CS 4611 – Spring 2017 – Laboratory 3
Assigned: 09/19/2017
Due: 09/21/2017 at 11:59 PM. Submit your file(s) to canvas.
Maximum Grade: 100 pts.

Objectives: The objectives of this lab are the following:

- **Practice how to write queries using relational algebra.**
- **Review the basic concepts of E-R diagrams: entity/entity sets, relationship/relationship sets, attributes, participation constraints (one-to-one, one-to-many, many-to-one, many-to-many), weak entity sets.**
- **How to reverse engineer a given a set of relation schemas, by obtaining an E-R diagram that satisfies the same user specifications.**

Activity 1: Use SQL Developer to connect to the Oracle server running in the machine akka.d.umn.edu. For your username use the first four letters of your last name followed by the first letter of your name. Example: "leale" would be my username. If your last name doesn't have more than four letters, then use your full last name followed by the first letter of your name.

Activity 2: Remember the same scenario of HW1: The Duluth Public Library wishes to update its old manual loan system by implementing its database in a relational DBMS. Assume that after talking to the people in charge of the loan system at the library, you come up with the following table schemas.

book(book_id, title, publisher_name, no_of_copies)
book_authors(book_id, author_name)
publisher(name, address, phone)
book_loans(book_id, card_no, date_out, due_date)
borrower(card_no, name, address, phone)

a. (20pts.) Submit a file named *lab3_yourname.sql* containing the Oracle SQL code to implement the following queries. Again, I have marked questions with asterisks according to their level of difficulty:
    i. Retrieve all pairs of different authors that have been coauthors in at least two books.
    ii. Find the name of the borrower who has borrowed the second largest amount of books.
    iii. Find the names of the borrowers who have borrowed all books that Lucy has borrowed. For this query you need to provide 2 different strategies to implement it with relational algebra, and just 1 strategy using Oracle SQL.

b. (20pts.) Submit a separate .txt, .doc, or .pdf file implementing the same queries using relational algebra. *Important: For query (a).(v). you need to provide 2 different strategies to implement it using relational algebra*.
c. (10pts.) Write the query tree of each of the above queries.

Activity 3: (25pts) Remember that as a DB designer, you usually start from the specification of user requirements (which you obtain from talking to the user). From this specification you then construct an E-R diagram. We'll soon see in class that you can transform this E-R diagram into the relational model, so that you can implement it in a relational DBMS. In this question what we want is for you to reverse engineer the scenario given in Question 1, i.e., given the relational tables, write down an E-R diagram that captures the same specification of user requirements. Remember that you need to also write down the user-defined constraints in the E-R diagram, i.e., those constraints that do not form part of the diagram, but that form part of the specification of user requirements.

Activity 4: (25pts) Do exercise 7.32 of the "ER Exercises Elmasri….pdf" file.