15-415: Database Applications
Problem Solving Assignment 1

School of Computer Science
Carnegie Mellon University, Qatar
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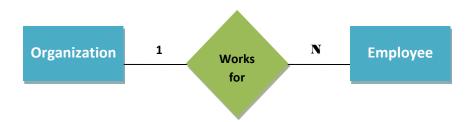
Assigned date: January 15, 2014
Due date: January 23, 2014 by 11:59PM

I.   **Building a Database for Qatar Foundation [40 points]:**

A recent meeting among the board of directors of Qatar Foundation (QF) has been concluded with the decision of collecting and storing information pertaining to all organizations in QF and their employees. The information will be used primarily for their emergency notification system among other things. An expert (you!) has been hired to design their database given the following description of entities and relations:

- Every organization has a unique name (e.g. Carnegie Mellon University in Qatar, Student Center, etc.,), address within QF, and contact numbers.
- An organization can be classified as University, Company, Vendor, or Activities Center. Texas A&M University, Al-Jazeera for Children, Al-Bateel Café, and Awsaj Recreational Center are examples of each category, respectively. QF records the majors, product line, cuisine, and types of activities for the above categories, respectively.
- Every employee has a name, contact number, and employee ID.
- An employee may work for several organizations, but at least for one. For example, employee X may work for the Recreation Center in the morning while for the Community Center in the afternoon. Accordingly, for every employee, we must record the start and end times at each organization.
- An employee is either a long-term or a short-term hire and is either local or expatriate. Note that for local hires, QF records the end date of their contracts.
- An employee may be appointed as a manager. A manager manages one or more organization(s). For example, the Recreation Center and Community Center may be managed by the same manager.
- Each organization should be managed by at most one manager.

1.1 Consider the works for relationship between the entities organization and employee. Correct the errors (if any) in the following E.R. Diagram. You may use the thin/thick 'arrow' notation of the book, or the M:N notation. **[2 points]**

1.2 Draw the E.R. diagram for QF's database as described above. Make sure to indicate primary and partial keys, cardinality constraints, weak entities, and participation constraints where applicable. Please state any assumptions that you make. **[15 points]**

1.3 State whether organization ISA hierarchy has (a) covering and/or (b) overlapping constraints. Explain briefly. **[3 points]**

1.4 State whether employee ISA hierarchy has (a) covering and/or (b) overlapping constraints. Explain briefly. **[5 points]**

1.5 Write SQL statements to create tables corresponding to your E.R. diagram. Make sure to indicate primary keys, and foreign keys (if any). Do not specify on delete clauses or check constraints. **[15 points]**

II.   Extending Qatar Foundation's Database [30 points]:

Suppose that Qatar Foundation wishes to extend their database to include the phone numbers of visitors and guests.

1.1 Qatar Foundation records the name, phone number, and destination of a visitor. A visitor can visit multiple destinations and QF records at least one. For example, a visitor can visit CMUQ followed by the Student Center. Extend the E.R. diagram from exercise 1 to include the entity visitor and the associated relationship. Clearly indicate primary and partial keys, cardinality constraints, weak entities (if applicable), and participation constraints. **[10 points]**

1.2 An employee is allowed to exercise at any Activities Center and is also allowed to have two guests associated with him/her. Information stored about a guest is his/her name and age. Guests are assumed to accompany the employee at all times and, hence, emergency messages are sent only to the employee. Once again, extend the E.R. diagram from exercise 1.1 to include the entity guest and all given relationships. Clearly indicate primary and partial keys, cardinality constraints, weak entities (if applicable), and participation constraints. **[10 points]**

1.3 Write SQL statements to create tables corresponding to your new E.R. diagram. Make sure to indicate primary keys, and foreign keys (if any). Do not specify on delete clauses or check constraints. **[10 points]**

III.   Building a Database for Hogwarts [30 points]:

In Harry Potter's School of Wizardry, Hogwarts, fortune-telling is a hot business attracting many witches and wizards. A fortune-telling center wishes to maintain information about their customers. However, the center has realized the shortcomings of witchery and their dire need for Databases. Therefore, they have invited a database expert (you!) to fly to Hogwarts to design their database given the following description.

The center employs a number of fortune-tellers. Each fortune-teller has an ID, first name, last name, hourly rate, and method used (e.g. tarot, astrology etc.). A magician (witch/wizard) can schedule a session with a specific fortune-teller on a specific date and for any desired duration. Of course, a fortune teller can see as many magicians as possible in a day. Most importantly, the predictions made during a session for a magician, including love, wealth, career, and luck are stored for reference. This ensures that this information is available when making predictions in later sessions for the same magician.

1.1 Draw the E.R. diagram for the fortune-telling database as described above. Make sure to indicate primary and partial keys, cardinality constraints, weak entities, and participation constraints where applicable. Please state any assumptions you make. **[6 points]**

1.2 Write SQL statements to create tables corresponding to your E.R. diagram. Make sure to indicate primary keys, and foreign keys (if any). Do not specify on delete clauses or check constraints. **[12 points]**

1.3 When a magician arrives for a session, the fortune-teller must see the history of predictions which were made for that magician in the past. Write a view to achieve this task. **[12 points]**