# COMP 306: Database Management Systems
Spring 2024 - Homework #1

Question 1. [25 pts] You are given the task of designing a database for a music recording studio. Read the following description and draw its ER diagram.

- Our recording studio has many musicians. Each musician has a SSN (unique), name, date of birth, and potentially many addresses. Musicians are either full-time musicians or part-time musicians; furthermore, it is possible for the same musician to be both (they may start as part-time and then switch to full-time, or vice versa). For full-time musicians, we need to keep track of their contract start date, contract end date, and monthly salary. For part-time musicians, we need to keep track of how many hours they worked and their hourly rate.

- Musicians play instruments. A musician can play many instruments and an instrument can be played by many musicians. Each instrument has a type (guitar, drums, etc.) and a unique ID number. Instruments are either musician-owned or studio-owned, but cannot be both. For studio-owned instruments, we need to keep track of the purchase date (when it was bought) and price. For musician-owned instruments, we need to keep track of which musician they are owned by. Note that each musician can own multiple instruments, but each instrument must have exactly one owner.

- Musicians produce albums. Albums have a title, speed, copyright date, and unique ID number. Each musician can produce many albums, but an album must be produced by exactly one musician. Albums contain many songs, and a song can appear in multiple albums. Each song's title and production date must be stored, along with its unique song ID.

- Finally, musicians perform in songs. Each musician can perform in many songs and a song may have many musicians performing in it. But each song must have at least one musician performing in it. The amount of payment a musician receives due to performing in a song should be stored in the database.

Question 2. [25 pts] Convert the following ER diagram to the relational model using the conversion algorithm. Your answer should consist of the CREATE TABLE statements necessary to create the appropriate relations. Make sure you specify all primary keys and foreign keys. You are welcome to choose a reasonable data type for each attribute (INT, CHAR, etc.).
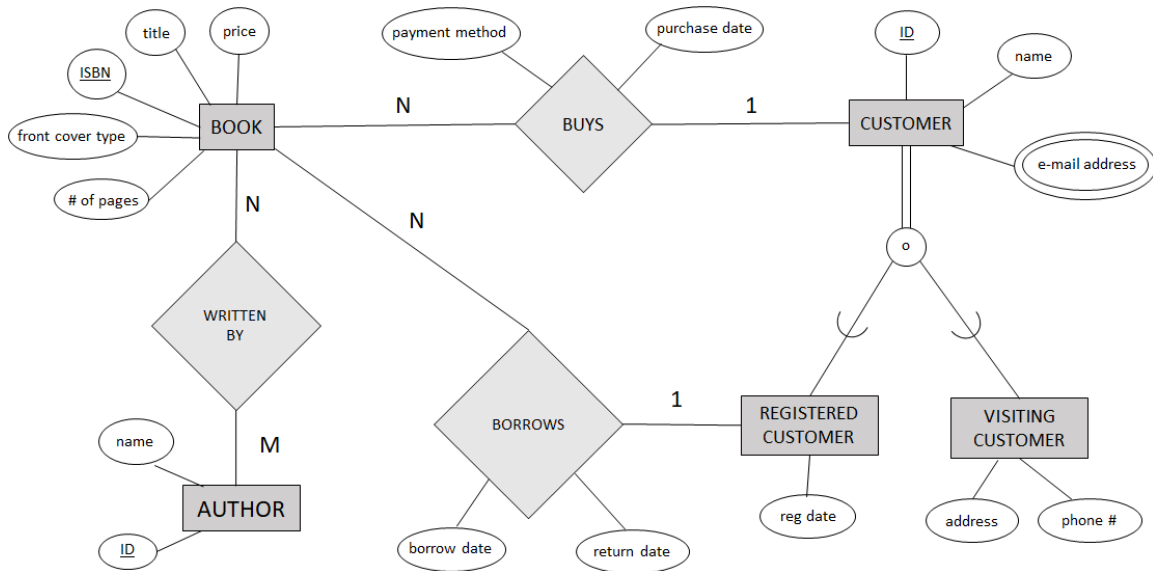
Question 3. [50 pts] Consider the following schema, which you are already familiar with from the lectures. Using this schema, write the given queries in relational algebra.

Employee(<u>Ssn</u>, Fname, Minit, Lname, Bdate, Address, Sex, Salary, Super_Ssn, Dno)
Department(<u>Dnumber</u>, Dname, Mgr_ssn, Mgr_start_date)
Dept_Locations(<u>Dnumber, Dlocation</u>)
Project(<u>Pnumber</u>, Pname, Plocation, Dnum)
Works_On(<u>Essn, Pno</u>, Hours)

(a) [6 pts] Find the first name, birthdate, address, and salary of those employees born on 01/01/1990 or after, who work in the "Sales" department.

(b) [6 pts] Find the full names of employees in department 8 who work more than 20 hours per week on the "Data Privacy" project.

(c) [6 pts] Find the last names and salaries of employees who work on every project controlled by department number 5.

(d) [6 pts] There are some employees who are not working on any project. Find the last names and salaries of those employees, together with their supervisors' last names.

(e) [6 pts] Find the names of departments which are either located in Istanbul or control a project that is located in Istanbul.

(f) [6 pts] Find the project numbers of projects that satisfy both of the following criteria: (i) the project has an employee with last name "Gursoy" working on it, (ii) the project is controlled by a department whose manager's last name is "Gursoy".

(g) [7 pts] Find the last name and salary of the manager who started managing a department most recently. (Hint: How will this manager's start date be, compared to all other managers?)

(h) [7 pts] Find the first and last names of employees who are supervising some employee that is older than them.