CS464/564: Introduction to Database Management
Spring 2020

Instructor:

Dr. Soraya Abad Mota   (email: soraya@cs.unm.edu)

Office: Farris Engineering Center 2040. Phone: 277-3052

Office hours: Monday 2:30-4:30 pm,
             Thursday 11:00 am - 12:30 pm and 3:30 - 4:00
             by email, and by appointment.

Teaching Assistants:

Aislinn Handley   (email: ahandley@unm.edu)

Office Hours: TBD
             FEC

Dheeman Saha   (email: dsaha@unm.edu)

Office Hours: Friday 12:00-2:00 pm
             FEC 2085

Class meets: Lectures: Tuesday and Thursday 4:30 - 5:45 pm,
                   Dane Smith Hall, Room 229 (DSH229)

1 Course Description

Many applications need to handle a significant amount of data or complex data. This need started in the early sixties (1960s!) and is even more prevalent today. Computer Science has responded to this need by developing a sub-discipline called *Databases*. Business applications were the first to demand features and services from commercial database management systems (DBMS). In the early nineties a broader set of applications discovered the usefulness of using a DBMS. Growing needs of the business community and more complex semantics and data volumes handled by diverse users have made the discipline evolve into different directions.

This course is an introduction to *Database Systems* at the senior level. It provides a broad description of the Database discipline. It starts by talking about data semantics, data models, and the notion of specifying the data required by an application through a database schema. The course presents the Entity-Relationship (ER) model to structure the semantics of the data from a specific domain. It then covers how to implement databases by describing how to translate an ER model into a relational schema. Once structured in a database, these data can be queried by high-level interrogation languages, of which *SQL* has been the most widely spread. The software to manage a database has become as complex as an operating system. The DBMS provides many valuable services to the administrators and users of the database.

According to the UNM catalog, this course provides an: "Introduction to database management systems. Emphasis is on the relational data model. Topics covered include query languages,

relational design theory, file structures and query optimization. Students will implement a database application using a nonprocedural query language interfaced with a host programming language. Prerequisite: 561."

The class covers a wide range of introductory topics including but not limited to:

- Basic concepts: data, users, database, applications, the database approach. Data models, database architecture, data independence.

- The Entity-Relationship Model and some of its extensions.

- The Relational Model: relations, normalization theory, relational algebra, relational calculus.

- Database applications. The SQL query language.

- Database Management Systems (DBMS): underlying models and services

- Approaches to: Query optimization, Concurrency control and recovery.

- Most recent DBMS paradigms.

- Relationship between Databases and Artificial Intelligence.

Because of the wide range of topics that will be covered, students will be expected to read ahead in the textbook (cited below), so that the class can move along at the necessary pace. In the last section of this document there is a tentative calendar with a distribution of the topics on the lecture days. The calendar is not final and it is subject to changes along the semester.

At the end of the term, the student should be able to:

- Understand and apply the database approach to different situations.

- List and describe the services provided by a Database Management System (DBMS).

- Use the acquired foundational background in database topics, to reason about and discuss/understand the information requirements of users that can be satisfied with a database.

- Demonstrate experience in modeling data using the ER model.

- Demonstrate experience in translating an ER schema into a relational schema.

- Demonstrate experience in writing queries in SQL.

- Enumerate and describe the different DBMS paradigms that coexist today.

2   Textbook

"Fundamentals of Database Systems" Ramez Elmasri y Shamkant Navathe, seventh edition, Pearson 2016.

3   Evaluations

Grades will be determined through the following types of evaluations.

Exams (35%):   Midterm exam (15%): Thursday, March 12 (Week 8)
                                                (CS464 and CS564)
                                 Final Exam (20%):   Tuesday May 12, 5:30 to 7:30 pm
                                                (cs464 students only)
                                 Students registered for CS564
                                 will have a final project instead of the final exam

Projects (45%):   approximately 3 in phases. Tentative dates provided in
                                 the calendar at the end of this syllabus.

