B.TECH/IT/5TH SEM/INFO 3104/2016

DATABASE MANAGEMENT SYSTEMS
(INFO 3104)

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 level of data abstraction which describes how the data is actually stored is
(a) physical level (b) storage level
(c) conceptual level (d) view level.

(ii) A relation R(A,B,C,D) is decomposed into R1(A,B) and R2(A,C,D), where A is the candidate key of R1. So, the decomposition is
(a) lossy (b) lossless
(c) both (a) and (b) (d) none of these.

(iii) Three of the following four relational algebra expression, based on two relations R(A,B) and S(B,C) yields same result . Identify the only expression, which yields different result from the other three:
(a) $\prod_{AB}(R \times S)$ (b) $R \times \prod_{B}(S)$
(c) $R \cap (\prod_{A}(R) \times \prod_{B}(S))$ (d) $\prod_{A,R,B}(R \times S)$

(iv) Transactions are initiated by BEGIN TRANSACTION and terminated
(a) by COMMIT TRANSACTION
(b) by ROLLBACK TRANSACTION
(c) either by COMMIT TRANSACTION or by ROLLBACK TRANSACTION
(d) none of these.

(v) Wait-die scheme for preventing deadlock is a
(a) pre-emptive scheme based on time-stamp
(b) non-pre-emptive scheme
(c) preemptive scheme
(d) non-preemptive scheme based on time-stamp.

(vi) Relation R = (A,B,C,D) with AB as primary key. Choose one FD such that R should be in 1NF but not in 2NF.
(a) AB -> C (b) AB -> D
(c) A -> D (d) AB-> CD.

(vii) A superkey set consists of {AB, A, BC, ABC}.Out of these the minimal super keys are
(a) {A, BC, AB} (b) {ABC}
(c) {A, AB} (d) {A, BC}.

(viii) TCL statements are
(a) grant and revoke (b) commit and rollback
(c) commit, rollback and savepoint (d) none.

(ix) Which of the following is not a property of transactions?
(a) Atomicity (b) Concurrency
(c) Isolation (d) Durability.

(x) Which of the following concurrency control protocols ensure both conflict serializability and freedom from deadlock?
I. Two-Phase locking II. Time-Stamp ordering
(a) I only (b) II only
(c) both I and II (d) neither I nor II.

Group – B

2. (a) Explain with a proper diagram, the ANSI-SPARC three-schema architecture of DBMS.

(b) Now using three-schema architecture, explain the concept of Logical data independence and Physical data independence.

8 + 4 = 12

3. (a) 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).

Construct a clean and concise ER diagram for the NHL database.

(b) Design a generalization, specialization hierarchy for a motor vehicle sales company. The company sales motor cycles, passenger cars, vans, buses. Justify your placement of attributes at each level of hierarchy.

8 + 4 = 12

Group – C

4. (a) Consider the schema
Airport (code, name, city, country)
Flight (number, airline, from_airport_code, to_airport_code)
Reservation (flight_number, seat_number, date, passenger_name)
Answer the following using relational algebra
(i) List the flight numbers of flights that take off from India
(ii) List the passenger who are on flight number 'SA 747'.
(iii) List all the flight information for Indian Airlines and Jet Airways.

(b) Set R(A,B,C) and S(B,C,D) be the relations:

R: A	B	C
a	c	c
a	e	c
a	c	d
b	d	d

S: B	C	D
c	c	a
d	c	a
e	d	b

Compute the following for the relations above:
$R \div \pi_c (S)$

(4 + 3 + 2) + 3 = 12

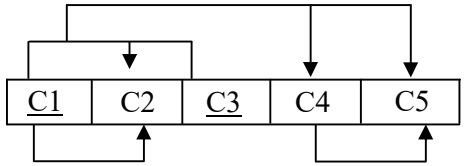
5. Consider the following relations:
(i) Employee (Emp_Code, Emp_Name, Desig, Manager, Date_of_Joining, Basic, Dept_Code)
With Constraints: *Primary Key* is Emp_Code
Foreign Key: Manager references Employee (Emp_Code), Dept_Code references Department (Dept_Code)
(ii) Department (Dept_Code, Dept_Name, Location)
With Constraints: *Primary Key* is Dept_Code
Write the following queries in SQL:
(a) List the names of the employees whose names either starts or ends with 'R';
(b) List the details of the department which is headed by employee 105;
(c) List average salaries of those departments which are employing at least 4 people;

(d) List the names of the employees who joined the company before their respective managers did;

(2 + 3 + 3 + 4) = 12

Group – D

6. (a) Given the dependency diagram shown in the following figure, (the primary key attributes are underlined)



(i) Identify and discuss each of the indicated dependencies.
(ii) Create a database whose tables are at least in 3NF, showing dependency diagram for each table.

(b) Let R = (A,B,C,D) and F be the set of functional dependencies for R given by {A->B, A->C, BC->D} . Prove A->D.

(4 + 5) + 3 = 12

7. (a) How does BCNF differ from 3NF? Explain 4NF with an example.

(b) Given a database schema Plane-Info (flight_no, date, miles, plane, airlines, from, to). The following FD's holds on the relation.

(flight_no , date)→ plane

flight_no→ (airlines, to, from, miles)

(from, to) → miles

(i) Find the candidate key/keys
(ii) Find the normal form in which it exists
(iii) Decompose the relation to BCNF preserving dependency.

(3 + 3) + 6 = 12

Group – E

8. (a) Consider 2 transaction T1 and T2 running in a centralized environment such that
T1 : R1(A) W1(A) R1(B) W1(B)
T2 : R2(A) W2(A) R2(C) W2(C)
Consider the schedule
S : R1(A) W1(A) R2(A) W2(A) R1(B) W1(B) R2(C) W2(C)

Find out whether the given schedule is conflict serializable or not
Also find whether the two schedules are view serializable or not.

(b) Two phase locking does not ensure freedom from deadlock. Justify this using an example. Describe wait-die and wait-wound protocol for deadlock prevention.

6 + (3 + 3) = 12

9. (a) Produce a wait-for graph for the following transaction scenario and determine whether a deadlock exists or not.

Transaction	Data items locked	Data items waiting for
T1	x2	x1,x3
T2	x3, x10	x7, x8
T3	x8	x4, x5
T4	x7	x1
T5	x1, x5	x3
T6	x4, x9	x6
T7	x6	x5

(b) Justify the following statement: Concurrent execution of transactions is more important when data must be fetched from (slow) disk or when transactions are long, and is less important when data are in memory and transactions are very short.

(c) "Primary Index is a dense index" — Justify for or against the statement.

6 + 4 + 2 = 12