



## CSCI 3920: Database Management System

2022 Winter Session	
<b>Total Class Sessions: 25</b> <b>Class Sessions Per Week: 6</b> <b>Total Weeks: 4</b> <b>Class Session Length (Minutes): 145</b> <b>Credit Hours: 4</b>	<b>Instructor: Staff</b> <b>Classroom: TBA</b> <b>Office Hours: TBA</b> <b>Language: English</b>

### **Course Description:**

This course introduces students to the foundations of database management system, with focus on concepts and structures necessary to design and implement a database system. Students will have an explorations on topics including database design, the relational model, SQL, transaction management, concurrency control, and brief introduction of schema Refinement and normal forms. Detailed case studies will be applied to provide better practical skills in this field.

### **Learning objectives:**

After finishing the course, students will be able to do the following:

1. Understand fundamental theories behind database management.
2. Understand the design methodology for databases and identify their correctness;
3. Apply databases and applications software to the relational model;
4. Use querying languages, primarily SQL, and other database supporting software;
5. Implement security policy relating to databases;
6. Gain individual and group work skills, which is needed in the future;

### **Course Materials:**

**Required Text:** Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd, McGraw-Hill, 2002, ISBN: 0072465638.

### **Course Format and Requirements:**

The course will take place in a computer lab and the course format including lecture, programming project, and in-class discussion. The specific topics that will be covered in the classes are listed in the course syllabus. The class period will consist of an active learning environment. During a majority of the class time, students will be actively working on problems in groups under the instructor's guides.

### **Attendance:**

More than three unexcused absences will result in an automatic reduction in your participation



grade, for instance from A- to B+. Your active participation in the class is expected and constitutes part of your grade.

### **Course Assignments:**

#### **Quizzes:**

There will be 6 quizzes administered through the whole semester and the LOWEST score will be dropped. Quizzes will always be completed in the first ten minutes of class. The quiz problems will be similar to problem sets and examples on slides. There will be no make-up quizzes.

#### **Problem Sets**

Problem sets are based on course needs, covering the following topics: The Relational Model, SQL, Internet Applications, Storing Data, Storage and Indexing, Query Evaluation and Evaluating Relational Operators.

#### **Weekly Projects**

Weekly Projects are designed to help students better understand the material we have covered, as well to give you practical programming experience. Students are expected to do your own work. Each student is expected to write his/her own programs independently. Students may, however, discuss project requirements and problem-solving strategies. Instances of copying the program of another student will result in loss of credit for that program as well as possible failure in the course by involved parties. Each project will have a due date.

#### **Exams**

##### Midterm Exam

There will be one midterm exam in this course. The midterm exam will be based on concepts covered in class. They will be in-class, close-book and non-cumulative.

##### Final Exam

The final will be cumulative and close-book. Note that the final will not be taken during the normal class times. Exact time and location for final will be announced later.

### **Course Assessment:**

Quizzes	7%
Problem Sets	8%
Weekly Projects	40%
Midterm Exam	20%
Final Exam	25%
<b>Total</b>	<b>100%</b>

### **Grading Scale (percentage):**

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
98-	93-	90-	88-	83-	80-	78-	73-	70-	68-	63-	60-	<60
100	97	92	89	87	82	79	77	72	69	67	62	

**Academic Integrity:**

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Chengdu University of Technology's Academic Conduct Code. Any work suspected of violating the standards of the Academic Conduct Code will be reported to the Dean's Office. Penalties for violating the Academic Conduct Code may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the Academic Conduct Code.

**Special Needs or Assistance:**

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.

**Course Schedule:**

Class	Topics	Assignments
Class 1~5	<ul style="list-style-type: none"><li>• Overview of Database Systems<ul style="list-style-type: none"><li>➤ Managing Data</li><li>➤ File Systems VS a DBMS</li><li>➤ Advantage of a DBMS</li><li>➤ Queries in a DBMS</li><li>➤ Transaction Management</li><li>➤ Structure of a DBMS</li></ul></li><li>• Introduction to Database Design<ul style="list-style-type: none"><li>➤ Database Design and ER Diagrams</li><li>➤ Entities, Attributes and Entity Sets</li><li>➤ Relationships and Relationship Sets</li><li>➤ Additional Features of the ER Model</li><li>➤ Conceptual Design with the ER Model</li><li>➤ The Unified Modeling Language</li></ul></li><li>• The Relational Model</li></ul>	<ul style="list-style-type: none"><li>• Quiz 1</li><li>• Textbook review</li><li>• Finish the hard copy of problem set about the Relational Model assigned by teacher</li><li>• Weekly Project</li></ul>



