

I320D: Database Design

Semester: Fall 2023 (28375)

Time and Location: Tuesday 2:00-5:00PM at JES A307A

Instructor: Ying Ding, ying.ding@ischool.utexas.edu, UTA5.432

TA:

Office Hours:

Instructor: TBD or <https://utexas.zoom.us/j/5128555388> or by appointment;

TA:

Course Description

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Database is the foundation of Data Science. It provides the unique design to store, retrieve, and manage data. Data become the essential gas to power the generative AI. How to model data, encode context, enforce business rules, and achieve efficiency are critical for database design. This course provides the introductory understanding of relational database design with the focus on three parts. The first part is centered around the database design lifecycle by introducing business rules, ER diagram, normalization, and UML chart. The second part talks about database query language SQL by explaining concepts and providing examples. The third part gives you the forward introduction of XML database which is the commonly used NoSQL database. The learning content will be delivered in the variety of exercises including lectures, tutorials, class activities, individual assignments, group assignments, and group projects. This course empathizes peer learning, hands-on practices, forward exploring, and risk taking.

Pre-Requisites

No pre-requisites for this course.

Learning Outcomes

After attending this course, you should be able to achieve the following goals:

- Have the basic understanding of database design lifecycle
- Be familiar with relational database concepts
- Gain sufficient practices on SQL
- Grasp the brief introduction of XML database as one example of NoSQL database

How Will You Learn?

Statement of Learning Success

Your success in this class is important to me. We all learn differently, and everyone struggles sometimes. You are not, ever, the only one having difficulty! If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we will develop

strategies to meet both your needs and the requirements of the course. I also encourage you to reach out to the student resources available through UT and I am happy to connect you with a person or Center if you would like.

Teaching Modality Information

Classes will be in-person which requires in-person attendance.

Communication

The course Canvas site can be found at utexas.instructure.com. Please email me through Canvas or using my email above (the preferred way). You are responsible for ensuring that the primary email address you have recorded with the university is the one you will check for course communications because that is the email address that Canvas uses.

Asking for Help

You can reach me anytime by just sending me an email using my UT email address above. If you have specific coding issues with SQL or python, please feel free to reach out to our TA using the email above. I will host the office hours each week either at my zoom or in my office. There is no formality, simply drop by if you have any questions to discuss or simply just want to chat. All are welcome. TA will host his office hours each week as well. If you have any specific questions about data, coding, and homework, please feel free to talk to him.

Diversity, Equity and Inclusion

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed, and that the diversity that students bring to this class can be comfortably expressed and be viewed as a resource, strength and benefit to all students. Please come to me at any time with any concerns.

Services for Students with Disabilities

The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Services for Students with Disabilities (SSD). Please refer to SSD's website for contact and more information: <http://diversity.utexas.edu/disability/>. If you are already registered with SSD, please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.

Course Requirements

Course Materials

Recommended books

Carlos Coronel and Steven Morris (2018). Database Systems: Design, Implementation, & Management (13th Edition). CenGage (ISBN10: 1337627909)

Rod Stephens (2008). Beginning Database Design Solutions. Wiley Publishing (ISBN10: 0470385499)

Bill Karwin (2017). SQL Antipatterns: Avoiding the pitfalls of database programming (ISBN10: 1934356557)

Michael J Hernandez (2020). Database Design for Mere Mortals (ISBN10: 0136788041)

Recommended Readings:

Data

Kaggle Datasets: <https://www.kaggle.com/datasets>

UC Irvine ML Datasets: <https://archive.ics.uci.edu/>

Government Data: <https://data.gov/>

Software

MySQL: <https://www.mysql.com/products/workbench/>

Python Coding using Google Colab: <https://colab.research.google.com/>

Oxygen: <https://www.oxygenxml.com/>

Required Devices

A laptop is required and should be brought to the classroom.

Classroom Expectations

Class attendance and participation are important to build a welcoming and engaging learning environment for all of us. They are required and count 10% of your final grade. If you cannot attend a class, please send me your written excuse via email.

