> KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
> DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Identify the user in the given scenario and specify their role in database as a user.

    a) Second Year MCA student who designs the web portal for 2024 SET conference.

    b) SBI bank manager who looks for any anti-money laundering through the accounts.

    c) Junior Lawyer who does e-filing for the upcoming case.

    d) Common citizen who books ticket in bookmyshow app.

2. Computer Sciences Department frequent fliers have been complaining to Dane County Airport officials about the poor organization at the airport. As a result, the officials have decided that all information related to the airport should be organized using a DBMS, and you've been hired to design the database. Your first task is to organize the information about all the airplanes that are stationed and maintained at the airport. The relevant information is as follows:

    Every airplane has a registration number, and each airplane is of a specific model. The airport accommodates a number of airplane models, and each model is identified by a model number (e.g., DC-10) and has a capacity and a weight. A number of technicians work at the airport. You need to store the name, SSN, address, phone number, and salary of each technician. Each technician is an expert on one or more plane model(s), and his or her expertise may overlap with that of other technicians. This information about technicians must also be recorded. Traffic controllers must have an annual medical examination. For each traffic controller, you must store the date of the most recent exam. All airport employees (including technicians) belong to a union. You must store the union membership number of each employee. You can assume that each employee is uniquely identified by the social security number.

The airport has a number of tests that are used periodically to ensure that airplanes are still airworthy. Each test has a Federal Aviation Administration (FAA) test number, a name, and a maximum possible score. The FAA requires the airport to keep track of each time that a given airplane is tested by a given technician using a given test. For each testing event, the information needed is the date, the number of hours the technician spent doing the test, and the score that the airplane received on the test.

Draw an ER diagram for the airport database. Be sure to indicate the various attributes of each entity and relationship set; also specify the key and participation constraints for each relationship set. Specify any necessary overlap and covering constraints as well.

3.   R:

A	B	C
1	K	2
2	P	9

S:

A	M	N	P
1	O	12	2
1	K	13	9
2	L	12	9

For the given table R and S, write the output for the following operations.

a) R ⋈ $_{B=M}$ S

b) R U S

c) $_A \mathcal{F}_{COUNT (*)}$ (S)

d) S(N,P) ÷ R(C)

e) R * S

4.(a) Consider the following relation for published books:

BOOK (Book_title, Author_name, Book_type, List_price, Author_affil, Publisher)

Author_affil refers to the affiliation of author. Suppose the following dependencies exist:

Book_title → Publisher, Book_type

Book_type → List_price

Author_name → Author_affil

i) What normal form is the relation in? Explain your answer.

ii) Apply normalization until you cannot decompose the relations further. State the reasons behind each decomposition.

OR

4.(b)   Outline the procedure to find the minimal set of functional dependencies and find the minimal cover of the given FD set

$$B \rightarrow A, D \rightarrow A, AB \rightarrow D$$

5.   Consider the following relations

Train (Tr_no, name, source, destination, start_time, reach_time)

Passenger (PNR_No, Serial_no, Name, Sex, Address, Age, Date_of_Journey, ID_PROOF, Status, kind_of_seat, seat_no, tr_no)

Write SQL queries to

a) Find the train names that start from Katpadi.

b) List the number of passengers in each train.

c) List the train numbers, names along with passenger names if it is reserved.

d) List the passenger names who have reserved in all trains starting from Chennai.

e) Print the passenger name and date_of_journey in the format "John Smith ********" "23rd December 2024" for whom journey is upcoming in next three days.

6.(a)   Draw the step-by-step query tree to construct a optimized query for the following query.

SELECT E.NAME FROM EMPLOYEE E, DEPARTMENT D, DEPENDENT T WHERE E.DNO=D.DNO AND D.MSSN =T.DSSN AND D.NAME='score' GROUP BY E.NAME HAVING COUNT(*) >=2;

OR

6.(b)   Illustrate the types of changes to SQL queries that may be worth considering for improving the performance during database tuning.

7. Suppose you are transferring money from your account to your friends account, what are the properties enforced by the concurrency control and recovery methods of the DBMS? Discuss in detail.

8. What is the difference between the UNDO/REDO and the UNDO/NO-REDO algorithms for recovery with immediate update? Develop the outline for an UNDO/NO-REDO algorithm.

9.
```
{
  "address": {
    "building": "1007",
    "coord": [ -73.856077, 40.848447 ],
    "street": "Morris Park Ave",
    "zipcode": "10462"
  },
  "borough": "Bronx",
  "cuisine": "Bakery",
  "grades": [
    { "date": { "$date": 1393804800000 }, "grade": "A", "score": 2 },
    { "date": { "$date": 1378857600000 }, "grade": "A", "score": 6 },
    { "date": { "$date": 1358985600000 }, "grade": "A", "score": 10 },
    { "date": { "$date": 1322006400000 }, "grade": "A", "score": 9 },
    { "date": { "$date": 1299715200000 }, "grade": "B", "score": 14 }
  ],
  "name": "Morris Park Bake Shop",
  "restaurant_id": "30075445"
}
```
For the above given restaurants collection structure, answer the following queries in MongoDB.

a) Display the fields restaurant_id, name, borough and cuisine, but exclude the field _id for all the documents in the collection restaurant.

b) Display the first 5 restaurant which is in the borough Bronx.

c) Find the restaurant Id, name, borough and cuisine for those restaurants which contain 'Wil' as first three letters for its name.

d) Find the restaurants that have a grade with a score of 2 and a grade with a score of 6 and are located in the borough of Manhattan or Brooklyn.

e) Find the restaurant that has the highest average score for the cuisine "Turkish".

10. Consider the following relations:

BOOKS(Book#, Primary_author, Topic, Total_stock, $price)

BOOKSTORE (Store#, City, State, Zip, Inventory_value)

STOCK (Store#, Book#, Qty)

Total_stock is the total number of books in stock and Inventory_value is the total inventory value for the store in dollars. For the following situations diagrammatically depict the distribution of the database i.e. show the database state.

a) Give an example of two simple predicates that would be meaningful for the BOOKSTORE relation for horizontal partitioning.

b) How would a derived horizontal partitioning of STOCK be defined based on the partitioning of BOOKSTORE?

c) Show predicates by which BOOKS may be horizontally partitioned by topic.

d) Show how the STOCK may be further partitioned from the partitions in (b) by adding the predicates in (c).

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