Course Syllabus

Syllabus CS5200

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Course Description

This course presents the database design process practiced when creating a relational database; it also presents the relational database management system's architecture as well as the fundamental ACID properties of a relational database management system. Extended entity-relationship models will be generated and represented using the Unified Modeling Language (UML) notation. Relational algebra and its relationship to the SQL language will be presented. Advanced topics include triggers, stored procedures, indexing, and fundamentals of transactions, concurrency and recovery. The course will also include an introduction to NoSQL databases and provide students the opportunity to compare SQL to NoSQL. MongoDB functionality and architecture will be reviewed. Students will define a database project that includes the design and implementation of a database as well as an application for interacting with the database.

Prerequisites

While the course does not have specific prerequisites, students are expected to have reasonably strong experience in programming in at least one modern programming language such as C++, Java, Python, Visual Basic, or R. The actual programming language used in the course is set by the instructor and is commonly *R*. Some understanding of key concepts in computer science at the undergraduate level, including computer systems, operating systems, multi-threaded programming, networking, discrete mathematics, data structures, and algorithms, is presumed.

Learning Outcomes

Upon completion of this course, the learner will be able to:

- Define an extended entity relationship diagram given a textual description of a data domain, model representation includes the Unified Modeling Language (UML) as well as MySQL E-R modeling tool.
- Represent SQL queries with relational algebra operations

- Convert relational algebra expressions into SQL commands
- Write complex SQL queries, SQL functions, SQL triggers and SQL procedures
- Connect a computer application to a commercial relational database (SQLite and MySQL) and access and manipulate data from the database within the application
- Act as database administer to a remote MySQL server, using basic shell commands
- Describe the architecture of a RDMS and the importance and implementation of the ACID properties
- Describe algorithms that implement transaction scheduling and database recovery mechanisms
- Describe the strengths and the weaknesses of both the SQL and NoSQL DBMS
- Programmatically access data stored in XML stores and/or MongoDB
- Describe the CAP theorem that is fundamental to NoSQL databases

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Required Texts

The textbook for this course is **Introduction to Database Systems by ITL Education Solutions Limited, (https://learning.oreilly.com/search/?query=author%3A%22ITL%20Education%20Solutions%20Limited%22&sort=relevance&highlight=true) Pearson India (https://learning.oreilly.com/library/publisher/pearson-india/)** , November 2008, ISBN: 9788131731925. This textbook is available at no cost to matriculated students at all Northeastern Campuses through the O'Reilly Learning portal. For more information on how to access the textbook, see **Course Resources, Text Book, Tools**.

Instructor & TA Information

Contact information about your instructor and teaching assistants along with their office hours is listed in **Module 0: Welcome**.

Office & Tutoring Hours

Office and tutoring hours are listed in **Module 0: Welcome** and reminders are posted in the Microsoft Teams class.

Learning Assessment

Achievement of learning outcomes will be assessed and graded through:

- Assignments (40%)

- Practicums (30%)
- Quizzes (10%)
- Peer Discussions (10%)
- Final Exam (10%)

The lowest assignment, discussion, and quiz grades are dropped.

Topics-at-a-Glance

The coverage and schedule for the topics below is dependent on the course format and delivery approach. Overall, the course is divided into three broad areas:

1. Relational Database Design, Theory, and Implementation
2. Database Architecture & Implementation
3. Non-Relational and Analytics Database Design

Topics in Detail

- Database Systems, Use, and Organization
- Data Modeling and Database Design
- Query Specification and SQL
- Relational Database Design & Data Normalization
- Programming Database Interactions in R, Java, or Python
- Stored Procedures, Triggers, and Database Programming
- Data Storage and Indexing Algorithms
- Concurrency Management, Transaction Control, and Recovery
- Data Security
- Architecture of Database Management Systems
- Data Warehousing, OLAP, and Data Mining
- XML Store and XPath Retrieval Specifications
- NoSQL Databases

Learning Methodology

For each module, students are expected to:

- Review the module's learning objectives
- Complete all assigned readings
- Complete all lessons and activities in the module

- Participate in required discussions
- Complete and submit any assignments by the due date
- Participate in the live recitation sessions or view the recording

Expected Effort and Time Commitment

A typical 4-credit graduate course in Khoury requires 12-15 hours of work per week. Over a 14 week semester that amounts to about 160 hours of work which includes attending lectures and recitations, completing readings, learning activities, assignments, group discussions, case studies, practicums, among other work. If the course is presented over an eight-week compressed summer session, the work increases to about 25-30 hours per week. If you cannot make that commitment, please reconsider your plans.

