COMP 306: Database Management Systems

Koç University, Spring 2024

Course Description

This is an undergraduate course on databases and database management systems (DBMSs). The course will cover conceptual and practical aspects of DBMSs, including database design, data models, query languages (especially SQL and relational algebra), database normalization and schema refinement, transaction management, scheduling, concurrency control, indexing, and recent trends in databases.

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KU Credits: 3

Language of Instruction: English

Lecture Time & Location: MoWe 2:30-3:40 PM, location: SOS B10

PS Sections: You should be enrolled in exactly one of the following PS sections:

- PS-A (Friday 8:30-9:40 AM, SCI Z07)
- PS-B (Thursday 5:30-6:40 PM, SCI Z07)

Pre-requisites: COMP 202 (Data Structures and Algorithms). This pre-requisite will be enforced, i.e., I will not give consent to students who wish to take COMP 306 without having passed COMP 202 beforehand.

Course Textbook: No mandatory textbook, but the following books are helpful:

- "Fundamentals of Database Systems" by Elmasri and Navathe
- "Database Management Systems" by Ramakrishnan and Gehrke

Note that your primary learning resources should be course lectures and slides. There may be changes in notation or formalization from one textbook to another, or from one edition of a textbook to another. Also, we may not cover the entire set of topics in all chapters. Thus, students are responsible from the material that is taught in class, in the way that it is taught.

Teaching Assistants (TAs): TBA

Office Hours: Time TBA, location my office (SNA Z27). TAs will also hold office hours. All office hour information will be announced after the semester begins.

List of Topics

- Introduction
- Entity-relationship model (E-R model)
- Relational model
- E-R model to relational model conversion
- Relational algebra

- SQL (Structured Query Language) and advanced SQL
- Functional dependencies, normal forms (1NF, 2NF, 3NF, BCNF) and normalization
- Transaction management, ACID properties, scheduling, serializability
- Concurrency control: locking, 2PL, deadlocks, multi-granularity locking
- Indexing (hash-based and tree-based indexing), B+ trees
- [Tentative] Query processing and optimization
- Introduction to NoSQL: key-value stores, graph databases, document-oriented databases, columnar databases

Grading

Midterm Exams	–	48%
Final Exam	–	30%
Homework Assignments	–	12%
Group Project	–	10%

Based on the circumstances, these percentages are subject to change (at most 5%) at the instructor's discretion.

Midterm Exams: We will have two midterms, each worth 24%, total 48%.

Final Exam: The final exam will be held during the finals' week. It will be worth 30% of the course grade.

In order to pass the course, the student's exam average across the 3 exams (two midterms + final) must be **at least 30%**.

Homework Assignments: There will be several homework assignments throughout the semester (expected: 4, max: 5). They will be announced and collected via Blackboard. Homework assignments must be completed **individually**, i.e., no collaboration.

Group Project: The group project will begin in the second half of the semester. Students will form groups (group size will be announced, but we expect ~5 students per group). Each group will pick one potential application area of DBMSs and develop a DBMS-powered application. The project **must** use a DBMS in its back end. The choice of front end is left to you; e.g., you may decide to have a web interface, a desktop app, or a mobile app, depending on what is appropriate. The project should be designed and implemented in a way that makes good use of the concepts learned in this course.

The group project is mostly focused on applying DBMSs in practice. Throughout the project, you will: (1) design your application and database, (2) populate your database with real/realistic data, (3) integrate complex queries into your system, and (4) demonstrate your system as a working, professional prototype.

Some project ideas are below, more will be announced later. New and innovative ideas are welcome. You may discuss the suitability of your project idea with the instructor.

- Supermarket management app (products, employees, customers, purchases, …)
- University management app (e.g., mini-KUSIS with students, courses, instructors, enrollment, …)
- Library management app (books, authors, customers, borrowing, …)
- E-commerce or online retail site (e.g., mini-Amazon)

Homework Policies

For late submission of homework assignments, we have the following policy:

- Up to 10 minutes late: -5% penalty
- 10 minutes to 1 hour late: -20% penalty
- More than 1 hour late: submission is not accepted

Assignments submitted more than 1 hour after the deadline will not be accepted unless the instructor's permission is obtained ahead of time with a valid excuse. Please do not ask for an extension close to a deadline or after a deadline that has passed. In order to be fair to students who submitted the assignment on time, such requests are almost always rejected.

In general, it is the student's responsibility to ensure that his/her homework submission is complete and includes all the files that the student was intending to submit. For hand-written submissions, it is again the student's responsibility to make sure that his/her handwriting is legible, and the scan/photo has sufficient quality so that the homework can be graded.

Academic Honesty Policy

Students may only collaborate in the Group Project. Remaining parts of the course must be completed individually. All submitted work must be the student's own; the use of AI/LLM tools is forbidden. Violation of this rule constitutes academic dishonesty.

Academic dishonesty is a serious violation of the trust upon which an academic community depends. By taking this course, students acknowledge that they must fully comply with Koç University's Student Code of Conduct (https://apdd.ku.edu.tr/en/academic-policies/student-code-of-conduct/). Violations of Student Code of Conduct, including cheating and plagiarism, will be reported to the University Disciplinary Committee.

Cheating will not be tolerated! Cheating includes but is not limited to: working jointly with another student on an assignment/exam, sharing your assignment answers with others, looking at another student's assignment/exam, having someone else do an assignment/exam for you (paid or not), making copies of homework and exam questions, distributing homework and exam questions and answers to others.

Exam and Make-Up Policy

As of the beginning of the semester, all exams are planned to be conducted physically, in-person. Unless there is a university-wide rule that enforces online exams for all courses and all students, I will not offer an online exam to any individual student. There will be no exceptions to this rule. All students who are taking this course are assumed to have read and understood this rule.

If a student misses a midterm or final exam with a valid excuse, he/she can apply for a make-up exam. For excuses to be valid, they must be accepted by Koç University and communicated with the instructor through official channels. Emergencies must be properly documented, and medical reports must be approved by Koç University Health Center. Do not send health reports directly to the instructor.

A single, joint make-up exam will be given at the end of the semester, which will cover all topics in the course. Regardless of which exam they missed, all students who are eligible for

a make-up will take this exam. The grade they receive from the make-up will count in place of the exam they originally missed.

If a student misses the make-up exam, the student automatically receives 0. There is no make-up for a missed make-up. Also, there is no make-up for a missed Bütünleme (Remedial) exam.

Attendance and Recording Policy

This policy is subject to change according to announcements made by YÖK and/or Koç University.

Lectures:

- Lectures will be held from the assigned classroom. In most lectures, slides and whiteboard will be used simultaneously.
- There is no formal attendance grade in the course, but **experience shows that attendance and letter grades are highly correlated**. Therefore, during the semester, the instructor may collect lecture attendance (regularly or irregularly) to incentivize attendance. Bonus points can be awarded to students with high attendance.
- Lecture recordings will be shared via Panopto. I highly recommend not relying on Panopto recordings instead of attending lectures.

PS sections:

- PS sections will be held in the assigned classrooms. PSs will involve solving exercises about lecture topics (e.g., solving past years' exam questions) or hands-on experience with DBMS tools.
- PS attendance will not be graded.
- PS recordings will not be shared, so you must participate in PSs to obtain the exercises and solutions.