Course Outline

All instructions, assignments, readings, rubrics and essential information will be on the Canvas website at utexas.instructure.com. Check Canvas regularly. Changes to the schedule may be made at my discretion if circumstances require. I will announce any such changes in class and will also communicate them via a Canvas announcement.

Schedule (tentative)

Date	Lecture (60mins)	Class Activities (45mins)	Lab/Tutorial (60mins)	Notes
L1- 8/22	Introduction, Knowing each other		Course Overview	Form the expert group (1- DB Design, 2-SQL, 3-Data Vis, 4-NoSQL)
L2- 8/29	Database Overview	Install/Access MySQL	T1: DB Design	Form a group randomly for self-learning tutorial about database design
L3- 9/5	Database design	Group 1 - DB Design	T1: DB Design	

L4-9/12	Relational Database	Group 2 - SQL	T2: Business Rule and ER Diagram	Your first table Due (MySQL)
L5-9/19	E-R Modeling	Group 3 – Data Vis	T2: Business Rule and ER Diagram	
L6-9/26	Normalization	Group 4- NoSQL	T3: Normalization	Business Rule and ER Diagram due
L7-10/3	Design Studio	Group 1 - DB Design	Work on your database design studio assignment	Normalization due
L8-10/10	UML	Group 2 - SQL	Work on your database design studio assignment	
L9-10/17	SQL Introduction	Group 3 – Data Vis	T4: MySQL	Database Design Studio Mid Term Feedback
L10-10/24	SQL Basics	Group 4- NoSQL	T4: MySQL	
L11-10/31	SQL Advanced	Group 1 - DB Design	T5: SQL in Python	MySQL
L12-11/7	Indexing	Group 2 - SQL	T5: SQL in Python	Group Assignment Due
L13-11/14	XML Database	Group 3 – Data Vis	Grading assigned group assignment	SQL in Python due
	Fall break			
L14-11/28	XQuery	Group 4- NoSQL	Grading assigned group assignment	Database Design Studio due
L15-12/5	Final Presentation			Final Group Report Due

Course Assignments and Grading

Assignments

Individual Assignments (55%)

1. Your first Table (5%)
2. Business Rule and ER Diagram (10%):
3. Normalization (5%):
4. MySQL (10%): Build a database and Develop 10 SQL queries in MySQL (powerpoint slides showing steps of building a database, business rules, ER diagram, SQL queries, meaning of each query, screenshots for results)
5. SQL in Python (10%): Load datasets and develop 10 SQL queries using Python (powerpoint slides, python code, screenshots of results).

6. Database Design Studio (15%): Design a database based on an application you selected or select a customer who has a need to build a database (powerpoint slides). It should contain the full process: 1) description of the data, 2) user profiles, 3) business rules, 4) ER diagram, 5) normalization, 6) build the database in one database platform, 7) 10 SQL queries, 8) evaluation, and 9) reflections and future improvement.

Group Assignment (15%): Self-learning tutorial about database design (powerpoint slides, code, and video)

- Instructor will pair two students to form a group
- Your group can select a topic to develop a tutorial about any topics related to database design, for example: 1) one real world example, 2) introduce a new database (e.g. MongoDB, Neo4J), 3) introduce new tools using database (e.g., Tableau, python packages), 4) digital story storytelling, 5) latest machine learning or deep learning methods using databases (e.g., TabTransformer), 6) ChatGPT and database, or more.
- Peer learning together: Another team will be assigned to learn the materials you have developed, provide feedback, and grade your tutorial
- The best way to learn is to be able to teach others: create slides and videos, and upload them to Canvas.

Group Project (20%): For a team with no more than 3 members to work on an interesting topic related to database design. Some examples are (but not limited to):

- Customer driven database design (reaching out to the community to find customers)
- Indexing technologies to improve data search
- Digital Storytelling using python visualization and databases
- Database application in specific domains
- Challenging SQL queries
- Using SQL for business intelligence
- Using SQL to prepare data or analyze features for machine learning tasks
- Large Language Model (TabTransformer)

Output: A report with less than 5 pages (aiming for a workshop paper using ACM template: <https://www.acm.org/publications/taps/word-template-workflow>), powerpoint slides, code, presentation/demo

Class presentations, participations, and final presentation (10%)

Late Work and Making Up Missed Work

Late work without proper excuse is not accepted. Each late work is subject to a 1-point grade reduction for every one hour late.

