

COS 343

Advanced Database Concepts

Department of Computer Science and Engineering
Taylor University

Three Credit Hours
Euler Science 103 • MWF 3:00–4:00
Final Exam: M/13-Dec, 10:00–12:00

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1 Description

Prerequisites: MAT 215

From the catalog: A study of the fundamental concepts of how database technologies work. An emphasis on relational databases will be explored, including normalization, advanced SQL queries, indexing, physical data storage, performance and tuning strategies, and concurrency control. Students will be introduced to other database technologies possibly including object-oriented databases, NoSQL, replication, etc.

2 Learning Objectives

Upon successful completion of this course, you will be able to:

1. Articulate key differences among various modern database architectures, including relational, key-value, and document databases
2. Design and document database designs using entity-relationship modeling
3. Employ multiple notations for database modeling
4. Understand relational algebra, the theoretical underpinning of relational databases
5. Normalize databases to ensure data integrity and maintainability while ensuring high performance
6. Index relational data for improved query performance
7. Express simple relational queries using Structured Query Language (SQL)
8. Write complex SQL queries that join multiple tables using complex logical and functional operators
9. Write queries that aggregate data from multiple rows of a data model
10. Perform insert, update, and delete operations using SQL
11. Use transactions to maintain data integrity
12. Understand concurrency control and locking
13. Employ a relational database using object-relation mapping tools
14. Known how to choose whether to use a relational or post-relational database for specific applications
15. Use a key-value database

16. Articulate the key concepts of document databases, including the object model, sharding, and replication
17. Write queries and other operations for document databases
18. Use several modern document databases for practical applications including data persistence for web services

3 Text

Rather than selecting a traditional textbook that you are “forced” to purchase by the bookstore, I encourage you to take advantage of [O’Reilly Learning](#) (formerly Safari Books Online). O’Reilly Learning is an outstanding subscription service that gives you access to thousands of technical titles, including many for this course. You can also download complete books for off-line access on your mobile devices.

For students, the cost to subscribe directly is about \$40/month. Access is also included in the very affordable student membership in the [Association for Computing Machinery](#) (ACM). The ACM is (along with the [IEEE Computer Society](#)) one of the two main professional societies for computer scientists.

Why use O’Reilly Learning instead of a standard textbook?

1. Rather than asking you to buy an entire textbook and use only *portions* of it, we will be draw on multiple resources that are *directly related* to the topics covered throughout the semester.
2. Your total cost will be about \$120, which is less than the cost of some single textbooks. If you are taking other courses from me this semester, you only need to pay the fee once.
3. You should have experience learning from written and electronic resources, which you will do throughout your technical career. I have been a member of O’Reilly Learning for many years and find it to be an invaluable resource when I am learning a new technology or buffing up my understanding of a familiar one.
4. You will have immediate access to a rich collection of technical material to advance your learning in this or other computer science courses.

4 Evaluation

The grading breakdown for the course is shown in Table 1. Refer to my *Periodic Table of the Grades* for the grading scheme. I reserve the right to award a higher grade than strictly earned; outstanding attendance and class participation figure prominently in such decisions.

Category		Weight
Assignments	Reading Quizzes	20%
	Programming	40%
Exams	Midterm	15%
	Final	25%
Total		100%

Table 1: Grading details

5 Course Expectations

Following are my expectations regarding the course.

5.1 Attendance

You are required to attend all class sessions. I will be in class each day, and I expect you to be there also.

In general, I am very understanding about students who must miss class due to a sanctioned Taylor activity, medical appointment, job interview, family emergency, and the like. If possible, let me know in advance that you will not be in class; I will work with you to arrange make-up instruction, homework, exams, etc.

5.2 Late Work

All course assignments will include an unambiguous due date. Usually, assignments are due at the beginning of class on the due date. If there are multiple sections of a class, the assignment is due at the beginning of the earliest such section. Barring exceptional circumstances like those mentioned in section 5.1, I expect your work to be submitted *on the due date*. Late work will *not* be accepted.

This policy on late work is intended to prepare you for real-world experience after graduation. In the marketplace, late work is not merely an inconvenience. Missing a deadline may alienate your customer, upset your manager, ruin your project, or terminate your employment! *Now* is the time to learn the self discipline and time management skills required to complete your work when it is due.

5.3 Conduct

I expect you to be prepared, awake, aware, and participatory during class. I will not hesitate to ask you to stand or move if you are distracted or sleepy.

I expect you to join in discussions, respond to questions from me and from your colleagues, and ask questions of me. I expect you to hold my feet to the fire if I am being unclear, unkind, or contradictory.

5.4 Gizmos

You may not use a laptop, tablet, or similar device to check e-mail, engage in social networking, surf the web, or any other activity not directly relevant to current class-room activity. If you use an electronic gizmo during class for legitimate academic purposes (e.g., note taking), be prepared to demonstrate relevant use on demand at any time.

