

PDPM IIITDM JABALPUR  
CS2003 Database Management Systems  
EndSem Exam November 24, 2022  
Part-B

MaxMarks 80

Time 2 hours 10 mins

Roll No: \_\_\_\_\_ Name: \_\_\_\_\_

**Note: Marks will be awarded only if the reason or steps will be given in each answer as applicable.**

1. [2] Consider a set of users A, B, C, D, E. Suppose user A creates a table T and thus is the owner of T. Now suppose the following set of statements is executed in order:

1. User A: grant update on T to B, C with grant option
2. User B: grant update on T to D with grant option
3. User C: grant update on T to D with grant option
4. User D: grant update on T to E
5. User A: revoke update on T from C cascade

After execution of statement 5, which user(s) has update permission on T with/without grant option?

**Answer:**

2. [3] Suppose we have two relations  $R(\underline{A}, B)$  and  $S(\underline{A}, B)$  with the same schema. The only key of R is {A}; the only key of S is {A} as well. Let relation  $T(A, B)$  be the set union of R and S, i.e.,  $T = R \cup S$ . What are the keys of T? Justify your answer.

**Answer:**

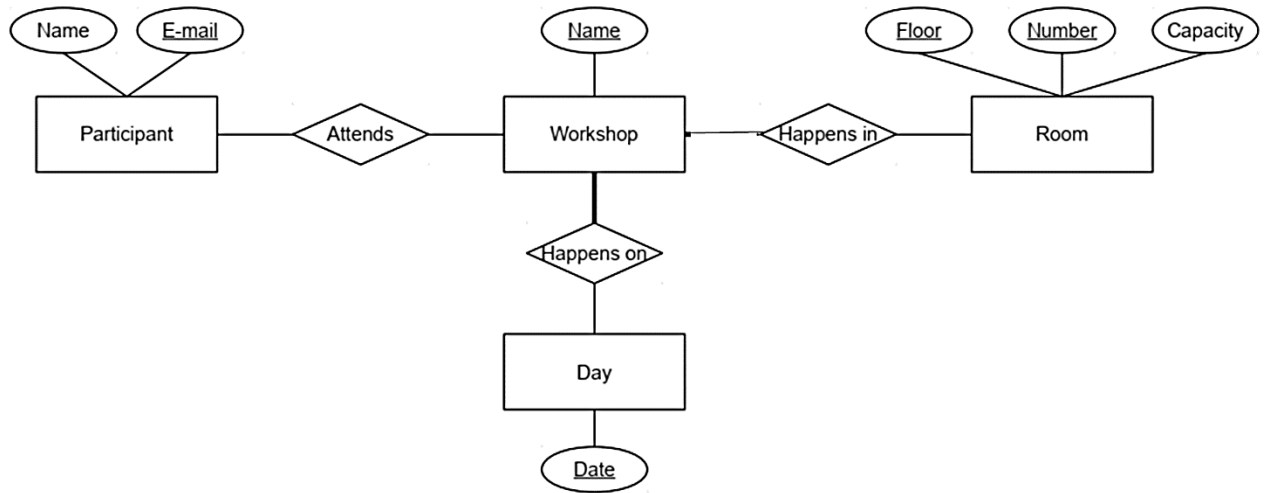
R=student name,student number  
S=student name,parents number  
jab union lenge toh  
shrey,9399531109  
shrey,7024071706  
toh akela A is not key.

3. [3] Consider a relation R(ABCDE) with FDs  $AB \rightarrow C$ ,  $B \rightarrow D$ ,  $C \rightarrow E$ ,  $D \rightarrow A$  and find (B)+

**Answer:**

4. [3] Consider the following ER diagram for organizing workshops in a student event where entities and attribute names are self-explanatory. Identify if we can represent the following information on this ER diagram and mention the updates need to be introduced to represent this information:

