CSCI3800 - Database Apps, Tools & Techniques

J. Pastorino

Spring 2022

1 Course Overview

In this 3-credit course, we will study different techniques used by relational databases to improve query performance and allow concurrent query execution. We will also look at modern database and data storage systems such as NoSQL data stores, document stores, graph databases and geographical databases among others. We will cover theoretical concepts during class presentations and discussions as well as a practical approach though practices and laboratories.

2 Instructor

Instructor:	**Javier Pastorino**.	Website $\nearrow$
Email:	*name . last name at* ucdenver.edu	
Office::	LSC #822 - 1380 Lawrence St. 8th floor.	
Office Hours:	Wed. 10-11:30am; appointments are required.	Schedule here $\nearrow$

3 Textbook

- **Fundamentals of Database Systems**, R. Elmasri, S. Navathe, 7th edition, Pearson. ISBN-13 978-0133970777. **Required**

4 Learning Objectives

4.1 Expected Knowledge at the Start of the Course

Students are required to understand the basis of database systems including database design, query languages (SQL and relational algebra) and physical database implementation (file structure, hashing and indexing)

- **Prerequisites**

    – **CSCI3287 – Database Systems**. Students need to sign prerequisite agreement before 5pm on Friday of first week of classes otherwise students will be administratively dropped from course.

4.2   Learning Outcomes

Students should learn more in-depth design of database systems including query processing and optimization, transaction management, database security and active databases with enhanced database constraints. In addition, the student should gather knowledge on more recent databases designs such as NoSQL databases, Distributed Databases and Spatio–Temporal databases.

5   Course Details Details

5.1   Course Topics/Objectives

The goal of this course is to introduce the following topics on database design and implementation:

- Query Processing and Optimization

- Transaction Processing, Concurrency Control and Recovery

- Active Database Development (triggers)

- Database Security Models

- NoSQL and Distributed databases

- Spatio-Temporal Databases

5.2   Course Delivery

The course will be delivery in–person sessions. We will be discuss the assigned material for the topics, and will apply the learned concepts in practical applications. Student attendance and participation will be required during the sessions. Missing class sessions is not recommended and will affect your grade.

Forming study groups is not only recommended but encouraged as will provide an environment for engaging and discussing between classmates. Further, it will offer great opportunities to prepare for class sessions.

- **Assigned Class Time:** Monday and Wednesday, 12:30 - 1:45 PM

- **Course Readings:** Each session/week will have readings assigned. Reading should be completed before the session as we will focus on discussion and analysis during the session. Readings will be assigned from out textbook and other relevant materials, such as research papers.

- **Practices & Laboratories:** There will assigned practices/labs to be completed during class time. Practices and labs may require preparation tasks to be completed before class.

5.3 Assessments

Learning will be assessed during class based on presentation and participation, and by the assigned practices and labs. Also, there will be short, take–at–home quizzes, to be competed <u>before</u> class based on the assigned readings, to help prepare students for the sessions.

- **Topic Presentation, Class Discussion and Participation**: Student groups will be formed to research a topic assigned based on the group preferences. The group will present to the rest of the class the researched topic. Further, a discussion will be conducted as well as a follow–up practice or lab. Presentations, discussions and participation counts towards 40% of the final grade.

- **Practices / Labs**: These activities will deepen the understanding of the readings by providing practical applications. Practices and labs are designed to be completed during a class session and will focus on concepts discussed during lectures/presentations. Practices and Labs counts towards 50% of the final grade.

- **Quizzes**: Each session has readings assigned to. A short quiz will be due before the session time to assess the basic understanding of the topic to be covered that session / week. Quizzes counts towards 10% of the final grade.

5.3.1 Grade Weights and Dissemination

- All grades will be posted on Canvas.

- **Below is a summary of the assessments' weight towards the final grade:**

Assessment Group	Percentage of Final Grade
Participation	40%
Practices & Labs	50%
Quizzes	10%

- **Re–grading:** in general there will be no re–grading. However, students are welcome to meet during office hours to revisit the marks and corrections. If a mistake was made, the assessment will be re–graded. **Students need to meet with the instructor within 7 days of posting the grades.**

- **Grades of Incomplete:** In general there will be no Incomplete (IC) grades unless extenuating circumstances, in which case the student need to discuss those with the instructor as soon as possible. Incomplete grades will depend on the CEDC and the CSE department guidelines.

5.4 Schedule

Figure 1 shows the tentative schedule for the semester.

6 Communications & Announcements

Class wide announcements will be posted through Canvas. Make sure your Canvas settings are properly set to avoid missing notifications. You can set email notifications or use the Canvas app in your mobile device with push notifications.