6 Pandemic

We will adhere to university guidance regarding the COVID-19 pandemic.

Taylor University is committed to its academic and spiritual mission, even as we teach and learn in a global pandemic.

1. As students, you can expect that your professor will communicate clearly and regularly about expectations for this course.
2. Should you need to be absent from class at any time, it is your responsibility to notify your professors.
3. Should it be determined that you will be absent due to isolation or quarantine, it is your responsibility to notify your professors. Professors will help you stay current with course content using tools appropriate to that content. Communication in a timely fashion will enable this to be possible.
4. If course delivery methods need to change or adapt to health concerns, updates will be announced in class sessions.

7 Course Management

We use several systems to help manage the course and for on-line communication.

7.1 Email

Electronic mail is an official channel of communication between all members of the university community. You are responsible to check your email regularly (daily) for information related to the course.

7.2 Canvas

The Computer Science and Engineering department uses Canvas as our Learning Management System. The URL for Canvas is <https://canvas.cse.taylor.edu>.

You are responsible for checking Canvas regularly to keep up with assignment due dates and other announcements. For due dates, *the Canvas calendar is your friend*.

7.3 Slack

This course will use Slack for informal communication, Q&A, last minute announcements, jokes, and the like. Find the *TU CSE Student* slack team at tucsestudents.slack.com. Look there for a *channel* dedicated to the course.

8 Final Exam Policy

Students must take their final examinations at the assigned hours listed in the schedule of classes. Exceptions will be made only because of serious illness or the death of an immediate member of the family. Reasons such as plane schedules, availability of flights, and rides leaving early are not acceptable exceptions. Students having three or more examinations on the same should report this to the Registrar's Office *ten days prior to the beginning of finals week*. Reasonable alternatives in alleviating this dilemma will be pursued by the registrar and the student in consultation with the appropriate faculty.

9 Academic Integrity

As a student at an institution whose goal is to honor Christ in all that it does, I expect you to uphold the strictest standards of academic integrity. You must do your own work, cite others when you present their work, and never misrepresent your academic performance in any way. Violation of these standards stains the reputations of you as a student, Taylor as an institution, and Jesus as our Lord.

Every assignment should indicate clearly that it is either:

- An **individual** assignment, to be done *entirely by you*, without any direct participation from other students.
- A **group** assignment, to be done *collectively with a group*

Unless otherwise stated, assignments are **individual** assignments.

You are *always* welcome to get help from the instructor on *any* homework assignment or project, whether an individual or group assignment.

9.1 What Constitutes Academic Dishonesty?

For purposes of this course, the following are *non-exhaustive* examples of violations of academic integrity.

1. Sharing code or other electronic files by copying, retyping, looking at, or supplying a copy of a file from this or a previous semester.

2. Sharing written assignments or exams by looking at, copying, or supplying an assignment or exam.
3. Using another student's code. Using code from this or previous offerings of the class, from courses at other institutions, or from any other source (e.g., software found on the Internet).
4. Looking at another student's code. Although mentioned above, it bears repeating: looking at other students' code or allowing others to look at yours is academic dishonesty. There is no notion of looking "too much," since no looking is allowed at all.

9.2 What Does Not Constitute Academic Dishonesty?

In contrast, the following are *non-exhaustive* examples of activities that *do not* violate academic integrity.

1. Clarifying ambiguities or vague points in class handouts or textbooks.
2. Helping others use the computer systems, networks, compilers, debuggers, profilers, or other system facilities without regard to a particular assignment or project.
3. Helping others with high-level design issues.
4. Helping others with high-level (*not* code-based) debugging.
5. Using code provided by the instructor from the course web site or elsewhere.

9.3 From the Provost

Taylor's Provost¹ defines *plagiarism* as follows:

In an instructional setting, plagiarism occurs when a person presents or turns in work that includes someone else's ideas, language, or other (not common-knowledge²) material without giving appropriate credit to the source. Plagiarism will not be tolerated and may result in failing this course, and may also result in further consequences as stipulated in the [Taylor catalog](#).

The Provost goes on to say:

¹At Taylor, the *Provost* is our Chief Academic Officer.

²*Common knowledge* means any knowledge or facts that could be found in multiple places or as defined by a discipline, department, or faculty member.

Academic dishonesty constitutes a serious violation of academic integrity and scholarship standards at Taylor that can result in substantial penalties, at the sole discretion of the University, including but not limited to, denial of credit in a course as well as dismissal from the University.

In short, a student violates academic integrity when he or she claims credit for any work not his or her own (words, ideas, answers, data, program codes, music, etc.) or when a student misrepresents any academic performance. Please see [the catalog](#) for a complete statement.

