

(i) Calculate the record size R in bytes.

(ii) Calculate the blocking factor bfr and the number of file blocks b, assuming an unspanned organization

(iii) Number of block access required on average for linear search on file

(iv) Number of block access required for binary search on file

(v) Suppose that the file is ordered by the key field SSN and we want to construct a primary index on SSN. Calculate the index blocking factor bfr and the number of blocks access required.

(b) State the ACID properties of transactions. Why concurrency control is needed in transactions?

(5)

(200)

[This question paper contains 16 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4662

J

Unique Paper Code : 2344002001

Name of the Paper : Database Management Systems

Name of the Course : GE (Common Prog Group)

Semester : IV

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. **Section A** is compulsory.
3. Attempt **any Four** Questions from **Section B**.
4. Part of a question must be answered together.

P.T.O.

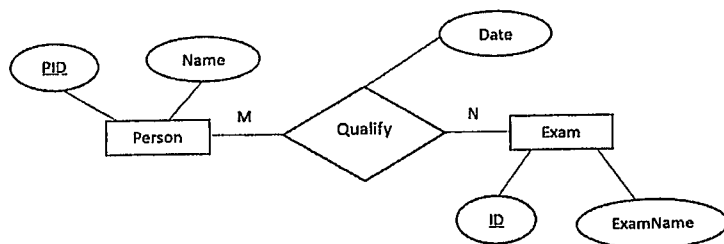
Section A

1. (a) Write the equivalent relational algebra notation for the following SQL statements: (3)

(i) SELECT CName, Code FROM country
WHERE currency = 'Rupees' AND
continent = 'Asia';

(ii) SELECT OName AS 'OwnerName',
PName AS 'PropertyName' FROM
Owner JOIN Property ON Owner.ID
= Property.OID;

- (b) Map the following Entity Relationship diagram to a relational schema. (3)



- (i) Insert <'Jyoti', 5, 1> into
Teacher
- (ii) Delete Department tuple with
Dno = 3
- (iii) Update Dno = 4 where Dno = 2
in Department
- (iv) Insert <2, 'Jyoti', 1> into
Teacher
- (v) Insert <NULL, 'Tanya', 1> into
Teacher

7. (a) Consider a disk with block size $B = 512$ bytes. A block pointer is $P = 6$ bytes long. A file has $r = 20,000$ STUDENT records of fixed length. Each record has the following fields: Name (30 bytes), SSN (9 bytes), Address (40 bytes), PHONE (10 bytes), Birth_date (8 bytes), Sex (1 byte), Dept_code (8 bytes) and Degree_program (3 bytes). An additional byte is used as a deletion marker. (10)

- (iii) Find the total number of times each book has been borrowed.
- (iv) Display list of books that have never been borrowed.
- (v) Display the names of members who have borrowed at least one book and titles of books that have been borrowed at least once.

(b) Consider the following relations: (5)

Teacher		
TID	Name	DNum
1	Sachin	3
2	Preeti	2
3	Shreya	1
4	Rohit	3

Department		
Dno	Dname	Room
1	CS	101
2	MT	201
3	ENG	301

DNum is the foreign key in Teacher relation that references Department relation. Indicate which database constraints may be violated, if any, by each of the following operations? Give explanation.

- (c) Give the three interpretations of NULL values in relations with suitable example for each. (3)
- (d) Consider the following relations: (3)

Books (BookID, Title, Genre, PublicationYear)

Author (AuthorID, Name, BirthDate)

Wrote (BookID, AuthorID, Contribution)

Write a SQL command to create a view named AuthorContribution that includes author name, book title and their contribution.

- (e) For the following entity types, suggest cardinality ratios based on the common meaning of the corresponding entities. Clearly state any assumptions you make. (3)

Entity Type 1

Entity Type 2

Country

President

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Student

Address

Actor

Movie

- (f) Consider the following relation for University database: (3)

University (StudentID, StudentName, Age, CourseName, CourseID, Marks)

Give one example of each, how insertion, modification and deletion anomalies might arise in the above database.

- (g) Consider the relation R (A, B, C, D, E) with the following set of functional dependencies: (4)

$F = \{A \rightarrow B, B \rightarrow C, CD \rightarrow E, E \rightarrow A\}$

- (i) Find $(A)^+$ and $(CD)^+$.

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(i) $P \rightarrow Q$

(ii) $PQ \rightarrow R$

6. (a) Consider the following relational schema: (10)

Books (bookID, title, genre, publicationYear, publisher)

Members (memberID, memberName, email, phone_num, city)

Borrow (borrowID, memberID, bookID, borrow Date, returnDate)

Write relational algebra expressions for the following queries:

- (i) Display the list of members who stay in 'Chennai' or 'Kolkata'.
- (ii) Display details of members along with the book titles they have borrowed.

