CS 410/510: Databases

Boise State University Dept. of Computer Science – Fall 2016

Catalog Description

Foundations of database management systems. Database models: relational, object and others. Database design: entity-relationship modeling, logical relational schema design, physical design, functional dependencies and normalization, and database tuning. Database application development using database interfaces embedded in host languages. PREREQ: CS 321.

Overview

Introduction to database concepts, data models, file structures, query languages, database management systems.

Topics we will cover include:

- Modeling data so it can be stored and used effectively
- The relational database model
- Creating databases based on these data models
- Storing, updating, and querying data in a relational database with SQL
- Accessing the database from applications
- Transactions and data integrity
- Current directions in databases (NoSQL, key-value stores, etc.)

The primary objective of this course is to provide you with a good foundation for modeling data and building data-driven applications. To that end, we will spend significant time on data modeling — understanding the data involved in a problem and translating that understanding to a database design — and integrating the database into applications.

Course Logistics

Number	CS 410/510
Credits	3
Prerequisites	CS 321 (Data Structures)
Lectures	MW 3:30-4:15 PM in CCP 259
Web site	Blackboard

Instructor

Michael Ekstrand

Office	CCP 255
E-mail	michaelekstrand@boisestate.edu
Phone	(208) 426-5761
Office Hours	M 4:30–5:30 pm
	Tu 10:30–11:30 am
	W 3–4 pm
	Other times by appointment (in-person or via Hangouts)

Textbook and Resources

Primary Text

This will be our primary textbook for the course.

> *Fundamentals of Database Systems*, 7th Edition, by Elmasri and Navathe (Pearson; ISBN 978-0-13-397077-7)

The course schedule will reference this text for the readings, and I recommend that you read it if you will benefit from an alternate presentation of the material, or if you would like to read about additional topics not covered in lecture. However, you will not be tested on details found only in the textbook.

Optional Text

I recommend this book if you would like a printed reference for SQL, the language that we will be using to interact with the database.

> *SQL in a Nutshell*, 3rd Edition, by Kline (O'Reilly; ISBN 978-0-596-51884-4)

Online Resources

There will be a variety of online resources that we use for the semester. The primary ones are:

- [PostgreSQL Reference Manual](#)
- [Java API documentation](#)
- Online Q&A sites such as [StackOverflow](#) and [DBA.SE](#) are likely to be useful in your studies as well

I may post additional learning resources to Blackboard throughout the semester.

Supplementary Books

These books are entirely optional, but they may be useful; they have informed my own study of the subject, and I will likely be referring to them in preparing my lectures.

Mastering Data Modeling by Carlis and Maguire (Addison-Wesley; ISBN 0-207-70045-X)

The Practical SQL Handbook by Bowman, Emerson, and Darnovsky (Addison-Wesley; ISBN 0-201-44787-8)

I have requested that the library acquire *Mastering Data Modeling* and place it on 3-day reserve. *The Practical SQL Handbook* is out of print, but you can get it from used marketplaces if you wish.

Grading and Course Components

There will be four primary components of this course, from which your grade will be computed as follows:

Component	Count	Contribution
Homework Assignments	5 (7)	30%
Project	1	25%
Quizzes	4	25%
Final Exam	1	20%

Final grades will be no worse than those that would arise from a standard 70–80–90 scale: if you have a total weighted grade of 90/100 points, then your grade will be no worse than an A.

Homework Assignments

There will be 5 homework assignments. These assignments must be completed individually and submitted via Blackboard. **Please follow submission instructions exactly** — if we ask for a PDF file, please do not submit a Word or Apple Pages document.

Each homework is due before class on. In addition, you have 3 'late days' that you may use throughout the semester, each of which extends the deadline by 24 hours. You can use them all on one assignment or apply them to separate assignments as your needs dictate.

Graduate students will have an additional 2 homework assignments, mostly around the relational algebra and formal database normalization.

Project

This course has a substantial project component. The project will be launched the third week of class, and there will be deliverables due throughout the semester.

Further details will be available on the launch day, but the main idea of the project is to design a data model and build a database-driven web application. Since the focus of this class is on databases, not on web programming, we will be minimizing the complexity of the web side of the project and keeping the focus on how to write real applications that work with a database.

Exams

There will be two categories of exams. There will be four *Quizzes* throughout the semester; each quiz will be about 30 minutes, and your lowest quiz score will be dropped. These quizzes are in lieu of traditional midterm exams.

The *Final Exam* will be during the ordinary final exam period, and will be a 2-hour comprehensive exam.

For each exam, you may have a single 8½ x 11" sheet of hand-written notes.

Course Policies

Announcements

From time to time, I will make announcements regarding the course materials, structure (such as assignment due dates, changes, or corrections), etc., either in lecture or via Blackboard announcements. You are responsible for these announcements. Make sure that you check Blackboard regularly, or have Blackboard announcements delivered to your e-mail (and check that).

