

ADAR 2020 501: Data Design, Analysis and Representation Syllabus

Professor: Dr. Dev Mukherjee

Spring, 2025

E-mail: Debasish.Mukherjee@unt.edu

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| Office Hours: Mon, Wed 1:30-2:30 | Class Hours: Tue - Thu 4:00 - 5:20 p.m. |
| Office: FRLD 366 | Classroom: FRLD 234 |

# Course Description

Introduction to basic concepts in data management, statistics and visualization of data patterns. Use of real-world datasets and know how to deal with incomplete and inconsistent information to produce reliable insights from structured and unstructured data. Topics include data generating processes, data sources and file formats, data management, wrangling and mining.

**Prerequisites**

Prerequisite(s): DSCI 2710, MATH 1680 or equivalent.

# Course Learning Outcomes

At the end of the course, you should:

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1. Describe different data sources and file formats.
2. Describe key concepts of data management.
3. Visualize and explore data.
4. Data Wrangling to ingest and manage data to be used for analysis
5. Design and Model data
6. Data models and types of data for Transaction vs Decision Making
7. Querying data and SQL
8. Case studies to understand and present data and database concepts

# Required Courseware & Materials

* Workplace Software & Skills(OpenStax) 2023, Rice University
* **Microsoft Excel**, installed in computer labs and available to download (Office 365) at [https:](https://aits.unt.edu/support/office365apps)
* [//aits.unt.edu/support/office365apps.](https://aits.unt.edu/support/office365apps)
* **SQL Software** to be used for exercises will be shared before the modules are started and will be made available in canvas for download
* **Canvas** [(https://unt.instructure.com/login/ldap)](https://unt.instructure.com/login/ldap): The lecture notes, case files, case quizzes, all of the exams and other material will be posted on Canvas so please make sure you keep up and check Canvas often.

# Course General Guidelines

**Brief notes about this course:**

* This course will include challenging material; however, the tests and assignments are designed so that any of you who is willing to put in the time to attend class consistently, work extensively outside of class, use or develop good study strategies, and contact me when you are struggling, can develop a thorough understanding of the course material and ultimately succeed in the course.
* It is important to understand the different types of information we use to design a data repository and make data interpretation. Relationships among different pieces of information allow to organize and group data in meaningful and efficient ways.
* As for data representations, it is key to understand the context of the data generating process. Graphs and charts can be easy to understand but sometimes cannot reflect the whole story.

**Guidelines**

* I encourage you to **study** all the posted material in the course. You are strongly encouraged to try and solve the problems included in the lecture slides individually or in group. Replicate all the steps to solve the problems, not simply verify that the provided solutions “make sense”.
* You should **work** independently or in groups on the homework assignments and case studies. The case studies are intended to assist you in better structuring the learning time you spend on mastering the course material. Exam questions will mostly refer to case analysis and assignments. The best way to prepare for exams is to go over the exercises seen in class or in homework/assignments.
* Therefore, **doing the assignments is essential for success in this course**. In fact, the assignments constitute a large portion of your grade in this course. You are encouraged to keep up with the homework and meet the submission deadlines.

# Assessment

To demonstrate your ability and performance in Data Design & Analysis, you will be evaluated on a number of homework assignments, case studies, and exam questions. Rather than being purely numerical, assignments, case problems and exams will require interpretation and thorough analysis of the problems presented showing a clear understanding of the topics and relationship with real-world applications.

You will be provided with varied material to assess four main learning areas:

* Reflective: based on videos, articles, books/chapters, or guest testimonials students should respond based on a set of either provoking questions or reflections with supporting statements.
* Case analysis: a real world example of the issues or concepts seen in class, students are asked to analyze problems and research, test and present potential solutions.
* Examination: standard formal tests
* Discussions: exchange of ideas on every class meeting will take place, discussion forums are opened electronically and brought to class discussion.

