

[This question paper contains 16 printed pages.]

Your Roll No.....23020107005

Sr. No. of Question Paper : 3028

I

Unique Paper Code : 2344002001

Name of the Paper : Database Management Systems

Name of the Course : Computer Science Generic
Elective (NEP-UGCF-2022
GE)

Semester : III

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. The paper has two sections. Section A is compulsory.
3. Attempt any four questions from Section B.
4. Parts of the question must be answered together.

P.T.O.

Section A

1. (i) Identify the multivalued and composite attributes from the following complex attribute:

Person_hobby (Name (First name, Last_name),
Phone (Area_code, Phone_No), {Hobbies}) (3)

- (ii) From the given SQL commands, identify whether it is DML, DDL or VDL.

(a) CREATE TABLE

(b) SELECT

(c) INSERT

(d) DELETE

(e) ALTER TABLE

(f) CREATE VIEW (3)

- (iii) Can the primary key of a relation be NULL?
Justify your answer. (3)

- ~~(iv)~~ Consider the following relation: (3)

| A | B | C |
|----|----|----|
| a1 | b1 | c1 |
| a1 | b1 | c2 |
| a2 | b1 | c1 |
| a2 | b1 | c3 |

For the given relational state, do the following functional dependencies hold? Justify your answer.

(a) $A \rightarrow B$

(b) $A \rightarrow C$

(c) $B \rightarrow A$

(v) Consider the following relation schema: (3)

Product

| Prod_id | Prod_Name | Price | Stock_in_hand | Date_of_mfr |
|---------|-----------|-------|---------------|-------------|
| | | | | |

P.T.O.

From the Product table above, create a view that selects the name of the product and the Price of every product with a price higher than 1000. Name the view as Product_higher.

(vi) Define the following: (3)

(a) Domain

(b) Attribute

(c) Entity

(vii) For the given relation schema: R (A, B, C) and S (D, E, F), write relational algebra expressions that are equivalent to the following SQL queries:

(3)

(a) Select * from R where B = 20;

(b) Select A, E from R, S;

(viii) Is the Index file created using the primary index an ordered file? Name the fields of the primary index file. On which field of the data file is the primary index created? (3)

(ix) Consider the following database, which records various products and their sales in the given two relations. (3)

| Sales | | | | |
|-------|---------|-----|------------|-------------|
| S_id | Prod_id | Qty | Sale_dt | Total_price |
| 1 | 106 | 2 | 2024-05-01 | 3000 |
| 2 | 102 | 3 | 2024-05-03 | 9000 |
| 3 | 103 | 2 | 2024-05-07 | 5000 |
| 4 | 104 | 4 | 2024-06-03 | 2000 |
| 5 | 105 | 6 | 2024-06-20 | 12000 |

$$\frac{2+3+2+4+6}{5} \Rightarrow \frac{17}{5} \Rightarrow 3.4$$

Product

| Prod_id | P_name | Category | Unit_Price |
|---------|------------|-------------|------------|
| 101 | Glucometer | Healthcare | 1500 |
| 102 | Headphones | Electronics | 3000 ✓ |
| 103 | Keyboard | Electronics | 2500 ✓ |
| 104 | Mouse | Electronics | 500 |
| 105 | BP Monitor | Healthcare | 2000 ✓ |

4000
5000
5

Give the result for each of the following SQL queries, when executed on the above two relations.

1900

P.T.O.

(i) SELECT *

FROM Sales

WHERE Qty > (SELECT AVG (Qty) FROM Sales);

(ii) SELECT Category, COUNT (*), AVG (Unit_Price)

FROM Product

GROUP BY Category;

- (x) What are the three reasons that lead to NULL values in a relation? Explain each with the help of an example.
- (3)

Section B

2. (i) Consider the following relational database schema that keeps the grade record of students. Following are two tables STUDENT and GRADE_REPORT.
- (10)

STUDENT

| S_Id | L_Name | F_Name | Major | EmailId |
|-------|--------|--------|------------------|-----------------------|
| B1234 | Sethi | Priya | Computer Science | sethipriya@gmail.com |
| B2233 | Negi | Manish | Management | negimanish@gmail.com |
| B6688 | Mishra | Jay | Computer Science | jaymishra@hotmail.com |

Grade Report

| S_Id | CourseNo | CourseTitle | Score |
|-------|----------|-----------------|-------|
| B1234 | CS2234 | Database | 88 |
| B2233 | CS2123 | Data Structures | 78 |
| B6688 | CS3212 | Web Design | 82 |

For each of the following operations, indicate whether it results in constraint violation and if so, why?