Absences

Each absence in class without proper excuse will get 1-point grade reduction from your final grade.

Equitable Accommodation

If you want to improve your grade, adding extra work to your assignments can be considered. Please discuss this with your instructor.

Grade Breaks

Grade	Cutoff
A	94%
A-	90%
B+	87%
B	84%
B-	80%
C+	77%
C	74%
C-	70%
D+	67%
D	64%
D-	60%
F	<60%

Course Policies and Disclosures

Academic Integrity Expectations

Students who violate University rules on academic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on academic dishonesty will be strictly enforced. For further information, please visit the Student Conduct and Academic Integrity website at: <http://deanofstudents.utexas.edu/conduct>.

Getting Help with Technology

Students needing help with technology in this course should contact the ITS Service Desk or email iSchool Helpdesk <help@ischool.utexas.edu> for software, hardware, or other technology available at our iSchool.

Content Warning

Our classroom provides an open space for the critical and civil exchange of ideas. Some readings and other content in this course will include topics that some students may find offensive and/or traumatizing. I'll aim to forewarn students about potentially disturbing content and I ask all students to help to create an atmosphere of mutual respect and sensitivity.

Religious Holy Days

By UT Austin policy, you must notify me of your pending absence as far in advance as possible of the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Names and Pronouns

Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. I will gladly honor your request to address you by your chosen name and by the gender pronouns you use. Class rosters are provided to the instructor with the student's chosen (not legal) name, if you have provided one. If you wish to provide or update a chosen name, that [can be done easily at this page](#), and you can add your pronouns to Canvas.

Land Acknowledgment

I would like to acknowledge that we are meeting on the Indigenous lands of Turtle Island, the ancestral name for what now is called North America. Moreover, I would like to acknowledge the Alabama-Coushatta, Caddo, Carrizo/Comecrudo, Coahuiltecan, Comanche, Kickapoo, Lipan Apache, Tonkawa and Ysleta Del Sur Pueblo, and all the American Indian and Indigenous Peoples and communities who have been or have become a part of these lands and territories in Texas.

University Resources for Students

SERVICES FOR STUDENTS WITH DISABILITIES (SSD)

The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Services for Students with Disabilities (SSD). Please refer to SSD's website for contact and more information: <http://diversity.utexas.edu/disability/>. If you are already registered with SSD, please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.

COUNSELING AND MENTAL HEALTH CENTER (CMHC)

All of us benefit from support during times of struggle. Know you are not alone. If you or anyone you know is experiencing symptoms of stress, anxiety, depression, academic concerns, loneliness, difficulty sleeping, or any other concern impacting your wellbeing – you are strongly encouraged to connect with CMHC. The Counseling and Mental Health Center provides a wide variety of mental health services to all UT students including crisis services, counseling services with immediate support and well-being resources. Additionally, CARE Counselors are located within the academic schools and colleges. These counselors get to know the concerns that are unique to their college's students. For more information on CMHC, visit <https://cmhc.utexas.edu> or call 512-471-3515.

UNIVERSITY HEALTH SERVICES (UHS)

Your physical health and wellness are a priority. University Health Services is an on-campus high-quality medical facility providing care to all UT students. Services offered by UHS include general medicine, urgent care, a 24/7 nurse advice line, women's health, sports medicine, physical therapy, lab and radiology services, COVID-19 testing and vaccinations and much more. For additional information, visit <https://healthyhorns.utexas.edu> or call 512-471-4955.

SANGER LEARNING CENTER

Did you know that more than one-third of UT undergraduate students use the Sanger Learning Center each year to improve their academic performance? All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit <https://ugs.utexas.edu/slc> or call 512-471-3614 (JES A332)."

