

**New York University Tandon School of Engineering**

Computer Science and Engineering

**CS-GY 6083 A** Principles of Database Systems

**Fall 2021**

**Professor Julia Stoyanovich**

**Time:** Monday 11am-1:30pm

**Location:** 6 MetroTech Center (Jacobs Academic Building), Room 475

To contact professor: [stoyanovich@nyu.edu](mailto:stoyanovich@nyu.edu)

Office hours: Monday 4-5pm or by appointment

**Course Prerequisites:** Graduate standing, CS 6003 or equivalent, familiarity with basic data structures and operating system principles. No prior experience with relational databases is required or expected. Familiarity with the python programming language is required.

**Course Description:** This course broadly introduces database systems, including the relational data model, query languages, database design, index and file structures, and query processing and optimization. Additional topics will be covered to give students the flavor of current data management research. Students will acquire hands-on experience in working with database systems and in building web-accessible database applications.

**Course Objectives:** After successfully completing the course, students are able to:

- Use the Entity-Relationship (ER) model to design a database application.
- Translate an ER model for a database application into a relational schema, and implement this schema in a relational database.
- Use normalization techniques to refine a relational database schema.
- Use SQL to retrieve and analyze relational data.
- Design an end-to-end database application.
- Gain basic familiarity with indexing and query processing techniques.

**Course Structure:** This course is made up of a lecture and a lab. Your synchronous participation is required for full credit. Recordings of lectures and labs, along with slides and exercises, will be available online for your reference.

**Reading:** "Database Management Systems", 3rd Ed. by Ramakrishnan and Gehrke (ISBN-10: 0072465638, ISBN-13: 978-0072465631).

### **Course Assessment**

There will be 5 homework assignments, a midterm exam, and a final course project. Homework assignments and the exam are to be completed individually. The course project is to be completed in teams of 2.

**Homeworks:** 5 homeworks x 8 points each = 40 points. Homework is usually assigned on Monday morning, and is due at 5pm on Friday of the following week.

Homeworks must be submitted on time. If a homework is submitted late, the student will receive no credit. Each student can make use of 2 additional days for late homework submission. If a late day is used, it is used in full. That is, if a student submits a homework assignment 2 hours late, this counts as a full day.

- **Homework 1:** ER and relational models (assigned 9/27, due 10/7)
- **Homework 2:** translating ER to relational model, relational algebra, (assigned 10/12, due 10/21)
- **Homework 3:** SQL (assigned 10/25, due 11/4)
- **Homework 4:** Normalization, storage and indexing (assigned 11/8, due 11/18)
- **Homework 5:** Datalog, recursive SQL (assigned 11/29, due 12/9)

**Midterm exam:** 25 points, taken in class on November 22, 2021, covers ER and relational models, relational algebra, SQL, and schema normalization.

**Project:** 25 points. Projects are to be conducted in teams of two. Partners should collaborate on all aspects of the project among themselves, but they should not collaborate with anyone outside of their team. There will be two project deliverables, note that late days cannot be used for the course project:

- **Project (part 1):** description, business rules, ER diagram (assigned 9/20, due 10/29)
- **Project (part 2):** ER to relational translation, queries, UI, final report, presentation video (assigned 10/29, due 12/13)

**Attendance and participation:** 10 points

A student can miss 2 class meetings without a penalty. For every additional lecture or lab that you miss we will deduct points, up to a total of 10% of the grade.

Every student is expected to participate in the lecture and in the lab they attend each week.

## Grading

Grades will be determined using this scale:

| Course Grade | Points Earned |
|--------------|---------------|
| A            | 94-100        |
| A-           | 90-93         |
| B+           | 87-89         |
| B            | 84-86         |
| B-           | 80-83         |
| C+           | 76-79         |
| C            | 70-75         |
| C-           | 65-69         |
| F            | 0-65          |

## Course Schedule

**09/13/2021** Introduction and overview, Entity-Relationship (ER) modeling

Reading: RG 1, 2.1-2.5 (RG = Ramakrishnan & Gehrke, "Database Management Systems", 3rd Ed.)

Assignments: none

**09/20/2021** Entity-Relationship (ER) modeling continued

Reading: RG 2.1-2.5

Assignments:

- **Project (part 1):** description, business rules, ER diagram, assigned 9/20, due 10/29

**09/27/2021** The relational model

Reading: RG 3.1-3.3

Assignments:

- **Project (part 1):** description, business rules, ER diagram, assigned 9/20, due 10/29
- **Homework 1:** ER and relational models, assigned 9/27, due 10/7

**10/04/2021** Translating ER models to relational schemas

Reading: RG 3.5

Assignments:

- **Project (part 1):** description, business rules, ER diagram, assigned 9/20, due 10/29
- **Homework 1:** ER and relational models, assigned 9/27, due 10/7

**10/12/2021 (Tuesday)** Relational algebra

Reading: RG 4.1, 4.2

Assignments:

- **Project (part 1):** description, business rules, ER diagram, assigned 9/20, due 10/29