## Grading Structure

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| --- | --- |
| 1 Midterm | 200 pts |
| 1 Final exam (cumulative) | 200 pts |
| 8 Assignments | 400 pts (50 points each) |
| 2 Case Study Quizzes | 200 pts (100 points each) |
| **TOTAL** | **1,000 points** |
| *extra-credit* | 5 pts for assignment completed on time 5 pts for completing syllabus quiz *TBD* pts for SPOT evaluation |

* **Exams**: The midterm and the final exams will be available on Canvas. For each exam you will be given the full class time to respond it. Both exams are in-class. You should be ready to take the timed exam at class time. The Final Exam is comprehensive and it is expected to be completed in max 120 minutes.
* **Assignments**: There are 8 assignments that need to be completed throughout the course. Assignments will be posted on Canvas. The due dates for the problem sets are listed on this syllabus. These form a significant part of the course grade and must be completed by the due date to receive full credit as well as bonus points (five extra credit points per assignment). Late submissions still receive full credit, provided they are completed by the end of day on May 12th, 2023; however, no bonus points are earned. No credit is awarded for any assignment completed after this date.
* **Case Study**: The course will present you with two case studies related to datasets with different real life applications. The case studies introduce the problems for you to work on possible solutions and communicate the findings. You will be trained to use some sample reports to practice on how to develop report items that are used in industry or social problems by communicating insights gained from a non-technical standpoint. These are an important part of the course grade. The case studies will be posted on Canvas and the initial due dates are posted in this syllabus. Case 2 it is highly connected with your PDA or APDA projects. So no initial instructions on Case 2 until we know more about your projects. The due dates can change throughout the course, please check regularly Canvas for any changes in date submissions.
* **Letter Grades**: If you achieve the following thresholds, you are guaranteed to receive the letter grade listed next to them:

≥ 900 points (or ≥ 90%) → A

≥ 800 points (or ≥ 80%) → B

≥ 700 points (or ≥ 70%) → C

≥ 600 points (or ≥ 60%) → D

< 600 points (or < 60%) → F

* **Extra Credit**: There are some opportunities for you to earn extra credit to push your grade to the next grade letter:

*Assignment submission*. - Each assignment that you finish on time (according to the due dates posted in this syllabus) earns you 5 extra credit points. That means a student who finishes all problem sets on time will receive 40 points in addition to the 400 points for the assignments.

*Syllabus quiz*. - Since this is the main document this course is using to pursue the learning outcomes, it is critical that you read it thoroughly and understand each item on it. You can respond a quiz related to the content of this syllabus and earn 5 extra-credit points. The due date is posted in the syllabus as well, but it has to be completed on the first week of the course.

*SPOT evaluation*. - I will give ec points for those who respond the course evaluation at the end of the semester. You will have to send me proof of your submission to get access to this extra-credit points.

These extra credit points are added to your total, but the maximum score is still out of 1,000 points.

