



T.E. (Comp.) (Semester – V) (RC) Examination, November/December 2015
DATABASE MANAGEMENT SYSTEMS

Duration : 3 Hours

Total Marks : 100

Instructions: 1) Answer **five** questions in **all**, selecting at least **one** question from **each** Module.

2) Assume necessary data, **wherever** required.

MODULE – I

1. a) The organisers of the EXAM 2015 international multi-conference need to keep track of a large collection of workshops associated with the event. Initial requirements analysis brings out the following information about what needs to be recorded.

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- Each workshop has a name, and happens on a particular date – or dates, as some workshops last more than one day.
- There are several participants, each of which may sign up to one or more workshops.
- For each participant, it is important to record their name, email address, and the workshops which they wish to attend.
- There are a number of meeting rooms at the conference venue, each of a fixed capacity. Meetings rooms are identified by a floor and room number.
- Every workshop needs an allocated meeting room; where a workshop lasts for two days, it will use the same room on both days.

A) Draw an entity-relationship diagram suitable for representing this information, in particular the connections between participants, workshops, rooms and dates.

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B) Further analysis reveals additional requirements. However, not all of these can be captured easily in an ER diagram.

- Each workshop must have an identified organiser among the conference participants.
- No participant may register for two workshops on the same day.
- Every participant may register for at least one workshop.
 - i) Identify two of these which can be captured in an ER diagram.
 - ii) For those two, show the additions required to your diagram.

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

c) Explain the responsibilities of the following subsystems of database (any 2) : 4

- i) Query processor
- ii) Storage manager
- iii) Transaction manager.

d) List any two advantages of DBMS. 2

2. a) Explain the distinction between condition defined and user defined constraints. Which of these constraints can the system check automatically ? Explain your answer. 6

b) For each of the following concepts give a brief description of what it means, how it is represented in the ER diagram and provide an example. 6

- i) Composite key
- ii) Total participation
- iii) Key constraint.

c) What do you mean by identifying relationship ? 2

d) Explain the following terms with the help of an example. Also discuss why are they required ? 6

- I) Aggregation
- II) Specialization.



MODULE – II

3. a) Differentiate between a relation schema and a relation instance. Define the term relation degree. What are domain constraints ? 3
- b) Let the following relational schema be given : 10
- EMPLOYEE (SSN, Name, Age, salary, Dno)
- WORK_ON (Project#, SSN)
- PROJECT (Project#, pname, plocation)
- For each of the following queries, give an expression in relational algebra :
- i) Display the names of employees working on project at "Delhi".
 - ii) Retrieve the name of the working on maximum projects.
 - iii) For each project retrieve the number of employees working on that project.
 - iv) Find the names of the employees who work on all the projects that "Mr. ABC" works on.
 - v) For each department that has more than 5 employees, retrieve the department number and the number of its employees who are making more than 50,000/-.
- c) What do you mean by safety of expressions in DRC ? 2
- d) Check whether the following set of functional dependencies are equivalent or not. 5
- $F1 = \{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$ $F2 = \{A \rightarrow CD, E \rightarrow AH\}$
4. a) Consider the following relations : 10
- Student (snum: integer, sname: string, major: string, level: string, age: integer)
- Class (name: string, meets at: time, room: string, fid: integer)
- Enrolled (snum: integer, cname: string)
- Faculty (fid: integer, fname: string, deptid: integer)



The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Write the following queries in SQL. No duplicates should be printed in any of the answers.

- i) Find the names of all Juniors (Level = JR) who are enrolled in a class taught by Prof. 'AB'.
- ii) Find the age of the oldest student who is either a History major or is enrolled in a course taught by Prof. BB.
- iii) Find the names of all classes that either meet in room R128 or have five or more students enrolled.
- iv) Find the names of all students who are enrolled in two classes that meet at the same time.
- v) Find the names of students who are enrolled in the maximum number of classes.
- b) Define a view. How is it different from a table ? Why are they used ? Provide an example of a view which cannot be updated and explain why it cannot be updated ? 5
- c) Consider the following set of functional dependencies :
 $F = \{A \rightarrow BCE, AB \rightarrow DE, BI \rightarrow J\}$. Compute the canonical cover for F. 5

MODULE – III

5. a) How does hybrid hash join improve on the basic hash join algorithm ? How many buffer blocks are required to implement hash join and hybrid hash join ? Explain. 7
- b) Define the term functional dependency. Why are some functional dependencies called trivial ? 6



- c) Consider a relation R with five attributes ABCDE. You are given the following dependencies :

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$A \rightarrow B$, $BC \rightarrow E$ and $ED \rightarrow A$

- i) List all keys for R.
- ii) Is R in 3NF ?
- iii) Is R in BCNF ?

6. a) Consider the following relational schema :

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Student(rollno, name, sem, dno) dept(dno, dname)

Subject(subid, sname, sem) marks_obt(rollno, subid, marks)

Write a query to retrieve the names of Computer Engineering students who obtained marks greater than 50 in the subject 'DBMS'.

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.

- b) Suppose you have a file with 20,000 blocks and you have five buffer blocks.

Answer the following questions, assuming that general external sorting algorithm is used :

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- i) How many runs will you produce in the first pass ?
- ii) How many passes will it take to sort the file completely ?
- iii) What is the total I/O cost of sorting the file ?
- iv) How many buffer pages do you need to sort the file completely in just two passes ?



MODULE – IV

7. a) Explain the following terms using an example :

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- i) Partial schedule
- ii) Recoverable schedule
- iii) Cascadeless schedule
- iv) Strict schedule
- v) Consider the following schedule.

$r_1(x); w_1(x); r_2(x); w_2(x); r_2(y); w_2(y); r_1(z); w_1(z); c_1; c_2;$

Check whether the given schedule is cascadeless. If not, write down the minimum changes required to convert it into cascadeless schedule.

b) Consider the following actions taken by transaction T1 on database objects

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X and Y :

$R(X), W(X), R(Y), W(Y)$

i) Give an example of another transaction T2 that, if run concurrently to transaction T without some form of concurrency control, could interfere with T.

ii) Explain how the use of Strict 2PL would prevent interference between the two transactions.

c) Bring out the differences between the basic two-phase locking, strict two phase locking and rigorous two-phase locking using a appropriate example.

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8. a) What is the difference between conflict serializability and view serializability ?
Which one of them is a stricter form ? Under what conditions conflict and view serializability are similar. Give example of the schedule which follows conflict serializability but not view serializability or vice versa. 10
- b) Briefly explain why concurrency control is required. Give an example where adding lock/unlock instruction to the transactions (not in 2-phase order) does not give us the serializable schedule but by following 2 phase locking protocol we get a serializable schedule devoid of deadlocks. 6
- c) What is the difference between wound wait and wait-die techniques ? 4
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