

CSE 4331/5331 DBMS Models and Implementation
Fall 2025, Modality: In-Person
(revised: Oct 18, 2025)

Instructor(s): Prof. Sharma Chakravarthy

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Instructor Office Hours: Tu/Th: 2:00 Pm to 3 Pm + by appointment (in person: ERB 632)

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Office Hours: TBD (Mon/Wed) + by appointment

Section Information: CSE 4331-001 and 5331 – 001

Time and Place of Class Meetings: Tu/Th 3:30 pm to 4:50 pm, WH 308

CANVASS URL: uta.instructure.com/

(For lecture notes, course projects, announcements, uploads, discussions, and grades)

Course Web Page:

<https://itlab.uta.edu/courses/cse5331And4331/current-offering/General/cse-4331-5331.htm>

Research URL: <https://itlab.uta.edu/>

(For those interested in BS/MS/PhD thesis or research projects)

Description of Course Content: DBMS system implementation involves implementation of several core modules, such as file support layer, buffer manager, index structures support, query optimizer, transaction manager (for concurrency control and recovery.) Other components such as SQL parsing, user-interaction, etc. are also needed. Introduction to advanced database models, such as cloud computing, Map/Reduce, and NoSQL DBMSs will be covered. Prerequisite: CSE 3330/CSE 5330, or consent of instructor.

Objective: The objective of this course is to understand the theoretical underpinnings as well as design and implementation of core technologies that are used in a relational database management system (RDBMS). Through a series of lectures and accompanying projects, students will understand and appreciate the implementation of techniques used for various modules, such as B+ tree index, buffer manager, transaction manager and recovery subsystems. We will introduce newer paradigms of data processing such as map/reduce and NoSQL to contrast it with relational DBMSs.

This course covers many systems aspects of Big Data Management and analysis through implementation projects to strengthen what you study in the course. Recommended for those interested in Big data management/Databases/Cloud Computing and for Data Analytics specialty

Course Outline: This course will cover various components of a Database Management system mainly from the systems/implementation viewpoint (as opposed to the users' viewpoint as in CSE 5330/3330 or Database I). Topics will be covered under four modules:

Module I: storage and indexing (File types, Buffer manager, B+ trees, Hash indexes, disk access analysis),

Module II: Transaction Management (concurrency control and recovery): ACID properties and their need, two-phase commit, ARIES recovery, relationship between this and the rest of the system,

Module III: Cloud computing/Big Data, Map/reduce paradigm and developing algorithms using M/R paradigm, and

Module IV: Query optimization (cost model-based query optimization, newer approaches.)

Student Learning Outcomes: A clear understanding of the inner-workings of a relational DBMS and other advanced data processing technologies. A detailed Understanding of different modules as well their interactions, and implementation of some of the modules of a relational DBMS as projects. Ability to learn and use a number of well-understood and tested approaches/techniques and apply it to new real-world problems.

Prerequisites

- CSE 3330/5330 or equivalent (e.g., undergraduate or graduate intro DBMS course)
- Consent of the instructor

Required Textbooks and Other Course Materials

- Database management Systems by R. Ramakrishnan and J. Gehrke (Third Edition) ISBN No. 0-07-246563-8, McGraw Hill publishers, 2003.
- Lecture slides will be made available on the course web site.

Course Schedule is posted on Canvas as a separate document by the 1st day of classes which clearly indicates the test dates and project assignments and due dates in addition to the details of material covered in each lecture.

"As the instructor for this course, I reserve the right to adjust this schedule in any way that best serves the educational needs of the students enrolled in this course. – Sharma Chakravarthy"

Descriptions of major assignments and examinations: Project: Since the emphasis of this course is on core DBMS modules, there will be a number of hands-on implementation/usage analysis projects in SQL/Java/C++/Scala as part of this course. I plan on using Minibase for some of the projects on implementing Heap files, buffer manager, join algorithms, B+ trees. Components of a transaction manager may be implemented using Java/C/C++. Map/Reduce may use Hadoop/Spark for understanding the use of different number of mappers/reducers. Students may be asked to present the details of their implementation in the class. Evaluation of the project will have a demo that includes Q/A session with the students to discuss the approach taken and to understand the learning outcomes. You may use ACCESS facility for Hadoop projects.

Cheating, Plagiarism, and Collusion: These will be taken seriously and if established, the penalty is an **automatic F grade** (for both in case of teams). This will be discussed in detail on the 1st day of classes. It is a requirement as an instructor to file appropriate forms for this with the university judicial office.