In-class aprticipation (5%)

**Homeworks and
other assignments (15%):** short assignments or exercises some from the textbook,
                                 to illustrate the concepts covered in the lectures (3 or 4)

General description of the projects: The purpose of the first two projects is to design a database starting with the conceptual schema. In the first project, students will be able to perform a first version of the conceptual design process and then refine the schema using some quality criteria. In the second project the refined conceptual schema is translated into the Relational Model, the database is populated with test data, and a set of queries will be written in SQL to satisfy some of the information requirements. This first database will be implemented either in Oracle or in PostgreSQL. In the third project students will use a No-SQL DBMS to design and implement a simple database and will also create test data for it.

Grading: The final grade will be calculated by weighing each exam and assignment score obtained by the student, according to the percentages described above. This numeric final grade (in a scale of 100) is converted into a letter final grade (A+,A,A-,B+,B, etc.).

The conversion process (from number to letter) is left to the instructor to decide, the student should not compute their letter grade according to their own or other faculty's conversion table. Our conversion strategy is very flexible, uses the main statistical indicators, some of these are: mean, median, standard deviation, as a guide to establish the boundaries between the letter grades, and in all cases will be more favorable to the student than a rigid table that decides the letter grade with a fixed predetermined range.

4 UNM learn platform

For all announcements and submissions of assignments we will use UNM learn available with your Net ID at learn.unm.edu. When you register for this class your UNM id is automatically included in the course platform list and this will allow you access to all the course materials. There will be no other formal website for this class. Students should be up to date with the announcements and material published in this platform. All projects and assignments will be submitted through Learn. Communication with the instructor and the teaching assistant will be done via email, if the email is individual. But if the question or comment pertains to the whole group of students in the class, it should be done through the discussion board in Learn.

5 Course and UNM Policies

This section contains the most important policies students are expected to comply with.

5.1 Specific Course Policies

1. Communication with instructor and Teaching assisstants will always be respectful. To get a timely response the instructor requires that you use the email address `soraya@cs.unm.edu` and **add CS464 or CS564 to the subject line**, accordingly.

2. Assignments will be handed out and collected using UNM Learn; assignments should only be submitted through learn, not email or other means. If you are unable to submit assignments on Learn due to technical difficulties, please email me the submission on time and we will coordinate later submission through Learn once the technical difficulties are resolved.

3. Students are responsible for turning in assignments on time. Unexcused late assignments will only be accepted by prior arrangement with the instructor before the due date/time, with significant penalties determined by this instructor. Late assignments will be accepted without penalty only in the case of documented extraordinary circumstances that make prior arrangement impossible. If you know that you will be unable to make a turn-in date due to circumstances outside of your control (e.g. illness, death in the family, etc.), please make arrangements with me either in person, by email, or by phone as soon as possible for an extension.

4. No make-up or extra credit assignments or tests will be given. In general, the dates of the exams and the due dates for assignments will be announced well in advance. If you must miss a midterm, your final exam grade will count for that midterm grade as well.

5. Requests for regrades of assignments must be made within two weeks from when the assignment is returned. Assignments will not be regraded after that point.

6. Assignments and tests for which a regrade is sought will be regraded in their entirety. Therefore the new grade could be lower or higher than the original grade (before regrading).

7. This course falls under all UNM policies for last day to drop courses, as described at http://www.unm.edu/studentinfo.html and in the UNM Course Catalog. Please see the UNM academic calendar for course dates, the last day to drop courses without penalty, and for financial disenrollment dates.

8. Any requests to drop the class or change grade mode (e.g. audit, CR/NC) with instructor permission must be made on or before the last regular class/lab meeting. Such request made after this date will not be approved except in the case of documented, extraordinary circumstances.

5.2 Academic Honesty

The university policy on academic honesty is contained in the Pathfinder; you should review this policy if you are unfamiliar with it. Any academic dishonesty will result in an automatic 0 in the *offending assignment* and might lead to an F for the entire semester and a *faculty adjudication form* sent to the UNM Dean of Students for further disciplinary action as they deem appropriate. There will be no second chances or extra warnings.

As a general rule, any work you hand in for this class must be your own original work. Do not, under any circumstances, share source code, writings, or assignments with your classmates without my explicit prior approval. Students can, however, verbally discuss assigned readings, written and lab assignments, and programming assignments outside of class, or using online mechanisms (email, Piazza, etc) that are the general equivalent of verbal communication. For example, feel free to describe verbally over email generally how you attacked a particular problem in a programming assignment.

