CS 1555: Database Management Systems

SPRING, 2025

INSTRUCTOR: Ming Xiao

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OFFICE HOURS: Office hours for the Spring Term will be held in person: Thur and Fir 3:30PM-4:30PM , I will also be available by appointment, usually via Tencent meeting.

LECTURES: We will meet for lecture in person. Lecture meetings will focus on discussion / examples / clarifications of the posted presentations.

RECITATION: To Be Determined

TEXTBOOK: Fundamentals of Database Systems, 7th Edition. Ramez Elmasri and Shamkant B. Navathe, 2016, 7th Edition [Publisher: Pearson]

TEACHING ASSISTANT: Mingjing Li, Qichen Shang

PREREQUISITE: None

DESCRIPTION: CS 1555 is a core course designed to build students' skills in the Database Management Systems and its related technologies. There are two principle objectives for this course. First, to introduce the fundamental concepts necessary for the design and use of a database, as well as the new trends (SQL vs. NOSQL). Second, to provide practical experience in applying these concepts using commercial database management systems.

COURSE OBJECTIVES:

1) To introduces the basic concepts of database management systems, including their architecture, components, and applications, to help students understand the role of databases in modern computing.
2) To teach database design and implementation, teaching students how to design and implement databases through entity-relationship modeling and relational data modeling.
3) To provides hands-on experience in SQL querying and database administration to ensure that students are able to master writing SQL queries and database administration skills through practice.

LEARNING OUTCOMES FOR THIS COURSE:

1) Solid foundation in database concepts and architecture
2) Database design skills in entity-relationship modeling
3) Proficiency in SQL operations
4) Understanding of database normalization and integrity
5) Basic knowledge of transaction management and concurrency control
6) Continuous learning and self-improvement ability

GRADE DETERMINATION: The final grade will be based on the score. The score is a number determined by: Midterm exam: 20% + Final exam 35% + Labs: 25% + Homework: 10% + Attendance 10%,
The final letter grade is determined from the following table.

A: 90 – 100	A−: 85 – 90	B+: 80 – 85	B: 76 – 80	B−: 73 – 76
C+: 70 – 73	C: 66 - 70	C−: 63 - 66	D: 60 – 63	F: < 60

EXAMS: This course will have one midterm exam and one final exam on the dates listed. The midterm exam will focus on the first half of the material (roughly) and the final exam will look at overall knowledge. Exams will be closed book. You should not access any notes, handouts, slides, web materials or any other information during the exams.

QUIZZES: Quizzes will be given during lectures, and will be announced at least one lecture before they are given. They will generally include material covered in the previous classes.

GRADE REBUTTAL: You must receive your own test or quiz paper. For any test or quiz, you have only one week to request correction if you feel your answer is mis-graded. No correction will be made after a week when the test paper is returned.

HOMEWORK: There will be approximately 4-5 homework assignments in this course, with a focus on program-writing types. They must be handed in before due date. **No late homework will be accepted.** Your TA will collect them and grade some problems. Homework solutions will be provided after the due date.

ATTENDANCE: Each class in this program will have an on-site electronic check-in to keep track of student attendance.

MAKE-UP POLICY: **No makeup work or tests will be allowed.**

MATERIAL COVERED: The sequence of the sections covered in this class is:

Week	Contents	Descriptions
1	1. Databases and Database Users (1.1-1.4)	o Introduction to Databases o Characteristics of the Database Approach o Actors on the Scene
2	1. Databases and Database Users (1.5-1.9)	o Workers behind the Scene o Advantages of Using the DBMS Approach o A Brief History of Database Applications o When Not to Use a DBMS o Summary and Review
3	2. Database System Concepts and Architecture (2.1-2.4)	o Data Models, Schemas, and Instances o Three-Schema Architecture and Data Independence o Database Languages and Interfaces o The Database System Environment
4	2. Database System Concepts and	o Centralized and Client/Server Architectures for DBMSs o Classification of Database Management Systems

	Architecture (2.5-2.7) 3. ER Data Modeling (3.1-3.2)	o Summary and Review o Using High-Level Conceptual Data Models for Database Design o A Sample Database Application
5	3. Data Modeling Using the Entity-Relationship (ER) Model (3.3-3.6)	o Entity Types, Entity Sets, Attributes, and Keys o Relationship Types, Relationship Sets, Roles, and Structural Constraints o Weak Entity Types o Refining the ER Design for the COMPANY Database
6	3. Data Modeling Using the Entity-Relationship (ER) Model (3.7-3.11)	o ER Diagrams, Naming Conventions, and Design Issues o Example of Other Notation: UML Class Diagrams o Relationship Types of Degree Higher than Two o Another Example: A UNIVERSITY Database o Summary and Review
7	4. The Enhanced Entity-Relationship (EER) Model (4.1-4.4)	o Subclasses, Superclasses, and Inheritance o Specialization and Generalization o Constraints and Characteristics of Specialization and Generalization Hierarchies o Modeling of UNION Types Using Categories
8	4. The Enhanced Entity-Relationship (EER) Model (4.5-4.8)	o A Sample UNIVERSITY EER Schema, Design Choices, and Formal Definitions o Example of Other Notation: Representing Specialization and Generalization in UML Class Diagrams o Data Abstraction, Knowledge Representation, and Ontology Concepts o Summary and Review
9	5. The Relational Data Model and Relational Database Constraints (5.1-5.4)	o Relational Model Concepts o Relational Model Constraints and Relational Database Schemas o Update Operations, Transactions, and Dealing with Constraint Violations o Summary and Review
10	6. Basic SQL (6.1-6.6)	o SQL Data Definition and Data Types o Specifying Constraints in SQL o Basic Retrieval Queries in SQL o INSERT, DELETE, and UPDATE Statements in SQL o Additional Features of SQL o Summary and Review
11	7. More SQL: Complex Queries, Triggers, Views, and Schema Modification (7.1-7.5)	o More Complex SQL Retrieval Queries o Specifying Constraints as Assertions and Actions as Triggers o Views (Virtual Tables) in SQL o Schema Change Statements in SQL o Summary and Review
12	8. The Relational Algebra and	o Unary Relational Operations: SELECT and PROJECT o Relational Algebra Operations from Set Theory

	Relational Calculus (8.1-8.4)	o Binary Relational Operations: JOIN and DIVISION o Additional Relational Operations
13	8. The Relational Algebra and Relational Calculus (8.5-8.8) 9. Relational Database Design by ER- and EER-to-Relational Mapping (9.1)	o Examples of Queries in Relational Algebra o The Tuple Relational Calculus o The Domain Relational Calculus o Summary and Review o Relational Database Design Using ER-to-Relational Mapping
14	9. Relational Database Design by ER- and EER-to-Relational Mapping (9.2-9.3) 10. Introduction to SQL Programming Techniques (10.1-10.3)	o Mapping EER Model Constructs to Relations o Summary and Review o Overview of Database Programming Techniques and Issues o Embedded SQL, Dynamic SQL, and SQLJ o Database Programming with Function Calls and Class Libraries: SQL/CLI and JDBC
15	10. Introduction to SQL Programming Techniques (10.4-10.6) 11. Web Database Programming Using PHP (11.1-11.2)	o Database Stored Procedures and SQL/PSM o Comparing the Three Approaches o Summary and Review o A Simple PHP Example o Overview of Basic Features of PHP
16	11. Web Database Programming Using PHP (11.3-11.5) Other Technologies for Database	o Overview of PHP Database Programming o Brief Overview of Java Technologies for Database Web Programming o Summary and Review o Course Content Review o Final Exam Preparation