**《数据库系统》教学大纲**

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| 课程代码 | 155147 |
| 课程名称 | 数据库系统 |
| 英文名称 | Database System |
| 课程类别 | 专业领域课 |
| 课程性质 | 必修 |
| 学时 | 总学时：64 上机学时：实验学时：16 实践学时 |
| 学分 | 3.5 |
| 开课学期 | 第四学期 |
| 开课单位 | 软件学院 |
| 适用专业 | 软件工程 |
| 授课语言 | 中英文双语授课 |
| 先修课程 | 离散数学, 数据结构与算法 |
| 毕业要求（专业培养能力） | 本课程对学生达到如下毕业要求有如下贡献：   1. 工程知识：掌握扎实的基础知识、专业基本原理、方法和手段，能够将数学、自然科学、本专业基础知识和专业知识用于解决复杂工程问题，并接触和掌握软件行业部分营运知识，为解决软件工程实际复杂问题打下知识基础。 2. 问题分析：能够应用数学、自然科学、本专业基本原理、方法和手段和软件行业营运知识，识别、表达、并通过文献研究分析软件工程中的复杂问题，以获得有效结论。 3. 设计/开发解决方案：能够设计针对软件工程复杂问题的解决方案，设计满足特定需求的软件系统，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。 4. 研究：能够基于科学原理并采用科学方法对软件工程复杂问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。 5. 使用现代工具：能够针对软件工程复杂问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对软件工程复杂问题的预测与模拟，并能够理解其局限性。 |
| 课程培养学生的能力（教学目标） | 完成课程后，学生将具备以下能力：   1. 掌握SQL 基本语法，学生具有创建、修改、更新、删除、查询数据库及其表格的能力。 2. 掌握数据库设计的基本知识，学生具有ER设计数据库, 判断数据库优劣和改进的能力。 3. 掌握查询优化, 事务的知识。 4. 掌握恢复系统的知识, 学生具有数据库备份和灾难恢复的能力。 |
| 课程简介 | 数据库应用广泛，是软件工程师必备的知识和技能，属于必修课。本课程主要讲授数据库的体系结构，管理系统，数据库系统，数据库设计的原理与方法，数据库应用与开发。 |
| 教学内容与学时分配 | 第1章 数据库介绍   1. 数据库总体介绍，4学时；   第2章 关系代数 CC. QB   1. 选择,投影,集合运算，连接，2学时； 2. 扩展的选择, 分组运算，2学时；   重点：选择,投影  难点：分组运算  第3章 SQL CC. QB   1. SQL数据定义，0.5 学时 2. SQL查询的基本结构，0.5学时； 3. 附加的基本运算，0.5学时； 4. 集合运算，0.5学时； 5. 空值，0.5学时； 6. 聚集函数，0.5 学时； 7. 嵌套子查询，0.5学时； 8. 数据库的修改，0.5学时；   重点：查询的基本结构  难点：聚集函数, 嵌套子查询  第4章 中级SQL CC. QB   1. 连接表达式，1学时； 2. 视图，1学时； 3. 完整性约束，1学时； 4. 授权，1学时；   重点：连接表达式, 视图  难点：完整性约束  第5章 数据库设计和E-R模型 CC. QB   1. 实体-联系模型, 1 学时； 2. 约束, 0.5 学时； 3. 从实体集中删除冗余属性 , 0.5 学时； 4. 实体－联系图, 1 学时； 5. 转换为关系模式, 1 学时； 6. 实体-联系设计问题, 1 学时； 7. 扩展的E-R特性, 0.5 学时； 8. 数据建模的其他表示法, 数据库设计的其他方面, 0.5 学时；   重点：实体－联系图  难点：转换为关系模式  第6章 关系数据库设计 CC. QB   1. 好的关系设计的特点, 0.25 学时； 2. 原子域和第一范式, 0.25 学时； 3. 使用函数依赖进行分解 , 2 学时； 4. 函数依赖理论, 2 学时； 5. 分解算法, 1.5 学时；   重点：函数依赖理论, 分解算法  难点：分解算法  第7章 索引与散列 CC. QB   1. 基本概念, 顺序索引, 0.25学时； 2. B+树索引文件, B+树扩展，多码访问, 1 学时； 3. 静态散列, 动态散列, 顺序索引和散列的比较, 2学时； 4. 位图索引, 0.25学时；   重点：B+树索引文件  难点：B+树扩展  第8章 查询处理 CC. QB   1. 查询代价的度量, 1学时； 2. 选择运算, 2学时； 3. 连接运算, 1 学时； 4. 排序运算, 1学时； 5. 表达式计算, 1学时；   重点：选择, 连接, 排序  难点：查询代价的度量  第9章 查询优化 CC. QB   1. 关系表达式的转换, 2学时； 2. 表达式结果集统计大小的估计, 1学时； 3. 执行计划选择, 1学时；   重点：选择, 连接  难点：查询代价的度量  第10章 事务 CC. QB   1. 可串行化, 1学时； 2. 事务隔离性, 原子性, 事务隔离性级别, 隔离性级别的实现,   1学时；  重点：事务隔离性, 可串行化  难点：可串行化  第11章 并发控制 CC. QB   1. 并发控制的基本含义，0.5学时； 2. 基于锁的协议, 死锁处理, 0.5学时   重点：基于锁的协议, 死锁处理  难点：死锁处理  第12章 恢复系统 CC. QB   1. 故障与恢复，1学时；   重点：恢复算法  难点：恢复算法 |
| 实验教学（包括上机学时、实验学时、实践学时） | 16学时 |
| 教学方法 | 课堂讲授、课堂研讨、课外作业等 |
| 考核方式 | 有平时成绩、期末成绩、实验成绩3种考核方式。期末考试是闭卷，实验考核需要上机等。成绩比例为：  作业+课堂表现: 10%  实验成绩: 20%  期末成绩: 70% |
| 教材及参考书 | Silberschatz A, Korth H F, Sudarshan S. Database system concepts[M] (Sixth Edition), New York: McGraw-Hill, 2014. |
| 制定人及制定时间 | 陈健， 2020.02.21 |

