



MONTANA
STATE UNIVERSITY

CSCI 440 - Database Systems

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Instructor: Carson Gross
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Course Goals

- To give you a broad understanding of relational databases
- To help you become proficient in SQL
- To help you be confident in schema design
- Enable you to work with databases in code (Java)
- Learn a bit of database theory and implementation
- Learn about some non-relational modern tools
 - NoSQL
 - Cloud Architectures

Instructor Introduction

- My name Carson Gross
- Recently arrived from Northern California
- Academic Background
 - BS in IE/OR from Berkeley (I dropped out of CS)
 - MS in CS from Stanford
- Career
 - Interned at Google
 - Staff Engineer at Guidewire Software
 - Gosu Programming Language
 - Founder/CTO at LeadDyno
 - Creator of many open source projects
 - <http://intercoolerjs.org>
 - <https://htmx.org>
 - <https://hyperscript.org>

Classroom Mechanics

- Lectures are at 11AM, MWF in Ried 105
- All lectures will be live streamed via YouTube
- TA will monitor chat room for questions during live streams
- You do **NOT** need to attend this class in person if you have health concerns. All assignments, lectures and tests will be available online

Grading

- Individual Programming Assignment - 70%
- Quizzes - 10%
- Home works - 20%

Programming Assignment

- The programming assignment will be a classic web CRUD application
- Tied to two different types of databases
 - A SQLite database for primary data
 - A Redis database for caching
- Done individually (I want you to learn) and graded primarily with an autograder via tests
 - Good introduction to Test Driven Development

Quizzes

- This class has no midterm or final
- Instead, we will have quizzes on the **Friday** of **every** even week
- The quizzes will be done online via D2L
- Open everything, but please do not communicate with other students
 - A small portion of your grade, it's not worth risking getting caught cheating, which will be an auto-fail
- Quizzes will start easy and get harder over time

Homeworks

- There will be three homework assignments during the class
- Generally they are oriented towards writing practical SQL
- Graded the same way we grade the project
- More variable than the project (which can be a little repetitive, but that's realistic!)

Autograding

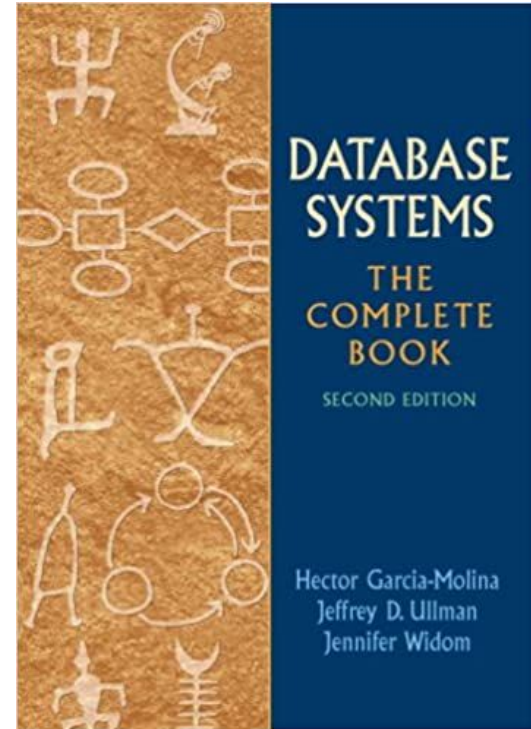
- I have created an autograding system
- I will run auto-grades occasionally during the lifetime of assignments
- The autograde system pushes the results up to your github repository
(More on this later)
- This means you will be able to see your results in your /grades folder
- No surprises!

Discord

- Discord has proven to be an excellent way to communicate with students
- Please join the MSU discord!
- A link can be found on the “Content” page in D2L
- Join the 440 group with the command !join-440

Book

Database Systems
The Complete Book

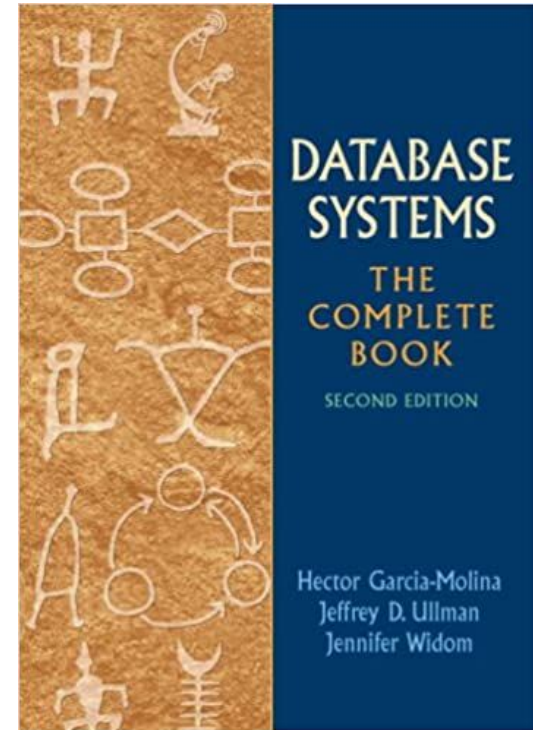


NB: I'm not a huge fan of this book

To be honest, you can probably get through the class without buying it

A better resource:

