

CSCI 455: Principles of Database Systems

Course Syllabus – Fall 2022

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Lecture Meeting Times: Mon/Wed/Fri 3:00p - 3:50p in TH 409

Final Exam: Wed, 12/14/2022, 4:00p - 6:00p

Office Hours (On Zoom - See canvas for link):

- Mon/Wed/Fri 4:00p - 5:00p
- Tue 3:00p - 5:00p
- By appointment

1 Course Information

The management of data is one of the classical problems in computing. This course centers around the fundamental concepts and theory behind the relational data model, which addresses numerous problems that plague data management, including data independence, access, consistency, and information loss. Course topics include the relational data model, database languages (*e.g.*, SQL), relational database theory, database design (by decomposition), query execution, and considerations that affect system performance. Students will design database schemas that effectively model an organization's information and write applications that require database integration. Students will also gain insight through the implementation of influential data structures and algorithms that are commonly used in modern relational database systems.

Prerequisites

Junior standing, and a grade of C- and above in the following courses are required or with permission from the instructor:

- CSCI 261 - Computer Science II
- MATH 210 - Introduction to the Mathematics of Computer Science

Textbook

- Silberschatz, Korth, and Sudarshan, *Database System Concepts*. 6th Ed. (Required)

Course Topics

- The Relational Model
- Database Languages: Relational Algebra and SQL
- Relational Database Theory and Normalization
- Performance Analysis

- File Organization
- Hashing and Indexing
- Transactions and Concurrency Control

2 Student Learning Outcomes

Students taking this course will:

- Analyze user requirements to prepare an appropriate relational database schema.
- Use normal forms and perform normalization in the design of a relational database.
- Analyze and solve problems related to external memory data structures and algorithms using suitable mathematics.
- Evaluate the merits among various file organization and indexing designs, with respect to space and time complexity.
- Design, code, test and debug programs which perform query and update transactions on a database in a team-based environment.

3 Grading

The following grade cutoffs are upper bounds. They might come down, but will not be set higher: A = 95, A- = 90, B+ = 87, B = 83, B- = 80, C+ = 77, C = 73, C- = 70, D+ = 67, D = 64, D- = 60, F = < 60. Your overall grade will be composed as follows:

	% Weight
Discretionary	2
Homework	33
Project	20
Midterm I	15
Midterm II	15
Final Exam	15

Table 1: Breakdown of Grades

Assignments

- **Homework Assignments** – Programming assignments account for a significant portion of the final grade. Homework assignments are to be completed individually unless otherwise stated. While you are encouraged to help each other and share ideas, please note that copying any code from outside sources (e.g., other students, former students, web sites) prohibited and considered plagiarism and will induce heavy penalties (refer to *Academic Integrity* below). When in doubt, ask me if a certain activity is allowed!

- **Term Project** – There will be an open-ended group project assigned about mid-way through the course. The most successful teams meet and physically work together at an agreed-upon location and time – that is, *uno animo*. It is a good idea to set up version control environments and practice scrum, to ensure everyone has something to do and is making progress. A final presentation will be given in the last week of classes (prior to finals week). Each member of the team should contribute equally to the assignment, and every student in a team will receive the same grade.
- **Late Work and Extensions** – For each day either a homework assignment is late (includes weekends), a $\lceil 3^d \rceil\%$ deduction, where d is the number of days late, will be assessed. Because ample amounts of time are provided to complete each assignment (usually around 2 weeks) no extensions be will given for homework assignments, unless there are unique circumstances or accommodations. Because labs are always due the next day and are graded on attendance and effort, there is no extension for labs.

Exams

There will be two midterms and a final exam. They will cover topics discussed in the lectures, readings from the assigned textbook, and assignments. The exams are cumulative. Study guides are provided and selected problems are reviewed on the lecture preceding the day of the exam.

Discretionary

Discretionary points will be given based on your...

- Attendance
- Class participation
- Turning in all assignments on time
- Refrain from activities that can disrupt others, e.g., texting, playing games on your laptop, etc.

4 Policies

Laptops and Phones

Laptops: Laptop computers have proved to be a distraction during my lectures. Except for those who can provide documentation of need from the office of Student Accessibility and Accommodation (SAA), please don't bring your laptops to lectures. **Phones:** Please put your phones on silent during class.

Academic Integrity

You should be aware of the *Student Integrity Code* at the university. Any suspected cheating (e.g., plagiarizing code, copying homework solutions, etc.) will be reported to the Registrar, which may result in possible suspension/expulsion. See this link for more info:

<http://www.pugetsound.edu/student-life/personal-safety/student-handbook/academic-handbook/academic-integrity>

Student Accessibility and Accommodation

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Peggy Perno, Director of the Office of Accessibility and Accommodation, 105 Howarth, 253.879.3395. She will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Classroom Emergency Response Guidance

Please review university emergency preparedness and response procedures posted at . There is a link on the university home page. Familiarize yourself with hall exit doors and the designated gathering area for your class and laboratory buildings.

If building evacuation becomes necessary (e.g. earthquake), meet your instructor at the designated gathering area so she/he can account for your presence. Then wait for further instructions. Do not return to the building or classroom until advised by a university emergency response representative.

If confronted by an act of violence, be prepared to make quick decisions to protect your safety. Flee the area by running away from the source of danger if you can safely do so. If this is not possible, shelter in place by securing classroom or lab doors and windows, closing blinds, and turning off room lights. Lie on the floor out of sight and away from windows and doors. Place cell phones or pagers on vibrate so that you can receive messages quietly. Wait for further instructions.

Student Bereavement Policy

The University of Puget Sound recognizes that a time of bereavement can be difficult for a student. Therefore, the university provides a Student Bereavement Policy for students facing the loss of a family member. Students are normally eligible for, and faculty members are expected to grant, three consecutive weekdays of excused absences, without penalty, for the death of a family member, including parent, grandparent, sibling, or persons living in the same household. Should the student feel that additional days are necessary, the student must request additional bereavement leave from the Dean of Students or the Dean's designee. In the event of the death of another family member or friend not explicitly included within this policy, a bereaved student may petition for grief absence through the Dean of Students office for approval.

Student Religious Accommodation

The university provides reasonable religious accommodations for academic courses and programs, and the university policy is found at:

<https://www.pugetsound.edu/about/offices-services/human-resources/policies/campus-policies/student-religious-accommodations-in-academic-courses-or-programs>.

5 Course Schedule

The following course schedule is tentative and subject to change.

Week	Topics	Reading
1	The relational model, set operations	Silberschatz, <i>et al.</i> : Chap 1
2	Relational model (cont.), start relational algebra	Silberschatz, <i>et al.</i> : Chap 2
3	Relational algebra	Silberschatz, <i>et al.</i> : Chap 6.1
4	SQL: data definition, integrity constraints	Silberschatz, <i>et al.</i> : Chap 3
5	SQL: data manipulation	Silberschatz, <i>et al.</i> : Chap 3
6	<i>Review and Midterm I</i>	—
7	Relational database theory and design	Silberschatz, <i>et al.</i> : Chap 8
8	Theory and design (cont.)	Silberschatz, <i>et al.</i> : Chap 8
9	Access patterns and file organization	Silberschatz, <i>et al.</i> : Chap 10.1 - 10.6
10	Indexing	Silberschatz, <i>et al.</i> : Chap 11
11	<i>Review and Midterm II</i>	—
12	Indexing (cont.); Hashing	Silberschatz, <i>et al.</i> : Chap 11
13	<i>Thanksgiving Break;</i>	—
14	Transactions	Silberschatz, <i>et al.</i> : Chap 14
15	<i>Review and reading period</i>	—