B.Sc. Engg. SWE 3rd Semester   11 March 2019 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
DURATION: 1 Hour 30 Minutes   FULL MARKS: 75

CSE 4307: Database Management Systems

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

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1. a) Consider the following Library Database Schema: 6
   Book *(ISBN, title, authorName, Price, yearPublished)*
   BookCopy *(copyNo, status, loanPeriod, ISBN)*
   BookLoan *(loanNo, dateOut, dateReturned, copyNo, borrowerNo)*
   Borrower *(borrowerNo, name, address)*
   Book table stores different information about the books. Each book must have a *title*. *authorName* can be either in English or Chinese. *BookCopy* table keeps track of individual copies of books. Here *status* can be from the set {'Available', 'Loaned'}. If one book is deleted from the *Book* table, all copies of it must be removed. *BookLoan* table keeps track of the books that is loaned by the borrowers. *Borrower* table stores information about different borrowers.
   Write DDL statements to create the tables. Make sure to include proper integrity constraints and references.

   b) Write SQL statements to perform the following operations based on the schema in Question   3×5
   1(a).
   i.   Count the number of books that have names starting with a consonant.
   ii.   Show all the information about the most expensive book.
   iii. Count the number of available books (not book copies).
   iv.   List the name of the people who borrowed at least one book from January 01, 2019 to January 31, 2019 (inclusive).
   v.   List the name and the number of copies of that book in the library. Remember to include the books which have no copies currently.

   c) Assume that there are *m* tuples in a relation *r(A, B)* and *n* tuples in another relation *s(C, D)*   2×2
   where *C* and *D* are compatible with attributes *A* and *B*, respectively. Determine the minimum possible number of tuples in the resulting relation after executing each of the following SQL statements:
   i.   `SELECT * FROM r UNION ALL SELECT * FROM s;`
   ii.   `SELECT * FROM s NATURAL JOIN r;`

2. a) Define super key, candidate key and primary key. Provide examples of each key using a   6
   single table.
   b) Write Relational Algebra expressions to answer the following queries based on the schema   1.5×4
   shown in Question 1 (a):
   i.   Find the *title* and *author* of the books published in 1999.
   ii.   Find the *ISBN*, *copyNo* and *dateReturned* of the books that were loaned by people living in 'Chittagong'.
   iii. Find the *name* of the borrowers that borrowed a book written by 'Silberschatz'.
   iv.   Rewrite the query from (iii) using natural join.
   c) Write an SQL statement to create a view *BorrowerList* containing the name of the borrowers   2+3
   and the number of books they borrowed. Is the view updateable? Justify your answer.

d) Write appropriate SQL statements to create the authorization graph shown in Figure 1. For each statement, identify which user will execute the command. Assume that you are only granting the SELECT privilege on *Book* table based on the database schema in Question 1(a). Explain what happens in the context of Oracle Database when DBA revokes privilege from U1.   6+2
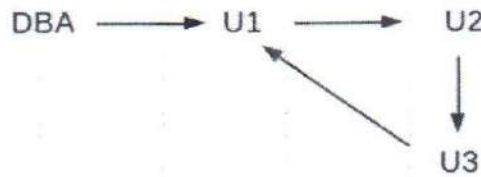
DBA ⟶ U1 ⟶ U2

U2 ⟶ U3

U3 ⟶ U1

Figure 1: Authorization Graph

3. a) Assume that as a part of an international conference organized by the Dept. of CSE, IUT, the organizers need to keep track of many workshops (day-long training) associated with the main event. Initial requirements analysis brings out the following information about what needs to be recorded: 8
   - Each workshop has a unique identifier, a name, and happens on a particular date or dates, as some workshops last more than one day.
   - A workshop may have many participants. Each participant is described by a unique identifier, a name and an address. A participant may sign up to one or more workshops. It is important to record the date when a participant signs up for a workshop.
   - A workshop may be divided into sessions. Each session is identified by an identifier, time of the day when the session takes place (e.g. morning, afternoon or evening) and a speaker of the session who is also a participant.
   - There are number of meeting rooms at the conference venue, each of a fixed capacity. Meeting rooms are identified by a floor and a room number. Every workshop needs an allocated meeting room where all sessions of the workshop takes place. If a workshop lasts for more than one day, it will use the same room on both days.
   - Each workshop is supervised by a faculty member of the department. Each faculty has a unique identifier, name and rank (Lecturer, Assistant Professor and so on). A faculty can supervise many workshops, possibly zero.

   Create an ER model based on the above mentioned specifications. Your ER model must be neat, concise and legible.

   b) Reduce the ER model that you have designed in Question 3(a) into a set of relations with proper justification. Identify the appropriate primary key for each relation.   6

   c) Describe appropriate scenarios where you can demonstrate the application of the following cardinalities: 2×3
      i.   one-to-one
      ii. one-to-many
      iii. many-to-many

   d) Explain the necessity of identifying entity sets in Entity-Relationship model. Provide necessary examples.   5

4. a) With proper examples, explain the bad designs that normalization aims to eradicate.   12
   b) Define data dictionary. Explain atomicity, consistency and durability in transaction management.   1+6
   c) List the components of a query processor and describe their functionalities.   6