Use of chatGPT for this course: Use of chatGPT in any of its avatars is explicitly prohibited for solving projects. That is, generating partial or complete code or SQL. **You can perhaps benefit from chatGPT use for understanding concepts (for the project or class lectures) that are not clear and confirm them by**

asking questions in the class. You need to clearly understand that chaptGPT gives answers to any question you ask and it is your responsibility to determine whether it is correct or not. Blindly assuming it is correct can be a costly mistake!

Technology Requirements: You will be using SQL, Java and C/C++ for programming in this course. You will do a map/Reduce project using Java on expanse. Use of Spark is optional. Get familiar with Linux on omega.uta.edu. you will be using Oracle DBMS on Omega. Your oracle login id is the same as your netid. Your default can be looked up on OIT website. Most of the projects will build upon given code (as in industry) and not from scratch.

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator of student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, **I encourage every student to not only attend the lectures but ask questions and make the class interactive. Based on my experience, this provides the best approach to learn and do well in the course!** However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student, a grade of F, faculty report must indicate the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

~~This is SYNCONLINE modality course to start with All lectures will be online using TEAMS in real time and the video will be available for later viewing. Tests may be conducted in person or online and will be communicated to the students on Canvas and during the lecture. All tests/exams, if online, will use lock down browser with respondus. Students should familiarize themselves with taking online tests/exams using lockdown browser and respondus. You may have to answer on separate sheets, scan them, and upload them on to Canvas.~~

Grading: There will be 3 hands-on projects that will constitute approximately 45% of the overall grade. There will be 3 in-class tests/exams that will constitute approximately 40% of the overall grade. Rest of the 15% is for pop quizzes (at least three during the semester.) A Homework on query processing using Oracle on Omega using SQL on a large IMDb data base may be given for practice. Class participation (asking questions, discussion) and presentation will be taken into consideration during grading. This is an initial proposal. The instructor reserves the right to re-distribute the percentages if deemed necessary. The students may be asked to make an in-class presentation on the project experiences. Class participation is important for doing well on the course. This includes visiting the Instructor and the GTA during office hours to understand the material and complete projects. **Grading for undergraduates will be done separately from graduates in a combined offering.**

Teams for projects for this course can have at most 2 members. These projects can also be done alone. For projects, as part of the document, what has been designed and implemented by each partner (division of labor for a team project) should be clearly stated and documented in the report submitted for each project. All team members will get the same grade (including same penalty in case of plagiarism, collusion, etc.) on the project. Hence, choose your project partner wisely. Change of partners during the semester will not be allowed.

No pre-defined cutoffs in my Couse. Based on past observations, typically, class average corresponds to a B grade. One standard deviation above the class average is guaranteed to earn an A. one or half standard deviation below class average is likely to be a C. Passing grade is 50%. Note that you must consistently do well on all projects and tests/exams/quizzes to **earn an A grade. Depending on class**

performance with respect to average, instructor reserves the right to modify the above to match the class performance meaningfully.

Expectations for Out-of-Class Study: Beyond the time required to prepare for and attend each class meeting, students enrolled in this course should expect to spend at least an additional 3 hours per week in course-related activities, including reading required materials, completing assignments, preparing for exams, etc. Meet the instructor or the TA for any doubts on projects or class lecture material.

Assignments and Deadlines:

- **All the assignments must be submitted through Canvass.** We will NOT take hardcopy or email submission, unless the university verifies that Canvass was malfunctioning or unavailable. If you are not able to submit through Canvass due to its technical failure, you can email your assignment to us, together with a screenshot showing the technical failure. We will verify with the university.
- **Everything is due by 11:59pm on the due date.** The deadline is automatically managed by Canvass. If you are allowed to submit assignments/home works late, you automatically lose designated points as specified in the project assignment after the due time, till you reach 0. (Each individual assignment is 100 points.) We cannot waive the penalty, unless there was a case of illness or other substantial impediment beyond your control, **with documented evidence**. Please come and discuss with me or the TA. Penalty will be levied on a day basis. No partial-day penalties.

Make-up tests/quizzes/Exams: No makeup tests or exams or quizzes (including pop up) will be given unless a student produces a justifiable, documented reason. The class schedule, exam, and project due dates are tentative. Project deadlines and exam dates may be changed (with enough notice) based on the progress made in the class.

