

Fall 2020

CS 331-003: Database System Design and Management

Canan Eren

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Recommended Citation

Eren, Canan, "CS 331-003: Database System Design and Management" (2020). *Computer Science Syllabi*. 217.

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Department of Computer Science

CS 331: Database System Design and Management

Fall Semester 2020 - Section 003 – Canan Eren

Prerequisites: CS 114 or equivalent

Objective

The objective of the course is to provide an introduction to modern database systems. It focuses on the following issues: data models, conceptual data models, the Entity-Relationship model, the Relational model, formal database query languages, the Relational algebra, the standard database language SQL, external hashing and indexing, formal database design theory, functional dependencies and normal forms, and transaction processing.

The students will learn how to design and create and then query and update a database through a small project. They will get hands-on experience with modern database management systems using the standard database language SQL.

Course (learning) outcomes

- Understand the data requirements of contemporary organizations and how database management systems meet them,
- Develop conceptual data model specifications,
- Design and implement database applications,
- Understand how data is stored, retrieved and maintained in different types of databases,
- Gain experience with the existing database management systems.

Course organization

- The slides for each lecture are available before the class. A good practice is to read from your book the material to be taught in class and to come prepared.
- After the theory on a certain topic is presented, you can download the corresponding questions and exercises which you should try to solve. Most of them are discussed in class in subsequent lectures.
- Five homework assignments will be given containing exercises on selected topics. Their solutions will be posted on the web page of the class in due time.
- You will work in groups on a project which has three to four deliverables during the semester. A project demonstration is required for the last deliverable of the project.

- There will be two exams: a midterm halfway through the semester, and a final on the last day of the class.
- Lecture slides, exercises, homework assignments, project requirements, and other material (e.g. Entity-Relationship diagrams and solutions of homework assignments) will be available for downloading in due time on this web page. Important announcements will be also placed on it. Bookmark the course web page. It is a "living document" and you have to visit it at least once a week.

Time and Place

Date and time: Tuesday: 12:30 – 1:50 PM (online)
Thursday: 12:30 – 1:50 (online)

Instructor

Dr. Joann (Canan) Eren

Office: GITC 4212

Office hours: Tuesday: 2:00 – 3:30 PM

Thursday: 2:00 – 3:30 PM.

(office hours not valid on the Reading day, during exam periods, holidays, and breaks)

If you cannot meet my office hours, send me an email to schedule an appointment.

Web page: <https://people.njit.edu/faculty/ce85>

Email: canan.eren@njit.edu

Textbooks

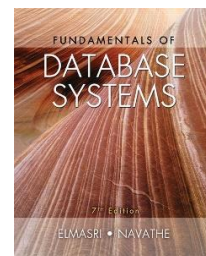
[Fundamentals of Database Systems, 7th Edition,](#)

R. Elmasri and S.B. Navathe

Pearson, © 2016.

ISBN-10: 0-13-397077-9

ISBN-13: 978-0-13-397077-7



Recommended other books (not required)

INTRODUCTORY DATABASE TEXTBOOKS

- Jeffrey D. Ullman, Jennifer Widom:
A First Course in Database Systems, 3rd Edition
Prentice Hall, © 2008.
- Michael Kifer, Arthur Bernstein and Philip Lewis:
Database Systems: An Application-Oriented Approach, Introductory Version, 2nd Edition
Addison-Wesley, © 2006.

GENERAL DATABASE TEXTBOOKS

- Raghu Ramakrishnan, Johannes Gehrke:
Database Management Systems, 3rd Edition
WCB/McGraw-Hill, © 2003.
- Michael Kifer, Arthur Bernstein and Philip Lewis:
Database Systems: An Application-Oriented Approach, Complete Version, 2nd Edition
Addison-Wesley, © 2006.
- Abraham Silberschatz, Henry F. Korth, S. Sudarshan:
Database System Concepts, 6th Edition
McGraw-Hill , 2010.
- C. J. Date:
An Introduction to Database Systems, 8th Edition
Addison-Wesley, © 2004.

