Question 1(a) [3 marks]

Define: Field, Record, Metadata

Answer:

- **Field**: A single unit of data representing one attribute of an entity
- **Record**: Collection of related fields that store data about an entity
- **Metadata**: Data about data that describes the structure, properties, and relationships of database objects

Mnemonic: "FRaMe" (Field, Record, Metadata)

Question 1(b) [4 marks]

Define: strong and weak entity set.

Answer:

Entity Type	Description	Identification	Example
Strong Entity	Exists independently	Has its own primary key	Customer, Employee
Weak Entity	Depends on strong entity	Requires parent entity key	Bank Account, Order Item

Mnemonic: "SWing" (Strong is With own identity, weak is Not Getting own identity)

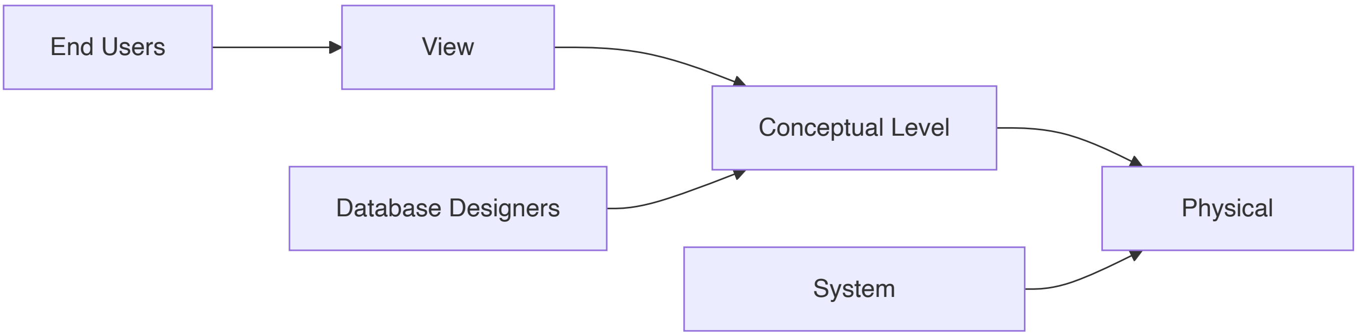
Question 1(c) [7 marks]

Explain 3 Levels of Data Abstraction

Answer:

Level	Description	Used By
Physical Level	Describes how data is stored physically	System Administrators
Conceptual Level	Describes what data is stored and relationships	Database Designers
View Level	Describes part of database relevant to users	End Users

Diagram:



Mnemonic: "PCV" (Physical, Conceptual, View - bottom to top)

Question 1(c) OR [7 marks]

Explain advantages and disadvantages of DBMS.

Answer:

Advantages	Disadvantages
Data Redundancy Control	**High Cost** of software and hardware
Data Consistency	**Complexity** in design and maintenance
Improved Data Security	**Performance Impact** with heavy usage
Data Sharing	**Vulnerability** to system failures
Data Independence	**Recovery Challenges** after failure
Standardized Access	**Increased Training Requirements**

Mnemonic: "BASIC-DV" (Benefits: Access, Security, Independence, Consistency - Drawbacks: Vulnerability)

Question 2(a) [3 marks]

Explain select operation in relational algebra with example

Answer:

Select Operation (σ)	Description
Syntax	σ(Relation)
Function	Retrieves tuples satisfying condition
Example	$\sigma_{salary>30000}$(Employee)

Mnemonic: "SERVe" (Select Exactly Required Values)

Question 2(b) [4 marks]

Define Primary, Foreign, Super, Candidate Keys in DBMS.

Answer:

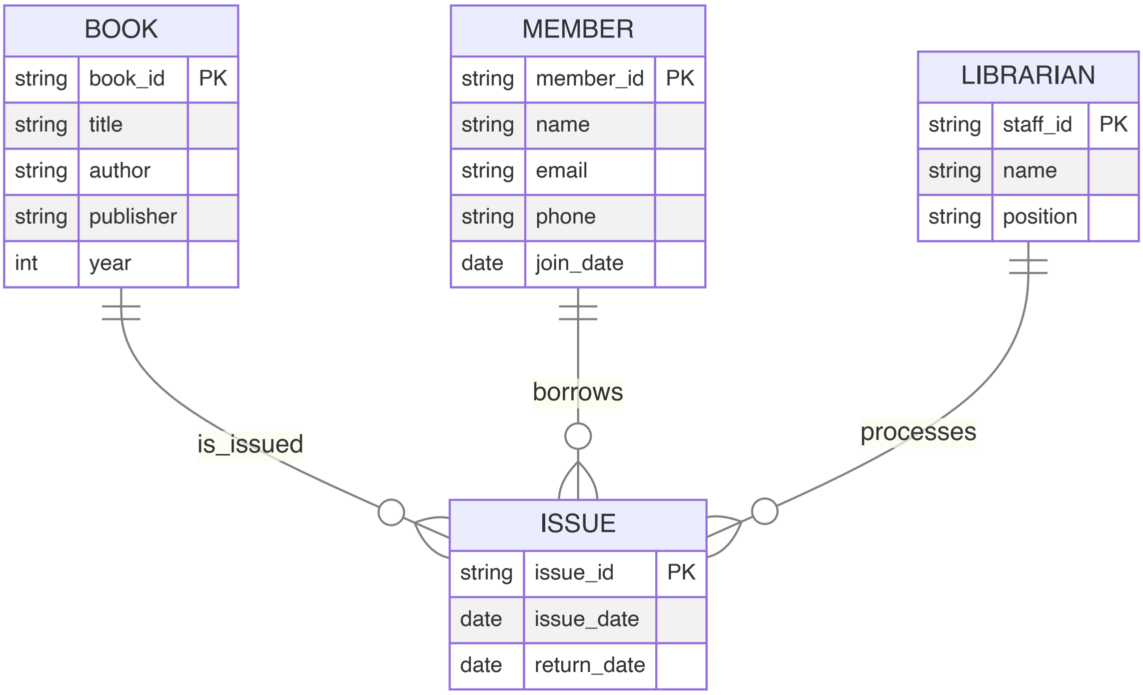
Key Type	Description
Primary Key	Unique identifier for each record
Foreign Key	Attribute linking to primary key in another table
Super Key	Set of attributes that can uniquely identify records
Candidate Key	Minimal super key that can be primary key

Mnemonic: "PFSC" (Person First Shows Credentials)

Question 2(c) [7 marks]

Draw E R Diagram of Library Management System.

Answer:



Mnemonic: "LIMB" (Library Items, Members, Borrowing)

Question 2(a) OR [3 marks]

Explain union operation in relational algebra with example.

Answer:

Union Operation (∪)	Description
Syntax	Relation1 ∪ Relation2
Function	Combines tuples from both relations
Requirement	Both relations must be union-compatible

Example: Students_CS ∪ Students_IT

Mnemonic: "CUP" (Combining Union of Parts)

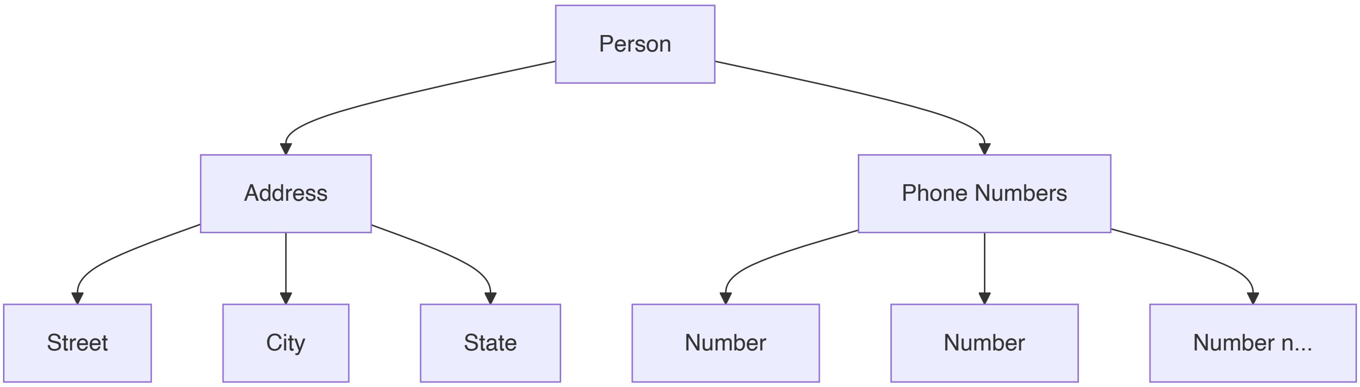
Question 2(b) OR [4 marks]

Define Composite attribute and Multivalued attribute with example

Answer:

Attribute Type	Description	Example
Composite	Can be divided into smaller subparts	Address (street, city, state, zip)
Multivalued	Can have more than one value	Phone numbers, Email addresses

Diagram:

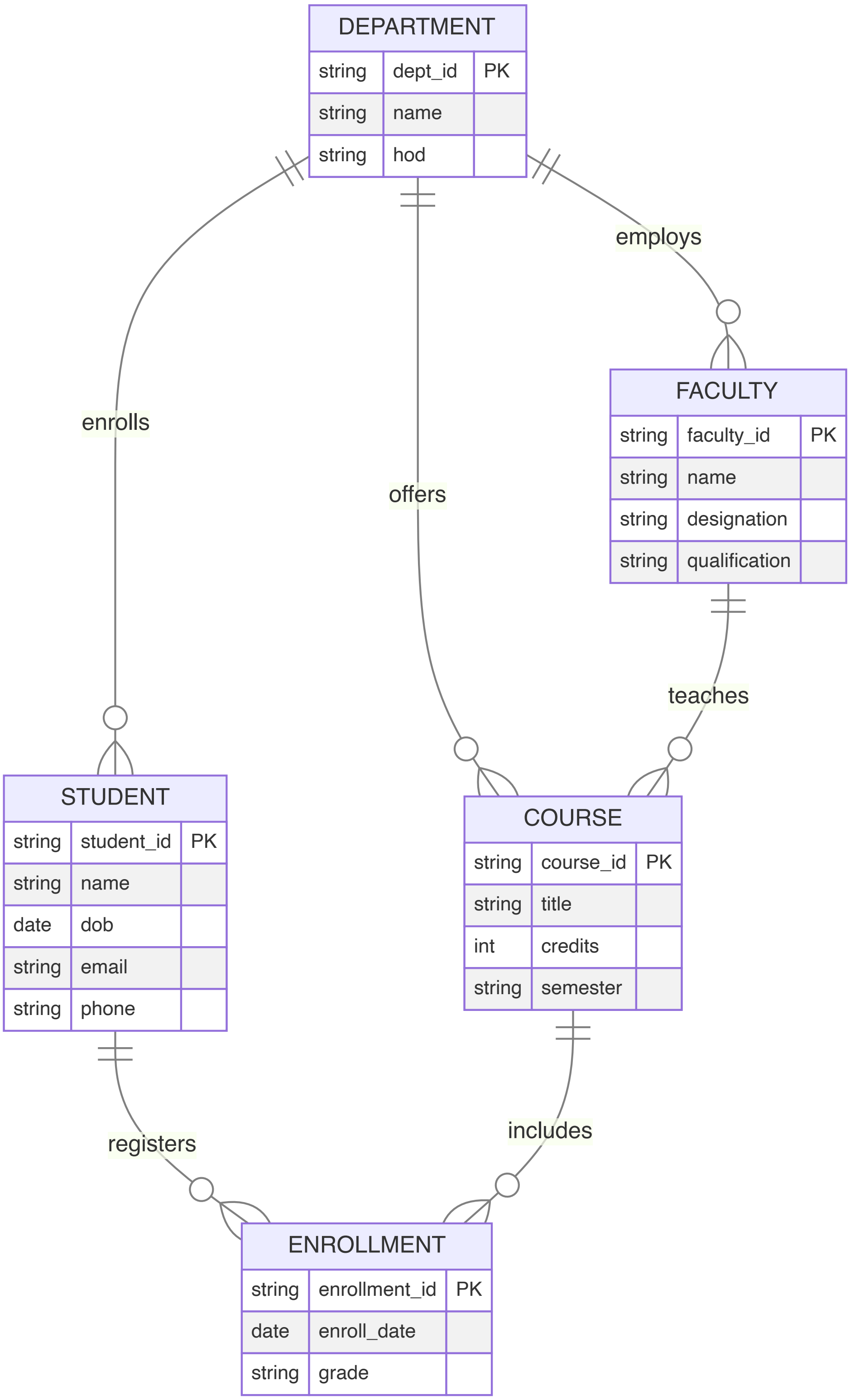


Mnemonic: "CoMbo" (Composite has Multiple components)

Question 2(c) OR [7 marks]

Draw E R Diagram of College Management System.

