CS157a Fall 2023 Sec3 Home Page/Syllabus

Introduction to Database Management Systems

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Office Hours: MW 1:30-2:45pm in MH214
Class Meets:
　　Sec3 MW 3:00-4:15 in MH225

Prerequisites

To take this class you must have taken:
[CS146](#)
with a grade of C- or better.

Texts and Links

Required Texts:	[Database Systems: The Complete Book](#). Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom
Online References and Other Links:	[Postgres](#). [Maria DB (MySql fork)](#). [Sqlite](#). [Oracle](#). [DB2](#). [Neo4j](#).

Description

From the Catalog: Relational data model. Relational algebra. Standard SQL. Design theory. Conceptual data modeling. Integrity constraints and triggers. Views and indexes. Transactions. Distributed data management. Interactive and programmatic interfaces to database systems. Application programming project using a prominent database system. In more detail for this section: Database management systems (DBMS) provide facilities to organize, to maintain, and to provide access to data. In this course, we will consider how databases are designed and deployed on DBMSs. We will learn about the three schema architecture used for databases, data independence, and client-server architectures. We will describe models for how data should be organized heuristically in a database using entity relationship (ER), extended entity relationship (EER), and UML diagrams. We will learn about what the relational model is and about relational database constraints. Then we will discuss how to translate EER diagrams into relations which could then be created as tables in a DBMS. We will see techniques to write relational algebra queries and to be able to predict given a database instance what such a query will return. SQL and enough about real world DBMSs will be introduced to allow us to be able to create a database in such a system and modify/alter them. SQL operations for inserting rows and updating these rows will be described. We will learan the SQL need to cause knows to be changed on a triggering event. We will learn how to write simple transactions using JDBC. Finally, we will discuss how to analyse the relations we have might get from ER modeling followed by conversion to the relational model with respect to various normal forms to be able

to judge how good they are. In particular, this means given a table decomposition we should by the end of this course be able to say which of the following normal forms it is in: 2NF, 3NF, 4NF, 5NF, or BCNF. We will also learn about the algorithms for testing if a decomposition is in a given normal form and the algorithms which given a set of functional dependencies can do able decomposition into 3NF or BCNF. Finally, we will briefly learn about techniques that might be used to split data to improve query performance.

Course Learning Outcomes (CLOs)

By the end of this course, a student should be able to:

CLO1 -- Explain basic database concepts, including the structure and operations of the relational data model

CLO2 -- Identify key components of database management systems and their functions at a high level

CLO3 -- Conduct normalization to decompose relations into 3NF or BCNF when that removes anomalies

CLO4 -- Use SQL as a data definition language (DDL) to create and alter databases, tables, views, and indexes

CLO5 -- Use SQL as a data manipulation language (DML) for querying and modifying databases

CLO6 -- Define and use constraints and triggers in SQL

CLO7 -- Describe the concept of transactions

CLO8 -- Build a simple database application in a high-level programming language (e.g., Java and Python) that interacts with a relational database system at the back-end

CLO9 -- Describe one of the well-known data distribution technologies such as replication and partitioning

Course Schedule

Below is a tentative time table for when we'll do things this quarter:

Week 1:Aug 21, Aug 23	Start Ch 1, what is a database, history of databases
Week 2:Aug 28, Aug 30	Finish Ch 1
Week 3:Sep 4 (No Class), Sep 6	Start Ch 2, Relational Model SQL
Week 4:Sep 11(Hw1), Sep 13	Finish Ch 2 Algebraic query languages, relational constraints
Week 5:Sep 18, Sep 20	Start Ch 3 Design of Databases, Functional Dependencies
Week 6:Sep 25, Sep 27	Finish Ch 3 Decompositions, 3NF
Week 7:Oct 2(Hw2), Oct 4	Start Ch 4, ER model, Weak Entity Sets.
Week 8:Oct 9, Oct 11(Midterm)	Review
Week 9:Oct 16, Oct 18	Finish Ch 4, ER to Relational Mapping, UML and ODL modeling and Mapping
Week 10:Oct 23(Hw3), Oct 25	Ch 5. Relational Algebra and its extensions, Datalog
Week 11:Oct 30, Nov 1	Ch 6 Writing Queries in SQL
Week 12:Nov 6, Nov 8	Ch 7 Constraints and triggers
Week 13:Nov 13(Hw4), Nov 15	Ch 8 Views and Indexes
Week 14:Nov 20, Nov 22 (No Class)	Ch 9 SQL in a Server Environment

Week 15:Nov 27, Nov 29	JDBC
Week 16:Dec 2, Dec 4	Ch 10 Semi-structured databases, XML
Week 17:Dec 4, Dec 6(Hw5)	Finish Ch 10, Review
	The final will be Monday, December 16 from 2:45pm-5:00pm

Grading

HWs and Quizzes	50%
Midterm	20%
Final	30%
Total	100%

Grades will be calculated in the following manner: The person or persons with the highest aggregate score will receive an A+. A score of 55 will be the cut-off for a C-. The region between this high and low score will be divided into 8 equal-sized regions. From the top region to the low region, a score falling within a region receives the grade: A, A-, B+, B, B-, C+, C, C-. If the boundary between an A and an A- is 85, then the score 85 counts as an A-. Scores below 55 but above 50 receive the grade D. Those below 50 receive the grade F.