**“****Database System” Syllabus**

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| Course Code | 155147 |
| Course Title | Database System |
| Course Category | Specialty-related Course |
| Course Nature | Compulsory Course |
| Class Hours | Total Hours：64 Experimental Hours：16 |
| Credits | 3.5 |
| Semester | Fourth Semester |
| Institute | School of Software Engineering |
| Program Oriented | Software Engineering |
| Teaching Language | Chinese and English |
| Prerequisites | Discrete Mathematics, Data Structure and Algorithm |
| Student Outcomes  (Special Training Ability) | This course has following contributions to meet requirements for graduation:  1. Engineering Knowledge. The course helps student to solidly grasp ground knowledge, principle and method of this speciality, enable student to apply mathematics, natural science and knowledge of this speciality to solve complicated problems of engineering. The course helps student to grasp service knowledge of software industry, and to building a solid foundation to solve complicated problems in software engineering.  2. Problem analysis. The course helps student to apply mathematics, natural science, principle and method of this speciality, and service knowledge of software industry to identify, describe, and analyze complicated problems of software engineering, to get effective solutions finally.    3. Solution. The course helps student to figure out solutions to complicated problems of software engineering, and to design software system meeting special requirements. What is more, the design shows innovations and considers factors such as social, health, security, law, culture and environment.  4. Research. The course helps student to research on complicated problems of software engineering using scientific principle and method. The research involves experimental design, data analysis and interpretation, conclusion achievement.  5. Modern tools usage. The course helps student to choose, employ and develop appropriate technologies, resources, modern tools, to solve complicated problems in software engineering. |
| Teaching Objectives | Upon completion of this course, participants will have gained knowledge of database system concepts and the ability to:   * create, alter, update, delete, query database and tables in SQL. * design database, judge the quality of a database design. * optimize queries, grasp knowledge of transactions * recover and backup databases. |
| Course Description | Database is widely used. The knowledge and technology of database is necessary for any software engineer. Database is a compulsory course. It covers fundamentals of database architecture, database management systems, and database systems. Principles and methodologies of database design, and techniques for database application development. |
| Teaching Content and Class Hours Distribution | 1. Introduction to Database System, 4 class hours； 2. The Relational Algebra CC. QB 3. selection, projection, set operation, join, 2 class hours； 4. extended selection, group operation, 2 class hours；   Emphasis: selection, projection  Difficulty: group operation   1. Introduction to SQL CC. QB 2. SQL data definition，0.5 class hours； 3. Basic Structure of SQL Queries，0.5 class hours； 4. Additional Basic Operations，0.5 class hours； 5. Set Operations，0.5 class hours； 6. Null Values，0.5 class hours； 7. Aggregate Functions，0.5 class hours； 8. Nested Subqueries，0.5 class hours； 