Answer:



Mnemonic: "DECFS" (Departments, Enrollments, Courses, Faculty, Students)

Question 3(a) [3 marks]

List different data types in SQL and Explain in brief

Answer:

Data Type Category	Examples	Usage
Numeric	INT, FLOAT, DECIMAL	Store numbers
Character	CHAR, VARCHAR, TEXT	Store text
Date/Time	DATE, TIME, TIMESTAMP	Store temporal data
Boolean	BOOLEAN	Store true/false values
Binary	BLOB, BINARY	Store binary data

Mnemonic: "NCDBB" (Numbers, Characters, Dates, Booleans, Binaries)

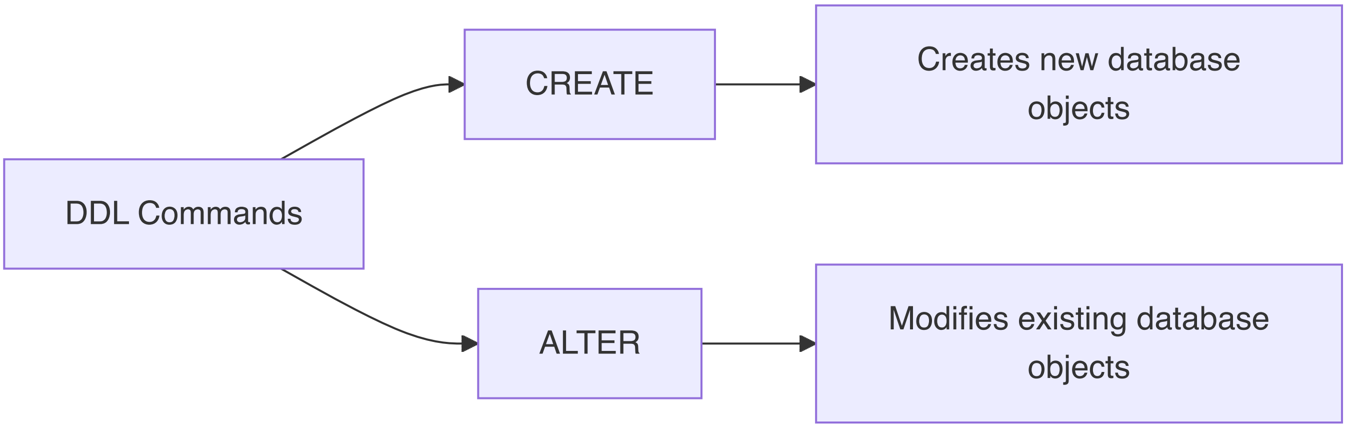
Question 3(b) [4 marks]

Explain any two DDL Commands with Syntax and Example

Answer:

Command	Syntax	Example
CREATE	CREATE TABLE table_name (column_definitions);	CREATE TABLE Student (id INT PRIMARY KEY, name VARCHAR(50));
ALTER	ALTER TABLE table_name ADD/DROP/MODIFY column_name data_type;	ALTER TABLE Student ADD email VARCHAR(100);

Diagram:


DDL Commands
CREATE
Creates new database objects
ALTER
Modifies existing database objects

Mnemonic: "CAD" (Create And Define)

Question 3(c) [7 marks]

Write the Output of Following Query.
a. CEIL(123.57), CEIL(4.1)
b. MOD(12,4), MOD(10,4)
c. POWER(2,3), POWER(3,3)
d. ROUND(121.413,1), ROUND(121.413,2)
e. FLOOR(25.3),FLOOR(25.7)
f. LENGTH('AHMEDABAD')
g. ABS(-25),ABS(36)

Answer:

Function	Result	Explanation
CEIL(123.57)	124	Smallest integer ≥ 123.57
CEIL(4.1)	5	Smallest integer ≥ 4.1
MOD(12,4)	0	Remainder of 12÷4
MOD(10,4)	2	Remainder of 10÷4
POWER(2,3)	8	2 raised to power 3
POWER(3,3)	27	3 raised to power 3
ROUND(121.413,1)	121.4	Round to 1 decimal place
ROUND(121.413,2)	121.41	Round to 2 decimal places
FLOOR(25.3)	25	Largest integer ≤ 25.3
FLOOR(25.7)	25	Largest integer ≤ 25.7
LENGTH('AHMEDABAD')	9	Number of characters
ABS(-25)	25	Absolute value of -25
ABS(36)	36	Absolute value of 36

Mnemonic: "CMPRFLA" (Ceiling, Modulus, Power, Round, Floor, Length, Absolute)

Question 3(a) OR [3 marks]

Explain any three Date Functions.