# University and School Policies and my course learning mindset

* DIVERSITY & INCLUSION: As members of the UNT community, we have all made a commitment to be part of an institution that respects and values the identities of the students and employees with whom we interact. UNT does not tolerate identity-based discrimination, harassment, and retaliation so we will work as a class to collaborate in ways that encourage inclusivity. Although disagreements and debates are encouraged, personal attacks are unacceptable. Together, we can ensure a safe and welcoming classroom for all.
* CAREGIVER RESPONSIBILITIES: I have great respect for students who are balancing their pursuit of education with the responsibilities of caring for children or other family members. If you run into challenges that require you to miss a class, or if your caregiving responsibilities are interfering with your ability to engage in learning, please contact me. There may be some instances of flexibility we can offer to support your learning.
* STAY INFORMED: Access regularly the course material posted on Canvas. If you feel that you are struggling with the material, please contact me.
* COMPLAINTS: I value the many perspectives students bring to our classroom. Please work with me to create a classroom culture of open communication, mutual respect, and inclusion. All discussions should be respectful and civil. If you ever feel like this is not the case, please stop by my office and let me know. We are all learning together.If you wish to register a complaint, you should first discuss your complaint with me. If you wish to carry it further, contact Dr. Dianne Gravley (the program director) and then other instances in New College, but only after first discussing it with your instructor.
* EXAMS: Even though exams are stressing, you are perfectly capable of solve them successfully. If you are under extenuating circumstances please reach out to me as soon as possible to receive support. I normally require written requests to fulfill UNT regulations. We can then discuss alternative arrangements.
* LEARNING SUPPORT: I’m here for you. My aim is to facilitate your learning process. Please do not hesitate to ask questions to me, (the professor, Dr. Palao). I will answer to your questions as quick as possible if you email me. Sometimes, similar questions may be raised by some of you, so in those cases I will post an announcement in Canvas to make sure everyone has the information. So, when you ask a generic question, others can benefit from your question. Since we do meet in person in-class questions are critical, because questions are automatically available to everyone in the classroom.
* WITHDRAWING / DROPPING THE COURSE: Keep in mind that if you are considering to withdraw the class, make sure you received all the possible support before. If you still feel necessary to do so, please check the academic calendar for properly withdraw before the scheduled last drop day. If you stop attending class, you should execute the drop procedure since failure to do so will result in a grade of “F” which cannot be changed.
* ACADEMIC INTEGRITY: This course adheres to the UNT policy on academic integrity. The policy can be found at [https://vpaa.unt.edu/fs/resources/academic/integrity.](https://vpaa.unt.edu/fs/resources/academic/integrity) Remember that if you engage in academic dishonesty you will receive a failing grade on the test or assignment, or a failing grade in the course. In addition, the case may be reported to the UNT Dean of Students/Academic Integrity Office, which maintains a database of related violations.

Students are expected to read <https://policy.unt.edu/policy/06-003> UNT’s Student Standards of Academic Integrity with defines academic dishonesty and sets out the consequences of unethical behavior.

* STUDENTS WITH DISABILITIES: The New College complies with the Americans with Disabilities Act (ADA) in making reasonable accommodations for qualified students with disability. If you have an established disability you should register with the Office for Disability Accommodation (ODA) and receive further instructions. Please see contact me as soon as possible if you have any questions.
* DEADLINES: Dates of drop deadlines, final exams, etc., are published in the university catalog and the schedule of classes. Please be sure you keep informed about these dates.
* SPOT: The Student Perceptions of Teaching (SPOT) is a requirement for all organized classes at UNT. This short Web-based survey will be made available to you at the end of the semester/session, providing you a chance to comment on how this class is taught. I am very interested in the feedback I get from students, as I work to continually improve my teaching. I consider SPOT to be an important part of your participation in this class.
* INCOMPLETE GRADE (I): The grade of "I" is not given except for rare and very unusual emergencies, as per University guidelines. An “I” grade cannot be used to substitute your poor performance in class. Do not let that happen and contact me as soon as possible!
* CAMPUS CLOSING: In the event of an official campus closing, please check your UNT e-mail for instructions on how to turn in assignments, how the due dates are modified, etc.

# Schedule and weekly learning goals

*The description and timelines contained in the syllabus are subject to change at Professor’s discretion based on the group learning’s pace or other events that may impact the current schedule.*

It is meant to be a guide and several items are subject to change. Exams may be moved in time & will be announced. I STRONGLY recommend that you adhere to the schedule below. This way, you should progress at a reasonable, sustainable pace. You will also be able to keep up with the Homework deadlines and Exam dates.