Recording and Sharing of Course Materials

You may make audio or video recording of my lectures for your own personal study, and you may share such recordings with your classmates in this offering of the course. You **may not** make such recordings publicly available, or share them with other students not in the course this term, without my prior written consent.

After each lecture, I will make the following available on Blackboard:

- My lecture notes
- Lecture slides, if I used any
- Scans or snapshots of drawings

- Example code and data sets

You may download and use these, as well as retain copies after the course has completed, for your own personal use and study. Please do not share or distribute them without asking me first, unless they are clearly labeled for redistribution (e.g. example code bearing an open source license).

Late Work

This course is designed with built-in measures to accommodate most ordinary need for extensions or late submissions. Therefore, with the exception of the late days allowed on the homework assignments, **no late work will be accepted.** Homework assignments and project deliverables must be turned in on time, and you must take exams at their scheduled times.

Exceptions to this policy will only be granted in extreme circumstances. Any requests for individual exceptions must be submitted by e-mail so that I have a record of the request and my response.

External Resources

You may consult external resources such as other books and web sites for understanding how to solve homework problems or portions of the project. In your assignment solution, list all external resources you used; if they are available online, provide the URL. You do not need to cite the textbook or the official documentation for the software we are using.

Besides the course forum in Piazza, you may ask questions related to completing the project or homework assignments on publicly accessible discussion forums such as Stack Overflow, newsgroups, or publicly-archived mailing lists[1]. Provide URLs to the forum discussion on the relevant web site or archive (Google Groups works well for newsgroup archives) with your assignment or project deliverable submission.

Restrict your questions to questions about how to go about a particular sub-portion of the problem, how something works, why something you are trying doesn't work, or other specific difficulties. Do not ask "how do I solve <the problem description>?", or similarly direct translations of the project requirements, or for specific code. Questions should be written to fill in a gap in

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[1] Sites that require registration, login, and/or payment to view answers, such as Experts Exchange, do not qualify as publicly-available.

your understanding that will then enable you to continue your work, not to get a solution to the assignment.

If you consult with other students in the class on a homework assignment or project, list those students' names in your submission.

Cheating and Academic Integrity

As both a programmer and a student, you are expected to do your own work, attribute sources, and respect the legal and moral rights of others with respect to their work; as a student, you are also required to abide by the Student Code of Conduct[2]. While I aim to allow you to make reasonable use of resources, cheating (including copying code, using unauthorized resources during tests, etc.) will not be tolerated. If you are found to be cheating, the penalty may range from an F on the assignment to an F on the course, and will also be reported to the university.

Conduct

I expect you to behave in a civil, respectful manner in all class interactions, both in official meetings such as lectures and out-of-classroom activities such as project group meetings and study sessions, and to contribute to a constructive learning environment. The Hacker School Social Rules are a good source of guidance on how to maintain a constructive and educational environment.

If you experience or witness harassment of any form, please let me know.

Disability Accommodations

If you need particular accommodations to be able to fully participate in this course, please talk with me as soon as possible. I may ask that you provide documentation from the Office of Disability Services, so if you have such documentation please bring it.

Safety Information

You can find information about safety in the College of Engineering and the City Plaza building (where Computer Science is located) here: http://coen.boisestate.edu/cs/safetydocument

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[2] https://deanofstudents.boisestate.edu/scp-codeofconduct/

Schedule

Following is a tentative schedule. It may be adjusted as we progress through the semester. **Bold** items are key dates for the project and exams.

Week	Date	Topic	Reading	Due
1	8/22	Introduction & Architecture	1–2	
2	8/29	Entity-Relationship Modeling	3, A	
3	9/5	The Relational Model and Algebra	5, 8	H1
4	9/12	Creating SQL Databases **Project Launch,** *Traveling 9/14–9/20*	6.1–6.2	
5	9/19	Querying	6.3	Q1,H2
6	9/26	Design and Normalization	14	
7	10/3	Programming with the Database	6.4, 10	Q2, H3
8	10/10	Advanced Querying **Project Design Review (Wed)**	7.1, 7.3	P. Design
9	10/17	Constraints and Consistency	6.1, 6.2	H4
10	10/24	Transactions and Data Integrity	20	Q3
11	10/31	Search and Information Retrieval	27	H5
12	11/7	Analyzing and Optimizing Queries	19	
13	11/14	*TBD*		Q4, H6
	11/21	*Thanksgiving*		
14	11/28	**Project Presentations**		Project
15	12/5	Additional Database Tech & Topics Review	12, 23, 24	
F	12/12	**Final Exam** (Dec. 14 @12:30 PM)		Final

Unless otherwise specified in the assignment description, all assignments are due **before class on Wednesday** of the week in which they are listed.

During the last week of class ('Dead Week'), we will not have any deadlines or tests.