9. Modification of the Database，0.5 class hours；   Emphasis: Basic Structure of SQL Queries  Difficulty: Aggregate Functions, Nested Subqueries   1. Intermediate SQL CC. QB 2. Join Expressions，1 class hours； 3. Views，1 class hours； 4. Integrity Constraints，1 class hours； 5. Authorization，1 class hours；   Emphasis: Join Expressions, Views  Difficulty: Integrity Constraints   1. Database Design and the E-R Model CC. QB 2. The Entity-Relationship Model, 1 class hours； 3. Constraints, 0.5 class hours； 4. Removing Redundant Attributes in Entity Sets, 0.5 class hours； 5. Entity-Relationship Diagrams, 1 class hours； 6. Reduction to Relational Schemas, 1 class hours； 7. Entity-Relationship Design Issues, 1 class hours； 8. Extended E-R Features, 0.5 class hours； 9. Other Aspects of Database Design, 0.5 class hours；   Emphasis：Entity-Relationship Diagrams  Difficulty：Reduction to Relational Schemas   1. Relational Database Design CC. QB 2. Features of Good Relational, 0.25 class hours； 3. Atomic Domains and First Normal Form, 0.25 class hours； 4. Decomposition Using Functional Dependencies, 2 class hours； 5. Functional-Dependency Theory, 2 class hours； 6. Algorithms for Decomposition, 1.5 class hours；   Emphasis：Functional-Dependency Theory, Algorithms for Decomposition  Difficulty：Algorithms for Decomposition   1. Indexing and Hashing CC. QB 2. Basic Concepts, Ordered Indices 0.25 class hours； 3. B+-Tree Index Files, B+-Tree Extensions, 1 class hours； 4. Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, 2 class hours； 5. Bitmap index, 0.25 class hours；   Emphasis：B+-Tree Index Files  Difficulty：B+-Tree Extensions   1. Query Processing CC. QB 2. Measures of Query Cost, 1 class hours； 3. Selection Operation, 2 class hours； 4. Join Operation, 1 class hours； 5. Other Operations, 1 class hours； 6. Evaluation of Expressions, 1 class hours；   Emphasis：Selection, Join  Difficulty：Measures of Query Cost   1. Query Optimization CC. QB 2. Transformation of Relational Expressions, 2 class hours； 3. Estimating Statistics of Expression Results, 1 class hours； 4. Choice of Evaluation Plans, 1 class hours；   Emphasis：selection, join  Difficulty：Estimating Cost of Query   1. Transactions CC. QB 2. Serializability, 1 class hours； 3. Transaction Isolation and Atomicity,   Transaction Isolation Levels,  Implementation of Isolation Levels, 1 class hours；  Emphasis：Serializability, Isolation  Difficulty：Serializability   1. Concurrency Control CC. QB 2. The Basic of Concurrency Control 3. Lock-Based Protocols, Deadlock Handling，0.5 class hours；   Emphasis：Lock-Based Protocols, Deadlock Handling  Difficulty：Deadlock Handling   1. Recovery System CC. QB 2. Failure Classification and Recovery，1 class hours；   Emphasis：Recovery Algorithm  Difficulty：Recovery Algorithm |
| Experimental Teaching | 16 class hours |
| Teaching Method | Lectures and discussions in classroom, extracurricular assignment and design |
| Examination Method | This course will estimate students in 3 ways: class performance and assignments (C), experiments (E), final exam (F), where the final examine is a close-book exam, and experiments will be taken on machines.  Final grade in the class will be determined by the following formula:  0.1 C + 0.2 E + 0.7 F |
| Teaching Materials and Reference Books | Silberschatz A, Korth H F, Sudarshan S. Database system concepts[M] (Sixth Edition), New York: McGraw-Hill, 2014. |
| Prepared by Whom and When | Jian Chen, 2020.02.21 |

