Introduction to Database Management Systems

**Instructor:** Chris Pollett  
**Office:** MH 214  
**Phone Number:** (408) 924 5145  
**Email:** chris@pollett.org  
**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**

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**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 learn 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:

<table>
<thead>
<tr>
<th>Week 1:Aug 21, Aug 23</th>
<th>Start Ch 1, what is a database, history of databases</th>
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<tbody>
<tr>
<td>Week 2:Aug 28, Aug 30</td>
<td>Finish Ch 1</td>
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<tr>
<td>Week 3:Sep 4 (No Class), Sep 6</td>
<td>Start Ch 2, Relational Model SQL</td>
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<tr>
<td>Week 4:Sep 11(Hw1), Sep 13</td>
<td>Finish Ch 2 Algebraic query languages, relational constraints</td>
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<td>Week 5:Sep 18, Sep 20</td>
<td>Start Ch 3 Design of Databases, Functional Dependencies</td>
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<td>Week 6:Sep 25, Sep 27</td>
<td>Finish Ch 3 Decompositions, 3NF</td>
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<td>Week 7:Oct 2(Hw2), Oct 4</td>
<td>Start Ch 4, ER model, Weak Entity Sets.</td>
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<td>Week 8:Oct 9, Oct 11(Midterm)</td>
<td>Review</td>
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<td>Week 9:Oct 16, Oct 18</td>
<td>Finish Ch 4, ER to Relational Mapping, UML and ODL modeling and Mapping</td>
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<td>Week 10:Oct 23(Hw3), Oct 25</td>
<td>Ch 5. Relational Algebra and its extensions, Datalog</td>
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<td>Week 11:Oct 30, Nov 1</td>
<td>Ch 6 Writing Queries in SQL</td>
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<td>Week 12:Nov 6, Nov 8</td>
<td>Ch 7 Constraints and triggers</td>
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<td>Week 13:Nov 13(Hw4), Nov 15</td>
<td>Ch 8 Views and Indexes</td>
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<td>Week 14:Nov 20, Nov 22 (No Class)</td>
<td>Ch 9 SQL in a Server Environment</td>
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<td>Week 15:Nov 27, Nov 29</td>
<td>JDBC</td>
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<td>Week 16:Dec 2, Dec 4</td>
<td>Ch 10 Semi-structured databases, XML</td>
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<td>Week 17:Dec 4, Dec 6(Hw5)</td>
<td>Finish Ch 10, Review</td>
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<td>The final will be Monday, December 16 from 2:45pm-5:00pm</td>
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**Grading**

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<table>
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<tbody>
<tr>
<td><strong>HWs and Quizzes</strong></td>
<td>50%</td>
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<tr>
<td><strong>Midterm</strong></td>
<td>20%</td>
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<tr>
<td><strong>Final</strong></td>
<td>30%</td>
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<tr>
<td><strong>Total</strong></td>
<td>100%</td>
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</tbody>
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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.