- (a) Insert (B1234', Bahl', Tina',

P.T.O.

'Bioinformatics', 'tinabahl@yahoo.com') into the STUDENT table.

- (b) Delete ('B2233', 'Negi', 'Manish', 'Management', 0920120120 negimanish@gmail.com) from the STUDENT table.
 - (c) Update the S_Id of Jay Mishra from 'B6688' to 'B4321' in the STUDENT table.
 - (d) Insert ('B6688', 'CS2234', 'Database', 72) into the GRADE REPORT table.
 - (e) Insert ('B2266', 'CS2234', 'Database', 84) into the GRADE REPORT table.
 - (ii) Differentiate between the following: (5)
 - (a) Database Intension and Database Extension
 - (b) Unary and Binary Relation
- Exemplify your answer by giving suitable diagrams.
- ✓ 3. (i) Given the following relation with its associated functional dependencies: (8)

| emp_proj | Emp_ssn | Proj_no | Hours | Emp_name | Proj_name |
|----------|---------|---------|-------|----------|-----------|
|----------|---------|---------|-------|----------|-----------|

$\text{Emp_ssn} \rightarrow \text{Emp_name}$

$\text{Proj_no} \rightarrow \text{Proj_name}$

$\text{Emp_ssn}, \text{Proj_no} \rightarrow \text{Hours}$

Identify the key attribute of the relation. Normalize the given relation up to 3NF showing all the steps. State the reasons behind each decomposition.

- (ii) Give SQL command to create a table T having attributes A, B, C, D, E where: (7)

- Attribute A is a number (maximum 10 digits in length) and cannot contain null values.
- Attribute B is a character string (maximum 50 characters in length).
- Attributes (A, B) form the primary key.
- Attributes C and D contain integer values.
- Default value of attribute C is 6.

P.T.O.

- Attribute D is a foreign key referring to attribute F from another table S (assuming S is already created).
 - Attribute E is of date datatype.
4. (i) Consider the following Movie database:

Customer

| Cust_id | Lname | Fname | Location |
|---------|-------|---------|----------|
| A01 | Ray | Radhika | SA |
| A02 | Suri | Vandana | MU |
| A03 | Dua | Annie | DA |
| A04 | Basu | Aditya | SA |

Movie

| Mv_no | Title | Type | Star | Price |
|-------|-----------------|--------|----------|-------|
| 1 | Rush Hour | Action | Jackie | 300 |
| 2 | Home alone | Comedy | Macaulay | 400 |
| 3 | Carry on Doctor | Comedy | Phillips | 350 |
| 4 | A Real Pain | Drama | Clarke | 250 |

Invoice

| Inv_no | Mv_no | Cust_id | Issue_dt |
|--------|-------|---------|-----------|
| I01 | 3 | A01 | 23-Jul-99 |
| I02 | 4 | A04 | 12-Aug-99 |
| I03 | 2 | A02 | 18-Oct-99 |
| I04 | 1 | A03 | 11-Aug-99 |
| I05 | 3 | A02 | 20-Nov-99 |

3028

Write the SQL queries for the following:

- Find the names of movies that are of type 'Action' or 'Comedy'.
- Count the number of movies in each movie type. *Select count(mv_no) from movie order by type*
- Determine the maximum and minimum movie prices. Rename the columns as max_price and min_price respectively. *Select max(price) as max, min(price) as min*
- Find the name of all customers having 'a' as the second letter in their Fname.
Select Fname from cust
- Find the mv_no which has been issued to 'Radhika'.

(ii) Consider the following schema: (5)

PROJECT (Proj_no, Proj_name, Architect)

EMPLOYEE (Emp_no, E_name)

ASSIGNED To (Proj_no, Emp_no)

Write the SQL commands for the following:

- Change the Proj_name of Proj_no = 'P02' to 'Airlines'.

P.T.O.

(b) Add a new column No of Hours in the table ASSIGNED TO.