- **Homework 2:** translating ER to relational model, relational algebra, assigned 10/12, due 10/21

#### **10/18/2021 SQL**

Reading: RG 5.1 - 5.5

Assignments:

- **Project (part 1):** description, business rules, ER diagram, assigned 10/1, due 10/29
- **Homework 2:** translating ER to relational model, relational algebra, assigned 10/12, due 10/21

#### **10/25/2021 SQL continued**

Reading: RG 5.5, 5.6

Assignments:

- **Project (part 1):** description, business rules, ER diagram, assigned 10/1, due 10/29
- **Project (part 2):** ER to relational translation, queries, UI, final report, assigned 10/29, due 12/13
- **Homework 3:** SQL, assigned 10/25, due 11/4

#### **11/01/2021 Schema refinement and normal forms (lecture + lab)**

Reading: RG 19.1-19.4

Assignments:

- **Project (part 2):** ER to relational translation, queries, UI, final report, assigned 10/29, due 12/13
- **Homework 3:** SQL, assigned 10/25, due 11/4

#### **11/08/2021 Schema refinement and normal forms (lecture), Database application development (lab)**

Reading: RG 19.5-19.6

Assignments:

- **Project (part 2):** ER to relational translation, queries, UI, final report, assigned 10/29, due 12/13
- **Homework 4:** Normalization, storage and indexing, assigned 11/8, due 11/18

#### **11/15/2021 Storage and indexing (lecture), Midterm exam review (lab)**

Reading: RG 8.1-8.4

- **Project (part 2):** ER to relational translation, queries, UI, final report, assigned 10/29, due 12/13

- **Homework 4:** Normalization, storage and indexing, assigned 11/8, due 11/18

**11/22/2021 Midterm exam** (lecture), Storage and indexing (lab)

Reading: RG 13.1-13.3

Assignments:

- **Project (part 2):** ER to relational translation, queries, UI, final report, assigned 10/29, due 12/13

**11/29/2021** Datalog, recursive SQL

Reading: Abiteboul, Hull, Vianu, "Foundations of Databases" Ch. 12

<http://webdam.inria.fr/Alice/pdfs/Chapter-12.pdf>

Assignments:

- **Homework 5:** Datalog, recursive SQL, assigned 11/29, due 12/9
- **Project (part 2):** ER to relational translation, queries, UI, final report, assigned 10/29, due 12/13

**12/06/2020** Responsible Data Management

Reading: Data, Responsibly Comics vol. 1 "Mirror, Mirror"

<https://dataresponsibly.github.io/comics/>

Assignments:

- **Homework 5:** Datalog, recursive SQL, assigned 11/29, due 12/9
- **Project (part 2):** ER to relational translation, queries, UI, final report, assigned 10/29, due 12/13

**12/13/2020** TBD

### **Moses Center Statement of Disability**

If you are a student with a disability who is requesting accommodations, please contact New York University's Moses Center for Students with Disabilities (CSD) at 212-998-4980 or [mosescsd@nyu.edu](mailto:mosescsd@nyu.edu). You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at [www.nyu.edu/csd](http://www.nyu.edu/csd). The Moses Center is located at 726 Broadway on the 3rd floor.

### **NYU School of Engineering Policies and Procedures on Academic Misconduct – complete Student Code of Conduct [here](#)**

A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School of Engineering are expected to exhibit those qualities in their academic work. It is through the process of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic

dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School's rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School's Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:

1. Cheating: intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person's work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.
2. Fabrication: including but not limited to, falsifying experimental data and/or citations.
3. Plagiarism: intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.
4. Unauthorized collaboration: working together on work meant to be done individually.
5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission has been received from the course instructor(s) or research adviser involved.
6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.

**NYU School of Engineering Policies and Procedures on Excused Absences – complete policy [here](#)**

A. Introduction: An absence can be excused if you have missed no more than **10 days of school**. If an illness or special circumstance has caused you to miss more than two weeks of school, please refer to the section labeled Medical Leave of Absence.

B. Students may request special accommodations for an absence to be excused in the following cases:

1. Medical reasons
2. Death in immediate family
3. Personal qualified emergencies (documentation must be provided)

#### 4. Religious Expression or Practice

Deanna Rayment, [deanna.rayment@nyu.edu](mailto:deanna.rayment@nyu.edu), is the *Coordinator of Student Advocacy, Compliance and Student Affairs* and handles excused absences. She is located in 5 MTC, LC240C and can assist you should it become necessary.

**NYU School of Engineering Academic Calendar – complete list [here](#).**

The last day of the final exam period is 12/20/2019. Final exam dates for undergraduate courses will not be determined until later in the semester. Final exams for graduate courses will be held on the last day of class during the week of 12/16/2019. If you have two final exams at the same time, report the conflict to your professors as soon as possible. Do not make any travel plans until the exam schedule is finalized.

Also, please pay attention to notable dates such as Add/Drop, Withdrawal, etc. For confirmation of dates or further information, please contact Susana: [sgarcia@nyu.edu](mailto:sgarcia@nyu.edu)