If you do better than an A- in this class and want me to write you a letter of recommendation, I will generally be willing provided you ask me within two years of taking my course. Be advised that I write better letters if I know you to some degree.

Course Requirements, Homework, Quiz Info, and In-class exercises

This semester we will have five homeworks, weekly quizzes, and weekly in-class exercises.

Every Monday this semester, except the first day of class, the Midterm Review Day, and holidays, there will be a quiz on the previous week's material. The answer to the quiz will either be multiple choice, true-false, or a simple numeric answer that does not require a calculator. Each quiz is worth a maximum of 1pt with no partial credit being given. Out of the total of thirteen quizzes this semester, I will keep your ten best scores.

On Wednesday's, we will spend 15-20 minutes of class on an in-class exercise. You will be asked to post your solution to these exercises to the class discussion board. Doing so is worth 1 "insurance point" towards your grade. A "insurance point" can be used to get one missed point back on a midterm or final, up to half of that test's total score. For example, if you scored 0 on the midterm and have 10 insurance points, you can use your insurance points, so that your midterm score is a 10. On the other hand, if you score 18/20 on the midterm, you can use at most 1 insurance point since half of what you missed (2pts) on the midterm is 1pt. In addition, to the weekly in-class exercises, one insurance point is available if in the week before the midterm you can convince me I know your name, and in the week before the final, I still know your name (Please help me improve my memory).

Links to the current list of homeworks and quizzes can be found on the left hand side of the class homepage. After an assignment has been returned, a link to its solution (based on the best student solutions) will be placed off the assignment page. Material from assignments may appear on midterms and finals. **For homeworks you are encouraged to work in groups of up to three people. Only one person out of this group needs to submit the homework assignment; however, the members of the group need to be clearly identified in all submitted files.**

Homeworks for this class will be submitted and returned completely electronically using the Canvas link for the name of the homework. Hardcopies or e-mail versions of your assignments will be rejected and not receive credit. Homeworks will always be due by midnight according to the Canvas server on the day their due. Late homeworks

will not be accepted and missed quizzes cannot be made up; however, however, your lowest score amongst the first four homeworks and your quiz total will be dropped. Homework 5 can't be substituted for.

When doing the programming part of an assignment please make sure to adhere to the specification given as closely as possible. Names of files should be as given, etc. Failure to follow the specification may result in your homework not being graded and you receiving a zero for your work.

Classroom Protocol

I will start lecturing close to the official start time for this class modulo getting tangled up in any audio/visual presentation tools I am using. Once I start lecturing, please refrain from talking to each other, answering your cell phone, etc. If something I am talking about is unclear to you, feel free to ask a question about it. Typically, on practice tests days, you will get to work in groups, and in so doing, turn your desks facing each other, etc. Please return your desks back to the way they were at the end of class. This class has an online class discussion board which can be used to post questions relating to the homework and tests. Please keep discussions on this board civil. This board will be moderated. Class and discussion board participation, although not a component of your grade, will be considered if you ask me to write you a letter of recommendation.

Exams

The midterm will be during class time on: Oct 11.

The final will be: Monday, December 16 from 2:45pm-5:00pm.

All exams are closed book, closed notes and in this classroom. You will be allowed only the test and your pen or pencil on your desk during these exams. The final will cover material from the whole semester although there will be an emphasis on material after the last midterm. No make ups will be given. The final exam may be scaled to replace a midterm grade if it was missed under provably legitimate circumstances. These exams will test whether or not you have mastered the material both presented in class or assigned as homework during the quarter. My exams usually consist of a series of essay style questions. I try to avoid making tricky problems. The week before each exam I will give out a list of problems representative of the level of difficulty of problems the student will be expected to answer on the exam. Any disputes concerning grades on exams should be directed to me, Professor Pollett.

Regrades

If you believe an error was made in the grading of your program or exam, you may request **in person** a regrade from me, Professor Pollett, during my office hours. **I do not accept e-mail requests for regrades.** A request for a regrade must be made no more than a week after the homework or a midterm is returned. If you cannot find me before the end of the semester and you would like to request a regrade of your final, you may see me **in person** at the start of the immediately following semester.

University Policies and Procedures

SJSU adheres to required safety measures from the California Department of Public Health and the Santa Clara County Public Health Department. Please refer to our [SJSU Health Advisories website](#) for the latest information and updates.

Per [University Policy S16-9](#), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on [Syllabus Information web page](#) (https://www.sjsu.edu/curriculum/courses/syllabus-info.php). Make sure to visit this page to review and be

aware of these university policies and resources. Below are some brief comments on some of these policies as they pertain to this class.

Academic Integrity

For this class, you should obviously not cheat on tests. For homeworks, you should not discuss or share code or problem solutions between groups! At a minimum a 0 on the assignment or test will be given. Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development.

Accommodations

If you need a classroom accommodation for this class, and have registered with the [Accessible Education Center](), please come see me earlier rather than later in the semester to give me a heads up on how to be of assistance.