CS 448/648 Database Systems Implementation
Winter 2023—LEC 001 & 002

Instructor:

Dr. Habib-ur Rehman **[h3rehman@uwaterloo.ca]**

Instructor Office Hours:

[F 10:30-11:30 Location: TBD]

Lecture Schedule:

[LEC 001: M/W 11:30-12:50 Location: RCH305]

[LEC 002: M/W 13:00-14:20 Location: RCH305]

Course Website: **[On the LEARN]**

Course Objectives

The objective of this course is to introduce students to fundamentals of building a database management system (DBMS), in particular a relational one. It focuses on the database engine core technology by studying topics such as storage systems (data layout, disk-based data structures), indexing, query processing algorithms, query optimization, transactional concurrency control, logging and recovery. It complements CS348 by looking at the internals of relational DBMSs.

Outline

Below is a broad agenda of this course and variations in the details and order are possible.

Review of relational database systems (3 hours)

Fundamentals of relational databases, relational calculus, relational algebra, integrity issues.

Storage Management (9 hours)

Data layout, buffer systems, file management, indexing techniques (tree-based and hashing).

Query Processing and Optimization (13 hours)

Query processing methodology, view expansion, query translation, implementation of relational operators, external sorting, cost-based query optimization.

Transaction Management (12 hours)

Transaction models, concurrency control algorithms, database recovery.

Meta-data Management (2 hours)

Implementation of catalogs and integrity constraints.

Course Website

LEARN will be used as the primary source for sharing the material, announcements, submission of assignments and grades for this course. This course outline is placed on the LEARN.

Please make sure that you check the LEARN on regular basis and subscribe to the announcements and notifications.

Course Material

Textbooks

There is no required textbook for this course.

We will use several sources during this course to cover our main topics of discussion in this course. Following are some of the books that will be used as reference material in this course. Additionally, there could be some research articles used/referenced. The lecture slides will be made available through the LEARN:

- Database Management Systems, 3rd ed., BY R. Ramakrishnan and J. Gehrke, McGraw-Hill, 2003.
- Database Systems: The Complete Book, BY Hector Garcia-Molina, Jeffrey Ullman, Jennifer Widom, 2008
- Fundamentals of Database Systems, 7/E BY Ramez Elmasri and Shamkant B. Navathe; **ISBN: 9780133971224**

Computer and other Electronic Equipment

All the assignments involved programming and students may require using/installing different languages and tools to complete those assignments. Therefore, please make sure that have sufficient computational resources available.

Course Assessments and Evaluations

Passing Criteria

The students are required to acquire the passing grade overall in the course and are not required to pass the individual assessment types. However, under no circumstances the weight of one assessment will be transferred to the other assessment.

Following is a general distribution of the different assessment that we will have in this course. Further details will be shared by the first week of the term:

Assignments:	**40%**	**3 assignments, each assignment due in 2-4 weeks after announcement**
Midterm Exam:	**25%**	**In week 6-8**
Final Exam:	**35%**	**During Examination Period**

For the graduate students who are registered in CS648, following distribution will be used. Further details will be shared by the first week of the term:

Assignments:	**30%**	**3 assignments, each assignment due in 2-4 weeks after announcement**
Research Article:	**10%**	
Midterm Exam:	**25%**	**In week 6-8**
Final Exam:	**35%**	**During Examination Period**

Assignments Submission & Grading

- The exact schedule for the assignments will be made available during the first week of the term.
- Assignments are primarily individual, but in some cases might require partial grouping.
- Assignments may require consulting material/resources that are not directly referred/discussed during the lecture. Students must always cite all the resources/material they have used at the time of submission. All submissions will be evaluated following the university policies related to academic integrity.

Extensions & Late Submissions

- **Missing or late assignments will be awarded zero, no matter what the circumstances are.**
- Students with accommodation will get extra time as per their approved accommodation.

Polices Governing Student Behaviour and Conduct

Academic Integrity:

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. Check **www.uwaterloo.ca/academicintegrity/** for more information.

Grievance:

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline:

A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about 'rules' for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties check Guidelines for the Assessment of Penalties.

Appeals:

A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student 5 Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

Students with disabilities:

UW's Accessibility Services (https://uwaterloo.ca/accessability-services/) office (AAS), located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AAS at the beginning of each academic term.

COVID-19 Contingency Plan:

- If in-person lectures are cancelled, the instructors will provide sufficient digital resources instead using LEARN/Bongo.
- If the instructor is unable to come in-person due to government/university policies related to health, the lectures or recordings will be provided online or rescheduled.
- If in-person exams are cancelled, the exams become online take-home exams.