Answer:

Date Function	Purpose	Example	Result
ADD_MONTHS	Adds months to date	ADD_MONTHS('01-JAN-2023', 3)	01-APR-2023
MONTHS_BETWEEN	Calculates months between dates	MONTHS_BETWEEN('01-MAR-2023', '01-JAN-2023')	2
SYSDATE	Returns current date and time	SYSDATE	Current system date/time

Mnemonic: "AMS" (Add_months, Months_between, Sysdate)

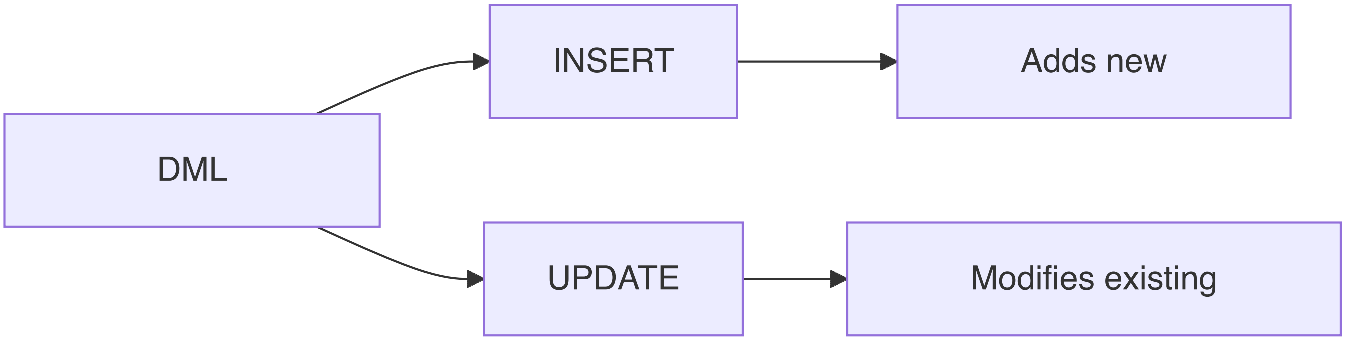
Question 3(b) OR [4 marks]

Explain any two DML Commands with Syntax and Example

Answer:

Command	Syntax	Example
INSERT	INSERT INTO table_name VALUES (value1, value2,...);	INSERT INTO Student VALUES (1, 'Raj', 'raj@example.com');
UPDATE	UPDATE table_name SET column=value WHERE condition;	UPDATE Student SET email='new@example.com' WHERE id=1;

Diagram:



Mnemonic: "IUM" (Insert, Update, Manipulate)

Question 3(c) OR [7 marks]

For the table: EMP(emp_no, emp_name, designation, salary, deptno), Write SQL commands for following operations.

Answer:

Operation	SQL Command
Create table EMP	CREATE TABLE EMP (emp_no INT PRIMARY KEY, emp_name VARCHAR(50), designation VARCHAR(30), salary DECIMAL(10,2), deptno INT);
Give the emp_no, emp_name, designation, salary, deptno of EMP	SELECT emp_no, emp_name, designation, salary, deptno FROM EMP;
Display information of all employees whose name starts with 'p'	SELECT * FROM EMP WHERE emp_name LIKE 'p%';
Display department wise salary total	SELECT deptno, SUM(salary) AS total_salary FROM EMP GROUP BY deptno;
Add new column email_id in EMP table	ALTER TABLE EMP ADD email_id VARCHAR(100);
Change the column name "designation" to "post"	ALTER TABLE EMP RENAME COLUMN designation TO post;
Delete all the records from the table person	DELETE FROM person;

Mnemonic: "CSDAACD" (Create, Select, Display, Aggregate, Add, Change, Delete)

Question 4(a) [3 marks]

List different aggregate functions and explain any one with syntax and example.

Answer:

Aggregate Function	Purpose
SUM	Calculates total
AVG	Calculates average
COUNT	Counts number of rows
MAX	Finds maximum value
MIN	Finds minimum value

Example for AVG:
`AVG(column_name)` - Calculates average of values in column
`SELECT AVG(salary) FROM Employee;` - Returns average salary

Mnemonic: "SCAMM" (Sum, Count, Avg, Max, Min)

Question 4(b) [4 marks]

Define the transaction with example.

