

3109

12

Map the ER diagram to a relation schema.
Mention all primary keys and foreign keys for each relation.

[This question paper contains 12 printed pages.]

5/6/24
Morning

Your Roll No.....

Sr. No. of Question Paper : 3109

H

Unique Paper Code : 32341403

Name of the Paper : Database Management Systems

Name of the Course : B.Sc. (H) Computer Science

Semester : IV

Year of Admission : 2019, 2020 & 2021

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Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **FOUR** questions from **Section B**.

SECTION A

1. (a) Consider the following relations : (6)

Book Author(AuthorID, Author_Name, City)

Book(BookID, Book_Name, AuthorID, Royalty_Fees)

- (i) Write the SQL command to insert a new record into the relation *Book* with the attribute *Price* in the relation *Book*.
- (ii) Write the SQL command to change the value of *City* to "New Delhi" for *AuthorID*="A1001".
- (iii) Write the SQL query to list the names of books written by author whose name has 5 letters and starts with 'A'.
- (iv) Write an SQL query to list the total of *Royalty Fees* for each author.

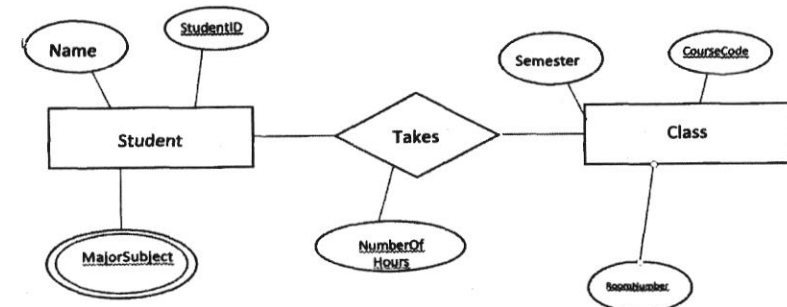
- (b) Differentiate between controlled and uncontrolled redundancy? Give suitable examples. (2)

- (c) What is Entity Integrity constraint in a relation? Explain the concept of weak entity. (3)

- (ii) Find the names of the sailors who have not reserved a red boat.
- (iii) Find the names of sailors who have reserved every boat reserved by those with a lower rating.

- (b) Given the following ER diagram : (3)

A *Student* entity is stored with *ID*, *Name* and *MajorSubject*, whereas, *Class* entity is stored with *Semester*, *CourseCode* and *RoomNumber*. The relationship between the entities student and class is given by *Takes*, which indicate that a student takes a class and spends *NumberOfHours* on it.



6. (a) Consider the schema $R(ABCDEFGH)$ with the following FDs : (7)

$BE \rightarrow GH, G \rightarrow FA, D \rightarrow C, F \rightarrow B$

Find the key of R and show the steps of derivation. Decompose the given schema R into the highest normal form possible. Is the resulting schema in BCNF? Justify.

- (b) Differentiate between database schema and database state. (3)

7. (a) Consider the following database schema : (7)

Sailor(sid, sname, rating, age)

Boats(bid, bname, color)

Reservation(sid, bid, date)

The table *Sailor* stores information about sailors and *Boats* stores information about boats. The table *Reservation* stores information about the reservation of boat by a sailor on a date.

Write the following queries in relational algebra :

- (i) Find the color of boats reserved by "Aman".

- (d) Give an example for each of the following using EER diagram : (4)

(i) Predicate-defined disjoint subclasses

(ii) Partial-overlapping specialization

- (e) Consider the given two sets of FDs, F and G , for a relation $R(A,B,C,D,E)$: (5)

$F = \{A \rightarrow B, AB \rightarrow C, D \rightarrow AC, D \rightarrow E\}$

$G = \{A \rightarrow BC, D \rightarrow AE\}$

Are F and G equivalent? Justify your answer.

