

**DATABASE MANAGEMENT SYSTEMS
(CSEN 3101)**

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) The decoupling of external level and the conceptual level is called
(a) Logical data Independence (b) Local data Independence
(c) Physical data Independence (d) Non-Local data Independence.
- (ii) Let R (A,B,C,D,E,F) be a relation with following functional dependencies: $C \rightarrow F$, $E \rightarrow A$, $EC \rightarrow D$, $A \rightarrow B$. Which of the following is a key for R?
(a) EC (b) AE (c) CD (d) AC.
- (iii) The following are clauses of the SELECT statement:
1. WHERE
2. FROM
3. ORDER BY
In which order should they appear in a query?
(a) 1, 3, 2 (b) 2, 1, 3
(c) 2, 3, 1 (d) The order of these clauses does not matter.
- (iv) The ____ operation of relational algebra allows us to find tuples that are present in one relation but not in the other.
(a) Union (b) Intersection (c) Set-difference (d) Projection.
- (v) In E-R diagram generalization is represented by
(a) Ellipse (b) Dashed ellipse (c) Rectangle (d) Triangle.
- (vi) Consider a schema R(A, B, C, D) and functional dependencies $A \rightarrow B$ and $C \rightarrow D$. Then the decomposition R1(A, B) and R2(C, D) is
(a) Dependency preserving but not lossless join
(b) Lossless Join but not dependency preserving
(c) Dependency preserving and lossless join
(d) Lossless Join.
- (vii) What is TRUE about atomicity?
(a) The transaction cannot be partially completed, since there is no midway.
(b) In each transaction, either the entire transaction is executed or it is not.
(c) Both A and B
(d) None of the above.

(viii) Which of the following are steps in query processing?

- (a) Parsing and translation (b) Optimization (c) Evaluation (d) All of the above

(ix) Which one of the following refers to the total view of the database content?

- (a) Conceptual view (b) Physical view (c) Internal view (d) External view

(x) If an index entry appears for only some of the search key values in the file, it is called as _____.

- (a) Sparse Index (b) Linear Index (c) Dense Index (d) Cluster Index

Group- B

2. JNOX Leisure Limited have decided to open a multiplex theatre complex with multiple screens in the Choubaga area. This will serve the need of residents of high rises in the locality. JNOX is planning to design a database for the purpose. The database should store data on movies, shows, actors and bookings as detailed below:

- Movie details will consist of movie titles, actors, producer, director and cost of production. No two movies will have the same title. A movie may have multiple shows.
- The name of every actor, sex, age, fee and preferred role need to be stored. Actor names are assumed to be unique.
- Data on booking must contain unique customer (viewer) identification number, name, address and contact number, the show date and time, show screen number along with seat number and price of ticket.

(i) Design an E-R diagram for the database.

[(CO1)(Design/HOCQ)]

(ii) Transform the E-R diagram designed into a set of tables.

[(CO1)(Design/HOCQ)]

(iii) Reduce the set of tables, if possible.

[(CO1)(Analyze/IOCQ)]

6 + 4 + 2 = 12

3. Consider the following relational database schema consisting of the three relation schemas.

Passenger (pid, pname, pgender, pcity)

Flight (fid, fdate, , src, dest)

Booking (pid, fid, fdate)

Answer the following questions using relational algebra queries;

(i) Get the complete details of all flights to New Delhi.

(ii) Get the details about all flights from Chennai to New Delhi.

(iii) Find only the flight numbers for passenger with pid 123 for flights to Chennai before 06/11/2020.

(iv) Find the passenger names for passengers who have bookings on at least one flight.

(v) Find the passenger names for those who do not have any bookings in any flights.

(vi) Find the passenger names for those who do have bookings in flights after 06/11/2020.

[(CSEN3101.2)(Formulate/IOCQ)]

(6 × 2) = 12

Group - C

4. Consider the following relational schema:

SALESPERSON (s_id, s_name, s_city, grade, commission)

CUSTOMER (cust_id, cust_name, cust_city, salesperson_id)

ORDERS (ord_id, order_amt, order_date, cust_id)

SALESPERSON table stores data on every salesperson with their grade and commission earned. s_city is the city where a salesperson lives. CUSTOMER table stores data on customers where cust_city is the city where a customer lives, and salesperson_id is the salesperson who serves the customer. A customer is served by one salesperson but a salesperson can serve a

number of customers. Orders are stored in ORDERS table. cust_id in ORDERS stores the customer who places the order. A customer can place a number of orders.

