CS34800 HOMEWORK 1

Due date: September 18, 2014 @ class time

1. (0.5 pts) What is the difference between a database schema and a database state?

2. (1 pt) List five advantages of using database management systems over using traditional file processing systems.

3. (0.5 pts) What is the difference between a conceptual data model and representational data model? Give an example for each.

4. (2.5 pts) Consider the Company database state shown in Figure 1 below. Suppose that the following update operations are applied to the database. For each update operation, list all the constraints (domain/referential/key (uniqueness)/entity integrity (non-null primary key)) violated by the operation along with a brief description of how it’s violated. If there is no constraint violation, write ‘No violation’. (Note: Pay attention to attribute domains!)
   a. Insert < 'Production', 1, '953775543', '01-OCT-88' > into DEPARTMENT
   b. Delete the EMPLOYEE tuple with SSN = '987654321'
   c. Modify the SUPERSSN attribute of the EMPLOYEE tuple with SSN = '999887777' to '943775543'
   d. Modify the MGRSSN and MGRSTARTDATE of the DEPARTMENT tuple with DNUMBER = 5 to '234567890' and 1988, respectively
   e. Delete the PROJECT tuple with PNAME = 'ProductX'
   f. Insert < 'ProductA', 4, 'Bellaire', 7 > into PROJECT
   g. Delete the WORKS_ON tuples with ESSN = '333445555'
   h. Insert < '677678989', null, '40.0' > into WORKS_ON
   i. Modify the HOURS attribute of the WORKS_ON tuple with ESSN = '666884444' and PNO = 3 to 5.0
   j. Insert < '453453453', 'John', X, '12-DEC-60', 'SPOUSE' > into DEPENDENT

5. (1.5 pts) Consider the following relations for a database that keeps track of automobile sales in a car dealership (OPTION refers to some optional equipment installed on an automobile):
   CAR(Serial_no, Model, Manufacturer, Price)
   SALE(Salesperson_id, Serial_no, Date, Sale_price)
   SALESPERSON(Salesperson_id, Name, Phone)
   OPTION(Serial_no, Option_name, Price)
Specify the primary key and foreign keys (along with which relation they refer to) of each relation schema.

6. (4 pts) A database is being constructed to keep track of the teams and games of a soccer league. Given the following requirements for the database, draw an ER diagram for the database. Make sure to mark participation (using single or double lines) and cardinality constraints (as 1, N or M on the connector lines) as well as primary keys on the diagram:
   - Each team is identified by a unique team_name.
   - Each player is identified by a unique player_name, which consists of (this means it's not a simple attribute!) a first_name, middle_initial, and last_name (we assume different players cannot have the same full name). A player plays for at most one team and every team has at least one player. The database keeps track of the start_date of the player in the team he is associated with.
   - Each game is identified by a unique game_number, and has a date, time and field. A player participates in zero or more games during the league season, but a game always has some participating players. A team is related to a game such that it is home_team of the game or is away_team of the game. A specific game has exactly one home team and one away team, but a team can be the home team or away team in multiple games throughout the season. The database also keeps track of the number_of_goals scored, number_of_red_cards and number_of_yellow_cards for both home and away teams.

7. (3 pts) Convert the ER diagram from Question 6 into the relational model. Show relation names, attributes, primary keys and the foreign keys (using connector lines with arrows pointing towards the attribute referred to).

8. (2 pts) Consider the ER diagram shown in Figure 7.21 below for part of a BANK database. Each bank can have multiple branches, and each branch can have multiple accounts and loans.
   a. List the strong (nonweak) entity types in the ER diagram.
   b. Is there a weak entity type? If so, give its name, its partial key, and its identifying relationship.
   c. List the names of all relationship types, and specify the (min, max) constraints on each participation of an entity type in a relationship type (i.e. draw subsets of the diagram showing only the two entities involved in the relationship, the relationship type and the (min, max) constraints).
   d. Suppose that every customer must have at least one account but is restricted to at most two loans at a time, and that a bank branch cannot have more than 1000 loans. How does this show up on the (min, max) constraints? (redraw the diagrams from (c)).
Figure 1. Sample database state for the COMPANY database
Figure 7.21
An ER diagram for a BANK database schema.