CS 442 Database Management Systems

Computer Science
Spring 2023

Instructor: Samuel Kim
Canvas Course Address: https://sit.instructure.com/
Course Schedule: Monday - Sunday
Contact Info: skim2@stevens.edu
Office Hours: Monday 4:00 - 6:00 pm ET
Virtual session URL: Go to the “Zoom” tab on the left-hand navigation bar to access live virtual sessions for this course.
Prerequisite: Students are expected to have good familiarity with mathematics and logic – having taken CS182 & CS135 or the equivalent.
Corequisite(s): N/A
Cross-listed with: N/A

COURSE DESCRIPTION

In this course, students will become acquainted with the fundamental concepts of database management systems during class. Presentations will emphasize relational databases in both mathematical foundational theory and practical applications in designing solutions for professional practice in database analysis, programming and additional studies.

STUDENT LEARNING OUTCOMES

After successful completion of this course, students will be able to…

- Summarize the purpose of database systems
- Represent and manipulate objects in database systems
- Compare and contrast different types of data models and the associated languages, including E-R model, relational model and relational database model
- Apply the basic design process and the purpose of E-R model
- Apply the relational model and its language, relational algebra
- Apply the relational database model and its language, SQL
- Build databases using design process and normalization

COURSE FORMAT AND STRUCTURE

This course is in-person. To access the course, please visit stevens.edu/canvas.

Course Logistics

- Class Lecture notes are posted with the instructor's notes about some of the specific topics, and the students are expected to read and understand the contents of the lecture notes as well as the instructor's notes prior to the weekly sessions.
- There are two types of assignments for the course:
    - One is a set of exercise questions from the textbook. Although they are not graded, those questions are chosen specifically to reinforce the learning for the given section of the course, and the students are expected to work on those questions independently. The answers for those exercise questions will be posted after a couple of weeks of posting the questions.
    - The other is a set of SQL programming assignments. A set of queries will be assigned, and the students will express those queries in SQL. All of the queries are analytical in nature (vs., modifying the tables, etc.), and will leverage some of the key concepts covered in the lectures. Students can discuss their ideas with their classmates but ultimately, they are encouraged to work independently on their own queries. Each assignment will have a due date, and it will be due at 11:59 PM ET of the due date. The Stevens Honor System will be strictly enforced, and any violation will result in a grade of F for the course. There will be no make-ups or late submissions.
- Class participation is strongly encouraged and will be used to resolve borderline grades.
- Students are encouraged to use their own machines (e.g., laptops) for all of the SQL programming assignments.
- PostgreSQLis the relational DBMS for the course–Please download it and install it on your machines as soon as possible.

Instructor's Online Hours

I will be available via email and will respond as soon as I am available (generally within 24-48) hours.

For the online discussions, I will check in at least 3 times per week. Keep in mind that it is not possible for me to respond to every single posting every week (nor is it pedagogically appropriate), but I will be sure to respond to a variety of postings and students each week and attempt to assure equality in terms of responses to students. If you feel you are being neglected in any way, please contact me.

When emailing me, please do so within Canvas (i.e., do not use the usual email tools such as Outlook, etc.). Please clearly place in the subject line the course number/section and the topic of the email (i.e. CS442 – Assignment 2 Question).

Online Etiquette Guidelines

I and your fellow students wish to foster a safe online learning environment. No matter how different or controversial they may be perceived, all opinions and experiences must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea, but you cannot attack an individual. Our differences, some of which are outlined in the University's inclusion statement below, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambiance. Please read the Netiquette rules for this course:

- Do not dominate any discussion. Allow other students to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language as it could lead to misinterpretation.
- Keep an "open-mind" and be willing to express even your minority opinion.
- Think and edit before you push the "Send" button.
- Do not hesitate to ask for feedback.

TENTATIVE COURSE SCHEDULE

Module	Topic(s)	Readings	Assignment
Module 01	Introduction to Database Management Systems View of Objects and Corresponding Data Different (Database) Data Models Database Design	Required: *Database System Concepts* (5th Edition). Ch. 1 [PP. 1-18] Optional: Module 1 Discussion Board	Module 1 Knowledge Check
Module 02	Overview of Database Design Process Data Modeling Entity-Relationship (E-R) Model	Required: *Database System Concepts* (5th Edition). Ch. 6 [PP. 201220] Optional: Module 2 Discussion Board	Module 2 Knowledge Check
Module 03	E-R Data Model for a Banking Enterprise	Required: *Database System Concepts* (5th Edition). Ch. 6 [PP. 236240] Optional: Module 3 Discussion Board	Module 3 Knowledge Check

