

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7004

K

Unique Paper Code : 2342573501

Name of the Paper : Database Management Systems

Name of the Course : B.A. (Prog.)/B.Sc.(P)/B.Sc. Maths. Sc. (NEP-UGCF)

Semester : V

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All parts of Question 1 (Section A) are compulsory.
3. Attempt any four questions from Section B.
4. All questions in Section B carry equal marks.
5. Attempt all parts of a question together.

SECTION A

- 1 (a) In the context of database systems, define the following terms and give one example of each of the following: (3)
 - (i) Naïve or parametric users
 - (ii) Standalone users
 - (iii) Sophisticated users
- (b) Give the Entity Relationship diagram (ERD) representation of the following entity: (3)

An entity STUDENT consists of Rollno, Name, Address, date of birth, age and Phone number attributes. Address attribute is split into House no, Street no, City and zipcode. An entity can have multiple phone numbers and age is derived from date of birth attribute.

- (c) Consider a relational schema $R(A, B, C, D, E)$ and the following set of functional dependencies defined on it: $F = \{A \rightarrow BCD, BC \rightarrow DE, B \rightarrow D, D \rightarrow A\}$ (3)
Determine any three candidate keys of R .

- (d) Consider the following tables R and S : (3)

R			S		
X	Y	Z	A	B	C
10	a	7	25	c	7
25	b	8	30	d	8
30	a	9	25	c	7
			10	a	7

The attributes X , Y , and Z of relation R are domain-compatible with the attributes A , B , and C of relation S , respectively. What will be the output produced on executing the following relational algebraic expressions?

- (i) $R \bowtie_{RZ=SC} S$
(ii) $R \times S$
(iii) $R - S$ (3)

- (e) Consider the following relation

P	Q	R	S	T
P1	Q1	50	S1	20
P2	Q2	60	S2	20
P3	Q1	70	S3	40

Which of the following functional dependencies are violated based on the above relation state? Justify your answer.

- (i) $Q \rightarrow R$
(ii) $S \rightarrow T$
(iii) $T \rightarrow P$
- (f) Explain the following set-at-a-time operations applied to a file in database systems: (3)
(i) FindOrdered
(ii) Reorganize
- (g) Suppose we have an ordered file with $r=300,000$ records stored on a disk with block size $B=4,096$ bytes. The file records are fixed size and unspanned, with record length $R=100$ bytes. Compute the blocking factor and the number of blocks needed for the file. (3)

(h) Consider the following relations:

(3)

SUPPLIER		
Sid	Sname	Pnumber
1	X	11
2	Y	12
3	Z	11

PART	
Pno	Pname
11	A
12	B
14	C

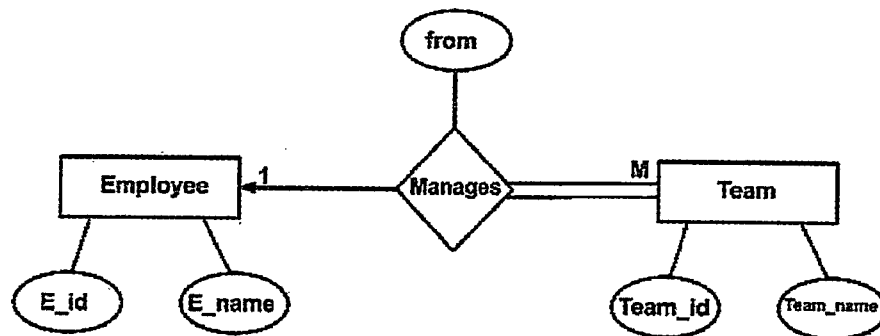
Sid is the primary key of SUPPLIER and Pno is the primary key of PART. Pnumber is a foreign key in SUPPLIER relation. For each of the following operations, which database constraints may be violated? Justify your answer.

- Insert <2, 'W', 14> in SUPPLIER relation.
- Delete the tuple <12, 'B'> from PART relation.
- Update the value of Pname from A to 10 in PART relation.

(i) Write SQL query to create a table EMPLOYEE based on the following information: (3)

- Table EMPLOYEE has the attributes Ecode, Name and age.
- Ecode is the primary key.
- Name should not be NULL.
- Age should take the values between 18 and 60 (both inclusive)

(j) Map the following Entity Relationship diagram to relational tables. Also, identify the primary keys and foreign key for each table. (3)



SECTION B

2 (a) Differentiate between database schema and database state. Also give an example of each. (5)

- (b) Consider a CONFERENCE_REVIEW database in which researchers submit their research papers for consideration. Reviews by reviewers are recorded for the paper selection process. The data requirements are summarized as follows: (10)

- Authors of papers are uniquely identified by e-mail id. First and last names are also recorded.
- Each paper is assigned a unique identifier by the system and is described by a title, and abstract
- A paper may have multiple authors, but one of the authors is designated as the contact author.
- Reviewers of papers are uniquely identified by e-mail address. Each reviewer's first name, last name, phone number, affiliation, and topics of interest are also recorded.
- Each paper is assigned between two and four reviewers. A reviewer rates each paper assigned to him or her on a scale of 1 to 10. Finally, each reviewer provides an overall recommendation regarding each paper.

Design an Entity Relationship diagram for CONFERENCE_REVIEW database, stating any assumptions you make. Clearly specify cardinality ratios and participation constraints.

