CSCI 455: Principles of Database Systems

Course Syllabus – Fall 2021

Instructor: David Chiu
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Course Page: https://canvas.pugetsound.edu/courses/6556
Office Hours (Zoom-only. See Canvas for Link):

- Mon/Wed/Fri 9:00am - 10:00am
- Tues 2:00pm - 4:00pm
- By appointment

Course Meeting Times: Mon/Wed/Fri 3:00pm - 3:50pm in TH 409
Final Exam: Wed, Dec 15, 4:00pm - 6:00pm

1 Required Accounts for Class

Use your @pugetsound.edu address to log in or sign up:

- Zoom (https://pugetsound-edu.zoom.us): For attending virtual office hours, tutoring

2 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

3 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.

4 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 (Work Alone!)** – You will be using Java to incrementally building a relational database system, DavidDB (the finest database system in the common era). There will be roughly 6-7 assignments that focus on system-building, as well as a significant assignment written in SQL.

  You must work alone on all homework assignments. Collaboration among students is encouraged for problem interpretation, brainstorming, etc., but in general, I expect every student to submit their own work. **Do not help write or share each other's answers or code!** Code duplications are *extremely easy* to catch, and the penalty for cheating is severe: course failure and a permanent record on your transcript.

- **Team Projects** – There will be four projects, starting with basic SQL usage to building a robust database-driven website. Project descriptions can be downloaded from the course page.

- **Late Work** – For each day either a homework or project assignment is late (includes weekends), a 10% deduction will be assessed, and no late work will be accepted one week after the due date.

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.

5 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.

6 Course Schedule

The following course schedule is tentative and subject to change.

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