Answer:

Transaction Concept	Description
Definition	Logical unit of work that must be completely processed or completely fail
Properties	ACID (Atomicity, Consistency, Isolation, Durability)
States	Active, Partially Committed, Committed, Failed, Aborted

Example:

```
BEGIN TRANSACTION;
    UPDATE Accounts SET balance = balance - 5000 WHERE acc_no = 'A123';
    UPDATE Accounts SET balance = balance + 5000 WHERE acc_no = 'B456';
COMMIT;
```

Mnemonic: "TAPS" (Transaction As Process Set)

Question 4(c) [7 marks]

What is an Operator in SQL? Explain Arithmetic and Logical operators with Syntax and Example

Answer:

Type	Operators	Example	Result
Arithmetic	+ (Addition)	5 + 3	8
	- (Subtraction)	5 - 3	2
	* (Multiplication)	5 * 3	15
	/ (Division)	15 / 3	5
	% (Modulus)	5 % 2	1
Logical	AND	salary > 30000 AND dept = 'IT'	True if both conditions true
	OR	salary > 50000 OR dept = 'HR'	True if either condition true
	NOT	NOT (salary < 20000)	True if salary not less than 20000

SQL Examples:

```
-- Arithmetic
SELECT product_name, price * 1.18 AS price_with_tax FROM Products;

-- Logical
SELECT * FROM Employees WHERE (salary > 30000 AND dept = 'IT') OR (experience > 5);
```

Mnemonic: "ASMDOLA" (Add, Subtract, Multiply, Divide, OR, AND, NOT)

Question 4(a) OR [3 marks]

List different numeric functions and explain any one with syntax and example.

Answer:

Numeric Function	Purpose
ROUND	Rounds a number to specified decimal places
TRUNC	Truncates a number to specified decimal places
CEIL	Returns smallest integer greater than or equal to number
FLOOR	Returns largest integer less than or equal to number
ABS	Returns absolute value

Example for ROUND:
`ROUND(number, decimal_places)` - Rounds number to specified decimal places
`SELECT ROUND(125.679, 2) FROM DUAL;` - Returns 125.68

Mnemonic: "RTCFA" (Round, Truncate, Ceiling, Floor, Absolute)

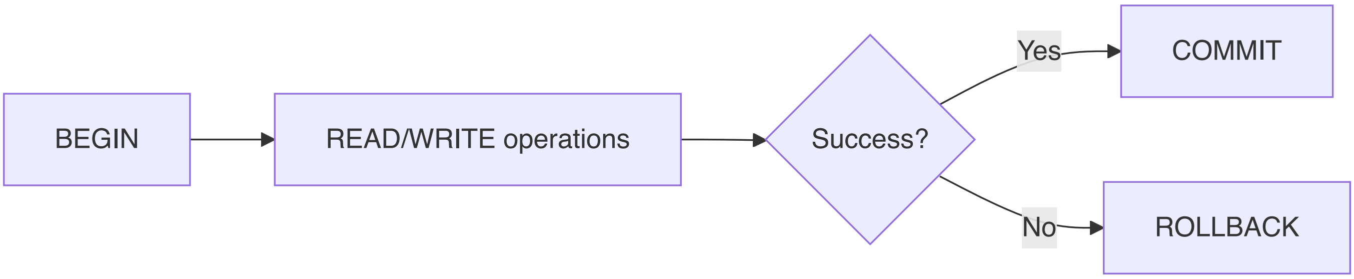
Question 4(b) OR [4 marks]

List various database operations of a transaction.

Answer:

Operation	Description
BEGIN/START	Marks transaction start point
READ	Retrieves data from database
WRITE	Modifies data in database
COMMIT	Makes changes permanent
ROLLBACK	Undoes changes and returns to start point
SAVEPOINT	Creates points to rollback partially

Diagram:



Mnemonic: "BRWCRS" (Begin, Read, Write, Commit, Rollback, Savepoint)

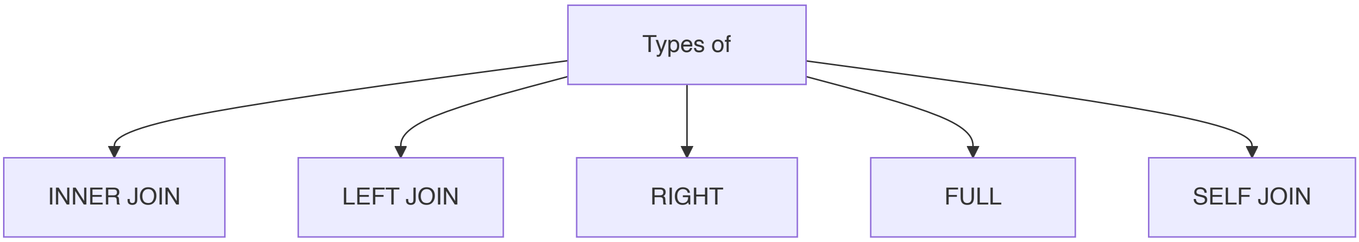
Question 4(c) OR [7 marks]

What is join? Explain different types of joins with syntax and example.