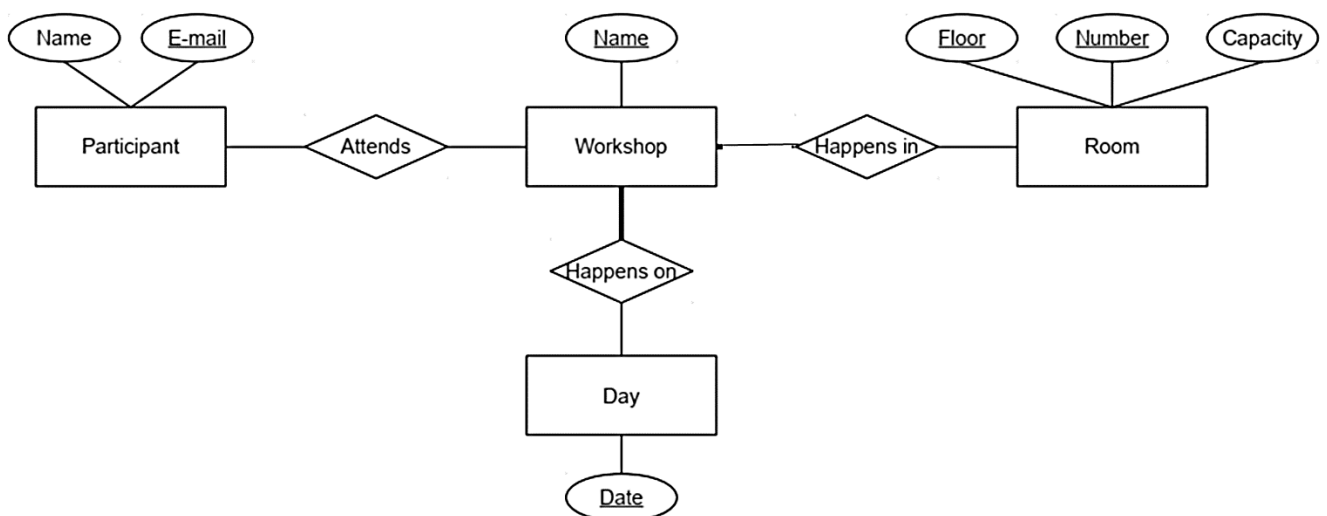
**“Every participant must register for at least one workshop.”**



**Answer:**

5. [3] Consider the following ER diagram for organizing workshops in a student event where entities and attribute names are self-explanatory. Identify if we can represent the following information on this ER diagram and mention the updates need to be introduced to represent this information:

**“Each workshop must have an identified organizer among the participants.”**




**Answer:**

6. [4] Consider the relation scheme  $R \{A, B, C, D, E, F, G, H, I, J\}$  with FDs  $AB \rightarrow C$ ,  $B \rightarrow EF$ ,  $AD \rightarrow GH$ ,  $G \rightarrow I$ , and  $H \rightarrow J$ . Find the key for  $R$ ?

**Answer:**

7. [3] Consider the following log sequence corresponding to a particular schedule at the point of a system crash for four transactions  $T1$ ,  $T2$ , and  $T4$ . Describe the recovery process from the system crash.



[start transaction, T1]  
[read item, T1, A]  
[read item, T1, D]  
[write item, T1, D, 20, 25]  
[commit, T1]  
[checkpoint]  
[start transaction, T2]  
[read item, T2, B]  
[write item, T2, B, 12, 18]  
[start transaction, T4]  
[read item, T4, D]  
[write item, T4, D, 25, 15]  
[read item, T4, A]  
[write item, T4, A, 30, 20]  
[commit, T4]  
[read item, T2, D]  
[write item, T2, D, 15, 25] ← system crash

**Answer:**

8. [4] Consider relations  $R(\underline{A}, \underline{B}, C, D, E, F)$  and  $S(\underline{A}, \underline{B}, C)$  with FDs  $AB \rightarrow C$ ,  $C \rightarrow ABDE$ , and  $ADE \rightarrow F$  in a database. Find out the current normal form for both relations.

Answer:

$R=2NF$ , but not in  $3NF$  coz  $C$  determines  $E$

$S=2,3$ , but not in  $bcnf$  coz  $C$  determines  $A$ .  $A$  is prime toh voh kisi se determine nhi hona chahiye

9. [4] Find if  $E = \{AB \rightarrow C, D \rightarrow E, E \rightarrow C\}$  is a minimal cover for the set of functional dependencies  $F = \{AB \rightarrow C, D \rightarrow E, AB \rightarrow E, E \rightarrow C\}$ .

Answer:

10. [4] Consider a database consisting of a single relation R (A) with tuples {(5), (10), (40)}. The following schedule may be

T1	T2
READ_LOCK(A(5))	
READ_LOCK(A(10))	
SELECT * FROM R WHERE A<=10	
	WRITE_LOCK(A(50))
	INSERT INTO R VALUES (50)
	UNLOCK(A(50))
SELECT * FROM R WHERE A<=10	
UNLOCK(A(5))	
UNLOCK(A(10))	

(a). REPEATABLE READ: Yes/No with reason

(b). SERIALIZABLE: Yes/No with reason

11. [4] Consider the relations Customer(cid, cname) and Purchase(cid, productname, price) and complete the following statement for creating a view named XYZ for the names of the customers who did not buy any product with price < 10.

