

## **Syllabus**

### **COMPSCI 345: Practice and Applications of Data Management**

#### **Course Catalog Description**

Modern computer systems make ample use of databases from where to share and synchronize many types of information. For example, commercial websites store information about clients and products in databases. Likewise, news organizations store news items and user preferences which can then be accessed from a variety of devices, and through a variety of formats. COMPSCI 345 provides a comprehensive introduction to the use of data management systems that can be used in such applications, with a strong emphasis on the relational database model. Some of the covered topics include application-driven database design, schema refinement, implementation of basic transactions, data on the web, and data visualization.

This course counts as a CS Elective toward the COMPSCI major (BA/BS). Students who have completed COMPSCI 445 are not eligible to take this course without instructor permission. Prerequisite: COMPSCI 187 (OR INFO 248 AND COMPSCI 186). 3 credits.

#### **Course Format**

This course will run in a flipped classroom format, which is different from many of the courses you might have taken before. In other courses, you get to hear and learn about new topics during class meetings, and then you do work outside of class time to practice and demonstrate engagement and proficiency with those topics. In this course, we will reverse what happens when: you will learn about new topics OUTSIDE of class time, and then do work during class time in order to practice and demonstrate proficiency. This means you will need to view materials BEFORE class. These materials will be available online on our Moodle page, as videos and slides/notes. You will need to view these materials BEFORE class.

To match these format, we will have two types of assignments. Pre-class assignments will be due BEFORE the class meeting where you practice with topics, to make sure you have a basic understanding of the material. After you practice with the material during class time, there will be a second post-class assignment due a week later.

#### **Course goals:**

By the end of this course, successful students will be able to:

- Describe the type of application that require the use of database systems.
- Access data stored in a relational database system via SQL commands.
- Explain the need for database normalization.
- Perform database normalization.
- Create tables/relations in a Postgres relational database.
- Insert data into SQL-compliant databases
- Use views to control access to data stores in relational databases
- explain the different isolation levels database transactions can run under, and understand the effect such isolation levels have on concurrent database operations.
- Describe the effect of indexing on particular database operations. Select the best type of indexes to use based on expected database operations.
- Use entity/relation diagrams to communicate database requirements. Turn entity/relation diagrams into corresponding database tables.

**Text book:**

Database Systems The Complete Book, Second edition, by Hector Garcia-Molina, Jeffrey Ullman, and Jennifer Widom. ISBN:9780131873254

**Grades**

Your grade in this course will be based on completing assignments, a midterm exam, and a final exam. These elements will be weighted as follows.

Homework	60%
Midterm	20%
Final exam	20%

You may expect the following approximate grading range. However, the final letter grade determination will be made at the end of the semester:

- 93 to 100 → A;
- 90 to 92 → A-;
- 87 to 89 → B+;
- 83 to 86 → B;
- 80 to 82 → B-;
- 77 to 79 → C+;
- 73 to 76 → C;
- 70 to 72 → C-;
- 67 to 69 → D+;
- 60 to 66 → D;

**Class philosophy:**

I strive to create a learning community among all of us. We are not in competition with each other. You are not in competition with each other. I measure success by how many of you do great in the course. I commit to coming to class prepared, to putting my best effort towards your learning, and to develop an environment where all of us can achieve their maximum. I hope you do the same. For all of us, this means coming to class prepared, being ready to work, being respectful of everyone, and working hard in order to do our best work. If there is something you think I can do that would create a better learning environment, let's talk about it.

**Inclusivity Statement**

We celebrate the diversity in our community and actively seek to include and listen to voices that are often silenced in the computing world. We welcome all individuals regardless of age, background, citizenship, disability, sex, education, ethnicity, family status, gender, gender identity, geographical origin, language, military experience, political views, race, religion, sexual orientation, socioeconomic status, and work experience.

This course is geared towards you working in groups. As such, we expect that you will observe social decorum at all times when interacting with peers. Please consult the UMass Guidelines for Classroom Civility and Respect: [http://www.umass.edu/dean\\_students/campus-policies/classroom](http://www.umass.edu/dean_students/campus-policies/classroom)

**Piazza**

Our course will make use of Piazza for class discussions. I encourage you to post your questions on Piazza. This will allow other students to benefit from your questions, your answers, and other people

answers. Seeing questions on Piazza also allows me know what material I might need to go over again. To find the Piazza page for our course, please follow the link you can find in our course's Moodle page.

