

CSCI 4707 (001): Practice of Database Systems  
Homework 1  
Fall 2023

**Due:** Oct 2, 2023, 13:00 online through Gradescope (PDF format).  
There will be a **10%** penalty off your grade for a 24-hours late submission.  
This homework can be done **individually** or **in a group of 2**.

---

### A. Entity Relationship Diagram (50 Points)

You receive a task from the university to design a database for the university's registration system. You are told that each student has a student id, email, name, and GPA. Every student is uniquely identified by their student id. Each course has an id, name, and credits. Each course is uniquely identified by its course id. Each professor has a staff id, email and name. Each professor is uniquely identified by their staff id. Draw an ER diagram that captures each of the following scenario (5 ER diagrams in total):

**1. (10 Points)** Each course is taught by one or more professors and each professor can teach zero or many courses. Students can register for zero or many courses and each course must have at least one student taking it. The university tells you that every time a student registers for a course, they want to keep track of the semester when the student registers. If the student registers the same course twice at different semesters, they want to be able to keep track of both registrations.

**2. (10 Points)** Now, the university does not think that it is necessary to keep track student's registration on the same course multiple times. They just want to keep track only the last semester that the student registers for the course. For example, if Sam registers for CSci 4707 on Fall 2021 and Spring 2022, we only need to keep track of the registration on Spring 2022. **HINT:** you cannot really specify which semester we want to keep in the database as this is the application logic not the database logic. What you can do is to ensure each registrations only appear once.

**3. (10 Points)** Following the scenario in Problem 2, the university wants to introduce a category (uniquely identified by an id) for each course. Each course must belong to one and only one category and each category can have zero or many courses. Categories can be nested where a category may have zero or many super-categories and zero or many sub-categories. For example, course CSci 4707 may belong to the "Database" category. The "Database" category has a super-category of "Computer Science" which also has a super-category of "Science and Engineering".

**4. (10 Points)** Following the scenario in Problem 3, the university wants to introduce two types of students, namely undergraduate students and graduate students. Both types of student have the same attributes as a student, however, undergraduate student has an additional attribute of year while graduate student has an additional attribute of research\_area. Each graduate student must have one or more professors as their advisor. Professors may or may not advise graduate students.

**5. (10 Points)** Following the scenario in Problem 4, each professor has zero or many projects. A project is uniquely identified by both its id and its name. Each project is owned by exactly one professor. A graduate student can work on at most one project. However, when a professor leaves the university, all projects under the professor must be removed from the university database.

---

### B. Relational Model (50 Points)

For each scenario in Problem A (scenario 1 - 5), provides the SQL statements to translate the diagram into relational tables. You must capture all constraints that are mentioned in the problem. If there is a constraint that cannot be captured by the CREATE TABLE statement, states the constraint. You can use any type that you want for any attribute.

---

### C. Submission Guideline

Homework must be typed, not scanned, or photographed from a handwriting work. This includes ER which should be drawn by using any software, e.g., Visio, Draw I/O, or Google Drawing. ER must be drawn in the same format that is taught in class. Each violation will result in a 0 grade for the violated problem.

Submit the homework in PDF format on Gradescope before 13:00 on Oct 2, 2023.

While submitting on Gradescope, please ensure that you have **matched** each question with the correct page(s) of your submission.

If the homework is done in group, **only one** submission is needed for each group. Please include all members' name and ID (x.500) in the submission, and please ensure to add all members while submitting on Gradescope.

**Late homework** must be emailed to [mosta041@umn.edu](mailto:mosta041@umn.edu) in pdf format.