

BASICS OF RDBMS
(CSEN 3206)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one 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) In RDBMS, the constraint that no key attribute may be NULL is referred as
(a) Entity Integrity (b) Multivalued dependency
(c) Referential Integrity (d) Functional dependency.
 - (ii) A table can have only one
(a) Super key (b) Primary key
(c) Foreign key (d) Candidate key.
 - (iii) A relation has 200 tuples and 10 attributes, then it's
(a) degree is 200 and cardinality is 10
(b) degree is 10 and cardinality is 200
(c) degree is 200×10 and cardinality is $200 \div 10$
(d) degree is $200 \div 10$ and cardinality is 10×10 .
 - (iv) Relations R1(A,B) currently has tuples {(1,2), (1,3), (3,4)} and R2(B,C) currently has {(2,5), (4,6), (7,8)}. Then the SQL query: SELECT * FROM R1 NATURAL JOIN R2; will produce _____ number of rows.
(a) 0 (b) 2 (c) 4 (d) 8
 - (v) In ER diagram design, a double rhombus is used to denote
(a) Strong entity (b) Strong relationship
(c) Weak entity (d) Weak relationship.
 - (vi) The property of a transaction that persists all the system crashes is
(a) Persistency (b) Atomicity
(c) Consistency (d) Durability.
 - (vii) Which of the following locks the data item from modification but not from read?
(a) Implicit Lock (b) Explicit Lock
(c) Shared Lock (d) Exclusive Lock.

- (viii) Transactions allow the database to be transformed from ____.
- (a) One consistent state to another consistent state
 - (b) One logical state to another logical state
 - (c) One pre-defined state to another pre-defined state
 - (d) One integral state to another integral state
- (ix) Which operator performs pattern matching in SQL?
- (a) SELECT
 - (b) FROM
 - (c) WHERE
 - (d) LIKE.
- (x) A clustering index is defined on the fields which are of type
- (a) Non-key and ordered
 - (b) Non key and not ordered
 - (c) Key and ordered
 - (d) Key and not ordered.

Group - B

2. (a) Explain the difference between physical data independence and logical data independence based on the three-tier architecture of DBMS. *[(CO1)(Understand/LOCQ)]*
- (b) What is a DBA? What major roles does the DBA play in a database management? *[(CO1)(Remember/LOCQ)]*
- (c) Name the four categories of database users. *[(CO1)(Remember/LOCQ)]*
- 4 + (2 + 4) + 2 = 12**
3. (a) Given is the following set of attributes and functionalities of a simple Online Book store:
- A Book can be identified by its ISBN. The Book has a title, year of publishing and price.
 - A Book is written by one or more Authors. Each Author can be identified uniquely by his/her Name. An Author may have multiple phone numbers and multiple books to his/her credit. An author may be attached to one or more Publishers.
 - A Book is published by a Publisher, uniquely identified by its name. A Publisher has address and a phone number. He/she may publish many books and has many Authors associated with it.
 - A Customer registers via his/her email id, and information about their name, address, and phone number is recorded. The Customer may add several books to their shopping cart.
- Construct a clean and concise ER diagram for the above database, clearly depicting each entity, required attributes, primary keys and cardinality of the relationships etc. You may add additional conditions also. Please mention clearly such assumptions. *[(CO1)(Design/HOCQ)]*
- (b) Define the following terms with suitable example(s):
- (i) Derived attribute (ii) One-to-Many mapping. *[(CO1)(Remember/LOCQ)]*
- 8 + (2 × 2) = 12**

Group - C

4. (a) Define 3NF and BCNF. *[(CO4)(Remember/LOCQ)]*
 (b) Give an example of a relation which is in 3NF, but not in BCNF. Establish your claim. *[(CO2)(Analyze/HOCQ)]*

- (c) Write Armstrong's axioms. State and prove pseudo-transitivity.

[[CO4](Analyse/IOCQ)]

$$(2 + 2) + (2 + 2) + (2 + 2) = 12$$

5. (a) Consider the following relations:

Project(PNo, PName, PIncharge)

Employee(ENo, EName)

Assignment(PNo, ENo)

Express the following queries in relational algebra:

(i) List the names of the employees working on at least one project.

