CS 631: Database Management System Design

Spring 2023

Credit: 3

Instructor: Dr. Shantanu Sharma

Location: **Kupfrian Hall 206**

Class sessions: Tuesday and Thursday 11:30 AM – 12:50 PM

Instructor Office: GITC 4201B

Instructor email: shantanu.sharma@njit.edu

Office Hours: Tuesday (2:00 PM – 3:00 PM) or by appointment over email.

Office Hours Location: GITC 4201B

Prerequisite:

Knowledge of C and data structures. Acquaintance with fundamental notions of relational database technology. Mathematical properties and usage of database programming languages. Methods of database design and conceptual modeling. Methods of physical storage for database information. Fundamental notions of concurrency control and recovery in database systems.

Course Overview:

This course will give a broad overview of database management systems. Fundamental concepts of databases will be explained. Topics include database system architecture, data modeling, storage of databases, query languages, indexing, concurrency control, transaction management, and big data processing systems (Hadoop and Spark), etc.

The outcome of the course:

Students will:

1. Gain knowledge of the requirements and applications of the database management system.
2. Understand the fundamental components and operations supported by a database management system.
3. Gain experience with a DBMS.

Primary Textbook:

1. Lecture slides will cover major topics.
2. Database management systems (3rd edition) by Raghu Ramakrishnan and Johannes Gehrke.
3. Database System Concepts (7th edition) by Avi Silberschatz, Henry F. Korth, and S. Sudarshan.

Lecture slide availability: *Slides will be online on Monday and Wednesday before 11:59 PM. If there will be any change in the slide before/during/after the lecture, they will be updated after the lecture.*

Other reference books: Students may refer to the following book to gain a deeper knowledge of databases. However, reading all such books is not mandatory.

1. Fundamentals of Database Systems (7th edition) by Ramez Elmasri and Shamkant Navathe
2. Database Systems: The Complete Book by Héctor García-Molina, Jeffrey Ullman, and Jennifer Widom
3. Architecture of a Database System by Joseph M. Hellerstein, Michael Stonebraker, and James Hamilton
4. Principles of Database and Knowledge-Base Systems, Volume I, by Jeffrey D. Ullman.

Grading policies:

Quiz (Biweekly in the class)	10
Assignments	39
Research paper discussion and presentation	16
End-term final exam	30
Attendance	5
Total	**100**
Bonus point (see details below)	***10***

I reserve the right to make small adjustments to grade weights or to add/remove assignments, project, or quizzes as the need arises.

Grade letter:

Grade letters will be allocated as follows:

Grade letter	**Points**
A	80 and above
B+	70 – 79
B	60 – 69
C+	50 – 59
C	40 – 49
F	Below 40

Quizzes: (10 points)

1. Each quiz will contain ***10 to 15 questions*** (multiple-choice, fill-in-the-blank, or small questions).
2. Each quiz will be in the classroom.
3. ***15 mins*** will be given to return the sheet.
4. Each student must submit their own quiz. No groups will be allowed.
5. The quizzes will be on the following dates:
   a) 01/27
   b) 02/10
   c) 02/24
   d) 03/10
   e) 03/31
   f) 04/07
   g) 04/21
6. **Grading of quizzes:** In the final grade, an *average of the best of the six quizzes* will be taken.

   For example, if one student receives the following points in the above seven quizzes: 10, 9, 8, 10, 6, 4, 10 respectively, then only the following points will be considered 10, 9, 8, 10, 6, 4, 10 (points of the 6^{th} quiz will not be counted). To include the quiz points in the final grade, we do the following: (10+9+8+10+6+4+10)/6 = 9.5.
7. The grade of each quiz will be published before the next quiz.

Assignments: (30 points)

1. Three assignments will be given.
2. Each student must submit their own assignments. No groups will be allowed.
3. Each assignment of 13 points.
4. The assignment will be published on the following date and will be due as mentioned in the following table

Assignment number	Published on web	Due date and time
1	02/10	02/20 11:59PM
2	03/10	03/20 11:59PM
3	03/10	14/20 11:59PM

5. All assignments must be submitted on Canvas on the due date.
6. *Assignments should **NOT be handwritten**.* Students may use Microsoft Word, Google Docs, or Overleaf.
7. The grade of each assignment will be published before publishing the next assignment.
8. ***Late submission*** of the assignment will be allowed with the given reasons. Each day will cause a deduction of 1 point. However, assignments will not be accepted after the 25th of each month and result in **zero points**. Without reason, late submissions are ***not*** allowed.

End-term (30 points):

1. Students can carry **books, printed notes, and printed slides**. However, Internet access is not allowed.
2. End-term date: will be announced.

Attendance (5 points):

1. There will be 1 or 2 guest lectures.
2. Attending and participating in each lecture will result in some points.
3. *If a guest lecture will not happen, then points will be added to the final exam.*

Research paper discussion and presentation

1. Students *may select a research paper given by the instructor*.
2. Each student will discuss a single research paper with the entire class.
3. Students can also use the slides of the paper available online. No point will be deducted if a student does not prepare slides on his own.
4. The list of papers will be uploaded soon on canvas.

Bonus points:

1. There is a provision for earning 10 bonus points.
2. However, if a student obtains 100 points in the final grade without a bonus, then their final grade will be 100. Students who will earn the final grade between 80 and 100 will secure A and the bonus points will not impact them.
3. To earn the 10 bonus points, a student needs to meet the instructor before 03/12.

Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu*

Note for Students with Disabilities

We will follow the university rules in this regard.

Weekly Schedule of the Lectures

(Tentative -- *the schedule may change according to the progress in the lectures*)

Week number	Topic to be covered
1	Introduction
2	Relational Model and Algebra
3	
4	SQL
5	
6	
7	Data storage
8	Review class
9	Indexes
10	
11	Query execution and optimization
12	
13	Database design and functional dependencies
14	Big-data, MapReduce, Hadoop, Spark
15	Discussion and others (ACID vs BASE)