Any conversation or sharing of information that moves beyond simple verbal discussion and begins discussing or sharing specifics of source code or mathematical operations, however, is potentially a violation of academic honesty requirements. If you are unsure about whether or not you can share a particular piece of information, please consult with Prof. Abad-Mota prior to sharing it.

As examples, the following, are clearly not acceptable and will be considered cheating: copying another person's code; co-developing code with someone else; mailing your code to another person; using the Internet (e.g. StackOverflow) to find a solution to the problem; making your files readable so another person can copy them; reading another person's files; using another person's listing (taken from the trash, for example); having another person write a portion of your code for you.

5.3   Copyright issues

All materials in this course fall under copyright laws and should not be downloaded, distributed, or used by students for any purpose outside this course.

5.4   Title IX

Our classroom and our university should always be spaces of mutual respect, kindness, and support, without fear of discrimination, harassment, or violence. Should you ever need assistance or have concerns about incidents that violate this principle, please access the resources available to you on campus, especially the LoboRESPECT Advocacy Center and the support services listed on its website (http://loborespect.unm.edu/). Please note that, because UNM faculty, TAs, and GAs are considered "responsible employees" by the Department of Education, any disclosure of gender discrimination (including sexual harassment, sexual misconduct, and sexual violence) made to a faculty member, TA, or GA must be reported by that faculty member, TA, or GA to the university's Title IX coordinator. For more information on the campus policy regarding sexual misconduct, please see: https://policy.unm.edu/university-policies/2000/2740.html.

5.5   ADA

In accordance with University Policy 2310 and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as I am not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow. Contact Accessibility Resource Center at 277-3506 for additional information.

5.6   Citizenship and/or Immigration Status

All students are welcome in this class regardless of citizenship, residency, or immigration status. Your professor will respect your privacy if you choose to disclose your status. As for all students in the class, family emergency-related absences are normally excused with reasonable notice to the professor. UNM as an institution has made a core commitment to the success of all our students, including members of our undocumented community. The Administration's welcome is found on our website: `http://undocumented.unm.edu/`.

Tentative Calendar CS464/564 Spring 2020

Week	Tuesday	Thursday
1 January	**21** Introduction & Basic Concepts #1 The Database Approach	**23** ER Model (1) #2 Project 1 (assign)
2	**28** ER Model (2) #3	**30** Extended-ER Model (1) #4
3 February	**4 HMWK 1 due**	**6** Extended-ER Model (2) #5
4	**11** The Relational Model (1) #6 **Project 1 version 1 due**	**13** The Relational Model (2) #7
5	**18** Translation ER-Relational #8	**20** Translation EER-Relational #9 Project 1 version 2: **Refined Conceptual Schema due**
6	**25** Relational Algebra(1) #10	**27** Relational Algebra(2) #11 **HMWK 2 due**
7 March	**3** Relational Algebra(3). SQL(1) #12 Project 2 phase I: **ER-Relational Translation due**	**5** Structured Query Language(2) #13
8	**10** SQL(3) #14	**12 Midterm Exam**
SP	**17** Spring	**19** Break
9	**24** SQL(4). Relational Calculus #15 (Final paper assigned)	**26** Normalization Theory (1) #16 Project 2 phase II: **Queries due**
10 March/April	**31** Normalization Theory (2) #17	**2** Normalization Theory (3) #18
11 April	**7** Normalization Theory (4) #19	**9** DBMS(2). Physical Design #20 **HMWK 3 due**
12	**14** Query Optimization(1) #21	**16** Transactions. Concurrency and #22 Recovery Concepts
13	**21** Conc. Control and Recovery (1) #23	**23** Conc. Control and Recovery (2) #24 **HMWK 4 due**
14	**28** Most recent DBMS paradigms(1) #25	**30** Most recent DBMS paradigms(2) #26
15 May	**5** Most recent DBMS paradigms(3) #27 Project 3: **No-SQL project due**	**7** Summary #28
16 Finals	**12** Final Exam: 5:30-7:30pm for CS464 only & missed midterm	**14 Final paper due for CS564 only**