- 3 (a) Consider the AIRLINE relational database schema which describes a database for airline flight information: (5)

AIRPORT(Acode, Aname, City, State)

FLIGHT(Flightno, Airline, Fare)

TRAVELINFO(Flightno, Date, Depart_acode, Arrival_acode, Depart_time, Arrival_time)

Primary Key in each relation is underlined.

- (i) Specify the foreign keys for this schema.
- (ii) Populate the relations with few sample tuples and write an SQL statement that violates the referential integrity constraint while inserting a tuple in TRAVELINFO relation.

- (b) Consider the AIRLINE relational database schema which describes a database for airline flight information: (10)

AIRPORT(Acode, Aname, City, State)

FLIGHT(Flightno, Airline, Fare)

TRAVELINFO(Flightno, Date, Depar_acode, Arrival_acode,
Departure_time, Arrival_time)

Primary Key in each relation is underlined.

Write relational algebraic expressions to perform the following:

- (i) Retrieve the code and name of all airports located in Chennai city.
- (ii) Display the flight numbers of TATA Airlines that have the minimum and maximum fares.
- (iii) Find the Flight numbers that are not flying on 2nd March 2025.
- (iv) Find the number of flights boarded from Chennai city.
- (v) Display airport code, airport name, airline, flight number arriving on 4th March 2025 at 10 am.

- 4 (a) Consider the BANK database, where the primary keys are underlined. Each bank can have multiple branches, and each branch can have multiple accounts and loans. Borrower relation corresponds to customers' loan details. Account relation stores customers' account details. (10)

BRANCH (branchID, branchName, branchCity)

CUSTOMER (custID, custName, custCity)

BORROWER (custID, loanNumber, branchID, amount)

ACCOUNT (accountNumber, branchID, custID, balance)

Give the following SQL queries to perform the following operations:

- (i) Find the names of customers who have an account but not a loan.
- (ii) Find branch names from which more than 10 customers have taken loan.
- (iii) Create a view to keep track of the names of customers, their account numbers and branch names.
- (iv) Find the names of all customers who live in the same city as the customer whose name is "Vijay".
- (v) List the names of all customers (in alphabetical order) having a loan in the "Kamla Nagar" branch.

- (b) Consider the following relation: (5)
 EMPLOYEE (Ecode, Ename, Dept_no, Salary)
 Here Ecode is the primary key.

Which of the following SQL queries is correct for the following statement?
 Justify the answer for both the queries.

For each department that has more than five employees, retrieve the department number and the number of its employees whose salary is more than Rs. 40,000.

- (i) SELECT Dept_no, COUNT (*)
 FROM EMPLOYEE
 WHERE Salary > 40000
 GROUP BY Dept_no
 HAVING COUNT (*) > 5;
- (ii) SELECT Dept_no, COUNT (*) FROM EMPLOYEE
 WHERE Salary > 40000 AND Dept_no IN
 (SELECT Dept_no
 FROM EMPLOYEE
 GROUP BY Dept_no
 HAVING COUNT (*) > 5)
 GROUP BY Dept_no;

- 5 (a) Consider the following relation: (4)
 STUDENT(Rollno, Name, {Phone}, {Degree})
 State First Normal Form. Is the relation in First Normal Form? If not, then normalise it into First Normal Form.
- (b) Consider the following tables EMPLOYEE and PROJECT: (4)

EMPLOYEE

Ecode	EName	Plocation
1	A	a
2	B	b
3	C	a
4	B	b

PROJECT

Ecode	Pno	Plocation
1	10	a
2	10	b
2	20	b

What will be the output when both the tables are equi-joined on Plocation attribute? Will the output produce spurious tuples? Justify your answer.

- (c) Consider the following relation for published books: (7)
 BOOK(Book_title, Author_name, Book_type, List_price, Author_affil, Publisher)
 Author_affil refers to the author's affiliation. Suppose the following dependencies exist:

Book_title -> {Publisher, Book_type}

Book_type -> List_price

Author_name -> Author_affil

- (i) What is the candidate key for BOOK relation?
- (ii) What normal form is the relation in? Apply normalization until the relations are in 3NF.
- 6 (a) Consider the following interleaved transactions T1 and T2, executed concurrently. Assume that the initial value of X is 10. (6)

T1	T2
read (X); X= X-3;	
	read(X); X= X-4;
write(X);	write(X);

Compute the value of X after the given schedule is executed. Is the value of X correct? If we remove the interleaving between the transactions T1 and T2, what will be the value of X?

- (b) Why does a binary search on the index file require fewer block accesses than a binary search on the data file? Also explain with suitable example. (4)
- (c) Define Transaction and ACID properties of transaction with respect to database. (5)
- 7 (a) Consider the following six relations for an order-processing database application in a company: (5)
- CUSTOMER (Cust#, Cname, City)
- ORDER (Order#, Odate, Cust#, Ord_amt)
- ORDER_ITEM (Order#, Item#, Qty)
- ITEM (Item#, Unit_price)
- SHIPMENT (Order#, Warehouse#, Ship_date)
- WAREHOUSE (Warehouse#, City)
- Here, Ord_amt refers to the total amount of order (in rupees), Odate is the date of order placed, and Ship_date is the date an order (or part of an order) is shipped from the warehouse. Assume that an order can be shipped from several warehouses.
- (i) What type of constraints would you expect to check?
- (ii) Depict the referential integrity constraints diagrammatically using a schema diagram.

- (b) Map the following Entity Relationship (ER) diagram to its corresponding relational schema. Specify all primary and foreign keys clearly. (10)

