DATABASE MANAGEMENT SYSTEMS
(MCAP 2101)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i)   A decomposition of a relation R into R1 and R2 is lossless if
   (a) common attributes between R1 and R2 is candidate key of both the decomposed relations.
   (b) common attributes between R1 and R2 is candidate key of at least one of the decomposed relations.
   (c) common attributes between R1 and R2 is a non key attribute of the decomposed relations .
   (d) common attributes between R1 and R2 is key attribute of both the decomposed relations.

   (ii)   **Statement 1:** It is not always possible to normalize a relation to BCNF decomposition, preserving all functional dependencies and lossless join property.
   Statement 2: It is always possible to normalize a relation to 3NF decomposition preserving all functional dependencies and lossless join property. Considering the above two statements choose the right option from the followings:
   (a) Only Statement 1 is correct.
   (b) Only Statement 2 is correct.
   (c) Both Statement 1 and Statement 2 are correct.
   (d) Both Statement 1 and Statement 2 are incorrect.

   (iii)   Isolation of the transactions is ensured by
   (a) Transaction management   (b) Application programmer
   (c) Concurrency control   (d) Recovery management.

   (iv)   Assume transaction A holds a shared lock R. If transaction B also requests for a shared lock on R,
   (a) it will result in a deadlock situation
   (b) it will immediately be rejected
   (c) it will immediately be granted
   (d) it will be granted as soon as it is released by A

(v) Given a set of Functional dependencies, F={S→C, C→ T, (S,P) → Z}
(a) the candidate key of F is S
(b) the candidate key of F is (S,C)
(c) the candidate key of F is (S,P)
(d) the candidate key of F is C

(vi) A _____type of index structure is used for a ordered key field of a data file
(a)secondary
(b)primary
(c)clustering
(d)multilevel

(vii) Fifth Normal form is concerned with
(a) Functional dependency
(b) Multivalued dependency
(c) Join dependency
(d) Domain-key.

(viii) Which of the following relational algebra operations must require the participating tables to be union-compatible?
(a) Inner Join
(b) Outer Join
(c) Intersect
(d) Natural Join

(ix) Consider a B+-tree in which the maximum number of keys in a node is 5. What is the minimum number of keys in any non-root node?
(a) 1   (b) 2   (c) 3   (d) 4

(x) Checkpoints are a part of
(a) Recovery measures
(b) Security measures
(c) Concurrency measures
(d) Authorization measures

Group- B

2. (a) Construct the canonical cover of the following FD.
$A \rightarrow DB, B \rightarrow Q, Z \rightarrow P, D \rightarrow B, A \rightarrow Q.$ [(CO1) (Remember/LOCQ)]

(b) A relation R (Y, Q , D , U , H) with attributes is given.
The given set of FD's are as follows: $\{YQ \rightarrow H, Y \rightarrow D, D \rightarrow U\}$
(i) Find out the candidate keys from the set of given FD's.
(ii) Find out in which normal form the relation is in. Convert the relation into its higher normal form such that dependency is preserved and lossless decomposition occurs.   [(CO1) (Finding/IOCQ)]

(c) Explain the concept of 4NF with proper example.
[(CO1)(Plan and Design/HOCQ)]
4 + 5 + 3 = 12

3. (a) Consider the relation shown in the following figure: [(CO1) (Identifying/LOCQ)]

X	Y	Z
x_1	y_1	z_1
x_1	y_1	z_2
x_2	y_1	z_1
x_2	y_1	z_3

     (i) List all the functional dependencies that this relation instance satisfies.

     (ii) Assume that the value of attribute Z of the last record in the relation is changed from z3 to z2. Now list all the functional dependencies that this relation instance satisfies.

(b)   (i) Find the problems occur if there is transitive dependency? Explain with proper examples.

     (ii) How the above problem is corrected ? [(CO1) (Finding/IOCQ)]

(c)   Produce the irreducible set of the following FD's given.
$$A \rightarrow B, B \rightarrow C, AB \rightarrow C, A \rightarrow C. \qquad [(CO1)(Produce/HOCQ)]$$

4 + 5 + 3 = 12

Group - C

4. (a)   Consider the following database tables with primary keys underlined.
Project(<u>Proj_ID</u>, PName, Mentor_empid, duration)
Mentor(<u>Emp_id</u>, EName, profile)
Scholars(<u>RollNo</u> , Name, Edu_qualification)
Assigned_to(<u>RollNo,Proj_ID</u>)

Formulate the following queries using SQL:
(i)   List the details of the Mentors working on the projects with duration more than 3 years.
(ii) List the details of scholars working on multiple projects
(iii) List the details of scholars and mentors working with each other.
(iv) List the details of scholars whom working on "Science" project.