CREATE VIEW \_\_\_\_\_

SELECT cname

FROM Customer

WHERE 10 \_\_\_\_\_ < \_\_\_\_\_ (SELECT price  
FROM \_\_\_\_\_ customer,purchase  
WHERE \_\_\_\_\_ customer.cid=purchase.cid)

12. [6] Consider the following SQL table declaration:

```
CREATE TABLE R (a INT, b INT, c INT, CHECK( [??] ));
```

Currently, R contains the tuples (1,4,14), (2,3,15), and (3,3,16).

Now the following SQL statement is executed:

```
INSERT INTO R VALUES (4,4,9);
```

Find out if this insertion will be accepted or rejected with each of the following tuple-based CHECK constraints:

- i.  $a < (\text{SELECT MAX}(b) \text{ FROM } R)$
- ii.  $a \leq \text{ALL} (\text{SELECT } c - b \text{ FROM } R)$
- iii.  $b > (\text{SELECT AVG}(a) \text{ FROM } R)$

Note: When a tuple-based check is invoked for an insert and includes a subquery over the same table, the subquery is evaluated on the table including the inserted tuple.

**Answer:**

13. [5] Consider two relations EMPs(ID, NAME, DEPT, SALARY) and MANAGERS(DEPT, MGR)  
The 1<sup>st</sup> gives the employee ID, their name, department, and salary; the 2<sup>nd</sup> gives for each department, the manager of that department, which is the employee ID of the person managing the department.

Suppose we wish to constrain the data so that in no department the employees can have a total salary greater than Rs. 1,000,000. The following is a framework for an assertion that will enforce this constraint:

```
CREATE ASSERTION cheap CHECK (  
    NOT EXISTS (Q) )
```

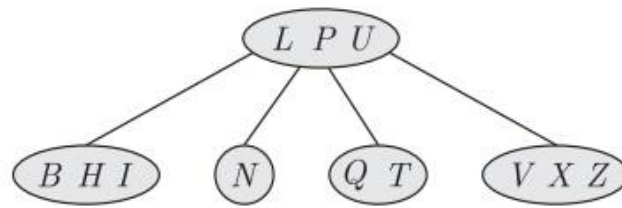
Three students were given the task of writing Q to enforce this constraint. Their answers are given below. Discuss the answer of each student and tell if it enforces this constraint:

(i) SELECT \* FROM EMPS WHERE SUM(SALARY) > 1000000

(ii) SELECT SUM(SALARY)  
FROM EMPS, MANAGERS WHERE ID = MGR  
GROUP BY EMPS.DEPT  
HAVING SUM(SALARY) > 1000000

(iv) SELECT DEPT FROM EMPS  
GROUP BY DEPT  
HAVING SUM(SALARY) > 1000000

14. [6] Consider the following 2-3-4 tree (i.e., B-tree with a minimum degree of two) in which each data item is a letter. The usual alphabetic ordering of letters is used in constructing the tree. Show the insertion of key G in this tree. Show the process.



15. [6] Consider the following trigger over a table R(a,b):

```
CREATE TRIGGER Rins
AFTER INSERT ON R
REFERENCING NEW ROW AS new
FOR EACH ROW
  WHEN (new.a * new.b > 10)
    INSERT INTO R VALUES (new.a - 1, new.b + 1);
```

Suppose we begin with table R empty. Consider the following possible tuples inserted into R. Show Table R after the completion of trigger execution in each case.

(a) (50,0) ; (b) (5,4); (c) (2,50)

Answer:



- [10] Consider the following schema for TV shows rating:

TVshow (TID, title, release\_year, director, producer)Reviewer (RID, name)Rating (TID, RID, rating, rating\_date)

Write the following query in relational algebra.

1. Find the id of reviewers who reviewed all movies.
2. Show the title of all TV shows released in 2019 and directed by Hirani.
3. Find the names of all reviewers who rated TV show Fariha.

17. [10] Consider the following relations which are self-explanatory:

Student(snum, sname, discipline, year, age)

Course(cid, cname, time, roomno, fid)

Enrolled(snum, cid)

Faculty(fid, fname, deptid)

Write the following queries in SQL. No duplicates should be printed in any of the answers.

(a). Find names of all courses in which 20 students are registered.

(b). Print the year and average age of students for that year if average age of students for that year is greater than 20.

(c). Names of students not enrolled in any class.