Answer:

Join Type	Description	Syntax Example
INNER JOIN	Returns rows when there is a match in both tables	SELECT * FROM TableA INNER JOIN TableB ON TableA.id = TableB.id;
LEFT JOIN	Returns all rows from left table and matched rows from right	SELECT * FROM TableA LEFT JOIN TableB ON TableA.id = TableB.id;
RIGHT JOIN	Returns all rows from right table and matched rows from left	SELECT * FROM TableA RIGHT JOIN TableB ON TableA.id = TableB.id;
FULL JOIN	Returns rows when there is a match in one of the tables	SELECT * FROM TableA FULL JOIN TableB ON TableA.id = TableB.id;
SELF JOIN	Joins a table to itself	SELECT * FROM Employee e1 JOIN Employee e2 ON e1.manager_id = e2.emp_id;

Diagram:



Mnemonic: "ILRFS" (Inner, Left, Right, Full, Self)

Question 5(a) [3 marks]

Convert the customer relation into 1NF shown below.
Customer

cid	name	address	Contact_no
CO1	Riya	Amu aavas, Anand	{5322332123}
CO2	Jiya	Sardar colony, Ahmedabad	{5326521456, 5265232849}

Answer:

Customer Table (1NF):

cid	name	society	city	Contact_no
CO1	Riya	Amu aavas	Anand	5322332123
CO2	Jiya	Sardar colony	Ahmedabad	5326521456
CO2	Jiya	Sardar colony	Ahmedabad	5265232849

Mnemonic: "AFM" (Atomic values, Flatten Multivalued attributes)

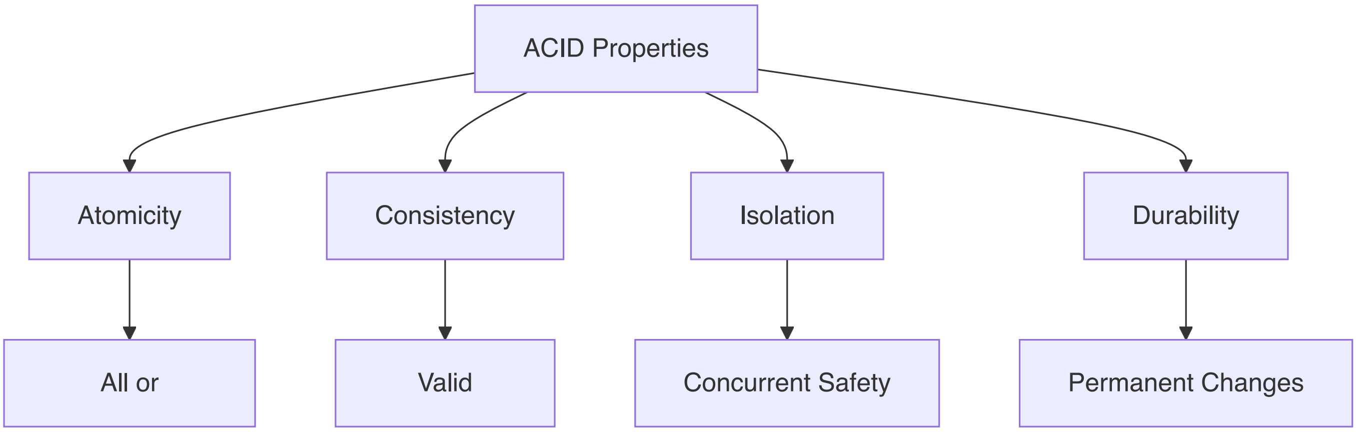
Question 5(b) [4 marks]

List and Explain ACID properties of transaction.

Answer:

ACID Property	Description
Atomicity	Transaction executes completely or not at all
Consistency	Database remains consistent before and after transaction
Isolation	Concurrent transactions don't interfere with each other
Durability	Committed changes are permanent even after system failure

Diagram:



Mnemonic: "ACID" (Atomicity, Consistency, Isolation, Durability)

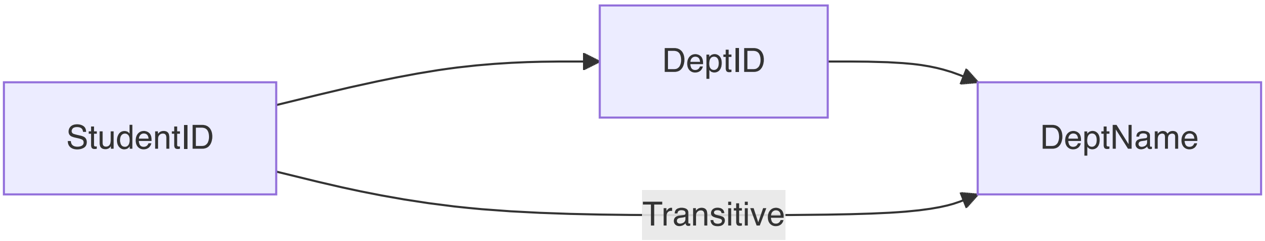
Question 5(c) [7 marks]