                                   [(CO2) (Apply/IOCQ)]

(b)   You have two table Customers and Orders. There may be no or one/many orders in the Order table for a customer. You want to find out the customer's detail along with the order details if any, irrespective of whether customer places any order or not. What type of join is most appropriate? Explain with SQL Query.

                                   [(CO2,CO6) (Analyze/IOCQ)]

8 + 4 = 12

5. (a)   Given two tables:
(i) Airport to store information of airports such as AirportId, AirportName, Location.
(ii) Schedule to store the schedule flights running between two airports. Each schedule contains information such as Scheduleid, SourceAirport, DestAirport, FlyingDateTime.

- Create statements for the above two tables with appropriate referential integrity constraints.
- Formulate a SQL query to display all the airports for which there is no flight scheduled for. You have to show AirportId, AirportName, Location in the order of Location and AirportName.   [(CO2, CO6) (Create /HOCQ)]

(b)   Illustrate Left outer join and Right outer join with example.

                                     [(CO2)(Analyze/IOCQ)]

6 + 6 = 12

Group - D

6. (a) Assume Salary table contains salary and emp_id of each employee. Write a PL/SQL block to calculate bonus of an employee as per following business rule and display it in console. Business rule: If salary < 500 applicable bonus percentage is 10%, If salary is between 5000 and 10000 applicable bonus percentage is 15%, If salary is > 10000 applicable bonus percentage is 20%, You have to Initialize the emp_id for which bonus will be calculated during execution time of the block. [(CO4) (Apply/IOCQ)]

    (b) What are cursor attributes? For which purpose these attributes are used?
    [(CO4) (Remember/LOCQ)]

    (c) Display the employee information from EMP (emp_no, city) table, whose emp_no is e01 and city is Kolkata using parameterized for cursor.
    [(CO4)(Apply/IOCQ)]
    4 + 4 + 4 = 12

7. (a) Discuss the differences between procedures and functions in PL/SQL. Explain with an example.   [(CO4) (Analyze /IOCQ)]

    (b) Write down the PL/SQL Trigger Execution Hierarchy.
    [(CO4) (Remember/LOCQ)]

    (c) What are the different parts of a database trigger? Why cannot we include triggers in database packages?   [(CO4)(Understand /LOCQ)]
    6 + 2 + 4 = 12

Group - E

8. (a) What is a two-phase locking protocol? How does it guarantee serializability?
    [(CO4) (Abstracting/LOCQ)]

    (b) In the schedule given below, the label Ri(X) indicates a read of element X by transaction Ti, and Wi(X) indicates a write of element X by transaction Ti.
    1. Draw the precedence graph for following schedule. R2(A) R1(C) R2(B) W2(B) R3(B) R1(A) R3(C) W3(C) W1(A).
    2. Is the above schedule conflict-serializable? If so, what order of the three transactions defines a conflict-equivalent serial schedule?
    [(CO4) (Executing/IOCQ)]

    (c) Two phase locking does not ensure freedom from deadlock - Justify this using an example.   [(CO4)(Justifying/HOCQ)]
    4 + 5 + 3 = 12

9. (a) Criticize on the following topics:
    1. B-tree.
    2. Log based recovery.   [(CO4)(Criticize/HOCQ)]

    (b) Explain the requirement of concurrent executions of transaction.
    [(CO4) (Understand/LOCQ)]

(c)   Suppose that an unordered file with 45000 records are stored on a disk with block of size 1024 bytes. Each record length of the file is of 100 bytes. A secondary index is created on the file. The index has search key of length 12 bytes and pointer field with size 5 bytes. (i) Find out the blocking factor and the number of blocks needed for the file. (ii) Find out the blocking factor and the number of the blocks needed for the index. (iii) Find out the number of block access required to search a record using the index.   [(CO4)(Analyze/IOCQ)]

3 + 4 + 5 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	30%	49%	21%

Course Outcome (CO):
After successfully completing this course, the students will be able to:

1. Apply relational algebra to interpret data in relational format up to a certain degree of normalization.
2. Apply the SQL queries, to retrieve the required information from the database.
3. Implement PL/SQL programming using concept of cursor management, error handling, package and triggers.
4. Demonstrate the use of database Transaction, Concurrency control as well as the storage mechanisms with different levels to optimize the query processing.
5. Design the database of a particular enterprise so that data can be stored with safety and security.
6. Implement the concepts in the real-world scenario without creating any inconsistency.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
MCA	https://classroom.google.com/c/NDA2MDE4OTM3Njc1/a/NDU2NTQ3ODg1MzA1/details