How to Do Well in This Course: Based on the feedback I have received over the years, Students who get the most out of this course will be the ones who keep up with the material covered in the class on a regular basis. If you want to do well, attend all the lectures, ask questions, read the assigned sections of the book/papers, and start early on your projects. Working out the assigned practice questions and questions from book chapters will immensely help in doing well on quizzes/tests. If you are having difficulty, you owe it to yourself to get help. **We will be more than happy to help you. Don't be lazy or afraid to come and see us. We hold extensive office hours. If you can't make it to office hours but really need help, contact one of us for an appointment. I sincerely want all of you to do well. It is your responsibility to check the web site at least twice a week.**

- **Grade Grievances:** Once the grade of a quiz/exam/project is distributed, you will have 5 business days to dispute it and get it re-evaluated. No re-evaluation will be entertained after the 5-day period. For projects, as part of the document, what has been designed and implemented by each partner (if it is done as a team) should be clearly stated and documented. **All team members will get the same grade/penalty on the project. So, choose your partner (if you want to do as a team) wisely!**

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wwwb.uta.edu/aao/fao/>).

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official

documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Title IX: The University of Texas at Arlington is committed to upholding U.S. Federal Law “Title IX” such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit www.uta.edu/titleIX.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Institution Information

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the [Institutional Information](https://resources.uta.edu/provost/course-related-info/institutional-policies.php) page (<https://resources.uta.edu/provost/course-related-info/institutional-policies.php>) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

The outcome of any cheating, plagiarism or collusion either on the project or on the quiz/exam/hw will be an automatic Fail grade (F) in the course. Use of Git or downloads from online or the use of ChatGPT is not

allowed for any submission in this course! For projects, all members of the team will receive the same grade/penalty; so, choose your partner wisely and make sure you are aware of what your partner is doing!

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as “lecture,” “seminar,” or “laboratory” shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

Additional Information

Face Covering Policy: *While the use of face coverings on campus is no longer mandatory, all students and instructional staff are strongly encouraged to wear face coverings while they are on campus. This is particularly true inside buildings and within classrooms and labs where social distancing is not possible due to limited space. If a student needs accommodation to ensure social distancing in the classroom due to being at high risk they are encouraged to work directly with the Student Access and Resource Center to assist in these accommodations. If students need masks, they may obtain them at the Central Library, the E.H. Hereford University Center’s front desk or in their department.*

Emergency Exit Procedures: Should we experience an emergency event that requires evacuation of the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, do not take an elevator but use the stairwells instead. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Students are encouraged to subscribe to the MavAlert system that will send information in case of an emergency to their cell phones or email accounts. Anyone can subscribe at [Emergency Communication System](#).

Academic Success Center: The Academic Success Center (ASC) includes a variety of resources and services to help you maximize your learning and succeed as a student at the University of Texas at Arlington. ASC services include supplemental instruction, peer-led team learning, tutoring, mentoring and TRIO SSS. Academic Success Center services are provided at no additional cost to UTA students. For additional information visit: [Academic Success Center](#). To request disability accommodations for tutoring, please complete this [form](#).

[The IDEAS Center \(https://www.uta.edu/ideas/\)](https://www.uta.edu/ideas/) (2nd Floor of Central Library) offers **FREE** [tutoring](#) and [mentoring](#) to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. Students can drop in or check the schedule of available peer tutors at www.uta.edu/IDEAS, or call (817) 272-6593.

Emergency Phone Numbers

Enter the UTA Police Department’s emergency phone number into your own mobile phone. In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381

Library Information

Research or General Library Help

Ask for Help

- [Academic Plaza Consultation Services](http://library.uta.edu/academic-plaza) (library.uta.edu/academic-plaza)
- [Ask Us](http://ask.uta.edu/) (ask.uta.edu/)
- [Research Coaches](http://libguides.uta.edu/researchcoach) (http://libguides.uta.edu/researchcoach)

Resources

- [Library Tutorials](http://library.uta.edu/how-to) (library.uta.edu/how-to)
- [Subject and Course Research Guides](http://libguides.uta.edu) (libguides.uta.edu)
- [Librarians by Subject](http://library.uta.edu/subject-librarians) (library.uta.edu/subject-librarians)
- [A to Z List of Library Databases](http://libguides.uta.edu/az.php) (libguides.uta.edu/az.php)
- [Course Reserves](https://uta.summon.serialssolutions.com/#!/course_reserves) (https://uta.summon.serialssolutions.com/#!/course_reserves)
- [Study Room Reservations](http://openroom.uta.edu/) (openroom.uta.edu/)