Database Systems Concepts and Design — Course Syllabus

Course Information

Course Prefix and Number: CS 6400

Course Name: Database Systems Concepts and Design

Instructor: Kexin Rong

Course Description

This course provides an advanced introduction to the use, design, and implementation of databases, focusing on relational databases. Topics include data models, schema design, data storage, indexing techniques, query processing, optimization, concurrency control, transactions, and failure recovery. These concepts are essential for organizing data effectively, ensuring efficient retrieval and management, maintaining data integrity and consistency in multi-user environments, and protecting against data loss. While this course introduces these concepts at a high level, implementation details will be covered more extensively in the follow-on course CS 6422.

What to Expect

Students are expected to be comfortable programming in languages such as Python and Java. While the course covers SQL programming, it does not provide a highly detailed introduction to the language. Those who have completed a first course in database management may find some repetition of material; however, the instructor aims to provide a deeper conceptual understanding of the database area for all students, regardless of prior experience.

Students who have sufficient undergraduate database coursework and a strong conceptual understanding of the subject matter are advised to proceed directly to CS 6422, which emphasizes the inner workings of a database system and its internal system issues.

Course Learning Outcomes

By the end of this course, students will be able to:

1. Design relational schemas using data modeling techniques (ER diagrams, relational algebra, and normalization theory) and express queries in SQL.
2. Explain how databases store, index, and retrieve data efficiently, including the design and tradeoffs of common index structures.
3. Analyze query execution and optimization strategies, and describe transaction management including concurrency control and crash recovery.
4. Describe emerging data-intensive computing paradigms such as OLAP, distributed databases, and NoSQL systems.
5. Apply and extend database concepts through a team project involving implementation, empirical evaluation, and written communication of results.

Required Course Materials

The following two textbooks may be used interchangeably for optional readings:

- *Database Systems: The Complete Book* (2nd edition) — Garcia-Molina, Ullman, and Widom
- *Fundamentals of Database Systems* — Elmasri and Navathe

No purchase is required. All assigned readings are optional and supplemental. Lecture slides are the primary resource and will be posted on the course website.

Grading Policy

The course grade is composed of three components:

- **Exams (40%):** Two individual exams covering course material.
- **Assignments (35%):** Individual programming assignments released throughout the semester.
- **Course Project (25%):** A team project (teams of 3–4) with three milestones: a proposal, a midpoint milestone, and a final report with code.

The default grading thresholds are:

- A: ≥ 90%
- B: [80%, 90%)
- C: [70%, 80%)
- D: [60%, 70%)

The instructor reserves the right to adjust grade thresholds downward to benefit students based on overall class performance. Thresholds will not be raised under any circumstances.

Late Assignment Policy

Each student is granted **one automatic late day** for the semester, which may be used for any individual assignment (excluding exams) without penalty. Beyond this, late assignments will incur a **10% deduction** of the total available points per 24-hour period (or part thereof). Assignments may be submitted up to 72 hours (3 days) late, with a maximum penalty of 30% of the total points. No late submissions are accepted for exams.

Makeup Exam Policy

No makeup exams will be offered for the midterm. If you miss the midterm due to a **documented and legitimate reason** (e.g., illness, family emergency, IAA), your final exam score will replace the missed exam score using a percentile adjustment. No adjustments will be made for unexcused absences.

Attendance Policy

Attendance is encouraged but not required. Lecture slides are posted on the course website, but slides alone may not capture the full depth of in-class discussion.

Academic Integrity

Students are expected to abide by the Georgia Tech Honor Code. You are encouraged to discuss course material with other students, but must solve homework problems and exams independently. You are responsible for understanding and being able to explain any solution you submit. Suspected honor code violations will be referred to the Office of the Dean of Students and the Georgia Tech Office of Student Integrity.

Generative AI Policy

Understanding how and when to use generative AI tools is an important and emerging professional skill. The use of generative AI is **encouraged with attribution** for tasks such as understanding concepts, brainstorming project ideas, and revising written work. However, **you should not use generative AI tools to complete the programming assignments.**

All AI-assisted content submitted in this course must be clearly documented and attributed. AI-generated text must be distinguishable from your own writing (e.g., different font color, direct quotation, or parenthetical citation). Undisclosed use of AI on prohibited work will be treated as an academic integrity violation.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Georgia Tech Office of Disability Services as soon as possible to obtain an accommodations letter. Please also email the instructor early in the semester to arrange any necessary adjustments. Students who fail to comply with the requirements set forth by the Office of Disability Services will not receive accommodation.

Student–Instructor Expectations

Georgia Tech is committed to an atmosphere of mutual respect, acknowledgment, and responsibility between instructors and students. The GT Expectations of Advisors and Advisees articulates basic expectations that students can have of the instructor and that the instructor has of students. Respect for knowledge, diligent effort, and collegial interaction will help build the environment we all seek.