

# CS 410/510: Databases

*Boise State University Dept. of Computer Science – Spring 2020*

## 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      | Tu/Th 9:00–10:15 AM in CCP 259 |
| Web site      | Blackboard                     |

## Instructor

Michael Ekstrand

|              |   |
|--------------|---|
| Office       | CCP 255   |
| E-mail       | <a href="mailto:michaelekstrand@boisestate.edu">michaelekstrand@boisestate.edu</a>          |
| Phone        | (208) 426-5761  |
| Office Hours | Tu 10:30-11:30 am<br>Tu/Th 3–4 pm<br>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*, 7<sup>th</sup> Edition, by Elmasri and Navathe  
(Pearson; ISBN 978-0-13-397077-7)

The course schedule will reference this text for the readings.

### *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*, 3<sup>rd</sup> 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 0201703092)

*SQL in 10 Minutes* by Ben Forta (Sams; ISBN 0672336073)

The library has *Mastering Data Modeling*.

**Grading and Course Components**

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

| <i>Component</i>            | <i>Count</i> | <i>Contribution</i> |
|-----------------------------|--------------|---------------------|
| <i>Homework Assignments</i> | 4            | 35%                 |
| <i>Project</i>              | 1            | 15%                 |
| <i>Midterms</i>             | 2            | 30%                 |
| <i>Final Exam</i>           | 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 4 homework assignments. These assignments must be completed individually and submitted via Blackboard. **Please follow submission instructions exactly** — if I ask for a PDF file, do not submit a Word or Apple Pages document. **Do not** include your name, student ID, or other identifying information in your submission file, as this will hinder anonymous grading.

Each homework is due at midnight on Wednesday. There is a late penalty of 10% for the first day and 25% for the second day; assignments more than 2 days late will not be accepted.

### *Project*

This course has a final project, which you may do with a partner if you choose.

### *Exams*

There will be two categories of exams. There will be two midterms and a final; the final will be comprehensive.

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).

*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<sup>1</sup>. 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 your understanding that will then enable you to continue your work, not to get a solution to the assignment.

*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<sup>2</sup>. 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

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

<sup>2</sup> <https://deanofstudents.boisestate.edu/scp-codeofconduct/>

environment. The [Recurse Center 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>

## Schedule

Following is a tentative schedule. It may be adjusted as we progress through the semester.

| Week | Topic  | Reading     | Due     |
|------|--|-------------|---------|
| 1    | 1/13 Introduction & E-R Modeling                     | 1–2         |         |
| 2    | 1/20 E-R and the Relational Model                    | 3, 5, 9.1   |         |
| 3    | 1/27 Relational Algebra<br><i>Ekstrand traveling</i> | 8, 6.3      |         |
| 4    | 2/3 SQL: DDL and Queries                             | 6           | 1       |
| 5    | 2/10 SQL Queries                                     |             |         |
| 6    | 2/17 Data Types and Null Values                      |             | 2       |
| 7    | 2/24 <b>Midterm A</b>                                |             |         |
| 8    | 3/2 Normalization                                    | 14          |         |
| 9    | 3/9 Programming with the Database                    | 10          | 3       |
| 10   | 3/16 Transactions and Data Integrity                 | 20          |         |
|      | 3/23 <i>Spring Break — No Class</i>                  |             |         |
| 11   | 3/30 Enhanced ERM<br><b>Midterm B</b>                | 4, 9.2      |         |
| 12   | 4/6 Indexing and Optimization                        | 7.2, 16, 17 |         |
| 13   | 4/13 Advanced Querying                               | 7.1         | 4       |
| 14   | 4/20 Text & Server Programming                       | 7.2         |         |
| 15   | 4/27 Beyond SQL                                      | 12, 23, 24  |         |
| F    | 5/4 <b>Final Exam</b>                                |             | Project |

Unless otherwise specified in the assignment description, all assignments are due **midnight Tuesday** of the week in which they are listed. Midterms are on Tuesdays during class.

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

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