<https://www.sqlitetutorial.net/>



Course Outline

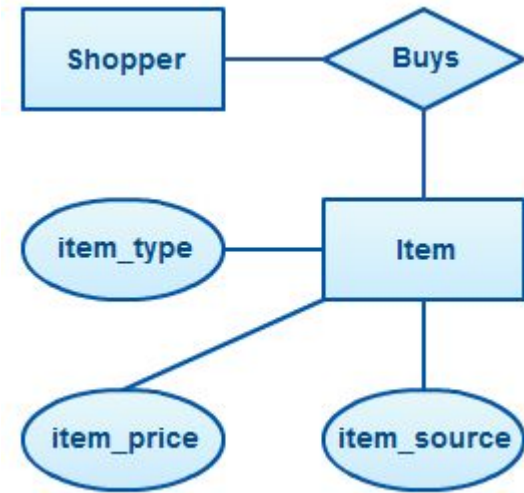
- Introduction
- E/R Data Modelling
- The Relational Model
- SQL
- SQL & The Web
- Database Management
- Theory & Implementation
- NoSQL
- Cloud Concepts

Introduction

- An Overview of Database Systems
- Understanding Git & Github
 - Not DB, but necessary for the class project and homeworks
- Using Database Tools in IntelliJ

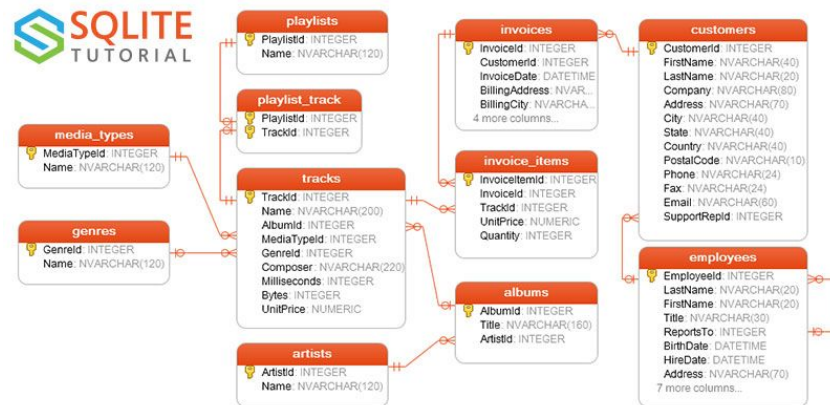
E/R Data Modeling

- Visual design of databases
- Used to some extent in industry
 - Not as much as some professors might think though
- A gentle introduction to data modeling



The Relational Model

- Develop an understanding of relations and the relational model
- Understand how E/R diagrams map to relations
- Discuss how polymorphism (Object Oriented Data) can be handled at the relation level



SQL

- The best part of the course!
- SQL - Structured Query Language
 - It's a programming language!
 - The most successful declarative programming language in history?
 - Maybe Excel?
- Used **universally** in industry and government

```
SELECT * FROM Customers  
WHERE City IN ('Paris', 'London');
```

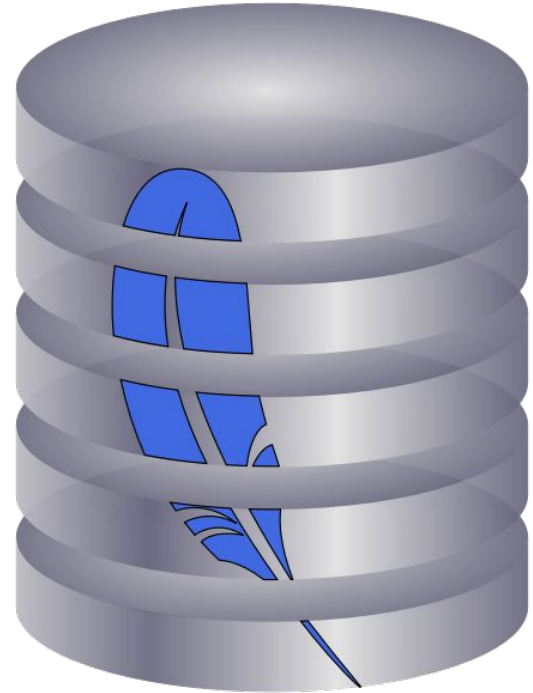
SQL & The Web

- SQL by itself is useful
- SQL tied to a web server...
 - Maybe 75+% of startups?
- We will be using Java
 - Very good database tools
 - Easy enough to program in
 - IntelliJ has good database tools
- Stack:
 - SparkJava
 - ActiveJDBC
 - SQLite