- (f) What is the role of data independence in three-schema architecture? Differentiate between logical data independence and physical data independence. (3)

- (g) Consider the tables $T1$ and $T2$ as follows : (6)

Table T1

P	Q	R
10	a	5
20	b	1
30	c	7
40	a	9

Table T2

X	Y	Z
20	a	5
40	b	4
10	a	6
40	a	8

The attributes P, Q, R and X, Y, Z, respectively, are domain compatible. Show the results for the following :

(i) $\Pi_{P,Q}(T1) \cap \Pi_{X,Y}(T2)$

(ii) $T1 \bowtie_{T1.P=T2.X} T2$

(iii) $\Pi_{T1.R, T2.Z} (\sigma_{T1.Q=T2.Y} (T1 \times T2))$

(h) Consider the following concurrent execution of two transactions, T1 and T2. Identify and explain the problem with its execution. (4)

Timestamp	T1	T2
T0	read_item(X);	
T1	X:=X+N;	
T2		read_item(X);
T3		X:=X-M;
T4	write_item(X);	
T5	read_item(Y);	
T6		write_item(X);
T7		
T8	Y:=Y-N;	
T9	write_item(Y);	

(i) Consider the following two relations : (2)

(ii) Show the tree after deleting key 18 from the tree.

(b) Consider a file having 20,000 *STUDENT* records of fixed length. Each record has the following fields: *ID#* (7 bytes), *NAME* (35 bytes), *ADDRESS* (46 bytes), and *COURSE* (12 bytes). This file is stored on a disk of block size B = 512 bytes.

(i) Calculate the record size and the blocking factor *bfr*.

(ii) Calculate the number of block accesses needed to search for a record if a binary search is performed on this file (assuming the records are stored sorted on *ID#*).

(iii) How many block accesses would be required to search for a record, if a primary index on the key *ID#* is created, given that the size of block pointer is 6 bytes?

(4)

The table *Author* stores information about authors and *Book* stores information about the books. *BookID* in *Author* references *BookID* in the table *Book*.

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

- (i) Insert <401, "Ramesh", 20> in Author
- (ii) Insert <401, "Vivek", 5> in Author
- (iii) Delete <5, "DBMS", 344> from Book
- (iv) Insert <17, "Transactions", 239> in Book
- (v) Update Author
set BookID=25, Name="Priyanka"
where AuthID=201

5. (a) Consider an empty B+ tree with order $p=3$ and perform the following : (6)

- (i) Insert keys 70, 15, 20, 35, 18, 55, 43 in the given order. Show the tree after each insertion.

Faculty

<i>FacultyID</i>	<i>Name</i>	<i>CourseID</i>
101	Rakesh	5
201	Shikha	12
301	Prakashtha	5
401	Daisy	10

Course

<i>CourseID</i>	<i>Name</i>
5	DBMS
12	Java
15	C++
10	AI

Show the result after the execution of the following on these two relations :

- (i) Right Outer Join
- (ii) Natural join

Section B

2. Design the ER diagram for the following database that contains information concerning sales representatives, sales areas and products. (10)

- (i) Each representative has a unique identifier with name, age and salary.
- (ii) Each area is described by a unique identifier with name, city and budget allocated to that area.

- (iii) Each product has a unique identifier with name, product description and price.
- (iv) Each representative is responsible for sales in one or more areas; and has the number of hours and revenue in rupees from sales in each area recorded. Each area has one or more representatives.
- (v) Similarly, each representative is responsible for sales of one or more products; and has the number of hours and revenue in rupees from sales of each product recorded. Each product has one or more responsible representatives.
- (vi) Every product is sold in every area. The quantity sold of every product is also recorded.

Specify key attributes and all constraints on the relationships.

3. Consider the following database schema : (10)

Item(Name, Category, Price)

Store(Name, City, Area)

Ordered(ItemName, StoreName, Date)

Give SQL queries for the following :

- (i) Create the table *Ordered*, with all the constraints.
- (ii) List maximum and minimum price for each category of items.
- (iii) List all items ordered by stores located in either "Pune" or "Delhi".
- (iv) List all items priced at more than Rs. 10000 and are never ordered by store located in area="North".
- (v) For each store, count the number of items ordered on "12 April 2023".
4. (a) Consider the following FDs for R(ABCDEFGH) :
- A→E, AD→BE, AC→E, E→B, BG→F, BE→D, BDH→E, F→A, D→H, CD→A
- Find a minimal cover for the given FDs. (5)
- (b) Consider the following relations : (5)

Author

<u>AuthID</u>	<u>Name</u>	<u>BookID</u>
101	Rakesh	5
201	Shilpa	12
301	Prakash	5

Book

<u>BookID</u>	<u>Name</u>	<u>Price</u>
5	DBMS	344
12	Dbase	489
15	C++	676