are called transactions. A database system must ensure proper execution of transactions despite failures—either the entire transaction executes, or none of it does. Furthermore, it must manage concurrent execution of transactions in a way that avoids the introduction of inconsistency. In our funds-transfer example, a transaction computing the customer’s total balance might see the checking-account balance before it is debited by the funds-transfer transaction, but see the savings balance after it is credited. As a result, it would obtain an incorrect result.

This chapter introduces the basic concepts of transaction processing. Details on concurrent transaction processing and recovery from failures are in Chapters 15 and 16, respectively. Further topics in transaction processing are discussed in Chapter 26.

通常，从数据库用户的角度来看，数据库上若干操作的集合似乎是一个单一的单元。例如，从客户的角度来看，将资金从支票账户转移到储蓄账户是一项单一的操作；然而，在数据库系统中，它由几个操作组成。显然，必须进行所有这些操作，或者在发生故障时，不进行任何操作。如果支票账户记入借方，而储蓄账户未记入贷方，这将是不可接受的。

构成单个逻辑工作单元的操作集合称为事务。数据库系统必须确保事务的正确执行，即使整个事务执行失败，或者没有一个事务执行失败。此外，它必须以避免引入不一致性的方式管理事务的并发执行。在我们的资金转账示例中，计算客户总余额的交易可能在资金转账交易记入借方之前看到支票账户余额，但在记入贷方之后看到储蓄余额。因此，它将获得不正确的结果。

本章介绍事务处理的基本概念。关于并发事务处理和故障恢复的详细信息分别在第15章和第16章中。第26章讨论了事务处理中的更多主题。

能力要求Capability Requirements：

1. Understanding: the basic concept and nature of transactions.

理解：事务的基本概念和性质。

1. Understanding: the state of a transaction.

理解：事务的状态。

1. Understanding: the concepts of concurrent execution and serial execution.

理解：并发执行、串行执行的概念。

1. Understand: the basic concepts of serializability, operation conflict, conflict equivalence, conflict serializability, view equivalence, view serializability, recoverability, recoverable scheduling, lock, etc. of concurrent scheduling.

理解：并发调度的可串行性、操作冲突、冲突等价、冲突可串行性、View等价、View 可串行性、可恢复性、可恢复的调度、锁等基本概念。

1. Master: serializability judgment and priority diagram.

掌握：可串行性判定、优先图。

1. Understand: the definition of transactions in SQL.

了解：SQL中事务的定义。

教学难点 Difficulties in Teaching：

1. Transaction and ACID properties

事务和ACID性质

1. Inconsistent state

不一致状态

1. Concurrency control system

并发控制系统

1. Recovery system

回复系统

1. Transaction state

事务状态

1. Concurrent executions

并发执行

1. Serial execution

串行执行

1. Conflict of operations

操作冲突

1. Conflict serializability

冲突序列化

1. Serializability testing and Serializability order

可串行化测试和可串行化顺序

1. Precedence graph

优先图

1. Concurrency control

并发控制

1. Locking

锁定

七、课内实验名称及基本要求**In-Class Experiment and Basic Requirements**（选填，适用于课内实验）

列出课程实验的名称、学时数、实验类型（演示型、验证型、设计型、综合型）及每个实验的内容简述。

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **序号**  No. | **实验名称**  Name of Experiment | **主要内容**  Main Content of the Experiment | **实验**  **时数**  Experiment  Hours | **实验**  **类型**  Experiment  Type | **备注**  Notes |
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七、实践环节各阶段名称及基本要求**Stages of Practicum and Basic Requirements**（选填，适用于集中实践、实习、毕业设计等）

列出实践环节各阶段的名称、实践的天数或周数及每个阶段的内容简述。

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **序号**  No. | **各阶段名称**  Name of Each Stage | **实践主要内容**  Main Content of the Stages | **天数/周数**  Days/Weeks | **备注**  Remarks |
|  |  |  |  |  |
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八、评价方式与成绩**Assessment Index & Weightage**

|  |  |  |  |
| --- | --- | --- | --- |
| **总评构成（1+X）**  **Grading Computation** | **评价方式**  **Assessment Index** | **占比（%)**  **Weightage（%）** | **评测的毕业要求/指标点编号**  **No. of the Learning Outcomes Evaluated** |
| 1 | 期末考核：个人项目报告（2000 words）  Final Personal Report（2000 words） | 50% | LO2, LO3, LO5 |
| X1 | 过程考核：个人作业（800 words）  Personal Work（800 words） | 20% | LO2, LO3 |
| X2 | 过程考核：小组团队作业（1200 words）  Team Work（1200 words） | 20% | LO3 |
| X3 | 过程考核：课堂表现、出勤  Class Performance | 10% | LO3 |

“1”一般为总结性评价, “X”为过程性评价，“X”的次数一般不少于3次，无论是“1”、还是“X”，都可以是纸笔测试，也可以是表现性评价。与能力本位相适应的课程评价方式，较少采用纸笔测试，较多采用表现性评价。

常用的评价方式有：课堂展示、口头报告、论文、日志、反思、调查报告、个人项目报告、小组项目报告、实验报告、读书报告、作品（选集）、口试、课堂小测验、期终闭卷考、期终开卷考、工作现场评估、自我评估、同辈评估等等。**一般课外扩展阅读的检查评价应该成为“X”中的一部分。**

同一门课程由多个教师共同授课的，由课程组共同讨论决定X的内容、次数及比例。

|  |  |
| --- | --- |
| 撰写人 叶元卯  Tutor Signature： | 系主任审核  Program Leader Signature： |
| 时间  Date： | 时间  Date： |