DATABASE MANAGEMENT SYSTEMS
(CSBS 3102)

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)   Database catalog or dictionary defining descriptive information which is stored in database is called
          (a) constrained data (b) metadata   (c) basic data   (d) filtered data.

    (ii) In E-R diagram generalization is represented by
          (a) Ellipse   (b) Dashed ellipse   (c) Rectangle   (d) Triangle.

    (iii) 'AS' clause is used in SQL for
          (a) Selection operation   (b) Rename operation
          (c) Join operation   (d) Projection operation.

    (iv) Non-prime attributes cannot be transitively dependent, so the relation must have the _____ normal form.
          (a) First   (b) Second   (c) Third   (d) Fourth

    (v)   Which of the following systems is responsible for ensuring durability?
          (a) Recovery system   (b) Atomic system
          (c) Concurrency control system   (d) Compiler system.

    (vi) Concepts of data models that are only useful to computer specialists rather than end users of programs are classified as
          (a) triggered data models   (b) logical data models
          (c) conceptual data models   (d) physical data models.

    (vii) Which of the following is not Armstrong's Axiom?
          (a) Reflexivity rule   (b) Transitivity rule
          (c) Pseudotransitivity rule   (d) Augmentation rule.

    (viii) A database is _____ to reduce the number of disk accesses needed to process queries in order to improve performance.
          (a) Non-indexed   (b) Indexed   (c) Inserted   (d) Updated

    (ix) If ___, then A -> B has trivial functional dependency.
          (a) B is a subset of A   (b) A is a subset of B
          (c) A is a subset of A'   (d) B is a subset of B'

(x) Let R = (A,B,C,D,E,F) be a relation scheme with the following dependencies
C->F, E->A, EC -> D, A->B.
Which of the following is a key for R?
(a) CD   (b) EC   (c) AE   (d) AC.

Group - B

2. Suppose you are given the following requirements for a simple database for the National Hockey League (NHL):
   - The NHL has many teams.
   - Each team has a name, a city, a coach, a captain, and a set of players.
   - Each player belongs to only one team.
   - Each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records.
   - A team captain is also a player.
   - A game is played between two teams (referred to as host-team and guest-team) and has a date (such as May 11th, 1999) and a score (such as 4 to 2).
   (i) Based on the description above, construct a clean and concise ER diagram for the NHL database. [(CO2)(Understand/LOCQ)]
   (ii) Convert the ER design into a set of tables. [(CO6)(Create/IOCQ)]
   (iii) Merge and reduce the set of tables without introducing redundancy, if possible.
   [(CO3)(Analyse and Apply/HOCQ)]
   (6 + 4 + 2) = 12

3. (a) Consider the following relational database schema consisting of the four relation schemas:
   passenger(pid, pname, pgender, pcity)
   agency(aid, aname, acity)
   flight(fid, fdate, time, src, dest)
   booking(pid, aid, fid, fdate)
   Underline notation defines as primary key.
   Give queries expressed in relational algebra for the following:
   (i) Get the details about all flights from Chennai to New Delhi.
   (ii) Find only the flight numbers for passenger with pid 123 for flights to Chennai before 06/11/2020.
   (iii) Find the agency names for agencies that located in the same city as passenger with passenger id 123.
   (iv) Get the details of flights that are scheduled on either of the dates 01/12/2020 or 02/12/2020 or both at 16:00 hours.
   (v) Find the details of all male passengers who are associated with Jet agency.
   [(CO1)(Apply/IOCQ)]
   (b) Define full outer join with a suitable example. [(CO2)(Understand/LOCQ)]
   (5 × 2) + 2 = 12

Group – C

4. (a) R = (A, B, C, D, E). We decompose it into R1 = (A, B, C), R2 = (A, D, E). The set of functional dependencies is: A → BC, CD → E, B → D, E → A. Check whether the dependency is a lossless decomposition or lossy decomposition. [(CO3)(Apply/IOCQ)]

(b) R = {A,B,C,D,E,F,G,H} F = {AC→G, D→EG, BC→D, CG→BD, ACD→B, CE→AG} Find the canonical cover of F. [(CO3)(Apply/IOCQ)]

(c) What is fourth normal form? Explain with example. [(CO3)(Understand/LOCQ)]

