Question Paper

Exam Date & Time: 31-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. DEGREE EXAMINATIONS - MAY/JUNE 2023
SUBJECT: CSE 2251/ CSE-2251 DATABASE SYSTEMS
(COMPUTER SCIENCE AND ENGINEERING - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING / COMPUTER SCIENCE AND ENGINEERING / COMPUTER SCIENCE AND ENGINEERING - CYBER SECURITY)

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A) Illustrate the various categories of applications in which database concepts can be used along with suitable examples. (3)

1B) Consider the following relations R(A,B,C,D) and S(C,D,E), and solve the following queries: (5)

R

A	B	C	D
1	2	3	4
2	2	5	1
3	4	2	6
4	2	5	3

S

C	D	E
1	2	4
3	4	1
5	1	6
4	2	3

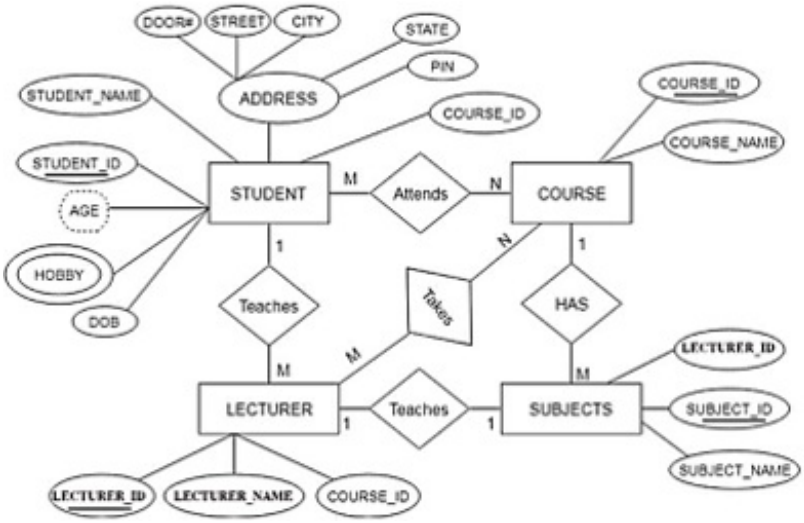
i. $R * S$
ii. $R \rhd\lhd_{R.D=S.D} S$ & $R \lhd\rhd_{R.D=S.D} S$
iii. $R \bowtie_{R.A=S.E} S$
iv. $R \cup S$ & $R \cap S$
v. R-S & S-R

1C) Suppose T1 & T2 are two transactions of the given schedule S. Analyse this schedule and identify whether it can be converted into the serializable schedule or not. A = 50, B = 50 (2)

T1	T2
Read(A)	
A = A- 50	
	Read(A)
	A = A+ 10
	Write(A)
	Commit
Read(B)	
B = B – 10	
Write(B)	
Commit	

2A) Why the B+ tree is preferred in database indexing compared to the B tree justify your answers in terms of the pros and cons of the same and justify your answer with the minimum 5 difference. (5)

2B) Consider the student-detail **ER Diagram**. Design the DDL commands for student, Course and Subjects entities using SQL. (3)



2C) Consider the following Product schema: (2)
Suppliers(*sid: integer, sname: string, address*: string)
Parts(*pid: integer, pname: string, color*: string)
Catalog(*sid: integer, pid: integer, cost*: real)

Solve the following queries using SQL.
1. Find the *sids* of suppliers who supply some red parts and stay at 221 Packer Street.
2. Find the *sids* of suppliers who supply some red parts.

3A) Consider the following Service Management schema provided in Table 3A. (5)

Clients (CID, name, phone)
Staff (SID, name)
Appointments (CID, date, time, service, SID)

Table 3A: Service Management Schema

Write the following SQL queries:
i) Find the appointment time and client name of all appointments for staff member 'Amar' in the June month irrespective of day and year.
ii) List the client details who have taken both the services of 'Order Processing' and 'Technical Support'.
iii) Find the names of the Staff who took up an appointment of the clients whose name begins with 'A' and ends with 'h'. Order all the names in descending order and eliminate all the duplicates.
iv) Compute all the client names who received an appointment date after at least one client who received an appointment for 'Technical Support' service. Rename the name of the clients to Client_Name.
v) Using SQL set operations, find the CID and name of the clients who received an appointment for 'Order Processing' service but have name different from the Staff who provided this service.

