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COMP 5 – 5 (RC)

T.E. (Comp.) (Semester – V) (RC) Examination, May/June 2013
DATABASE MANAGEMENT SYSTEMS

Duration : 3 Hours | Total Marks : 100

Instructions : *Answer **any five** questions, selecting at least **one** from **each** Module.*
***Assume** necessary data, **wherever** required.*

MODULE – I

1. a) Design a database for an automobile company to provide to its dealers to assist them in maintaining customer records and dealer inventory and to assist sales staff in ordering cars. Each vehicle is identified by a Vehicle Identification Number (VIN). Each individual vehicle is a particular model of a particular brand offered by the company (e.g., the XF is a model of the car brand Jaguar of Tata Motors). Each model can be offered with a variety of options, but an individual car may have only some (or none) of the available options. The database needs to store information about models, brands and options, as well as information about individual dealers, customers and cars. Design should include an ER diagram, set of relational schemas and the list of constraints. **10**

   b) Give an example for the following : **4**

      i) Disjoint and complete specialization

      ii) Overlapping and complete specialization.

   c) What is the importance of the query processor in the DBMS ? What are the various components of the Query Processor ? **6**

2. a) How is the physical data independence different from the logical data independence ? **2**

   b) What is a participation role in an ER diagram ? When is it necessary to use role names in the description of entity types ? Provide example. **5**

   c) Describe any four advantages of DBMS over the file processing system. **4**

   d) What is aggregation ? Why is it required ? Justify using an example. **4**

   e) What do you mean by a discriminator ? **2**

   f) What is meant by a recursive relationship type ? Provide example. **3**

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MODULE – II

3. a) With the help of an example explain what is the difference between the superkey and the candidate key ? 2

b) Consider the following relations for a database that keeps track of student's enrollment in courses and the books adopted for each course.

Student(SSN, Name, Major, Bdate)

Course(CourseNo, Cname, Dept)

Enroll(SSN, CourseNo, Quarter, Grade)

Book_adoption(CourseNo, Quarter, Book_ISBN)

Text(Book_ISBN, Book_title, Publisher, Author).

i) Answer the following questions in relational algebra.

A) List the number of courses taken by all students named 'Megha Jain' in Summer 2011 (i.e. Quarter ="S11"). 2

B) Produce a list of textbooks (include CourseNo, Book_ISBN, Book_title, author) for courses offered by the IT department that have used more than three books. 3

C) List any department that has all its adopted books published by 'Tata McGraw Publishing'. 3

ii) Answer the following questions in SQL.

A) List the details of a student who has obtained more than 3 'AB' grades in his coursework. 2

B) Find out, if any, the name of the books which are used by more than 1 course. 2

C) Find out the course with maximum enrolment in any quarter and indicate which quarter it is. 3

iii) Give SQL commands to enforce the following constraints on the above database : 3

A) Grade attribute in the Enroll relation must be a valid grade (i.e. any one of the following AA, AB, BB, BC, CC, DD, FF).

B) CourseNo in enroll relation must be a valid CourseNo existing in the database.

C) Every book must have a publisher entry for it.

4. a) Specify the following relational algebra operation in TRC and DRC : 4

($\sigma_{A='10'}$ (R(A,B,C)*S(C,Y,Z))).

b) Consider the following set F of functional dependencies on the relation schema r(A,B,C,D,E,F)

F={A->BCD,BC->DE, B->D, D->A},

i) Compute the key for the above relation. 2

ii) What is a canonical cover ? What is its significance ? Compute the canonical cover for the above set of functional dependencies. 7

c) Suppose user A is the owner of the relation r(A,B,C,D). User A wants to grant privileges to the users. Give SQL commands for the following : 7

I) Give select privilege on r to all the existing/future users.

II) Give update privilege on B and C attribute of r to user C, with a power to pass on this privilege to other users.

III) Give all the privileges on r to all the existing/future users. (provide one command)

IV) Revoke the delete privilege on table r from user D and also revoke it from all the users to whom user D (or anyone in the hierarchy) might have granted this privilege.