- (i) Consider a College Library database that maintains the data about the books, readers and its staff members. The following are data requirements:
- Staff members are described as name, staff_id, password. (10)
 - Book is described by book_id, book title, price, category, edition, and author name. Books are maintained by the staff member.
 - Readers are registered with their reader_id, email, name (first name, last name), address, and phone number. A reader can have multiple phone numbers.
 - Readers can return/reserve books that have an issue date and return date. A reader can reserve multiple books and one book can be reserved by only one reader. Staff members keep track of all the readers.
 - Staff members also generate multiple reports about books and readers. Each report has a

3028
report number, reader_id, book_id, return date and issue date.

- (a) Identify the cardinality ratio and participation constraints.
- (b) Identify essential attributes associated with each entity with primary attributes marked.
- (c) Construct an ER diagram for the college library database with the above specifications. Also, state any assumptions that are made.
- (ii) Consider the following two interleaved transactions (T1, T2) executed concurrently. Assume that the initial value of variable W is 10. (5)

| | |
|--------------|----|
| T1 | T2 |
| 1. read(W); | |
| 2. W:=W-2; | |
| 3. read(W); | |
| 4. W:=W-3; | |
| 5. write(W); | |
| 6. write(W); | |

P.T.O.

The primary keys are underlined in the schema:

(7)

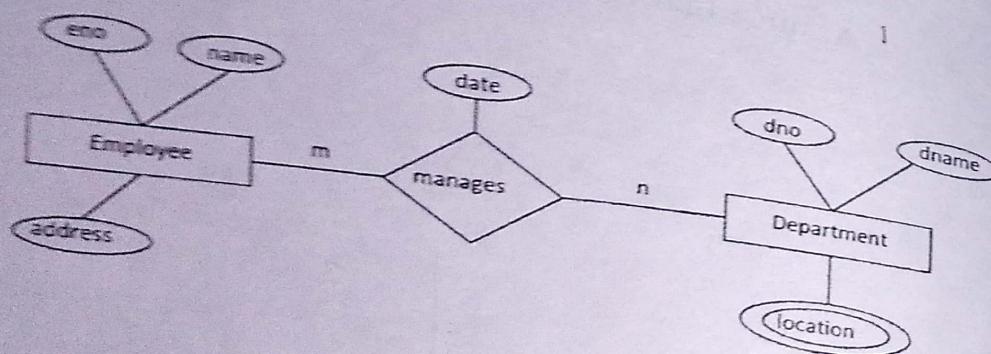
BOOKS (Bid, Title, Publisher, Year)

STUDENTS (Stid, StName, Major, Age)

AUTHORS (AName, Bookid, Address)

Compute the value of W after the given schedule is executed. Is this value of W correct? If the transactions (T1, T2) are not interleaved what would be the value of w?

- (i) Consider the following ER diagram.
- (ii) Map the given diagram into the relational schema (8)
- (iii) Specify the primary key and foreign key for each relation.



- (ii) Use the following schema to write relational algebra statements for the questions that follow.

- (i) List the Year and Title of each book.
- (ii) List all information about students whose Major is 'CS'.
- (iii) List all books published by 'McGraw-Hill' before 1990.
- (iv) List the names of those authors who are living in 'Davis'.

7. (i) Consider the following relations R and S. Show the result of the following operations: (10)

P.T.O.

R

| Sno | Dept |
|-----|------|
| S1 | Phyl |
| S2 | Psy |
| S3 | Chem |
| S4 | Jour |

S

| Sno | Department | Floor |
|-----|------------|-------|
| S10 | Maths1 | 4 |
| S3 | Chem | 3 |
| S15 | Eng | 1 |
| S4 | Jour | 1 |

- i. $S \times R$
- ii. $R \cup S$
- iii. $S - R$
- iv. $R \cap S$
- v. $R \bowtie S$ where $R.Sno = S.Sno$

- (ii) In each of the following binary relations, suggest the cardinality ratio between Entity 1 and Entity 2. Justify your answer, stating any assumptions you make. (5)

| Entity 1 | Cardinality Ratio | Entity 2 |
|----------|-------------------|------------|
| Manager | 1:1 | Department |
| Student | M:M | Teacher |
| Owner | 1:1 | Vehicle |
| Faculty | M:1 | Department |
| Employee | M:M | Project |