

CSCI B561 | ADVANCED DATABASE CONCEPTS – Syllabus – Fall 2023

INSTRUCTOR

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EMAIL

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OFFICE LOCATION

Luddy Hall 2024

OFFICE HOURS

TR 3:00 – 4:00

COURSE OVERVIEW

Introduction to database concepts and systems. Topics include database models and systems; hierarchal, network, relational, and object-oriented; database design principles; structures for efficient data access; query languages and processing; database applications development; views; security; concurrency; recovery.

REQUIRED TEXT

The following textbook is required for this course:

- Database Systems: The Complete Book (2nd Edition) by Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom, Pearson, ISBN-10: 0131873253, ISBN-13: 978-0131873254

In some cases, I will use other texts and sources. There will be lecture notes that are original and do not have a corresponding coverage elsewhere.

Additional learning resources will be provided on Canvas.

COURSE GOALS

By the end of the course students should be able to demonstrate a solid understanding of basic as well as advanced database concepts including database models and systems, query processing and data structures and algorithms for efficient query processing. They should have a firm grasp on SQL with the ability to write complex queries.

LEARNING OUTCOMES

- Formulate pure SQL and Boolean queries.
- Formulate queries using aggregate functions and quantifiers.
- Formulate queries in relational algebra.
- Formulate queries in tuple relational calculus.
- Express tuple relational calculus queries as SQL queries.
- Formulate queries in object relational model.
- Translate and optimize SQL queries to relational algebra expressions.
- Write database triggers.
- Use query plans to determine time complexity of SQL queries.
- Differentiate between database indexing techniques

GRADE DISTRIBUTION

ASSESSMENT	WEIGHT
Quizzes (12)	12%
Assignments (7)	49%
Class participation ¹	4%
Midterm (1)	15%
Final (1)	20%
Total	100%

ATTENDANCE & IN-CLASS ACTIVITIES

Regular class and lab attendance is highly recommended, even though it carries no marks. 75% class and lab attendance are needed to avail the makeup assignment and extra quiz opportunity. In-class activities will be provided via Top Hat.

TECHNICAL EXPECTATION

You are expected to bring a laptop to the classroom with a Java IDE installed as the course requires in-class coding. You should also have access to Top Hat to take part in the in-class activities.

COURSE POLICIES

Assignments: Assignments will be released each Friday, unless otherwise stated. Late submissions up to 24 hours of the deadline are acceptable with a 10% penalty. Assignments can only be submitted through. No email submissions. It is your responsibility to make sure that all the submission requirements are fulfilled. No marks will be assigned for incorrect/incomplete submissions.

The AI's will not grade all problems on the assignments. Rather, I will select a subset of the problems that will be graded. For the non-graded problems, a default score will be given for each attempted problem. An attempted problem should be non-trivial.

The score for each assignment will be determined as follow:

- 70% of the score will be based on the graded problems.
- 30% of the score will be based on the attempted problems (so attempting each problem guarantees a score of 30%)

Quizzes: Quizzes will be released each Tuesday at 12:00 pm unless otherwise stated. The duration will be 10-15 minutes with a ~36-hour availability till 11:59 pm on Wednesday.

Makeup Assignment & Extra Quiz: There will be an opportunity toward the end of the semester to submit a makeup assignment and take an extra quiz. You need 75% attendance to avail this opportunity.

Grade Appeal: Grade appeals must be made to your AI, in writing, no sooner than 24 hours after the assignment or exam is graded (this is the "cool off period"), and no later than 5 days after it is graded. No requests will be entertained after this.

¹ Class participation is through TopHat. Marks are assigned based upon participation and not correctness.

Plagiarism and Academic Dishonesty: All course deliverables including in-class exercises, lab assignments, or exams are assigned for individual work. No group work is permitted unless specifically allowed. Students are encouraged to engage in discussion or use other resources (such as books or internet resources) but must write their own answers. At any time, student must not reproduce code/answers from other resources (AS IS or with cosmetic changes) and the answers must not be shared. Any plagiarism (even partial work) or cheating on assignments, quizzes, projects, or exams is NOT acceptable and will result in a grade of 0 for that assessment. The source code submitted must be your own and must not be taken from any other resource (including online forums or solution manuals). Barely changing the variable and function names in someone's code is not sufficient and will be considered plagiarism.

COURSE POLICIES: DISABILITY, CODE OF CONDUCT, TITLE IX

Disability services for students: <https://studentaffairs.indiana.edu/student-support/disability-services/index.html>

Code of Student Rights, Responsibilities, and Conduct: <https://studentcode.iu.edu/responsibilities/index.html>

Title IX Sexual Misconduct: <https://stopsexualviolence.iu.edu/>

Counseling and Psychological Services: <https://healthcenter.indiana.edu/counseling/index.html>

IMPORTANT DAYS

Classes Begin: Tuesday, August 22, 2023

Midterm Exam: Thursday, October 12, 2023

Thanksgiving Break: Sunday, November 19, 2023 – Sunday, November 26, 2023 (no classes)

Final Exam: Thursday, Dec 14, 2023, (12:40 pm – 2:40 pm)

COURSE SCHEDULE

Note: The schedule is subject to change depending on the progress of the course. The instructor reserves the right to make policy and course changes to the syllabus at any time with advance notice to students.

Week	B561	Quizzes	Assignments
1	Course Intro, Relational Model, Intro to SQL		
2	SQL with set predicates	Quiz 1	Assignment 1
3	Tuple Relational Calculus, Views	Quiz 2	
4	Relational Algebra, Joins and semijoins	Quiz 3	Assignment 2
5	Translating SQL to Relational Algebra	Quiz 4	
6	Query optimization	Quiz 5	Assignment 3
7	SQL expressions, User defined functions	Quiz 6	
8	SQL aggregate functions	Quiz 7	
8	Midterm Exam		Assignment 4
9	Triggers, Generalized quantifiers	Quiz 8	
10	Object-relational DBs		Assignment 5
11	Nested relational DBs, PL/pgSQL	Quiz 9	
12	Physical DB organization, Indexing	Quiz 10	Assignment 6
13	Join algorithms, query processing	Quiz 11	
	Thanksgiving break (no classes)		
14	Spark data model, E/R model	Quiz 12	Assignment 7
15	Concurrency control	Quiz 13	
16	Final Exam		