(ii) List ENo of employees who do not work on project number PR125.

[[CO2](Understand/IOCQ)]

- (b) Consider relation R(A,B,C,D) and the set of functional dependencies $F = \{A \rightarrow B, A \rightarrow C, BC \rightarrow D\}$

Prove that $A \rightarrow D$.

[[CO4](Analyze/HOCQ)]

- (c) What will be the highest normal form for a relation with two attributes, out of which one is a candidate key? Justify.

[[CO4](Analyze/HOCQ)]

$$(3 + 3) + 3 + 3 = 12$$

Group - D

6. (a) Consider the following given tables:

Hotel (h-no, h_name, city)

Room(r-no, h-no, type, price)

Booking (h-no, g-no, date_from, date_to, r-no)

Guest (g-no, g-name, address)

Where the underlined attributes are the primary keys.

Write the following queries using SQL:

i) List all hotel numbers (h-no) and names (h-name) which are located in 'Shimla' and the hotel name starts with 'S'.

ii) List the names of guests, who have booked 'Park Hotel' between 23rd May, 2023 and 2nd June, 2023.

iii) Modify the table Booking such that the room no (r-no) field must always contain some value.

iv) Display the different cities and the number of hotels in each city, sorted in the alphabetical order of the cities.

[[CO3](Design/HOCQ)]

- (b) What is a View? Why is it used?

[[CO3](Understand/LOCQ)]

$$(4 \times 2) + (2 + 2) = 12$$

7. (a) What is trigger? What are different types of triggers?

[[CO3](Remember/LOCQ)]

- (b) Write a Oracle procedure / function to calculate the factorial of an integer.

[[CO3](Understand/IOCQ)]

- (c) What is materialized view? Given ITEM(ITEMNO, DESC, PRICE, ITEMTYPE) table. Write a SQL to create a materialized view consisting of DESC and PRICE.

[[CO3](Remember/LOCQ)]

$$(2 + 4) + 3 + (1 + 2) = 12$$

Group - E

8. (a) Let T1 and T2 be transactions that operate on same data items P, Q & R. Let r1(P) mean that T1 reads P, w1(P) mean that T1 writes P, same for T2. Given are two schedules S1 & S2.
Using precedence graphs, determine if they are conflict serializable or not?
If a schedule is serializable, write down the equivalent serial schedule(s).
S1: r1(P); w1(P); r2(P); w2(P); r1(P); w1(P)
S2: r1(P); w1(P); r2(P); w2(P); r1(Q); w1(Q); r2(R); w2(R)
[[C05](Analyze/IOCQ)]
- (b) Describe the Two-phase locking protocol. Why is it required? Discuss its limitations.
[[C05](Understand/LOCQ)]
(6 + 2) + (2 + 1 + 1) = 12
9. (a) Construct a B+ tree for the key values 3,10,12,14, 29, 38, 45, 55, 60, 68, under the assumption that the number of key values that fit in a node is 3. Show the steps involved in creating the tree. Now insert 11, and 30. [[C06](Analyze/HOCQ)]
- (b) Write the differences between B-tree and B+tree. [[C06](Remember/LOCQ)]
(8 + 2) + 2 = 12

<i>Cognition Level</i>	<i>LOCQ</i>	<i>IOCQ</i>	<i>HOCQ</i>
<i>Percentage distribution</i>	40.63	21.87	37.50

Course Outcome (CO):

After the completion of the course students will be able to

- CO1. Identify the basic concepts and various data model used in database design. Be able to model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model.
- CO2. Formulate relational algebra expression for queries and evaluate it using the concept of query processing and optimization.
- CO3. Create RDBMS schema mapping various business validations and formulate queries based on that schema using SQL to satisfy business requirements.
- CO4. Apply normalization and various types of dependencies for evaluating a relational database design.
- CO5. Apply and relate the concept of transaction, concurrency control and recovery in database.
- CO6. Understand with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

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