MODULE – III

5. a) Normalize the following schema, with given constraints, to BCNF : 7

Books (accessionno, isbn, title, author, publisher)

Users (userid, name, deptid, deptname)

F = {Accessionno ->isbn

isbn - > title

isbn -> publisher

isbn -> author

userid -> name

userid -> deptid

userid -> deptname }

b) Let relations r1(A,B,C) and r2(C,D,E) have the following properties : r1 has 20000 tuples, r2 has 45000 tuples, 25 tuples of r1 fit on one block and 30 tuples of r2 fit on one block. Estimate the number of block transfers and seeks required for each of the below mentioned operations :

i) r1*r2 using Nested Loop join

ii) r1*r2 using block nested loop join

iii) σB=100(r1), using binary search. 6

c) List the design goals for relational databases, and explain why each is desirable. 3

d) Define 5NF. What type of dependencies are handled in 5NF ? 4

6. a) What is external sorting ? Explain the sort-merge algorithm for external sorting. A file of 4096 blocks is to be sorted with an available buffer space of 64 blocks. How many passes will be needed in the merge phase of the external sort-merge algorithm ? Compute the number of seeks and transfers. 8

b) Consider the universal relation R={A,B,C,D,E,F,G,H,I,J} and the set of functional dependencies F={AB->C, A->DE, B->F, F->GH, D->IJ}. 6

Consider the following decomposition D={R1,R2,R3,R4,R5};

R1={A,B,C,}, R2={A,D,E}, R3={B,F}, R4={F,G,H}, R5={D,I,J}

for the relation Schema R. Determine whether the above decomposition has

i) dependency preservation property

ii) lossless join property with respect to F.

c) Consider the query to find the names of all the employees who works for a company located in the same city as the city in which the employee lives and are earning a salary less than the manager of the company. Draw the initial query tree for the above query and then show how the query can be translated to the optimized query. Under what circumstances would you use each of the query trees ? Assume the Schema as employee (ename,street,city); Works(ename,cname,salary);Company(cname,city); Manager(ename,mgr_name). 6

MODULE – IV

7. a) During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain why each state transition may occur. 4

   b) Consider the 3 transactions T1, T2 and T3 and the schedule S1 given below. Draw the precedence graphs for S1, and state whether schedule S1 is serializable or not. If the schedule is serializable, write down the equivalent serial schedules. Can the schedule S1 be recoverable schedules ? If yes give the corresponding recoverable schedule. 5

   T1:r1(x);r1(Z);w1(X)

   T2:r2(Z);r2(Y);w2(Z);w2(Y)

   T3:r3(X);r3(Y);w3(Y)

   S1:r1(X);r2(Z);r3(X);r1(Z);r2(Y);r3(Y);w1(X);w2(Z);w3(Y);w2(Y);

   c) When do we say that a schedule is view serializable ? Give an example of the schedule which is conflict serializable but not view serializable. 6

   d) Most implementations of the database systems use strict two-phase locking. What is strict 2-phase locking ? Suggest three reasons for the popularity of this protocol. 5

8. a) Explain the two-phase locking protocol. Does it always give us serializable schedules ? Justify your answer with the help of an example. Is 2-phase locking a deadlock-free protocol ? If no, suggest modifications to the algorithm to get a deadlock-free schedule and justify using modifications using an example. 12

   b) What is recoverable schedule ? Why is recoverability desirable ? Consider the schedules S1 and S2 given below. Determine whether each schedule is cascadeless and recoverable. Ci represents commit of transaction i; ri(x)-represents read of data item x by transaction i; wi(x) represents write on data item x by transaction i.

   S1:r1(x);r2(z);r1(z);r3(x);r3(y);w1(x);c1;w3(y);c3;r2(y);w2(z);w2(y);c2;

   S2:r1(x);r2(z);r3(x);r1(z);r2(y);r3(y);w1(x);c1;w2(z);w3(y);w2(y);c3;c2; 8