Module 04	Overview of Relational Databases Structure of Relational Databases Language of Relational Model (terms) Introduction to Basic Relational Operators (SELECT, PROJECT, UNION, SET DIFFERENCE, CARTESIAN PRODUCT, RENAME)	Required: *Database System Concepts* (5th Edition). Ch. 2 [PP. 37-54] Optional: Module 4 Discussion Board	Module 4 Knowledge Check
Module 05	Overview of Relational Model - Algebra Operations Introduction to Additional Relational Operators (SET INTERSECTION, NATURAL JOIN, DIVISION, ASSIGNMENT, AGGREGATE, OUTER JOIN, DELETE, INSERT, UPDATE)	Required: *Database System Concepts* (5th Edition). Ch. 2 [PP. 55-69] Optional: Module 5 Discussion Board	Module 5 Knowledge Check
Module 06	Overview of SQL Introduction to Relational Database Model Basic Query Structure (SELECT FROM WHERE) Introduction to SQL Operations (AS, STRING OPERATORS, ORDER BY, SET OPERATIONS)	Required: *Database System Concepts* (5th Edition). Ch. 2 [PP. 75-89] Optional: Module 6 Discussion Board	Homework #1
Module 07			Midterm Exam
Module 08	SQL - Aggregate Functions, Nested Subqueries Aggregate Functions NULL values Nested Subqueries	Required: *Database System Concepts* (5th Edition). Ch. 3 [PP. 89-97] Optional: Module 7 Discussion Board	Module 8 Knowledge Check
Module 09	Overview of SQL - Derived Relations, WITH, Views,	Required: *Database System Concepts* (5th	Module 9 Knowledge Check

	Modifications, Joins, Data Types and DDL Derived Relations, WITH, Views Introduction to SQL Operations (DELETE, INSERT, UPDATE, JOINs) Data types in SQL, BLOB and CLOB Integrity Constraints	Edition). Ch. 3 & 4 [PP. 97114; 121-132] Optional: Module 7 Discussion Board	
Module 10	Relational DB Design Features of Good Relations/Tables First Normal Form	Required: *Database System Concepts* (5th Edition). Ch. 7 [PP. 263270] Optional: Module 7 Discussion Board	Module 10 Knowledge Check
Module 11	Overview of Relational DB Design - Functional Dependencies, BCNF & 3NF Functional Dependencies & Closure of Functional Dependencies Boyce-Codd Normal Form (BCNF) & Third Normal Form (3NF)	Required: *Database System Concepts* (5th Edition). Ch. 7 [PP. 270278] Optional: Module 7 Discussion Board	Module 11 Knowledge Check Homework #2
Module 12	Overview of Relational DB Design - Normalization Functional-Dependency Theory, Closure of Functional Dependencies, Closure of Attribute Sets (CAS) Lossless-Join Decomposition, Dependency Preservation BCNF vs. 3NF	Required: *Database System Concepts* (5th Edition). Ch. 7 [PP. 278282; 285-293] Optional: Module 7 Discussion Board	Module 13 Knowledge Check
Module 13			Final Exam

COURSE MATERIALS

Textbook: ***Database System Concepts*** (5th Edition) – Required by Silberschatz, Korth & Sudarshan (ISBN: 0072958863), McGraw Hill

TECHNOLOGY REQUIREMENTS

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Canvas

Technology skills necessary for this specific course

- Live web conferencing using Zoom

Required Equipment

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

Required Software

- Current or first previous major release of PosgreSQL
- Current or first previous major release of Chrome, Firefox, Edge, or Safari browser
- Acrobat Reader (for PDF review)
- Microsoft PowerPoint
- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint

GRADING PROCEDURES

Grades will be based on:

Quizzes	20%
Homework Assignments	20%
Midterm Exam	25%
Final Exam	35%

Late Policy

- No late assignments will be accepted (i.e., assignments submitted past the due date/time will receive 0 point).

- Similarly, both midterm and final exams must be taken on the assigned dates – no exceptions will be granted.

Academic Integrity

- Students are bound by the Honor System.

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at http://web.stevens.edu/honor/

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

Special Provisions for Undergraduate Students in 500-level Courses

The general provisions of the Stevens Honor System do not apply fully to graduate courses, 500 level or otherwise. Any student who wishes to report an undergraduate for a violation in a 500-level course shall submit the report to the Honor Board following the protocol for undergraduate courses, and an investigation will be conducted following the same process for an appeal on false accusation described in Section 8.04 of the Bylaws of the Honor System. Any student who wishes to report a graduate student may submit the report to the Dean of Graduate Academics or to the Honor Board, who will refer the report to the Dean. The Honor Board Chairman will give the Dean of Graduate Academics weekly updates on the progress of any casework relating to 500-level courses. For more information about the scope, penalties,

and procedures pertaining to undergraduate students in 500-level courses, see Section 9 of the Bylaws of the Honor System document, located on the Honor Board website.

EXAM CONDITIONS

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Conditions on the quiz or exam.

1. Students may NOT use any materials during quizzes and/or exams (i.e., no textbook, no reference materials, no notes, etc.).
2. Students are NOT allowed to work with or talk to other students during quizzes and/or exams.

LEARNING ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/office-disability-services. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone 201-216-3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments can be made by phone (201-216-5177).

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.