BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSc **SEMESTER : VI/ADD**
BRANCH: MATHS AND COMPUTING **SESSION : SP/2025**

SUBJECT: CS301 DATABASE MANAGEMENT SYSTEMS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Distinguish strong entity set with weak entity set? Draw an ER diagram to illustrate Weak entity set? Using Armstrong's axioms, prove that if A→B, BC→D, then AC→D.	[5]	1	2
Q.1(b)	Let there be a relation R=⟨A, B⟩ having 100 tuples and A as the primary key. If the number of distinct entries in B is 10, estimate the size of the following query. $R \bowtie \pi_B(R)$, where π_B denote the projection operator. Consider the following relations: Sailors (sid: integer, sname: string, rating: integer, age: real) Boats (bid: integer, bname: string, color: string) Reserves (sid: integer, bid: integer, day: date) Write the relational algebra query for the following questions. a) Find the sailor IDs who have reserved a boat with a red color. b) Find the IDs of sailors who have reserved at least two different boats. c) Find the names and ratings of sailors whose rating is better than some sailor called "ABC".	[5]	3	4
Q.2(a)	Consider the following relational database employee (ID, person name, street, city) works (ID, Company name, salary) Company (Company name, city) manages (ID, manager id) Write the following query in SQL. (a) Find the ID, name, and city of residence of each employee who works for "ABC" branch and earns more than 10000. (b) Find employees who earn more than the average salary. (c) List names of employees along with the names of their managers.	[5]	3	3
Q.2(b)	Given the table: born (name, age, city) which describes which city a person was born in and the person's current age, the following query was formulated. select name, age from born as b where age = (select max(age) from born where b.city = city) group by name, age having (age > 60) What does the query return? Suppose the query is changed to the following: select name, age from born as b where age = (Select age from born where b.city = city) group by name, age having (age > 60) Would it still return the same result? Explain in brief.	[5]	3	3

PTO

Q.3(a)	We are given the relational schema: R = <S, T, U, V, W, X, Y, Z> and a set of functional dependencies: F = {UZ → Y, S → TU, T → UXZ, W → S, X → WY} (a) Find the candidate keys of R (b) Determine the highest possible normal form that R satisfies. (c) If R is not in 2NF, find the 2NF decomposition and show that the decomposition is lossless.	[5]	4	3
Q.3(b)	Consider the following set of dependencies: X→ YZ, Y → XZ, and Z → XY. Show that both Y and Z are extraneous in X→ YZ. Using this example, can you show that there can be more than one canonical cover for the given set of functional dependencies.	[5]	4	2
Q.4(a)	Suppose a B tree can hold up to 4 pointers and 3 keys. What is the order of the tree? Insert the following keys to the B tree: 10, 20, 5, 6, 12, 30, 7, 17, 22, 11, 36, 45.	[5]	2	3
Q.4(b)	Given a table R (A, B, C, D) what can you say about the underlying organization of the table, if it is known that the attribute A has a *dense secondary* index built on it? Prove or disprove the statement "View serializability ensures conflict serializability". What is a cascading rollback? Explain with an example.	[5]	2, 5	3
Q.5(a)	Consider the following schedule S of transactions T1, T2, T3, T4: **T1**: Writes(X), Commit **T2**: Reads(X), Writes(Y), Reads(Z), Commit **T3**: Writes(X), Commit **T4**: Reads(X), Reads(Y), Commit Check whether the following schedules of transactions is serializable or recoverable or not. If it is serializable, then find the serial schedule to which it is equivalent.	[5]	5	3
Q.5(b)	What is two-phase locking. Show that the two-phase locking protocol ensures conflict serializability. Prove or disprove the statement" Two-phase locking ensures deadlock free schedules."	[5]	5	4

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