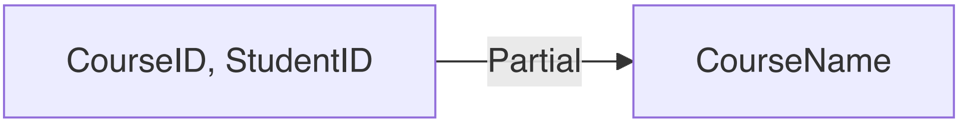
List different types of functional dependencies and explain each using example.

Answer:

Functional Dependency	Description	Example
Trivial FD	X → Y where Y is a subset of X	{StudentID, Name} → {Name}
Non-trivial FD	X → Y where Y is not a subset of X	{StudentID} → {Name}
Partial FD	Part of composite key determines non-key attribute	{CourseID, StudentID} → {CourseName}
Transitive FD	X → Y and Y → Z implies X → Z	{StudentID} → {DeptID} and {DeptID} → {DeptName}
Multivalued FD	One attribute determines set of values for another	{CourseID} →→ {TextbookID}

Diagram:





Mnemonic: "TNPTMv" (Trivial, Non-trivial, Partial, Transitive, Multivalued)

Question 5(a) OR [3 marks]

Convert the Depositor_Account relation into 2NF shown below.
Where functional dependencies(FD) are as under,
FD1: {cid, ano} → {access_date, balance, bname}
FD2: ano → {balance, bname}

Depositor_Account

cid	ano	access_date	balance	bname

Answer:

Account Table (2NF):

ano	balance	bname

Depositor Table (2NF):

cid	ano	access_date

Mnemonic: "RPKD" (Remove Partial Key Dependencies)

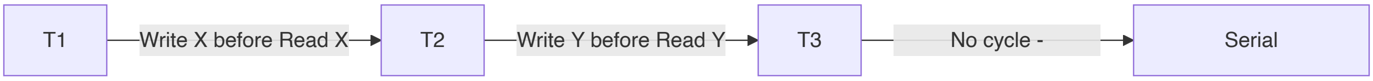
Question 5(b) OR [4 marks]

Explain conflict serializability.

Answer:

Concept	Description
Definition	Schedule is conflict serializable if equivalent to some serial schedule
Conflict Operations	Read-Write, Write-Read, Write-Write operations on same data item
Conflict Graph	Directed graph showing conflicts between transactions
Testing	Schedule is conflict serializable if conflict graph has no cycles

Diagram:



Mnemonic: "COGS" (Conflict Operations Graph Serializable)

Question 5(c) OR [7 marks]

Explain 3NF normalization with example

Answer:

Normal Form	Definition	Example
1NF	Atomic values, no repeating groups	Student(ID, Name, Phone1, Phone2) → Student(ID, Name, Phone)
2NF	1NF + No partial dependencies	Order(OrderID, ProductID, CustomerID, ProductName) → Order(OrderID, ProductID, CustomerID) + Product(ProductID, ProductName)
3NF	2NF + No transitive dependencies	Student(ID, DeptID, DeptName) → Student(ID, DeptID) + Department(DeptID, DeptName)

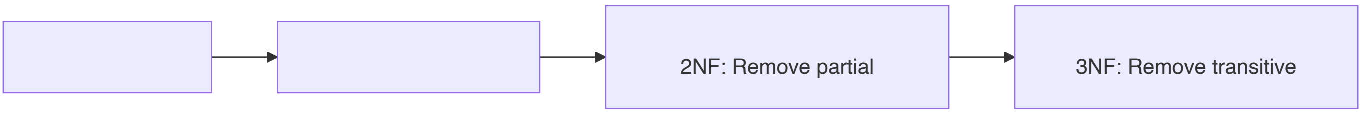
Violation Example:

```
Employee(EmpID, EmpName, DeptID, DeptName, Location)
```

3NF Conversion:

```
Employee(EmpID, EmpName, DeptID)
Department(DeptID, DeptName, Location)
```

Diagram:



Mnemonic: "APTN" (Atomic values, Partial dependencies removed, Transitive dependencies removed, Normalized)