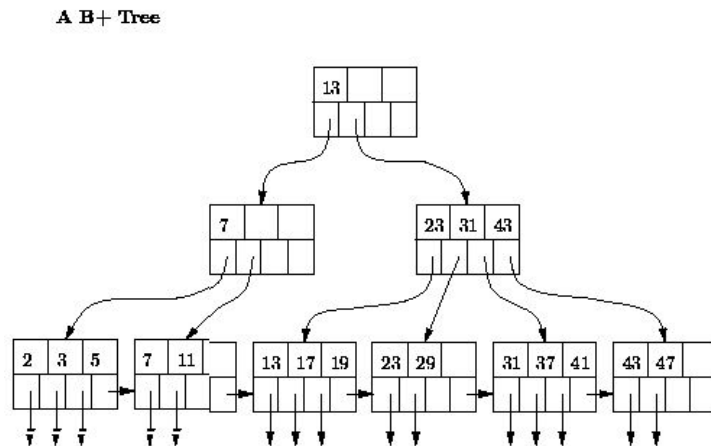
Database Management

- Creating & modifying databases
- Transaction management
- Making databases run fast



Theory & Implementation

- Some light theory
 - Relational Algebra
 - Relational Calculus
 - Learn how B-Trees work
 - B-Trees are used in lots of applications, it's worth learning about them



Non-Relational Tools

- Relatively recent development (late aughts)
- Databases that do not use the relational model
 - Often use JSON
- We will focus on the biggest two:
 - MongoDB
 - Redis



Cloud Concepts

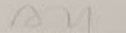
- Most applications today are deployed in a Cloud
 - e.g. Amazon's AWS
- Overview of typical architectures
- Concepts
 - Clustering
 - Sharding



Cheating

- **Don't**
- Seriously, you are only cheating yourself. You will need to interview to get a job & you don't want to embarrass yourself
- What's OK:
 - Discuss programming assignments (not answers) with other people
 - Helping other people debug (not write) their program
- What's Not:
 - Share code with other people
 - Submit code that you did not write (small snippets from StackOverflow OK)
 - Modify someone else's solution and claim it as your own

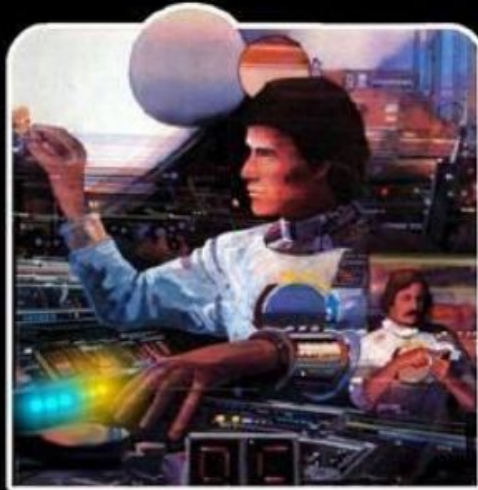
**WORK
HARD
&
BE NICE
TO PEOPLE**


Anthony Barbi

Homework 0

- Install IntelliJ
 - Student licenses are available
- Set up your Github repository
 - Head to <https://github.com/msu/csci-440-fall2021>
 - Follow the instructions under “Getting Your Private Copy”

THE TWO STATES OF EVERY PROGRAMMER

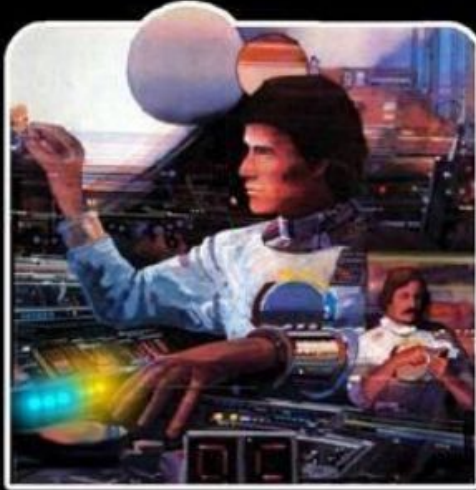


I AM A GOD.



**I HAVE NO IDEA
WHAT I'M DOING.**

THE TWO STATES OF EVERY PROGRAMMER



I AM A GOD



**I HAVE NO IDEA
WHAT I'M DOING.**

ME, MOST OF THE TIME



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