9.4 Personal Reflection

I wrote an initial version of this section as a Slack message in the wake of several students who admitted to cribbing code for homework assignments from the Internet:

Plagiarism—We all look to the Internet to search for quick solutions to all manner of computing problems: checking a function signature, getting more detail on the meaning of an error code, recalling the behavior of a language construct, or finding a canonical implementation of a standard algorithm.

Professional honesty and integrity demand that if we employ the results of such a search in our own work, we do so only if:

1. It is permitted (e.g., if the material is posted publicly)
2. We cite the source (e.g., a comment in our code).

This is true whether we're working on a project in college or on a multi-year product after we've been in professional practice for decades.

Searching for documentation on a function, however, is *qualitatively different* from searching for the solution to a homework assignment. The former search is a quick and effective way to shore up our understanding. The latter is the gateway to academic dishonesty: cheating by plagiarism.

As mentioned (Section 9.1, item 4), even *looking* at code written by someone else as you try to solve a class assignment is expressly forbidden. The reason for this prohibition is simple: if you find someone else's solution to a homework assignment, you are no longer even *able* to solve the problem independently (or with your team). You can't "un-see" the existing solution. Your solution can no longer be your own—it's your repackaging of someone else's work. You are now faced with three options:

1. Don't submit a solution at all because any solution you construct would not be your own work. You will receive no credit.

2. Submit the work with an explicit citation of the source from which it is derived. You avoid the charge of plagiarism, but you will also receive no credit for the work because it's not yours.
3. Submit the work as if it is your own without citing the source. This is *outright plagiarism*. According to university and course policy, it could result in penalties ranging from a zero on the assignment, to failing the course, to expulsion from the university.

In other words, once you decide to search for answers for a homework assignment, if you want to be honest with yourself and others, you really have no good options.

You might try to skirt this fact by telling yourself: This course is *really* hard. The answers are out there *somewhere* on the internet anyway. Nobody is really harmed by this “one” infraction. I can pretty up someone else's code and pass it off as my own. I can put one over on my prof or TA. And so forth.

What you ought to do, however, is ask yourself: Do I want to be the kind of person who cheats? Am I willing to sell my professional birthright for a quick workaround? If I fail to act morally in this little thing, how can I expect to be entrusted with big things down the road? How will I feel when I'm fired from my job or sued for professional malpractice?

I know plagiarism is happening. I sympathize with the challenges posed by our curriculum. I was a student for *way* longer than you and faced similar pressure. What I'd ask are two things:

1. If you have committed plagiarism, admit to it, take a zero on that work, and clear your conscience.
2. Go and sin no more. Stop cheating. Do your own work. Be proud of what you yourself can accomplish with the intellectual gifts God gave you.

10 Support Services

Be aware of the following *excellent* support services available to you as a Taylor student.

10.1 Academic Assistance

The Academic Enrichment Center (AEC), located in the Zondervan Library, provides individualized academic skills help (e.g. test preparation, note taking, planning, etc.). Contact **Dr. Scott Gaier**, scgaier@taylor.edu.

10.2 Tutoring

Peer Tutoring Services, located in the AEC in Zondervan Library, provides free help to students in most content areas. For further information, contact **Darci Nurkkala**, drnurkkala@taylor.edu.

10.3 Library

The Zondervan Library helps students identify, obtain, and evaluate information and resources for papers, projects, and other academic work. Contact them for research assistance:

1. Email: zonlib@taylor.edu
2. Phone: 765/998-4357
3. In person at the **Ask** desk:
 - (a) Monday–Thursday: noon–midnight
 - (b) Friday: noon–8pm
 - (c) Saturday: 9am–8pm
 - (d) Sunday: 3pm–midnight
4. By appointment for consultation, especially for larger projects, email:
 - (a) **Lana Wilson**, lnwilson@taylor.edu
 - (b) **David Dunham**, david_dunham@taylor.edu

10.4 Writing Center

Writing Center tutors can help you on all of your writing in any stage of your writing process, but they will usually focus on content and organization before they look at grammar and style. Expect to be actively involved during your session, whether you are developing a better thesis, reorganizing your main points, or consulting a style manual to understand formatting rules. To arrange an appointment visit taylor.mywconline.com.

10.5 Students with Special Needs

The Academic Enrichment Center provides a variety of services for students who have disabilities. This includes, but is not limited to, mental, emotional, physical, and learning disabilities. Contact **Dr. Scott Barrett**, scott_barrett@taylor.edu, to learn more. If you need accommodations due to a disability, please also see me so that I can help accordingly.

10.6 Counseling Services

The stresses of academic life can be hard for anyone. Too often, mental health issues get ignored until they become unmanageable. Just as with physical well-being, we all need to stay on top of our mental health as well. Taylor has terrific counseling services available to help you navigate these issues. See the course web site for an up-to-date overview of available services and contact information.

This document updated August 31, 2021.