Grading

The course requires a 70% overall score to pass the course with two additional requirements to pass the course: (1) the average of all practicums is at least 70% and (2) the final exam score is at least 70%. In other words, you cannot pass the course without getting a passing grade on the final exam and on the practicums. So, if you get a 65% on the final and get a 100% on everythingâ€¯else you will not pass. Of course, getting a 100% on the final and a 0% on everything else also means you will not pass as you did not meet the minimum passing grade for the course. In case a student gets below a 70% on the final exam, the student may submit a research paper on a topic chosen by the instructor, which, if of sufficient quality, will boost the grade on the final exam to at least a passing grade.

The lowest assignment, discussion, and quiz grade is dropped. No practicum grade is dropped. The lowest grade is dropped for any reason -- we do not require you to notify us and consequently we do not consider any excuses for a missing submission.

Grading Scale

Score	Letter	GPA	Qualitative Meaning
95% and above	A	4.0	Outstanding and exemplary work without flaws
90% - 94.9%	A-	3.7	Excellent work with only a few but very minor flaws
87% - 89.9%	B+	3.3	Very good work with a several minor but immaterial flaws

84% - 86.9%	B	3.0	Good and solid work having only immaterial flaws
80% - 83.9%	B-	2.7	Reasonably good work but significant flaws
77% - 79.9%	C+	2.3	Adequate work; some significant flaws
73% - 76.9%	C	2.0	Adequate work; several significant flaws
70% - 72.9%	C-	1.7	Barely adequate work; several significant flaws
Less than 70%	F	0.0	Inadequate with significant flaws

Participation/Discussion Board

Interaction occurs primarily through Teams, but graded peer group discussions are on Canvas. As part of each module, students are expected to:

- Post their questions in the designated Teams channel
- Respond or comment on other students' posts
- Join the live recitation sessions
- Participate in group discussion on Canvas

Participation in the Canvas discussions is graded and it is expected that the posts, replies, and all other interactions are made on time, the posts are meaningful, reflective, professional, error-free, and advance the learning of your peers. They may not be directly copied from third party sources and proper citations are expected for any passages that are copied or any sources that are consulted.

The posts on Teams are not graded and direct copying is allowed -- but for those posts only.

Communication

Communication between instructor, teaching assistant, and students is through

- E-mail via the Canvas distribution list
- Announcements posted on Canvas
- Notes and clarifications posted on Teams
- Private chats on Teams

Submission of Work

To receive full credit, all work for the course is expected to be completed by 11:59pm ET

(Boston Time) on the due date and must be submitted in the provided Assignments folder on Canvas. Assignments or other required work that is submitted after the due date is accepted with a 5% penalty for each day late. **No email submissions are accepted**.

In the Assignments link on Canvas, click on the specific Assignment link to view an assignment. Attach all required files or documents along with explanatory comments. Once an assignment has been graded, students will be able to view the grade and feedback via the grade book. Multiple submissions are accepted but only the last submission will be considered. After submission, check that your submission was successful.

Academic Integrity Policy

The University views academic dishonesty as one of the most serious offenses that a student can commit while in college and imposes appropriate punitive sanctions on violators. Here are some examples of academic dishonesty. While this is not an all-inclusive list, we hope this will help you to understand some of the things instructors look for.

Any incident of academic misconduct will result in a 0 for the graded item, a report to OSCCR, and a two-letter reduction in the final course grade or an F if it is on the final exam or especially egregious.

The following is excerpted from the University's policy on academic integrity; the complete policy is available in the Student Handbook.

Cheating – intentionally using or attempting to use unauthorized materials, information or study aids in an academic exercise

Fabrication – intentional and unauthorized falsification, misrepresentation, or invention of any data, or citation in an academic exercise

Plagiarism – intentionally representing the words, ideas, or data of another as one's own in any academic exercise without providing proper citation; that includes online posts, blogs, and prior term's submissions or solutions

Unauthorized collaboration – instances when students submit individual academic works that are substantially similar to one another; while several students may have the same source material, the analysis, interpretation, and reporting of the data must be each individual's independent work.

Participation in academically dishonest activities – any action taken by a student with the intent of gaining an unfair advantage, including but not limited to copying work, submitting someone else's work, submitting previously published solutions

Facilitating academic dishonesty – intentionally or knowingly helping or attempting to violate any provision of this policy

Impersonation – working on behalf of another students or allowing someone else to represent a student online, in discussion groups, in classes or sessions, or exams

Sharing – sharing materials, assignments, solutions, exams, exam question on sharing sites, such as CourseHero or Chegg