HOMEWORK #2

Problem 1

Suppose you're designing a database for a take-out restaurant. The restaurant manager says they want to keep track of customers, dishes (e.g. "cheeseburger", "fried chicken", etc), and how many of each dish was ordered by each customer. A customer has a name, phone number and an address. No two customers have the same phone number. Each dish has a unique name, a description, ingredients and a price. The database will keep track of how many of which dish was ordered by which customer, along with its status (e.g. "in preparation", "ready","out for delivery", etc).

1. Draw an ER diagram modeling this information. It should have an entity set representing customers, an entity set representing dishes, and one relationship set. Initially, assume that the restaurant does not want to keep track of historical data, i.e., they only want the database to track current orders.
2. While reviewing this ER diagram with you, the restaurant manager realizes that some of the dishes have different sizes with different prices (e.g., "small tomato soup for $3.00 and large tomato soup for $5.00). Modify the ER diagram to deal with this. Hint: use a weak entity set. Think about which entity sets participate in the relationship set representing orders.
3. And after further thought, the manager decides that they should also keep track of the date and time on which each order was made. Modify the ER diagram to allow this.
    - Note that adding a "date" and "time" attribute to the "ordered" relationship set is not sufficient, as this still will not allow the a customer to order the same dish on different date and times. Explain.
    - Modify the ER diagram to allow this. (Hint: Use a ternary relationship set).

Problem 2

Consider the bookstore E-R in Figure 7.29 (also shown in a slide in the chapter 7 powerpoints). You may submit one E-R diagram with all of these modifications.

1. Modify the E-R diagram to indicate that a book is published by at most one publisher.
2. Modify the E-R diagram to indicate every book has at least one author.
3. Modify the E-R diagram to indicate every shopping basket has at least one book and at max 20 books.

Problem 3

A youth soccer league has hired you to design a database to represent information about players, coaches, teams, and games. Each person (player or coach) has a unique ID, a name, and an e-mail address. A player also has an age, which is derived from his/her date of birth and a gender. There are several divisions, each with a unique name and a description. Each team is in one division. Each team has a number that is unique within its division (e.g. team 3 of the girls age 12 and under division) and a uniform color. A team has between twelve and fifteen players. A player can be on at most one team, a team has at least one coach, and a coach cannot coach more than one team. Draw an E-R diagram for the league.

Problem 4

Consider The E-R diagram in Fig. 7.29 (before the modifications from Problem 2). Make the following changes:

- omit the warehouse entity set and the stocks relationship set.
- omit the publisher entity set and the published_by relationship set
- Change the cardinality constraints on the basket_of relationship set to indicate that every shopping basket is associated with exactly one customer.
- Change the phone number attribute of customer to a multi-valued attribute.
- Change the name attribute of the customer entity set to a composite attribute with components first_name and last_name.

Following the rules we studied, derive the corresponding relational schema from the E-R diagram. Show your answer in the form of a schema diagram, in the style of figure 2.8. (That is, For each relation, draw a rectangle that lists the relation's attributes; underline the primary key(s); draw arrows to indicate foreign key contstraints.)

Problem 5.

Back in the dark ages, before Netflix, there were movie rental stores, like Blockbuster, where people rented VHS tapes, or, later, DVDs of movies. (Ask your parents about them).

Design an ER model for a chain of video rental stores, where

- Customers want to rent movies
- Branches (stores) have movies
- There can be many copies of each movies
- Each copy belongs to one branch

- There can be several copies of the same movie in same branch, each with a number that is unique for the movie and the branch, but not universally unique. Note ... you can generalize the idea of a weak entity set here, allowing a weak entity set to have more than one associated strong entity set.
- Copies borrowed from a branch need to be returned to same branch
- The system needs to keep track of when customer's borrowed and returned copies
- Customers may rent same movie or same copy of a movie many times
- Amount that customer is charged is derived from number of days for which copy of movie was rented.