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(i) Identify the key in R.

(ii) Based on the identified key, is this relation in 1NF, 2NF, or 3NF? Justify your answer.

(iii) How would you successively normalize it in BCNF?

(b) Consider a relation R (P, Q, R) with the following relational state. (5)

Tuple#	P	Q	R
1	p1	q1	r1
2	p2	q2	r2
3	p1	q1	r1
4	p1	q2	r1
5	p2	q1	r1

Check whether the following dependency hold true or not (as per the current state). Justify your answer.

(ii) Can A be a possible candidate key for R.

Justify your answer.

(h) Consider the following relations: (4)

R (A, B, C, D)

S (A, P, Q)

Identify the attributes which will appear in the resultant table, on execution of following SQL queries? Give explanation.

(i) Select * from R Natural Join S;

(ii) Select * from S Full Outer Join R Where Q=C;

(i) Two transactions T1 and T2 are executing concurrently (assuming concurrency control not in place) with initial value of A = 15 and B = 20

(4)

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T1	T2
	read_item(A)
	read_item(B)
	A = A * 2
read_item(A)	
A = A - 10	
write_item(A)	write_item(A)
read_item(B)	
B = B + A	
	B = B + 10
write_item(B)	
commit	write_item(B)
	commit

What will be the value of A and B after completion of transactions T1 and T2. Identify and explain the problem in the transaction schedule given above.

Section B

2. (a) A hotel wants to maintain records of its operations. The database should capture the following: (10)

- (b) Consider the following Employee schema: (5)

Employee (EID, Ename, Department, Salary, PhoneNo)

Write SQL statements for the following:

- (i) Drop PhoneNo field from the table
- (ii) Update name of employee to 'John' where EID = 10
- (iii) Delete all the entries having department = 'HR' from the table
- (iv) Add the age field in Employee table having value in range 24- 70 with default value 30

5. (a) Consider the relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies $FD1 = \{\{A, B\} \rightarrow \{C\}, \{B\} \rightarrow \{E, F\}, \{A, D\} \rightarrow \{G, H\}, \{G\} \rightarrow \{I\}, \{H\} \rightarrow \{J\}\}$. (10)

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Customer (CID, Cname, Address,
PhoneNo)

OrderSupplied (OID, PID, CID, SID,
OrderDate)

Answer the following queries in SQL:

- (i) Fetch the names of suppliers whose name starts with 'A' or ends with 'S'
- (ii) Fetch list of products that belongs to Electronics or Automobile category
- (iii) Fetch the names of suppliers along with the product details supplied by them on '2025-01-20'
- (iv) Fetch the list of products that are not ordered by any customer
- (v) Fetch the name of customers who have placed more than 5 orders

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- Each hotel has a unique HotelID, Name, Location, and Rating.
- Each hotel employs multiple staff members, identified by a StaffID, Name, Role (e.g., Manager, Secretary etc), and Phone No.
- Guests who stay at the hotel are identified by a GuestID, Name, ContactInfo, and DateOfBirth.
- Each room is associated with a unique RoomNumber, Type (e.g., Standard, Deluxe, Suite), Price per Night, and its Status (e.g., Available, Booked).
- A guest can book multiple rooms, and each room can have multiple bookings over time. For each booking the database should track record of CheckInDate and CheckOutDate.

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Identify:

- (i) Entities of interest
- (ii) Attributes of interest for each entity
- (iii) Draw the ER diagram for the above scenario.

Also specify clearly, all the constraints on relationships. State any assumptions you make.

- (b) Define database management system. List any four advantages of database over traditional file system.
- (5)

3. (a) Consider the following relations R and S: (10)

R		
A1	A2	A3
1	a	15
2	b	10
3	c	20
4	b	10

S		
B1	B2	B3
2	a	10
1	c	20
2	b	10
3	c	20

The attributes A1, A2, A3 are type compatible with B1, B2 and B3 respectively. Give the results of the following Relational Algebra operations:

- (i) $S \cup R$
- (ii) $R \bowtie_{A2=B2} S$
- (iii) $S \bowtie_{A1=B1} R$
- (iv) $\Pi_{B1, B3} (\sigma_{B2=c} (S))$
- (v) $R - S$
- (vi) $R \bowtie_{A2=B2 \text{ and } A3=B3} S$

- (b) Explain the three-schema architecture with the help of a diagram. Which one is harder to achieve: physical data independence or logical data independence and why?
- (5)

4. (a) Consider the following relational schema below: (10)

Product (PID, Pname, Category, Price)

Supplier (SID, Sname, Location)