

15/12/14 Afternoon



Regular

COMP 5 – 5 (RC)

T.E. (Comp.) (Semester – V) (RC) Examination, Nov./Dec. 2014
DATABASE MANAGEMENT SYSTEMS

Duration : 3 Hours

Total Marks : 100

Instruction : Attempt **any five** questions by selecting at least **one** question from **each** module.

MODULE – 1

1. a) A database is to be designed for a college. The college provides a number of module, each being characterised by its code, title, credit value, module leader, teaching staff and the department they come from. A module is co-ordinated by a module leader who shares teaching duties with one or more lectures. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed : some modules require pre-requisites modules and some degree programmes have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance (i.e. modules taken and examination results). Draw an ER diagram to represent this information and convert the resulting ER into tables. 10
- b) How is the physical data independence different from the logical data independence ? 3
- c) Define the concept of aggregation. Give an example where this concept is useful and show the resulting tables. 5
- d) What do you mean by role in a ER diagram ? When is it mandatory to specify a role in a ER diagram ? 2
2. a) Give an example for the following : 4
 - i) Disjoint and complete specialization.
 - ii) Overlapping and complete specialization.

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- b) State any four advantages of the DBMS system over file processing system. 4
- c) Give an example of an entity which is existent dependent on another entity but is not a weak entity. 2
- d) What is a data model ? Explain in brief the relational data model using appropriate example. 4
- e) Draw an E-R Diagram for the following scenarios. 6
- An Employee may be assigned a company CAR, but some Employees do not qualify for a company CAR. A CAR will be assigned to one and only one employee.
 - To be an athlete, you must play one of the following sports : Basketball, Tennis or Soccer. Athletes can play more than one sport.
 - In a Manufacturing company, a part has at least one alternative part (or substitute part). Some parts do not serve as an alternative (substitute) for any parts. Also, a part may serve as an alternative for many different parts.

MODULE – 2

3. a) What is the difference between schema and the instance of a relation ? 2
- b) Specify the following relational algebra operations in DRC. 6
- $\sigma_{A=C}(R(A,B,C))$
 - $\Pi_{\langle A,B \rangle}(\sigma_{B=C}(R(A,B,C)))$
 - $R(A,B,C) \cap S(C,D,E)$
- c) Given 2 sets F1 and F2 of functional dependencies for a relation R, Check whether they are equivalent. 4
- F1 = $\{A \rightarrow B, AB \rightarrow C, D \rightarrow AC, D \rightarrow E\}$
- F2 = $\{A \rightarrow BC, D \rightarrow AE\}$



- d) What is a functional dependency ? Consider the relation given below. Identify all the functional dependencies satisfied by this relation. Explain whether your answer will reflect the semantics of your data or not ? What are trivial functional dependencies ?

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A	B	C
a1	B1	c1
a1	b1	c2
a2	b1	c1
a2	b1	c3

- e) What do you mean by the degree of a relation ?

2

4. a) What are the restrictions that are put on the update operations using a view ? Explain using examples.

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- b) Consider the following database schema

Student (Name, studNo, Class, Major)

Course (Title, CourseNo, Credit Hours, Department)

Section (SectionIdentifier, CourseNo, Semester, Year, Instructor)

Grade_report (StudNo, SectionId, Grade)

Prerequisite (Course No, PrerequisiteNo).

- 1) Answer the following queries in SQL.

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- Retrieve the titles of courses taught by Professor Sinha in 2001 and 2005.
- For each section taught by professor Gupta, retrieve the course No, semester, year and the number of students who took the section.
- Retrieve the names and Major department of those students who have a grade A in all their courses.



- iv) Identify the students who have taken all the courses offered by computer science department in fall 2010.
- v) Identify the course in fall 2012 with maximum A credits.

- II) Answer the following queries in relational algebra. 6
- i) Retrieve the names and Major department of those students who do not have a grade A in any of their courses.
 - ii) Identify the student with maximum A credits.
 - iii) Find the courses having more than two prerequisites.

MODULE – 3

5. a) Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I\}$ and the set of functional dependencies $F = \{AB \rightarrow C, BD \rightarrow EF, AD \rightarrow GH, A \rightarrow I, H \rightarrow J\}$. 8
- i) Find the key.
 - ii) Relation R is in which normal form ?
 - iii) Apply Normalization on R until it cannot be decomposed further. Also give reasons for decomposition.
- b) What do you mean by double buffering ? 2
- c) Define join dependencies and 5 NF. 4
- d) Let relations $r_1(A, B, C)$ and $r_2(C, D, E)$ have the following properties : r_1 has 30000 tuples, r_2 has 50000 tuples, 30 tuples of r_1 fit on one block and 50 tuples of r_2 fit on one block. A primary index is available on attribute A of relation r_1 , with the number of levels is equal to 4. Estimate the minimum number of block transfers and seeks required for each of the below mentioned operations : 6
- i) r_1 join r_2 using block nested loop join
 - ii) $\sigma_{A=100}(r_1)$.
6. a) Extend the sort merge join algorithm to implement the outer join algorithm. 5
- b) Consider the following relation 10
- emp (id, name, salary, city)
- Workson (eid, pno, hours)
- project (pno, name, plocation)



Consider the following query :

Retrieve the project no, project name and the number of employees from 'Mapusa' who work on 'Research' project for than 20 hours per week.

- i) Draw the initial query tree and the query graph for the above query.
 - ii) Optimize the given query, and provide relational algebra expression for the final optimized query.
 - iii) Provide SQL expression for the optimized query.
- c) With the help of a neat diagram, explain the various steps in query processing. 5

MODULE – 4

7. a) Consider the following two transactions : 8

T0	T1
Read (A)	Read (A)
$A = A - 50$	$T = A * 0.5$
Write (A)	$A = A - T$
Read (B)	Write (A)
$B = B + 50$	Read (B)
Write (B)	$B = B + T$
	Write (B)

- i) Show, any parallel execution of T0 and T1 which produces a serializable schedule.
- ii) Show, any parallel execution of T0 and T1 which produces a non-serializable schedule.
- iii) For concurrency control in the above case, which lock can be used and how will that lock solve the problem ?



- b) What is a recoverable schedule ? Why is recoverability of schedules desirable ?
Are there any circumstances under which it would be desirable to allow non-recoverable schedules ? Explain your answer.
- c) Consider the following schedule :

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T1	T2	T3
Read (A) A = f1 (A) Read (C) Write (A) A = F2 (C)		
	Read (A) Read (B)	
Write (C)		
		Read (C)
	B = f3 (B) Write (B)	
		C = f4 (C) Read (B) Write (C)
	A = f5 (A) Write (A)	
		B = f6 (B) Write (B)

Draw the precedence graph. Is the schedule conflict serializable ? If yes then state the corresponding serial schedule. Does the schedule also satisfy view serializability ?

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8. a) Draw a state diagram and discuss the typical states that a transaction goes through during execution. 4
- b) Does 2PL protocol ensures conflict serializability ? Justify with the help of an example. 6
- c) Describe strict 2PL. What benefit does strict 2PL provide ? What are its disadvantages ? 6
- d) What are deadlocks ? How cautious waiting does avoids deadlock ? 4
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