Based on the above tables, write the following queries using SQL:

- (i) Display the customer name, customer city along with their salesperson name, salesperson city, salesperson commission if the following are true:
 - salesperson does not live in the same city where the customer lives and
 - Salesperson has received a commission of more than Rs. 12000/- from the company.
- (ii) Generate a list of the name; city and grade of salespersons who serve one or more customers. The list should be in ascending order of names.
- (iii) Display the number of salespersons for every grade if the grade is above the average grade of salespersons living in New Delhi city.
- (iv) Find ord_id, order_amt, order_date and cust_id of all the orders issued by the salesperson named 'V Krishnamurthy'.

[[CO3](Design/HOCQ)]
(3 × 4) = 12

5. For relation $R = (L, M, N, O, P)$, the following dependencies hold:

$M \rightarrow O, NO \rightarrow P, P \rightarrow L$ and $L \rightarrow MN$. R is decomposed into $R_1 = (L, M, N, P)$ and $R_2 = (M, O)$.

- (i) Is the above decomposition lossless-join decomposition? Explain.
- (ii) Is the above decomposition dependency preserving? If yes, show how the dependencies are preserved. Otherwise, list all the dependencies that are not preserved.
- (iii) What is the highest normal form satisfied by the above decomposition.

[[CSEN3101.4](Apply/HOCQ)]
(4 + 4 + 4) = 12

Group - D

6. Examine the table shown below:

branch No	branchAddress	telNos
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618, 503-555-2727, 503-555-6534
B002	City Center Plaza, Seattle, WA 98122	206-555-6756, 206-555-8836
B003	14-8 th Avenue, New York, NY 10012	212-371-3000
B004	16-14 th Avenue, Seattle, WA 98128	206-555-3131, 206-555-4112

- (i) What is the normal form of the table? Justify your answer.
- (ii) Describe and illustrate the process of normalizing tables in general to 3NF.
- (iii) How to identify the primary, candidate and foreign keys after the above table is normalized?

[[CSEN3101.4](Apply/HOCQ)]
2 + 6 + 4 = 12

7. Consider the table $R (A,B,C)$ with no non-trivial functional dependencies. Identify the normal form of the table. Explain your answer.

- (a) Justify with appropriate examples, which of the following is (are) true?
 - (i) Every (full) functional dependency is a multi-valued dependency.
 - (ii) Every multi-valued dependency is a (full) functional dependency.
- (b) Consider the following two sets of FDs:

$F1 = \{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$ and $F2 = \{A \rightarrow CD, E \rightarrow AH\}$.

Determine whether $F1$ and $F2$ are equivalent or not. Justify your finding.

[[CSEN3101.2](Formulate/IOCQ)]
3 + 3 + 6 = 12

Group - E

8. (a) Let T1, T2 and T3 be three transactions that operate on the same data items A, B and C. Let r1(A) mean that T1 reads A, w1(A) means that T1 writes A. The same is applicable for T2 and T3.
Consider the following schedule:
S1: r2(C), r2(B), w2(B), r3(B), r3(C), r1(A), w1(A), w3(B),w3(C), r2(A), r1(B), w1(B), w2(A).
Draw the precedence graph for the given schedule S1.
Is the schedule conflict- serializable? [(CO5) (Analyze/IOCQ)]
- (b) "Every cascadeless schedule is also recoverable" – Justify this statement. [(CO5) (Understand/LOCQ)]
- (c) Explain how the Wait-die and Wound-wait schemes help in deadlock prevention in transactions. [(CO5)(Remember/LOCQ)]
(3 + 1) + 4 + (2 + 2) = 12
9. (a) What is multi-level indexing? Why is it used? [(CO6) (Understand/LOCQ)]
- (b) Critically discuss the merits and demerits of B+ tree indexing. [(CO6) (Analyse/IOCQ)]
- (c) What do you understand by Query Optimization? What are the purposes of a query optimizer? [(CO6)(Remember/LOCQ)]
(2 + 2) + 4 + (2 + 2) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	16.67	35.42	47.92

Course Outcome (CO):

After the completion of the course students will be able to

CSEN3101.1. 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.

CSEN3101.2. Formulate relational algebra expression for queries and evaluate it using the concept of query processing and optimization.

CSEN3101.3. Create RDBMS schema mapping various business validations and formulate queries based on that schema using SQL to satisfy business requirements.

CSEN3101.4. Apply normalization and various types of dependencies for evaluating a relational database design.

CSEN3101.5. Apply and relate the concept of transaction, concurrency control and recovery in database.

CSEN3101.6. 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