DATABASE THEORY

- Serge Abiteboul, Richard Hull, Victor Vianu:
[Foundations of Databases: The Logical Level](#).
Addison-Wesley, 1995.

DBMS IMPLEMENTATION

- Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom:
Database Systems, The Complete Book 2nd Edition.
Prentice-Hall, © 2009.

SQL

- A lot of resources online.

Attendance and Participation

You are supposed to attend all the classes. Participation is highly encouraged to make the class more interactive. Class attendance and participation are taken into consideration by the instructor for the evaluation of the students. Experience shows that students that do not attend the classes do not perform well in the midterm and final exams. If you miss one class be sure to consult one of your classmates about the content of the lecture and visit the course web page to get notes, exercises, assignments, deadlines and announcements.

Homework assignments

There will be five homework assignments. If you work reasonably on them you will get all the points. Solutions are provided for you to compare with your own solutions.

Project

A project to design and implement a simple database system using a modern database management system will be assigned. It will proceed progressively through different steps. The methodology for database development learned in class should be used.

Project groups

Groups of at most 3 students are required. You can choose the classmates you want to work with. You can also work by yourselves if you prefer. In order to form a group you have to fill a form available in class Canvas page or in my office during office hours. If you do not express any preference, I will put you in a group randomly.

Project phases

The project has three deliverables. Each group needs to contact the TA to fix an appointment for demonstrating the final application (see lecture schedule above).

Project description and deliverables:

Project description

Deliverable 1

Deliverable 2

Deliverable 3

Example solutions for the project:

A possible solution E/R diagram for Phase 1 (I suggest that you use this one for the second phase of the project).

A possible solution Relational Schema for Phase 2. (I suggest to use this one for the third phase of the project).

Submissions and Late policy

The **five homework assignments** and **all 3 project deliverables** should be submitted on or before the day and time they are due **through Canvas**. Every Canvas submission should be a **SINGLE FILE** in **MS word** or **PDF** format **only**. A hard copy should also be slid under the door of my office.

Late submissions will not be accepted or will get penalties.

Grading

The midterm, the assignments, the project and the final exam contribute to the course grade as follows:

Midterm	30%	
Project	25%	Deliverables and demonstration
Assignments	10%	Four assignments
Final	35%	

COURSE OUTLINE – Topics to be covered in the course

BASIC CONCEPTS - GENERALITIES ABOUT DATABASES Introduction to databases. Database users Database systems concepts and architecture. Data models.
CONCEPTUAL MODELING, DATABASE DESIGN The Entity Relationship (ER) model The Enhanced Entity Relationship (EER) model
THE RELATIONAL MODEL: CONCEPTS AND FORMAL QUERY LANGUAGES Basic Definitions, Integrity Constraints, Update Operations Relational Algebra Relational Algebra Example Queries
FROM CONCEPTUAL MODELS TO LOGICAL MODELS Mapping ER and EER diagrams to Relational schemas
SQL: A STANDARD DATABASE LANGUAGE Data Definition, Basic Integrity Constraints, Schema Changes Basic Queries Complex Queries, Aggregate Functions and Grouping Data Change Statements, Views and Complex Constraints Using SQL in an application - Database programming
FORMAL DATABASE DESIGN THEORY Functional dependencies (FDs), Inference of FDs,

Normal forms
DATABASE PHYSICAL ORGANIZATION
File Organizations
Indexing

MIDTERM and FINAL exams

All exams will be conducted on-line.

The midterm exam will be composed of several exercises/questions to be answered.

Make-up Exams:

Make-up exams need to be approved by the Instructor.

Consideration will be given to those students who contact me before the exam (via e-mail or phone) and provide a valid, documented reason for missing the exam.

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”*

Links

[ACM SIGMOD](#)

[IEEE TCDE](#)

[The VLDB Endowment](#)

[The EDBT Endowment](#)

[DBLP - Database and Logic Programming Bibliography](#)

[Interactive Online SQL Training](#)

[Advanced Online SQL Training](#)