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National Institute of Technology, Delhi

Name of the Examination: End-Term (B. Tech)

Branch : CSE **Semester: III**

Title of the Course: Database Management Systems **Course Code: CSB 202**

Time: 3 Hours **Maximum Marks: 50**

Section A (10 Marks)

Q1. Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic values. F = {CH -> G, A -> BC, B -> CFH, E -> A, F -> EG} is a set of functional dependencies (FDs) so that F+ is exactly the set of FDs that hold for R. How many candidate keys does the relation R have?

Q2. Which of the following statements are TRUE about an SQL query?

P: An SQL query can contain a HAVING clause even if it does not a GROUP BY clause

Q: An SQL query can contain a HAVING clause only if it has a GROUP BY clause

R: All attributes used in the GROUP BY clause must appear in the SELECT clause

S: Not all attributes used in the GROUP BY clause need to apper in the SELECT clause

(A) P and R (B) P and S (C) Q and R (D) Q and S

Q3. Let E1 and E2 be two entities in an E/R diagram with simple single-valued attributes. R1 and R2 are two relationships between E1 and E2, where R1 is one-to-many and R2 is many-to-many. R1 and R2 do not have any attributes of their own. What is the minimum number of tables required to represent this situation in the relational model?

Q4. Explain composite, single, simple, composite and derived attribute.

Q5. Explain recursive relationship with example?

Q6. What is serializability? How it is tested?

Q7. Discuss the conflict and view serialzability with example.

Q8. With an example show how a referential integrity can be implemented.

Q9. Database _____ which is the logical design of the database, and the database _____ which is a snapshot of the data in the database at a given instant in time

Q10. For a database relation R(a, b, c, d) where the domains of a, b, c, d include only atomic values, only the following functional dependencies and those that can be inferred from that hold:

a->c b->d

The relation is in:

a) In 1NF but not in 2NF b) In 2NF but not in 3NF c) In 3NF but not in 2NF d) In both 2NF and 3NF

Section B (4 Marks each)

Q.1 Consider the following four schedules due to three transactions (indicated by the subscript) using read and write on a data item x, denoted by r(x) and w(x) respectively. Which one of them is conflict serializable?

S1: r1(X); r2(X); w1(X); r3(X); w2(X)

S2: r2(X); r1(X); w2(X); r3(X); w1(X)

S3: r3(X); r2(X); r1(X); w2(X); w1(X)

S4: r2(X); w2(X); r3(X); r1(X); w1(X)

Q2. Consider a simple checkpointing protocol and the following set of operations in the log.

(start, T4); (write, T4, y, 2, 3); (start, T1); (commit, T4); (write, T1, z, 5, 7);

(checkpoint);

(start, T2); (write, T2, x, 1, 9); (commit, T2); (start, T3); (write, T3, z, 7, 2);
If a crash happens now and the system tries to recover using both undo and redo operations, what are the contents of the undo list (if any) and the redo list?

Q3. Consider the following two transactions:

T1	T2

read(A);
read(B);
if A = 0then B := B + 1;
write(B)
	read(B);
	read(A);
	if B = 0then A := A + 1;
	write(A)

Add lock and unlock instructions to transactions T1 and T2, so that they observe the two-phase locking protocol.

Q4. Referring above Q3, can the execution of these transactions result in a deadlock? If yes, show it through example.

Q5. We want to maintain information about hospital staff, including doctors, nurses, and patients at the hospital. The information we need includes:

- Staff names, addresses, employee ids.
- Patients' names, addresses, and the name of their insurance company.
- Patients are each assigned to a ward (room).
- The nurses are assigned to zero or more wards. Each ward has at least one nurse assigned.
- The doctors are assigned to zero or more patients. Patients may or may not have a doctor assigned, and they may have more than one doctor.

Define a conceptual schema (ER) for the above scenario.

Section C (10 Marks each - Attempt any 2)

Q1. You are given the below set of functional dependencies for a relation R(A,B,C,D,E,F,G),
F = {AD→ BF,CD →EGC,BD →F,E →D, F →C,D → F}.
a. Find the minimal cover for the above set of functional dependencies.
b. Using the functional dependencies that you computed in step a, find the keys for this relation. Is it in BCNF? Explain your reasoning. Show the normalization steps at each normalised form.

Q2. Consider the following schema:
Suppliers(**sid:** integer, sname: string, address: string)
Parts(**pid:** integer, pname: string, color: string)
Catalog(**sid**: integer, **pid**: integer, cost: real)
The key fields are bold, and the domain of each field is listed after the field name. The Catalog relation lists the prices charged for parts by Suppliers.
a. Find the names of suppliers who supply some red part.
b. Find the sids of suppliers who supply some red or green part.
c. Find the sids of suppliers who supply some red part or are at 221 Packer Street.
d. Find the sids of suppliers who supply some red part and some green part.
e. Find the sids of suppliers who supply every part.

Q3. (a) Write a PL/SQL block to find the maximum number from given three numbers.
(b) Write a PL/ SQL procedure to reverse string using for loop