Homework 3

Instructions

1. For questions 1 and 3, please prepare your answers in a word processor.
2. For question 2, it would be preferable if you could use a word processor with an equation editor, but if that is too difficult, you may hand write your answers and scan them in. However, you must write **neatly** or you may receive a 0 if the TA cannot read your handwriting.
3. For questions 4 and 5 prepare your answers using either a word processor or by neatly sketching diagrams and then scanning them into a single digital document (e.g., scan them into a word processing document and then create a pdf file of the word processing document).
4. Please submit your answers as a single file. You should insert scanned pages into your word processing document.

Problems

Questions 1-3 can be found at the end of the Relational Calculus handout on Canvas.

1. 5.8 parts a, c, and f. As an illustration of the type of answer I want, here is an example answer for 5.8d:

   > *This will produce a (left outer) join of Guest and those tuples of Booking with an end date (dateTo) greater than or equal to 1-Jan-2002. All guests who don't have a booking with such a date will still be included in the join. Essentially this will produce a relation containing all guests and show the details of any bookings they have beyond 1-Jan-2002.*

2. 5.12, b-f.
   a. Only generate the relational algebra and tuple relational calculus expressions.
   b. Do not generate the domain relational calculus expressions.
   c. You can use mysql's CURDATE() function and its between syntax for finding currently occupied rooms, although if you do so, subtract 1 from dateTo.
   d. 5.12c should read "list the names and addresses of all guests" rather than the cities of all guests.
   e. For the relational algebra query for 5.12.f you will need an outer join.
   f. For the relational calculus query for 5.12.f, you will need two subqueries that are combined using the or operator. One of the subqueries will return all the rooms at the Grosvenor Hotel and the second subquery will return all the occupied rooms at the Grosvenor Hotel with the guest name. When the union occurs, the rooms with no guest from the first query will get their guest field filled in while the rooms with no current guest will continue to have an empty field. The first subquery will not involve guests and the second subquery will involve guests.

3. 5.10. Question 5.10d should read:

d) $\{H.hotelName, G.guestName| Hotel(H) \land Guest(G) \land (\exists B1)((\exists B2)(Booking(B1)$

$\land Booking(B2) \land H.hotelNo = B1.hotelNo \land$

$G.guestNo = B1.guestNo \land B2.hotelNo = B1.hotelNo \land$

$B2.guestNo = B1.guestNo \land B2.dateFrom \neq B1.dateFrom)\}$

Questions 4 and 5 give you practice with ER diagrams/design

4. You are required to create a conceptual data model of the data requirements for a company that specializes in IT training. The Company has 30 instructors and can handle up to 100 trainees per training session. The Company offers five advanced technology courses, each of which is taught by a teaching team of two or more instructors. Each instructor is assigned to a maximum of two teaching teams or may be assigned to do course development on one or more new courses. Each training session presents exactly one of the company's advanced technology courses.

   a. Identify the main entity types for the company.

   b. Identify the main relationship types and specify the multiplicity for each relationship. State any assumptions you make about the data.

   c. Using your answers for (a) and (b), draw a single ER diagram to represent the data requirements for the company.

5. The following problem describes the data requirements for a video rental company. The video rental company has several branches throughout the USA. The data held on each branch is the branch address made up of street, city, state, and zip code, the telephone number, and the manager. Each branch is given a branch number, which is unique throughout the company. Each branch is allocated staff, which includes a Manager. The Manager is responsible for the day-to-day running of a given branch. The data held on a member of staff is his or her name, position, and salary. Each member of staff is given a staff number, which is unique throughout the company. There is no special additional information kept about a manager, so you should not define a separate entity for a Manager.

   The company has a catalog of video titles. The data held on a video title is the catalog number, title, category, daily rental fee, purchase cost, the names of the main actors, and the director. The catalog number uniquely identifies each video title. Each branch may have one or more copies of a video title. Each copy has a rental status, and the individual copies are identified using the video number. A video title is given a category such as Action, Adult, Children, Drama, Horror, or Sci-Fi. The rental status indicates whether or not a specific copy of a video is currently rented. Before

renting a video from the company, a customer must first register as a member of a local branch. The data held on a member is the first and last name, address, the date that the member registered at a branch, and the branch at which the member registered. Each member is given a member number, which is unique throughout all branches of the company. Once registered, a member is free to rent videos, up to a maximum of ten at any one time. The data held on each video rented is the rental number, the full name and number of the member, the video number, title, and daily rental, and the dates the video is rented out and date returned. The rental number is unique throughout the company.

(a)   Draw a single ER diagram to represent the data requirements of the video rental company. State any assumptions necessary to support your design.

(b)   Identify attributes and associate them with entity types. Do not worry about duplicating data in entities in this assignment. The next assignment will use normalization to eliminate redundant data and unnecessary data dependencies.

(c)   Identify candidate and primary key attributes for each entity type. Make reasonable assumptions about the uniqueness of attributes and state what those assumptions are if in doubt. For example, do not assume that customer names are unique but it is reasonable to assume that two customers with the same names do not live at the same address.