**《数据库系统》实验教学大纲**

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| 课程代码 | 155147 |
| 课程名称 | 数据库系统 |
| 英文名称 | Database System |
| 课程类别 | 专业领域课 |
| 课程性质 | 必修 |
| 学时 | 总学时：64 上机学时：实验学时：16 实践学时 |
| 学分 | 3.5 |
| 开课学期 | 第四学期 |
| 开课单位 | 软件学院 |
| 适用专业 | 软件工程 |
| 授课语言 | 中英文双语授课 |
| 先修课程 | 离散数学, 数据结构与算法 |
| 毕业要求（专业培养能力） | 本课程对学生达到如下毕业要求有如下贡献：   1. 工程知识：掌握扎实的基础知识、专业基本原理、方法和手段，能够将数学、自然科学、本专业基础知识和专业知识用于解决复杂工程问题，并接触和掌握软件行业部分营运知识，为解决软件工程实际复杂问题打下知识基础。 2. 问题分析：能够应用数学、自然科学、本专业基本原理、方法和手段和软件行业营运知识，识别、表达、并通过文献研究分析软件工程中的复杂问题，以获得有效结论。 3. 设计/开发解决方案：能够设计针对软件工程复杂问题的解决方案，设计满足特定需求的软件系统，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。 4. 研究：能够基于科学原理并采用科学方法对软件工程复杂问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。 5. 使用现代工具：能够针对软件工程复杂问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对软件工程复杂问题的预测与模拟，并能够理解其局限性。 |
| 课程培养学生的能力（教学目标） | 了解数据库系统特点、功能、结构与基本概念，熟悉DBMS的操作，SQL语言的语法和功能。 |
| 课程简介 | 本课程主要讲授数据库的实践技能, 要求学生采用SQL语言，读写数据库，完成给定任务。 |
| 主要仪器设备与软件 | 一台普通PC机器，操作系统Win XP及其以上版本，MySQL最新版本 |
| 实验报告 | 写明构造出的SQL句子，截图说明执行结果 |
| 考核方式 | 现场考核（80%）+实验报告（20%） |
| 教材、实验指导书及教学参考书目 | 自编实验手册 |
| 制定人及发布时间 | 陈健， 2020.02.21 |

**《数据库系统》实验教学内容与学时分配**

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| 实验项目编号 | 实验项目名称 | 实验学时 | 实验内容提要 | 实验类型 | 实验要求 | 每组人数 | 主要仪器设备与软件 |
| 1 | 数据库的安装与使用 | 4 | 1. 通过对某个商用数据库管理系统安装和使用，了解DBMS的工作原理和系统构架。 2. 熟悉对DBMS的操作 3. 搭建今后实验的平台 | 综合性 | 必做 | 1 | PC, OS不限  数据库: MySQL |
| 2 | 交互式SQL 1（DDL语言实践） | 4 | 1. 熟悉数据库的交互式SQL工具。如：MySQL 查询分析器。 2. 掌握SQL语言的DDL子语言，在MySQL环境下实现表的定义、删除与修改，掌握索引的建立与删除方法。 3. 掌握SQL语言的DDL子语言，在MySQL环境下实现表的定义中主键、外键、唯一值、检查、非空和默认值等列级或表级完整性约束条件的使用。 | 综合性 | 必做 | 1 | PC, OS不限  数据库: MySQL |
| 3 | 交互式SQL 2（DML：表操作） | 4 | 1. 采用MySQL实现查询操作，包括单表查询和连接查询（如：等值连接、自然连接、自身连接、外连接和复合条件连接）的方法 2. 采用MySQL实现数据更新 3. 采用MySQL实现视图的定义、删除、查询与更新。 | 综合性 | 必做 | 1 | PC, OS不限  数据库: MySQL |
| 4 | 交互式SQL 3（数据控制） | 4 | 1. 熟悉SQL对数据进行安全性控制 2. 掌握MySQL中触发器的使用方法。熟悉SQL的触发器对数据进行功能更强的完整性控制。 | 综合性 | 必做 | 1 | PC, OS不限  数据库: MySQL |

