CS 377: Database Systems

Homework #2

Due: Friday, February 10, 2016 at 11:59 PM on Gradescope

SUBMISSION: Please submit/upload your homework onto Gradescope. You can use any software to draw the relational tables or do it by hand, but make sure it is legible. Questions about the homework can be asked in office hours or posted on Piazza. Also, make sure the work you submit is YOUR OWN.

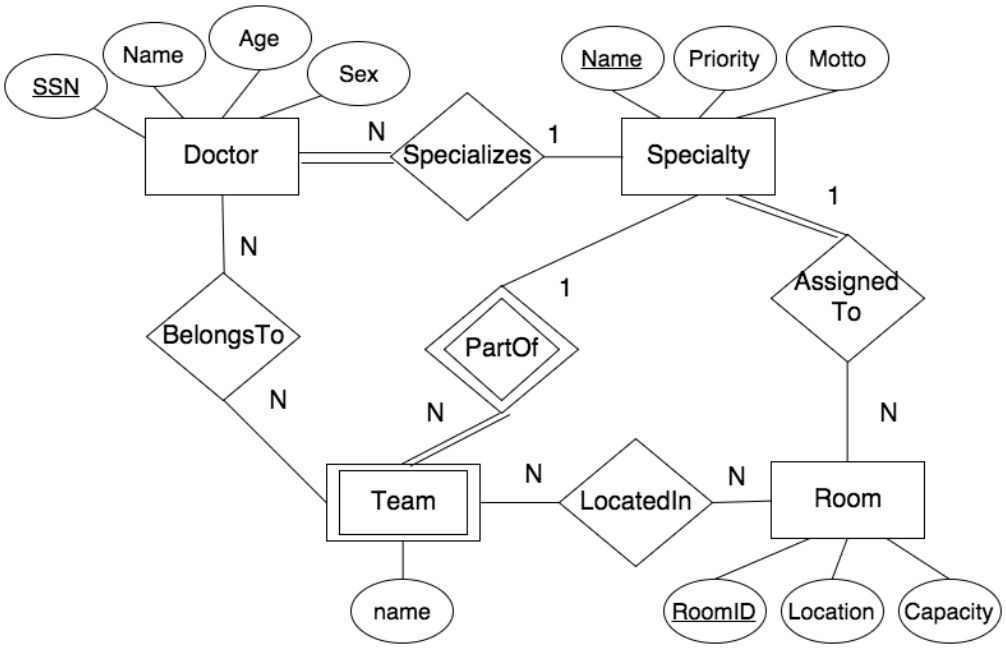

Figure 1: ER diagram for Hospital Database

1. **Hospital Database** (35 points): Map the ER diagram for a Hospital System Database shown in Figure 1. The relational model should follow these guidelines:
   - Use the *smallest* possible number of relations
   - Minimize the number of attributes in the resulting relations with 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*

2. **Library** (5+5 = 10 points): Consider the following relational schema for a library:

   ```
   member(member_no, name, dob)
   books(isbn, title, authors, publisher)
   borrowed(memb_no, isbn, date)
   ```

   Express the following queries in Relational Algebra:

   (a) Find the name of members who have borrowed all books published by "McGraw-Hill".

   (b) For each publisher, find the name and membership number of members who have borrowed more than five books of that publisher.

3. **Company Database Relational Algebra Queries** (10+10+10+10 = 40 points): Consider the company database relational data model discussed in class and shown below. Formulate the following queries in Relational Algebra:

   (a) Find the name of the projects in Atlanta that have been worked on at least a total of 100 person hours.

   (b) Find the name of the department(s) that pay the highest salary.

   (c) Find the fname & lname of the employee(s) who work the highest total number of hours.

   (d) Find the department(s) in which *all* employees in the department have at least one dependent.

4. **Company Database Relational Calculus Queries** (5+5+5 = 15 points): Consider the company database relational database and formulate the following queries in *Relational Calculus*:

   (a) Retrieve the names of all employees in department 5 who work more than 10 hours per week on the ProductX project.

   (b) List the names of all employees who have a dependent with the same first name as themselves.

   (c) Find the names of all employees who are directly supervised by Franklin Wong.

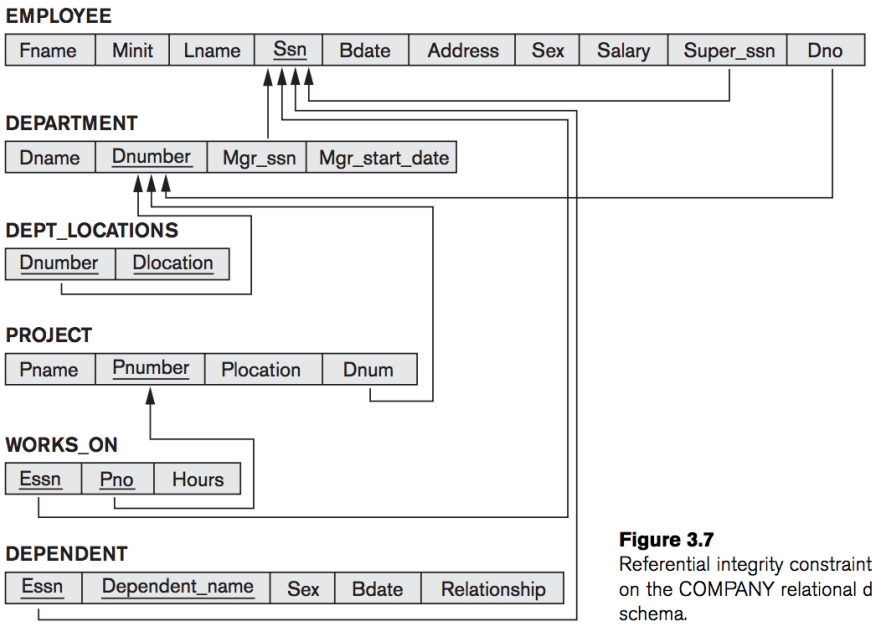

Figure 3.7
Referential integrity constraints displayed on the COMPANY relational database schema.

Figure 2: Company Database Relational Model