5 + 5 + 2 = 12

5. (a) Suppose a relational schema R (A B C D E F G H) and set of functional dependencies F: {A -> B, ABCD -> E, EF -> G, EF -> H, ACDF -> EG} Check out that relation is in 3NF or not? If not decompose it in 3NF. [(CO3)(Apply/IOCQ)]

(b) Suppose, a relational schema R (A, B, C, D, E, F) and set of functional dependencies: F{AB -> C, BC-> AD, D-> E, CF-> B } Compute BCF^+, CD^+, D^+. [(CO3)(Apply/IOCQ)]

(c) Consider Universal relation with attributes ABC and FDs AB -> C, C->B, A->B. Find the Irreducible set. [(CO3)(Apply/IOCQ)]

4 + 4 + 4 = 12

Group - D

6. (a) Consider the relational database given bellow, where the primary keys are underlined.
   (i) client (<u>client-id</u>, name, city)
   (ii) product (<u>product-id</u>, description, cost)
   (iii) salesman(<u>salesman-id</u>, name, target, city)
   (iv) sales_order(<u>order-id</u>, date, client_id, salesman_id)
   (v) order_details(<u>order-id, product_id</u>, quantity)
   Write SQL queries to implement the following:
   (i) Display descriptions of all products ordered by Vishal and sold by a salesman located in the city "Kolkata".
   (ii) Display descriptions of products that have been ordered at least once.
   (iii) Display all cities in which at least one client or salesman are located.
   (iv) List all salesmen grouped by city along with the total cost of all items sold by them, in decreasing order of total cost.
   (v) Display the names of all salesmen who sales all the products.

   [(CO4)(Apply/IOCQ)]

(b) Justify the comments with example, "TCL commands can only use with DML commands". [(CO4)(Evaluate/HOCQ)]

(5 × 2) + 2 = 12

7. (a) Consider the following relations:
   Student (<u>snum: integer</u>, sname: string, major: string, level: string, age: integer)
   Class (<u>name: string</u>, meets at: time, room: string, fid: integer)
   Enrolled (<u>snum: integer, cname: string</u>)
   Faculty (<u>fid: integer</u>, fname: string, deptid: integer)
   Write the following queries in SQL.
   (i) Find the names of all classes that either meet in room R128 or have five or more students enrolled.
   (ii) Find the names of all students who are enrolled in two classes that meet at the same time.
   (iii) Find the names of faculty members who teach in every room in which some class is taught.

      (iv) Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.

      (v) Find the Level and the average age of students for that Level, for each Level.

                                              [(CO4)(Apply/IOCQ)]

  (b) What is the difference between nested subquery and correlated subquery? Explain with example.   [(CO4)(Understand/LOCQ)]

(5 × 2) + 2 = 12

Group - E

8. (a) What are ACID Properties? Explain each of the properties with proper example.

                                              [(CO5)(Remember/LOCQ)]

  (b) Check whether the schedule S given bellow, is conflict serializable or not. If yes, then determine all the possible serialized schedules.   [(CO5)(Apply/IOCQ)]

T1	T2	T3	T4
			R(A)
	R(A)		
		R(A)	
W(B)			
	W(A)		
		R(B)	
	W(B)		

  (c) Every conflict-serializable schedule is also view serializable, but there are view serializable schedules that are not conflict serializable – justify with proper example.

                                         [(CO5)(Evaluate/HOCQ)]

(2 + 3) + 4 + 3 = 12

9. (a) What is lock conversion? When it is needed?   [(CO5)(Remember/LOCQ)]

  (b) What do you mean by fixed-length records and variable-length records? Explain with example. What is the difference between a primary index and a secondary index?

                                              [(CO5)(Remember/LOCQ)]

  (c) When is it preferable to use a dense index rather than a sparse index? Explain your answer.   [(CO5)(Evaluate/HOCQ)]

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

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	27.08	62.5	10.42

Course Outcome (CO):

After the completion of the course students will be able to

CSBS3102.1. Demonstrate the concepts of various data model and schemas used in database design.

CSBS3102.2. Design relational database schemas using the conceptual modeling tools like ER diagrams.

CSBS3102.3. Analyze the functional dependencies and normalizethe relational database design.

CSBS3102.4. Apply the query language to manipulate the relational databases.

CSBS3102.5. Describe the concept of transaction, basic database storage structures, and indexing.

CSBS3102.6. Construct database schema for various real life problems.

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