# Schedule, weekly topics and assignment, exams

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| --- | --- | --- | --- | --- |
| **Main Topic** | **Week** | **Dates** | **Sub Topics** | **Dues**  **Assignments,**  **Cases,**  **& Exams** |
| Data Management – Intrdoduction, Visualization, Wrangling, Data Models/Design | Week 1 | 13 Jan | Introductions & Course Syllabus |  |
| 15 Jan | **L0. Introductory concepts:**  Data & Analytics |  |
| Week 2 | 20 Jan | **L.1 Data Management:** Data & Analytics | Break – MLK Day |
| 22 Jan | **L.1 Data Management:**  Data Visualization |  |
| Week 3 | 27 Jan | **L.2 Data Management**  Data Visualization |  |
| 29 Jan | **L.2 Data Management**  Data Visualization | Assignment 1 |
| Week 4 | 3 Feb | **L.3 Data Management**  Data Wrangling |  |
| 5 Feb | **L.3 Data Management**  Data Wrangling | Assignment 2 |
| Week 5 | 10 Feb | **L.4 Data Design**  Data Models |  |
| 12 Feb | **L.4 Data Design**  Data Models – Types and OLTP vs OLAP | Assignment 3 |
| Week 6 | 17 Feb | **L.5 Data Design**  Read Write - Normalization |  |
| 19 Feb | **L.5 Data Design**  Read only - Denormalization | Assignment 4 |

# Schedule, weekly topics and assignment/exam dues (*Cont.*)

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| --- | --- | --- | --- | --- |
| **Main Topic** | **Week** | **Dates** | **Sub Topics** | **Dues**  **Assignments,**  **Cases,**  **& Exams** |
|  | Week 7 | 24 Feb | **L.6 Data Management – Case Study 1** |  |
| 26 Feb | **L.6 Data Management – Case Study 1** | Case 1 instructions out |
| Week 8 | 3 Mar | **L.7 Data Management – Case Study 1 Presentation** | Case Study Presentations |
| 5 Mar | **L.7 Data Management – Case Study 1 Presentation** | Case Study Presentations |
| Week 9 | 10 Mar  12 Mar | SPRING BREAK  No Classes!  Work on your Case 1  Enjoy Spring break! | |
|  | Week 10 | 17 Mar | Mid Term Prep and Review |  |
| 19 Mar | **MIDTERM** (*in-class*) |  |
| Week 11 | 24 Mar | **L.8 SQL Database:**  Queries - Select |  |
| 26 Mar | **L.8 SQL Database**  Queries - Select | Assignment 5 |

# Schedule, weekly topics and assignment, exams

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| --- | --- | --- | --- | --- |
| **Main Topic** | **Week** | **Dates** | **Sub Topics** | **Dues**  **Assignments,**  **Cases,**  **& Exams** |
| Databases, SQL Queries and Case study 2 | Week 12 | 31 Mar | **L.9 SQL Database:**  Queries - Select |  |
| 2 Apr | **L.9 SQL Database:**  Queries - Select | Assignment 6 |
|  | Week 13 | 7 Apr | **L.10 SQL Database:**  Queries - Select |  |
| 9 Apr | **L.10 SQL Database:**  Queries - Select | Assignment 7 |
| Week 14 | 14 Apr | **L.11 SQL Database:**  Queries - Select |  |
| 16 Apr | **L.11 SQL Database:**  Queries - Select | Assignment 8 |
| Wrapping  Up | Week 15 | 21 Apr | **Case Study 2**  Overview, Instructions |  |
| 23 Apr | **Case Study 2**  Presentations – in Groups | Case Study 2 Presentations |
| Week 16 | 28 Apr | **Case Study 2**  Presentations – in Groups | Case Study 2 Presentations |
| 30 Apr | Study time, work on pending assignments |  |
| 5 May | Review – Final Exam |  |
| 7 May | **FINAL EXAM – in class** |  |

# Policies, procedures and standard practices in response to COVID-19

* Faculty, students and staff are free to decide whether to wear a face covering indoors. Actions like get vaccinated and continue to monitor their health to help keep our UNT community safe and healthy are highly recommended.
* Classrooms will be equipped with a camouflage bucket with sanitizing spray. Students may continue to use these cleaning supplies to sanitize their classroom space when they arrive. Supplies will be replenished nightly by custodial staff.
* Students are expected to attend class meetings regularly, even though attendance will not be graded. It is important that you communicate with me, the professor, prior to being absent, so you and I can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform me if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

If you are experiencing any symptoms of COVID-19 please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Team at COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.

* UNT encourages everyone to protect yourself and others from COVID infection, as recommended by current CDC guidelines. Face covering guidelines could change based on community health conditions.