CS 377: Database Systems

Homework #1

Due: Friday, Jan 27, 2016 at 11:59 PM

SUBMISSION: Please submit your homework electronically **on *Gradescope***. You can use any software to draw the ER diagrams or do it by hand, but make sure what you upload is legible. If you use a software to create the diagram, make sure it conforms to the notation that was introduced in class. Questions about the homework can be asked in office hours or posted on Piazza. Finally, make sure the work you submit is YOUR OWN.

1. **Emory College University Database** (50 points): You were just hired to develop the Emory College Database. Design an ER diagram for the college based on the following requirements:

    (a) The Emory College consists of a number of Departments (e.g., MathCS, Physics, Psychology, etc.).

    (b) A department has a unique name, address, phone number, and can have a number of faculty members.

    (c) Each faculty member has a SSN, name, office, phone number, and salary.

    (d) Each faculty member belongs to a department.

    (e) A department has one department chair with a starting date.

    (f) A department always has a chair.

    (g) A department can teach a number of courses but may not teach any courses.

    (h) A course has a unique ID, a course name, and a description.

    (i) A course will not be offered by more than one department.

    (j) A semester has an ID (e.g., F14, S14, F15, etc.), a start date and an end date.

    (k) A number of sections of a course is offered in a semester and a section will be taught by one faculty member.

    (l) Not every course will be offered in a semester and some courses may have multiple offerings (multiple sections of the course).

    (m) A student has an ID, name, and address.

    (n) A student can enroll in one section of some course.

(o) A student can be enrolled in multiple sections of *different courses* in one semester (enforcing different courses can be challenging to represent in the ER diagram, but students should be allowed to take multiple sections).

Make sure your design represents all of the above information correctly. You must specify the **cardinality** and **participation constraints** in the relationships.

Some frequently asked questions on this problem:

- Does every student have to take at least one section? No.
- Does every section have to have students enrolled? No.
- Is at least one section taught in each semester? Yes.
- Does the entity section have any attributes not mentioned in the problem? No, but you can add some so long as you justify them.
- Does a faculty member have to teach at least 1 section? No.
- Does a course have to be offered in at least one section? No.
- Can a faculty teach more than one section each semester? Yes.
- Different sections in the same semester can be taught by different faculties and a section of the same course in different semesters can also be taught by different faculty members.

2. **Online Bookstore** (30 points): You have been tasked with building an online bookstore, similar to Barnes & Noble (`www.barnesandnoble.com`). You may want to refer to the Barnes & Noble website to familiarize yourself. Your bookstore will be a simpler form with just the following requirements:

(a) Each customer has a unique email, name, address, and phone number.

(b) Customers can add books to their shopping cart (similar to adding items to your shopping cart in Amazon). Each customer can have multiple carts with different books. It is important to note that this is different than the traditional e-commerce websites which only allow each user to have 1 cart.

(c) Each book has an ISBN, title, publication year, and the price.

(d) A book is written by one or more authors.

(e) Each author has a unique ID, name, address, and webpage URL.

(f) Each book is published by a single publishing company (also known as a publisher).

(g) A publisher has a unique name, address, phone, and webpage URL.

Create an ER diagram that represents the above information. You must specify the **cardinality** and **participation constraints** in the relationships. Note any unspecified requirements and your assumptions used to make the specification complete.

3. **Car Insurance Database** (20 points): Map the ER diagram for a car insurance company shown in Figure 1 into a relational database.

- Use the *smallest* possible number of relations
- Attributes in the resulting relations must not have NULL values
- Use the entity names in the ER-diagram as the name of the relation
- Use the attribute names in the ER-diagram for attribute names in the relational model
- If you augment an existing relation with an attribute x to represent a relationship R, give the attribute the name: $R.x$
- If you define a new relation to represent a relationship, use the name of the relationship for the name of the relation
- **Underline** the *primary key* in every relation
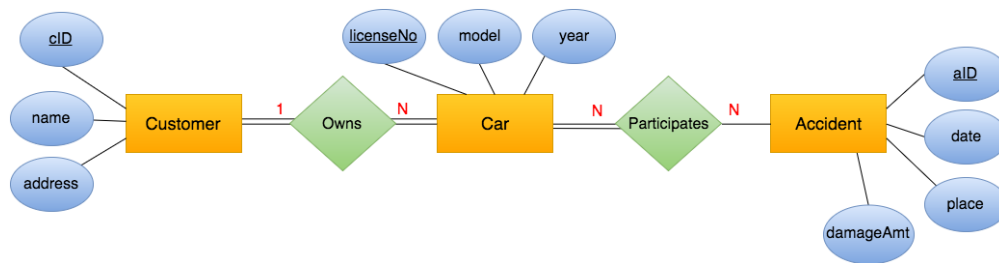- Draw an arrow from each *foreign key* to its corresponding *primary key*

Figure 1: ER diagram for a car insurance company