***“Database System” Syllabus***

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| Course Code | 155147 |
| Course Title | Database System |
| Course Category | Specialty-related Course |
| Course Nature | Compulsory Course |
| Class Hours | Total Hours：64 Experimental Hours：16 |
| Credits | 3.5 |
| Semester | Fourth Semester |
| Institute | School of Software Engineering |
| Program Oriented | Software Engineering |
| Teaching Language | Chinese and English |
| Prerequisites | Discrete Mathematics, Data Structure and Algorithm |
| Student Outcomes (Special Training Ability) | This course has following contributions to meet requirements for graduation:  1. Engineering Knowledge. The course helps student to solidly grasp ground knowledge, principle and method of this speciality, enable student to apply mathematics, natural science and knowledge of this speciality to solve complicated problems of engineering. The course helps student to grasp service knowledge of software industry, and to building a solid foundation to solve complicated problems in software engineering.  2. Problem analysis. The course helps student to apply mathematics, natural science, principle and method of this speciality, and service knowledge of software industry to identify, describe, and analyze complicated problems of software engineering, to get effective solutions finally.    3. Solution. The course helps student to figure out solutions to complicated problems of software engineering, and to design software system meeting special requirements. What is more, the design shows innovations and considers factors such as social, health, security, law, culture and environment.  4. Research. The course helps student to research on complicated problems of software engineering using scientific principle and method. The research involves experimental design, data analysis and interpretation, conclusion achievement.  5. Modern tools usage. The course helps student to choose, employ and develop appropriate technologies, resources, modern tools, to solve complicated problems in software engineering. |
| Teaching Objectives | Upon completion of this course, participants will have gained knowledge of database system concepts and the ability to:   1. create, alter, update, delete, query database in language SQL to meet the given requirements. 2. create, alter, update, delete, query tables and views in language SQL to meet the given requirements. 3. create, alter, delete, employ indexes in language SQL to meet the given requirements. |
| Course Description | This course mainly covers database skill and technology in practice. It asks students to read or write database system via SQL to fulfill the given tasks. |
| Instrument and Equipment | A regular PC machine, which installed Win XP or a higher version, and the latest MySQL version |
| Experiment Report | Present the SQL sentence and record the result in screenshots |
| Assessment | Final grade in the class will be determined by the following formula:  0.8 E + 0.2 R  E is the score of the test and R is the score of experimental report. |
| Teaching Materials and Reference Books | Silberschatz A, Korth H F, Sudarshan S. Database system concepts[M] (Sixth Edition), New York: McGraw-Hill, 2014. |
| Prepared by Whom and When | Jian Chen, 2020.02.21 |

***“******Database System” Experimental Teaching A*rrangements**

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| No. | Experiment Item | Class Hours | Content Summary | Category | Requirements | Number of StudentsEach Group | Instruments, Equipments and Software |
| 1 | Installation and usage of the database | 4 | 1. Understand the principle and architecture of DBMS by installing and using a database management system. 2. Master the usage of DBMS. 3. Build a platform for future experiments. | Comprehensive | Compulsory | 1 | PC with Windows 2000 or Linux, My SQL |
| 2 | Interactive SQL 1 (DDL language practice) | 4 | 1. Master the usage of interactive SQL tools, such as MySQL Query Analyzer. 2. Understand the definition, deletion and modification of tables as well as the creation and deletion of index in MySQL. 3. Study the primary keys, foreign keys, unique values, checks, non-null and default values of tables in MySQL. | Comprehensive | Compulsory | 1 | PC with Windows 2000 or Linux, My SQL |
| 3 | Interactive SQL 2 (DML: table operations) | 4 | 1. Implement queries in MySQL, including single-table queries and join queries. 2. Update the data in MySQL. 3. Realize the definition, deletion, query and update of the view. | Comprehensive | Compulsory | 1 | PC with Windows 2000 or Linux, My SQL |
| 4 | Interactive SQL 3 (data control) | 4 | 1. Understand data security control of SQL. 2. Master the usage of triggers in MySQL. | Comprehensive | Compulsory | 1 | PC with Windows 2000 or Linux, My SQL |