STUDENT EMERGENCY SERVICES (SES)

Student Emergency Services in the Office of the Dean of Students helps students and their families during difficult or emergency situations. Assistance includes outreach, advocacy, intervention, support, and referrals to relevant campus and community resources. If you need to be absent from class due to a family emergency, medical or mental health concern, or academic difficulty due to crisis or an emergency situation, you can work with Student Emergency Services. SES will document your situation and notify your professors. If immediate mental health assistance is needed, call the Counseling and Mental Health Center (CMHC) at 512-471-3515 or you may also contact Bryce Moffett, LCSW (iSchool CARE counselor) at 512-232-2983. Outside CMHC business hours (8a.m.-5p.m., Monday-Friday), contact the CMHC 24/7 Crisis Line at 512-471-2255. Additional information is available at <https://deanofstudents.utexas.edu/emergency/> or by calling 512-471-5017.

Important Safety Information

If you have concerns about the safety or behavior of fellow students, TAs or professors, contact BCCAL (the Behavior Concerns and COVID-19 Advice Line) at <https://safety.utexas.edu/behavior-concerns-advice-line> or by calling 512-232-5050. Confidentiality will be maintained as much as possible, however the university may be required to release some information to appropriate parties.

CLASSROOM SAFETY AND COVID-19

To help preserve our in-person learning environment, the university recommends the following.

- Adhere to university [mask guidance](#). Masks are strongly recommended, but optional, inside university buildings for vaccinated and unvaccinated individuals, except when alone in a private office or single-occupant cubicle.
- [Vaccinations are widely available](#), free and not billed to health insurance. The vaccine will help protect against the transmission of the virus to others and reduce serious symptoms in those who are vaccinated.
- [Proactive Community Testing](#) remains an important part of the university's efforts to protect our community. Tests are fast and free.
- We encourage the use of the [Protect Texas App](#) each day prior to coming to campus.
- If you develop COVID-19 symptoms or feel sick, stay home and contact the [University Health Services](#)' Nurse Advice Line at 512-475-6877. If you need to be absent from class, contact [Student Emergency Services](#) and they will notify your professors. In addition, to help understand what to do if you have been had close contact with someone who tested positive for COVID-19, see this [University Health Services link](#).
- [Behavior Concerns and COVID-19 Advice Line](#) (BCCAL) remains available as the primary tool to address questions or concerns from the university community about COVID-19.
- Students who test positive should contact [BCCAL](#) or self-report (if tested off campus) to [University Health Services](#).
- Visit [Protect Texas Together](#) for more information.

TITLE IX DISCLOSURE

Beginning January 1, 2020, Texas Senate Bill 212 requires all employees of Texas universities, including faculty, to report any information to the Title IX Office regarding sexual harassment, sexual assault, dating violence and stalking that is disclosed to them. Texas law requires that all employees who witness or receive any information of this type (including, but not limited to, writing assignments, class discussions, or one-on-one conversations) must be report it. If you would like to speak with someone who can provide support or remedies without making an official report to the university, please email advocate@austin.utexas.edu. For more information about reporting options and resources, visit <http://www.titleix.utexas.edu/>, contact the Title IX Office via email at titleix@austin.utexas.edu, or call 512-471-0419. Although graduate teaching and research assistants are not subject to Texas Senate Bill 212, they are still mandatory reporters under Federal Title IX laws and are required to report a wide range of behaviors we refer to as sexual misconduct, including the types of sexual misconduct covered under Texas Senate Bill 212. The Title IX office has developed supportive ways to respond to a survivor and compiled campus resources to support survivors.

Faculty members and certain staff members are considered “Responsible Employees” or “Mandatory Reporters,” which means that they are required to report violations of Title IX to the Title IX Coordinator. I am a Responsible Employee and must report any Title IX-related incidents that are disclosed in writing, discussion, or one-on-one. Before talking with me or with any faculty or staff member about a Title IX-related incident, be sure to ask whether they are a responsible employee. If you want to speak with someone for support or remedies without making an official report to the university, email advocate@austin.utexas.edu For more information about reporting options and resources, visit the Title IX Office or email titleix@austin.utexas.edu.

CAMPUS SAFETY

The following are recommendations regarding emergency evacuation from the [Office of Campus Safety and Security](#), 512-471-5767,

- Students should sign up for Campus Emergency Text Alerts at the page linked above.
- Occupants of buildings on The University of Texas at Austin campus must evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.
- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors. Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
- For more information, please visit [emergency preparedness](#).