CS-GY 6083 - B, Fall 2023
Principles of Database Systems

Course Prerequisites: Good programming skills, familiarity with the basics of operating systems (incl. file systems, caching, locking, and concurrency), and knowledge of basic algorithms and data structures (incl. sorting, heaps, search trees, and hashing). Formally, you need to have taken a course on data structures or algorithms, and a course on operating systems, at the graduate or undergraduate level, or have permission from the instructor.

Instructor: Prof. Amit Patel (asp13@nyu.edu)

Instruction Mode: In-Person

Class Location: NYU Tandon – JAB (Jacob Academic Bldg.), Room# 474, 6 Metro Tech Center, Brooklyn, NY

Class Schedule: 09/09/2023 to 12/16/2023 (Saturdays), 11:00 AM to 1:30 PM

Course Textbook: Database System Concepts, 7the Edison
A. Silberschatz, H. Korth, S. Sudarshan
McGraw-Hill, 2010.
ISBN-10:0073523321
ISBN-13: 9780073523323
(You may also use the 4th or 5th edition if those are cheaper or easier to get.)

Grading Policy:

Participation: 10% (All ungraded assignments are mandatory and will be counted towards participation points).

Four Problem sets (each 5%): 20%.

Midterm exam: 20%.

Final exam: 20%.

Final Project: 30% (Part 1 and Part 2, each 15%)

General Information: The course aims to give a broad introduction to relational database systems, including the relational data model, query languages, index and file structures, query processing and optimization, concurrency and recovery, transaction management, and database design, plus optional material if time permits. The workload of the course is expected to be above average, and class attendance is strongly recommended.

Policy on Academic Dishonesty: Please see the school's policy on academic dishonesty on our school's website at,

https://engineering.nyu.edu/sites/default/files/2018-06/code-conduct2-2-16.pdf

Common examples of misconduct include cheating, fabrication, plagiarism, and/ or unauthorized collaboration. Students are expected to work on their own, with the possible exception of group projects if allowed by the Professor. Students may discuss work with other individuals either in the class or outside the class, but they may not reuse code, results, or text received or retrieved from any source unless clearly disclosed in their submissions. Any student who is found to be violating this policy will be given a failing grade for the work and will be reported to the authorities, including the CSE department's student records, as described in the University's Student Code.

Moses Center Statement of Disability: If you are a student with a disability who is requesting accommodation, please contact New York University's Moses Center for Students with Disabilities (CSD) at 212-998-4980 or mosescsd@nyu. edu. You must be registered with CSD to receive accommodations. See http://www.nyu.edu/students/communities-and-groups/students-with-disabilities.html for information about the Moses Center. The Moses Center is located at 726 Broadway on the 2nd and 3rd floors.

Programming Assignments: In addition to written problems, there will also be one or two programming assignments as part of the homework, plus a two-part project using a database system of your choice:

1. **Programming Assignments:** How to use a DBMS, design and develop database schemas, write queries, query processing & optimization, implement indexes, transactions controls, and manage backup & recovery

2. **Project Part i:** Design, develop, and implement a complex database schema for a given business case

3. **Project Part ii:** Implement a web-based application based upon the schema and scenario implemented in Part i using relational database systems such as MySQL, Oracle, or any other relational database systems, and programming language, typically with PHP (recommended, but students can use any other

web-based applications such as Java, Python or framework such as Django that can be interfaced with relational database systems.)

Students will perform the course project in groups of three students.

Assignment guidelines: All assignments (whether graded or ungraded) are mandatory. Students are required to participate in discussion forums for collaborative and peer-to-peer learning. All assignments must be submitted to NYU Brightspace Course website as instructed, on or before assignment deadlines. NO assignment submission will be accepted by email.

For each day in assignment submission delay beyond the deadline, there will be 10% of score deduction penalty. No submission will be graded after the possible solution is published (usually a day after the submission deadline)

Course Outline (tentative)

1. Introduction and Basics (Chapters 1 to 2 and 6) (weeks 1-2-3)

  (a) Overview

  (b) Rationale for Database Systems

  (b) Relational Model

  (c) Relational Algebra

  (d) Relational Calculus

2. Database and Application Design (Chapters 7 to 9) (weeks 4-5-6)

  (a) Intro to the ER Model

  (b) Relational Design

  (c) Extended ER Model

  (d) Data normalization

3. Relational Queries (Chapters 3 to 5) (weeks 7-8-10)

  (a) Basic SQL

  (b) Advanced SQL

  (c) Integrity Constraints

  (d) Analytical functions

  (e) PL/SQL (Database trigger, function, procedure)

Midterm Exam: (Tentative: at Week 9)

4. Storage and Indexing (Chapters 10 and 11) (weeks 10)

    (a) Disk Models

    (b) External Sorting

    (c) Disk and File Organization

    (d) Indexing

5. Query Processing (Chapters 12 and 13) (weeks 11-12)

    (a) Query Evaluation

    (b) Query Optimization

6. Transaction Management (Chapters 14 to 16) (weeks 13-14)

    (a) Database Transactions

    (b) Concurrency Control

    (c) Backup and Recovery

Group Project Demo: Week 15

Final Exam: (Cumulative Exam: Week15)