If you need to contact me, please use email (do not use Canvas messages), I usually reply emails within 24-48 hours. My email is listed at the beginning of this document. **Include "CSCI3800" in your subject for a quick response.**

However, to discuss exercises/problems, please schedule an appointment during my office hours, as I will usually not be able to answer those kind of questions over email.

7   Code of Conduct

7.1   Student expectations

1. **Civility**: Our commitment is to create a climate for learning characterized by respect for each other and the contributions each person makes to class. Student should follow the same commitment.

2. **Professionalism**: Since mobile devices can be a distraction during class, I ask that all devices be put into "silent" mode and not utilized during class; this include any notifications that you have in your devices while on a remote session.

7.2   Collaboration and Cheating

I encourage you to review material and discuss ideas with other students while preparing for your assessments. Moreover, I strongly recommend you to set a study group to go over examples, practices and problems from the textbook.

However, **make sure you then create your own work** when taking homework and examinations and follow the guidelines depicted in each one. It's important that you go through the analysis and implementation of your own solution to develop the required skills and achieve the best understanding of the topic. "Working within a team" does not mean that one student does the majority of the work and other students just include their names on the submission. If you have any questions about what this means, please meet with me.

We reserve the rights to use automated similarity metrics in order to detect plagiarism in this course as **all students must create their own work on their own!**

Any instances of cheating will result in a zero for the assignment, a grade of zero (an "F") in the course, or sanctions determined by the college (including probation, suspension and expulsion).

All students must follow the College of Engineering, Design and Computing - Student Honor Code ⤤

7.2.1   University Policies

1. **Access:** The University of Colorado Denver is committed to providing reasonable accommodation and access to programs and services to persons with disabilities. Students with disabilities who want academic accommodations must register with Disability Resources and Services (DRS) ⤤. I will be happy to provide approved accommodations, once you provide me with a copy of DRS's letter. Please schedule and appointment to discuss your accommodations for the course.

2. **Academic Honesty and Student Code of Conduct:** Students are expected to know, understand, and comply with the ethical standards of the university, including rules against plagiarism, cheating, fabrication and falsification and complicity in academic dishonesty. For more information check the Academic integrity ⤢ and the Student Code of Conduct ⤢.

CSCI 3800 - Spring 2022

Week	Date	Topic	Type	Readings
#1	Mon, Jan 17	Holiday - No Class		
	Wed, Jan 19	Course Introduction - Prerequisite Assessment		
#2	Mon, Jan 24	DB Storage	Lecture	Ch. 16
	Wed, Jan 26	Indexing	Lecture	Ch. 17
#3	Mon, Jan 31	Query Processing & Optimization	Lecture	Ch. 18
	Wed, Feb 02	Query Processing & Optimization	Lecture	Ch. 19
#4	Mon, Feb 07	Query Processing & Optimization	Lecture	
	Wed, Feb 09	Query Processing & Optimization	Practice	
#5	Mon, Feb 14	Query Processing & Optimization	Lab	
	Wed, Feb 16	Query Processing & Optimization	Lab	
#6	Mon, Feb 21	Triggers	Presentation	Ch. 26
	Wed, Feb 23	Triggers	Lab	
#7	Mon, Feb 28	Transactions	Presentation	Ch. 20
	Wed, Mar 02	Transactions	Practice	
#8	Mon, Mar 07	Concurrency	Presentation	Ch. 21
	Wed, Mar 09	Recovery	Presentation	Ch. 22
#9	Mon, Mar 14	Concurrency & Recovery	Lab	
	Wed, Mar 16	Distributed DB	Lecture	Ch. 23
#10	Mon, Mar 21	Spring Break - No Classes		
	Wed, Mar 23			
#11	Mon, Mar 28	No-SQL. & Mongo DB	Lecture & Presentation	Ch. 24 & Others
	Wed, Mar 30	MongoDB	Lab	
#12	Mon, Apr 04	MongoDB	Lab	
	Wed, Apr 06	Graph Databases	Presentation	Ch. 24 & Others
#13	Mon, Apr 11	Graph Databases	Lab	
	Wed, Apr 13	GeoDatabases	Presentation	Ch. 26 & Others
#14	Mon, Apr 18	GeoDatabases	Lab	
	Wed, Apr 20	GeoDatabases	Lab	
#15	Mon, Apr 25	Spanner - GCP	Presentation	TBD
	Wed, Apr 27	Spanner - GCP	Lab	
#16	Mon, May 02	DB Security	Presentation	Ch. 30
	Wed, May 04	DB Security	Practice	
Finals	Mon, May 09	Finals Week		
	Wed, May 11			

Figure 1: Tentative schedule.

Last Updated on: Friday 14th January, 2022