10/6/16

COMP 5 – 5 (RC)

**T.E. (Comp.) (Semester – V) (RC) Examination, May/June 2016
DATABASE MANAGEMENT SYSTEMS**

Duration : 3 Hours   Max. Marks : 100

Instruction : *Answer* **any five** *questions by selecting atleast* **one** *question from* **each** *Module.*

MODULE – I

1. a) A university registrar's office maintains data about the following entities :   **10**

   a) Courses, including number, title, credits, syllabus and prerequisites ;

   b) Course offerings, including course number, year, semester, section number, instructor(s), timings and classroom ;

   c) Students, including student-id, name and program ; and

   d) instructors, including identification number, name, department and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints. Convert the resulting ER into tables, clearly specifying the constraints.

   b) What do you mean by aggregation ? When is it required ? Provide two examples of aggregation.   **6**

   c) What are advantages of using DBMS over file systems ?   **4**

2. a) Explain the following terms with respect to an ER diagram (provide examples).   **6**

ii) Key constraint

iii) Integrity constraints.

b) What is an identifying relationship ? How is it represented in an ER diagram ? Provide examples. **4**

c) What are the various levels of schema abstraction in DBMS ? Why is it required ? **4**

d) What is data independence ? What role does the data independence play in database design ? How is physical data independence different from logical data independence ? **6**

MODULE – II

3. a) What do you mean by safety of expression in TRC ? **3**

b) What are views ? Can views be updated ? Justify using examples. **5**

c) Suppose that we have the following three tuples in a legal instance of a relation schema S with three attributes ABC (listed in order) : (1, 2, 3), (4, 2, 3) and (5, 3, 3). **4**

   i) Which of the following dependencies can you infer does not hold over schema S ?

      a) $A \rightarrow B$ b) $BC \rightarrow A$ c) $B \rightarrow C$

   ii) Can you identify any other dependencies that hold over S ?

d) Consider the following database : **8**

   Faculty (fid, fname, faddress, fage, salary)

Answer the following queries in relational algebra.

i) Retrieve the name of the faculties along with the subject they teach.

ii) Retrieve the number of courses taught by each faculty.

iii) Retrieve the name of the faculty teaching maximum number of courses in a given year.

iv) Retrieve the name of the faculties who have taught the same course more than once.

4. a) Consider the attribute set R = ABCDEG and the FD set
   $F = \{AB \rightarrow C, AC \rightarrow B, AD \rightarrow E, B \rightarrow D, BC \rightarrow A, E \rightarrow G\}$.   **10**

   i) Name the strongest normal form that is not violated by the relation containing these attributes.

   ii) Decompose it into a collection of BCNF relations if it is not in BCNF

   iii) Check if the following decomposition of R into three relations {ABC, ACDE, ADG} with the same set of dependencies F, is

   A) dependency-preserving.

   B) Lossless-Join.

   b) What do you mean by foreign key ? Explain using an example.   **2**

   c) Consider the following database :   **8**

   Person (name text, age int, gender text) ;

Answer the following queries in SQL

i) Find the names of all females who eat at least one pizza served by Straw Hat.

ii) Find all pizzerias that serve at least one pizza for less than $10 that both Amy and Fay eat.

iii) Find the names of all people who eat at least one pizza served by Dominos but who do not frequent Dominos.

iv) Find the age of the oldest person (or people) who eat mushroom pizza.

MODULE – III

5. a) Assume the following relations :

> Books (DocId, Title, Publisher, Year)
>
> Student (StId, StName, Major, Age) .
>
> Author (AName, Address)
>
> borrows (DocId, StId, Date)
>
> has-written (DocId, AName)

Consider the query "find the name and age of students who are 'CS' majors and have borrowed book(s) written by author 'Navathe' ".

Draw the query graph and the initial query tree for the above query and then show (each step) how the query can be optimised. Provide the final optimised query.

8

b) Consider a relation R with four attributes ABCD. Given the following sets of FDs, assuming those are the only dependencies that hold for R, do the following :

8

c) If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies.

$$F = \{AB \rightarrow C, AB \rightarrow D, C \rightarrow A, D \rightarrow B\}$$

c) What do you mean by left deep trees ? Why are they preferred by query optimizers ?   **4**

6. a) Suppose you need to sort a relation of 20 GB, with 4KB block size, using memory size of 20 MB. Suppose the cost of a seek is 5ms, while the disk transfer rate is 40 megabytes per second. Find the cost of sorting the relation, in seconds. Assume bb = 1, where bb is the buffer blocks allocated to each run during merge phase. What is the max/ideal value we can choose for bb ? What is the cost of sorting the relation, in seconds, when we consider bb equal to this ideal value ?   **10**

b) What do you mean by Multivalued Dependency (MVD) ? Briefly explain MVD's using a example relation and then normalize the relation in 4NF.   **7**

c) Briefly explain the differences between pipelining and materialization.   **3**

MODULE – IV

7. a) What is the difference between the 2 phase locking protocol and the tree protocol ?   **4**

b) Give an example where adding lock/unlock instruction to the transactions (not

c) What is the difference between strict and basic two phase locking ? Provide a schedule which is allowed under basic 2PL but not under strict 2PL.   6

d) What are the various deadlock prevention techniques used in databases ?   6

8. a) Consider a database with objects X and Y and assume that there are two transactions T1 and T2. Transaction T1 reads objects X and Y and then writes object X. Transaction T2 reads objects X and Y and then writes objects X and Y.

     i) Give an example schedule with actions of transactions T1 and T2 on objects X and Y that results in a write-read conflict.

     ii) Give an example schedule with actions of transactions T1 and T2 on objects X and Y that results in a write-write conflict.

     iii) Check whether strict 2PL will allow/disallow above two schedules.

   b) Consider the following classes of schedules, serializable, conflict-serializable, view-serializable, recoverable and strict. For each of the following schedules, state which of preceding classes it belongs to. If you cannot decide whether a schedule belongs in a certain class based on the listed actions, explain briefly. The actions are listed in the order they are scheduled and prefixed with the transaction name. If a commit or abort is not shown, the schedule is incomplete ; assume that abort or commit must follow all the listed actions.   10

     i) T1 : R(X), T1 : R(Y), T1 : W(X), T2 : R(Y), T3 : W(Y), T1 : W(X), T2 : R(Y)

     ii) T2 : R(X), T3 : W(X) ; T3 : Commit, T1 : W(Y) T1 : Commit, T2 : R(Y)

c) Consider the data given below and determine whether deadlock exists : **4**

Transaction	Data items locked by transaction	Data item transaction is waiting for
T1	X2	X1, X3
T2	X3, X10	X7, X8
T3	X8	X4, X5
T4	X7	X1
T5	X1, X5	X3
T6	X4, X9	X6
T7	X6	X5

If it exists, what measures can be taken for handling the deadlock ?