3B) List all the non-trivial functional dependencies satisfied by the relation in Table 3B (3)

A	B	C
a_1	b_1	c_1
a_1	b_1	c_2
a_2	b_1	c_1
a_2	b_1	c_3

Table 3B

3C) For the **Service Management** schema provided in Table 3A. , write the following SQL queries: (2)
i) For each staff, determine number of distinct clients serviced per service category.

ii) Delete the staffs who never provided any service.

4A) Consider the given relations class and class_info: (5)

class	
ID	Name
1	Abhi
2	Adam
3	Alex
4	Anu

class_info		
ID	Block No	Room No
1	AB5	215
2	AB1	302
3	AB5	316

i) Compute the output of following operations:
a) NATURAL JOIN
b) LEFT OUTER JOIN
c) FULL OUTER JOIN
ii) Consider University Database schema and analyse the statement- "If department number is deleted from the parent table (department table), if the employee table contains the corresponding department number value, it leads to violation of referential integrity". What is this referential integrity and how can the above violation be handled?

4B) Consider a company's personnel database which contains the following information: a) The company has a set of departments. b) Each department has a set of employees, and a set of projects. C) Each department includes: department number(unique), budget and the department manager's employee number(unique). Employee details includes employee number(unique), current project number, office number, and phone number. Also, for each project details like project number(unique) and budget must be considered. Design an appropriate set of 3NF relations to represent this database design. State any assumptions you make concerning the dependencies. (3)

4C) Reduce the ER Diagram to relational schema given in Figure 4C: (2)

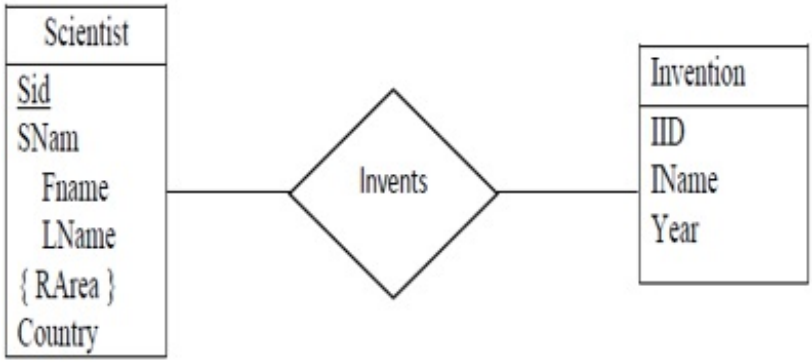


Figure 4C.

5A) Consider the following set F of functional dependencies on the relation schema R(A, B, C, D, E, F): (5)

A→BCD
BC→DE
B→D and
D→A

i) Compute B+.
ii) Prove AF is a super key.
iii) Compute a canonical cover for the above set of functional dependencies F; give each step of your derivation with an explanation.
iv) Give a 3NF decomposition of R based on the canonical cover.
v) Give a BCNF decomposition of R using the original set of functional dependencies.

5B) Compute closure of the following set F of functional dependencies for relation schema r (A, B, C, D, E). Specify atleast any 6 additional members of closure F_C. (3)

A→BC
CD→E
B→D
E→A

5C) Consider the following two transactions: (2)

T13:
read(A);
read(B);
if A = 0 then B := B + 1;
write(B).

T14:
read(B);
read(A);
if B = 0 then A := A + 1;
write(A).

Let the consistency requirement be A = 0 $\vee$ B = 0, with A=B=0 as the initial values. Show a concurrent execution of T13 and T14 that produces a non-serializable schedule.

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