## **HOMEWORK**

- **Homework submissions are via Gradescope**
  - We will be using gradescope to upload homework and provide feedback. You can find a link and instructions on our course's main Moodle page.
- **Late Homework Policy**
  - Turning homework in late helps no one. When students turn homework in late, they fall behind, and then cannot receive feedback on time. TAs and UCAs then cannot grade things in a timely way, because they have started to move into the next topic. Instructors cannot detect what material needs to be re-emphasized, etc. Because of this, the general rule is that late homework will not be accepted. The only exception to this is justified medical or personal situations that fall outside the ordinary. If you have a medical situation that keeps you from turning an assignment in, please ask for and provide documentation from a medical professional. If you have a personal life situation that keeps you from submitting an assignment on time, let me know as quickly as humanly possible. I might ask you for documentation in those cases too. I'm not trying to be stricter than I need to be, I just want to avoid assignment submissions from turning into a free-for-all.
  - If you have an accommodation need officially documented with UMass, please provide me with an official letter, and I will, of course, provide whatever accommodations are needed, in terms of assignments, exams, or anything else. This also applies to the midterm and final exams.
  - I recommend you start working on assignments as soon as they are assigned.

## **Academic Honesty and Collaboration Policy:**

You may collaborate with 1-2 other students on homework assignments, provided that (a) you indicate anyone with whom you worked and (b) the final presentation is entirely your own. As a guideline, to distinguish permitted collaboration from plagiarism, feel free to discuss problems verbally or via temporary written means (e.g. whiteboard) but do not share written files, printouts, or pages, or take screenshots. It is OK, and even encouraged, for you to talk about code ideas, and even sketch code together. You should then, though, write code into your own files, and submit only those files. If you have questions about this matter, please ask.

Please, please, observe this academic honesty policy. Every semester I share this announcement with students, and every semester some students ignore it, and cheat, either in assignments or in exams. If they are caught, my policy is the following: they will receive an F for the course. I don't enjoy doing that, but I will if necessary. If you are struggling with class material, your option should never be do cheat. I will be thrilled to help you with material until you are successful, in an honest and responsible way.

We follow the university's Academic Honesty Policy and Procedures. You can find those at <https://www.umass.edu/honesty/> .

## **Accommodation statement**

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you

succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

**Course Topics**

(this schedule is subject to change, as might be required based on semester-specific needs)

<b>Week</b>	<b>Topics</b>	<b>Book Chapters</b>	<b>Work due</b>
1	<ul style="list-style-type: none"> <li>• Introduction to databases</li> <li>• Very basic SQL commands</li> </ul>	2 & 6	
2	<ul style="list-style-type: none"> <li>• SELECT queries</li> <li>• Commands to create an SQL database</li> </ul>	2 & 6	Pre-class HW#1
3	<ul style="list-style-type: none"> <li>• Groups and aggregations</li> <li>• Join commands</li> <li>• Subqueries</li> </ul>	6	Post-class HW#1 Pre-class HW#2
4	<ul style="list-style-type: none"> <li>• Further practice with SELECT commands</li> </ul>	6	Post-class HW#2 Pre-class HW#3
5	<ul style="list-style-type: none"> <li>• Further practice with SELECT commands</li> </ul>	6	Post-class HW#3
6	<ul style="list-style-type: none"> <li>• Entering data into databases</li> </ul>	4	Midterm exam
7	<ul style="list-style-type: none"> <li>• Entity/Relation diagrams</li> </ul>	7	Pre-class HW#4
8	<ul style="list-style-type: none"> <li>• Constraints</li> </ul>	8	Post-class HW#4
9	<ul style="list-style-type: none"> <li>• Database normalization</li> </ul>	3	Pre-class HW#5
10	<ul style="list-style-type: none"> <li>• Database normalization</li> </ul>	3	Post-class HW#5
11	<ul style="list-style-type: none"> <li>• Indexing</li> </ul>	8	Pre-class HW#6
12	<ul style="list-style-type: none"> <li>• Views and security</li> </ul>	18 & 19	Pre-class HW#7
13	<ul style="list-style-type: none"> <li>• Concurrency</li> </ul>	20	Post-class HW#7 Pre-class HW#8