Databases I. Exercises (06-03-2019)

1. Alice has a large DVD movie collection. Her friends like to borrow her DVD's, and she needs a way to keep track of who has what. She maintains a list of friends, identified by unique FID's (friend identifiers) and a list of DVD's, identified by DVDID's (DVD identifiers). With each friend is the name and the all-important telephone numbers which she can call to get the DVD back. With each DVD is the star actor name and title. Whenever a friend borrows a DVD, Alice will enter that fact into her database along with the date borrowed. Whenever the DVD gets returned, that fact, too, gets noted along with the date returned. Alice wants to keep a complete history of her friends' borrowing habits so that she can ask favors of the heavy borrowers (or perhaps refuse to make further loans to those who habitually don't return them quickly).

   a. Draw the ER model!
   b. Translate the ER model to relational model!

2. Karl Andersson has a boat rental. As summer season approaches, he thinks of the mess of paper that he has to deal with every year. It would be so much more convenient to have everything organized digitally. We know the following: Every boat has a license plate that identifies the boat, a name, and a type (sailing-, motor boat etc.). Furthermore, Karl stores the customer's name and address (pcode is the postal code). Every rental has a number. A boat is rented from a certain date and time to a certain date and time. The status stores the information whether the boat has been returned or not.

   (a) Mark the primary key in the ER model (adjust the model if necessary) and give a short explanation, why the primary keys are possible to use.

   (b) Add cardinality and briefly explain your decision.

   (c) Translate the ER model to the relational model. For the relationship types: Do you need an extra table? Why or why not?

3. UPS prides itself on having up-to-date information on the processing and current location of each shipped item. To do this, UPS relies on a company-wide information system. Shipped items are the heart of the UPS product tracking information system. Shipped items can be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date. Shipped items are received into the UPS system at a single retail center. Retail centers are characterized by their type, uniqueID, and address. Shipped items make their way to their destination via one or more standard UPS transportation events (i.e., flights, truck deliveries). These transportation events are characterized by a unique scheduleNumber, a type (e.g, flight, truck), and a deliveryRoute. Please create an Entity Relationship diagram that captures this information about the UPS system. Be certain to indicate identifiers and cardinality constraints.

   Translate the ER model to a relational model!

4. Given the following business scenario, create an EER diagram using a specialization hierarchy if appropriate. Two-Bit Drilling Company keeps information on employees and their insurance dependents. Each employee has an employee number, name, date of hire, and title. If an employee is an inspector, then the date of certification and certification renewal date should also be recorded in the system. For all employees, the Social Security number and dependent names should be kept. All dependents must be associated with one and only one employee. Some employees will not have dependents, while others will have many dependents.

   Translate the EER model to a relational model!

Examples of Functional Dependency and Normal Forms:

5.   Given AB -> CDE, is R(A,B,C,D,E) in 2NF?

6.   Given B -> ACDE, is R(A,B,C,D,E) in 2NF?

7.   Given AB -> CD and B -> E, is R(A,B,C,D,E) in 2NF?

8.   Consider this table:

      EMPLOYEE (Emp_no, Name, Project_no, Project_location)

      with FDs

      Emp_no -> Emp_no, Name, Project_no

      and

      Project_no -> Project_location

      Is this table in 1NF, 2NF, 3NF? Decompose the table if necessary.

9.   Consider this table:

      R(A, B, C, D, E, F)

      with FDs

      AB -> CD, D -> E, E -> F

      Is this table in 1NF, 2NF, 3NF? Decompose the table if necessary.