	<ul style="list-style-type: none"> <li>➤ Integrity Constraints over Relations</li> <li>➤ Enforcing Integrity Constraints</li> <li>➤ Querying Relational Data</li> <li>➤ Logical Database Design: ER to Relational</li> <li>➤ Introduction to Views</li> </ul>	
Class 6~10	<ul style="list-style-type: none"> <li>• Relational Algebra and Calculus <ul style="list-style-type: none"> <li>➤ Selection and Projection</li> <li>➤ Set operations</li> <li>➤ Renaming</li> <li>➤ Joins</li> <li>➤ Division</li> <li>➤ Tuple Relational Calculus</li> </ul> </li> <li>• Domain Relational Calculus</li> <li>• SQL: Queries, Constraints, Triggers <ul style="list-style-type: none"> <li>➤ The Form of a Basic SQL Query</li> <li>➤ UNION, INTERSECT, and EXCEPT</li> <li>➤ Nested Queries</li> <li>➤ Aggregate Operators</li> <li>➤ Null Values</li> <li>➤ Complex Integrity Constraints in SQL</li> <li>➤ Triggers and Activate Databases</li> <li>➤ Designing Active Databases</li> </ul> </li> <li>• Database Application Development <ul style="list-style-type: none"> <li>➤ Assessing Databases from Applications</li> <li>➤ JDBC, JDBC Classes and Interfaces</li> <li>➤ SQLJ</li> <li>➤ Stored Procedures</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Quiz 2 and 3</li> <li>• Textbook review</li> <li>• Finish the hard copy of problem set about SQL, Internet Applications and Storing Data assigned by teacher</li> <li>• Weekly Project</li> </ul>
Class 11~15	<ul style="list-style-type: none"> <li>• Internet Applications <ul style="list-style-type: none"> <li>➤ HTML Documents</li> <li>➤ XML Documents</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Quiz 4</li> <li>• Midterm</li> </ul>



	<ul style="list-style-type: none"><li>➤ The Three-tier Application Architecture</li><li>➤ The Presentation Layer</li><li>• Storage and Indexing<ul style="list-style-type: none"><li>➤ File Organizations and Indexing</li><li>➤ Index Data Structures</li><li>➤ Comparison of File Organizations</li></ul></li><li>• Storing Data: Disks and Files<ul style="list-style-type: none"><li>➤ The Memory Hierarchy</li><li>➤ Redundant Arrays of Independent Disks</li><li>➤ Disk Space Management</li><li>➤ Buffer Manager</li><li>➤ Files of Records</li></ul></li><li>• Tree-Structured Indexing</li><li>• Hash-Bases Indexing</li></ul>	<ul style="list-style-type: none"><li>• Textbook review</li><li>• Finish the hard copy of problem set about Storage and Indexing assigned by teacher</li><li>• Weekly Project</li></ul>
Class 16~20	<ul style="list-style-type: none"><li>• Query Evaluation<ul style="list-style-type: none"><li>➤ Algorithms for Relational Operations</li><li>➤ Query Optimization</li><li>➤ Alternative Plans: A Motivating Example</li><li>➤ What a Typical Optimizer Does</li></ul></li><li>• External Sorting</li><li>• Evaluating Relational Operators<ul style="list-style-type: none"><li>➤ General Selection Conditions</li><li>➤ The Projection Operation</li><li>➤ The Join Operation</li><li>➤ The Set Operations</li><li>➤ Aggregate Operations</li></ul></li><li>• A typical Relational Query Optimizer<ul style="list-style-type: none"><li>➤ Translating SQL Queries into Algebra</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Quiz 5</li><li>• Textbook review</li><li>• Finish the hard copy of problem set about Query Evaluation and Evaluating Relational Operators assigned by teacher</li><li>• Weekly Project</li></ul>



	<ul style="list-style-type: none"><li>➤ Estimating the Cost of a Plan</li><li>➤ Relational Algebra Equivalences</li><li>➤ Enumeration of Alternative Plans</li></ul>	
Class 21~25	<ul style="list-style-type: none"><li>• Transaction Management<ul style="list-style-type: none"><li>➤ Concurrent Execution of Transactions</li><li>➤ Lock-Based Concurrency Control</li><li>➤ Transaction Support in SQL</li></ul></li><li>• Concurrency Control<ul style="list-style-type: none"><li>➤ 2PL, Serializability, and Recoverability</li><li>➤ Introduction to Lock Management</li><li>➤ Concurrency Control without Locking</li></ul></li><li>• Crash Recovery</li><li>• Schema Refinement and Normal Forms<ul style="list-style-type: none"><li>➤ Functional Dependencies</li><li>➤ Properties of Decompositions</li><li>➤ Normalization</li><li>➤ Schema Refinement in Database Design</li></ul></li><li>• Wrap-up</li></ul>	<ul style="list-style-type: none"><li>• Quiz 6</li><li>• Textbook review</li><li>• Weekly Project</li><li>• Final exam (cumulative) TBA</li></ul>