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1. Define ACID properties of Transaction. Explain its types in details.

A transaction is a collection of several operations on the database that appears to be a single unit from the point of view of the database user. For example, a transfer of funds from one account to another account is a single operation from customer’s point of view but within the database system, however, it consists of several tasks.

The ACID properties are required to maintain integrity of database. They are:

1. Atomicity: It ensures that the transaction is either completely executed or not at all. If a transaction is unsuccessful due to failure or constraints, any changes applied to the database during the transaction must be undone through ROLLBACK/ABORT command. It prevents the database from staying in partial state.
2. Consistency: It ensures that the transaction, after complete execution without interference from other concurrent transactions, takes the database from one consistent state to another. The state during execution is inconsistent state which must be hidden to user.
3. Isolation: The transaction is not interfered by the concurrent execution of other transactions. The state of database after concurrent execution of transaction must be equivalent to the state reached after serial execution of transaction in same order,
4. Durability: The changes applied to a database after execution of transaction must be persistent. Once a transaction is committed, all updates to the database must remain permanently even during failures like system crash and power loss.
5. What is sql join ? explain its different types of join Operations with examples.

SQL join is a binary relation operation used to combine tuples of multiple relation on the basis of matching values in common attributes. It can be understood as a cartesian product of relation followed by selection criteria.

The types of join operations are:

* 1. Inner Join: By using inner join, the resulting join relation only includes the tuples that satisfy the matching criteria, excluding others.

1. Theta Join: It is a type of join operation in which the join consdition can be any comparison operator (<,>,=,<=,>=,!=).
2. Equi Join: It is a type of join operation in which the join consdition can be only equality comparison operator (=).
3. Natural Join: It is a type of join operation in which tuples are joined by matching same values in common attribute and eliminating redundant attributes.
4. Outer Join: By using outer join, the resulting join relation includes the tuples that satisfy the matching criteria as well other tupels with missing criteira.
5. Left Outer Join: It is a type of join operation in which all tuples of left relation are kept. The tuples in left relation without matching values in right relation, have their attributes filled by NULL value.
6. Right Outer Join: It is a type of join operation in which tuples of right relation are kept. The tuples in right relation without matching values in left relation, have their attributes filled by NULL value.
7. Full Outer Join: It is a type of join operation in which all tuples of both relation are kept. The tuples in any relation without matching values in other relation, have their attributes filled by NULL value.
8. Compare the DDL and DML with Example.

|  |  |  |
| --- | --- | --- |
| Feature | DDL (Data Definition Language) | DML (Data Manipulation Language) |
| Purpose/Role | Used to define data structures and database schemas | Used to perform operations at the conceptual/external level. |
| What it Modifies | Modifies the database schema or data structure. | Modifies the data stored in the database, but not the schema. |
| Control | Defines storage structure and access methods. | Can be procedural (low-level, specifying *how* to get data) or non-procedural (high-level, specifying *what* data is needed). |
|  |  |  |
| Example Statements | CREATE, ALTER, DROP. | Query, Delete, Update, Insert. |

1. Define the time stamp base protocol . explain the condition for R/W  operations
2. A company stores information about EMP(ssn\_no, phone , salary , address,details,remarks ), department (did, name, budget, dno) ,make your own assumptions about the relationships between the entities. Write Inner join , Outer join ,cross join relations for those entities.
3. Define Referential Integrity Constraints. What is the main purpose of implementing referential Integrity in dbms?
4. From the given relations, write SQL statements for given queries:

COMPANY\_details (companyID, companyName, address, phone, estd Year)

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Find the list of all the companies that were established in the Year 2023.

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1. What is a database management system? Discuss the Advantage of DBMS over File System.

A Database Management System (DBMS) is a software system designed to store, retrieve, manage, and manipulate data efficiently. It provides a structured way to organize data in databases, ensuring data integrity, security, and easy access.. A Traditional File System is a method of storing data in flat files (e.g., .txt, .csv, .dat) without a structured database. Each file contains records, but there is no relationship between files, leading to data redundancy and inconsistency.

The advantages of using DBMS over traditional filing system are given below:

1. Data Redundancy Control: DBMS minimizes duplication of data through normalization, while file systems often have redundant data across multiple files stored in different locations.
2. Data Consistency: Ensures all data conforms to rules and constraints, unlike file systems where consistency must be manually maintained.
3. Data Sharing: Allows concurrent access by multiple users/applications, while file systems typically allow only one user at a time.
4. Data Integrity: Provides mechanisms to maintain accuracy and validity of data through constraints and validation rules.
5. Security Features: Offers user authentication, authorization, and access controls at various levels.
6. Backup and Recovery: Built-in mechanisms for data backup and recovery from failures.
7. Data Independence: Separates physical storage from logical representation, allowing changes without affecting applications.
8. Efficient Query Processing: Provides powerful query languages (like SQL) for complex data retrieval.
9. Centralized Management: Single repository for data with centralized administration.
10. Concurrency Control: Manages simultaneous access by multiple users to prevent inconsistencies.
11. What is functional dependency? Explain Different Inference rules.
12. Explain two-phase locking protocol in detail.
13. What do you mean by Functional Dependency , write with example.
14. Explain 2NF, 3NF with suitable examples.
15. What is a serializable schedule? Characterize schedule based on recoverability.
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17. What do you mean by view? What is the use of view in SQL. Write the syntax with relevant examples of view.
18. Write sql and relational algebra statement for the following scheme

Food(code, packName, price, description)

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Calculate total price of food ordered by customer "Ishmi" till now.

1. Construct the ER diagram of the bank using all possible components like different types of entities, attributes, relationship etc  and convert it into a database schema.
2. Describe different types of join operations used in SQL?
3. What is data abstraction? Explain with its level.

The three-schema architecture is a framework to separate the database into three levels of abstraction. Its purpose is to seaparte user applications from physical database, to allow data indepenece and to simplify database management, maintenance and security.



Figure 1: 3-schema architecture

The layers of abstraction are:

1. Internal Level (Physical Schema):

It is the lowest level of abstraction. It describes how data is physically stored in the database. Includes file structures, indexes, compression, storage devices, etc. Example: Student data is stored as binary records in files on a hard disk, sorted by roll.

2. Conceptual Level (Logical Schema):

It is the midlle level of abstraction. It describes the structure of the entire database for a community of users. It is independent of physical storage through logical data independence .It includes entities, relationships, constraints(primary & foreign keys), data types, etc. Example: Student(Roll, Name, Major) is a logical table, with Roll as primary key and possibly foreign keys to other tables.

3. External Level (View Schema):

It is the highest level of abstraction. It describes how individual users or applications see the data. Each user can have a customized view. It allows access control, simplification, and security. Example:

A teacher’s view: Student(RollNo, Name)

A finance department’s view: Student(RollNo, FeeStatus)

1. What is Normalization? Explain any two normal forms in detail.
2. Define roles of DBA on Relational Database
3. Explain in detail about ACID properties.

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4. Durability: The changes applied to a database after execution of transaction must be persistent. Once a transaction is committed, all updates to the database must remain permanently even during failures like system crash and power loss.
5. Describe different components of DBMS.
6. What is the difference between physical and logical data independence?

| **Aspect** | **Logical Data Independence** | **Physical Data Independence** |
| --- | --- | --- |
| **Definition** | Ability to change the conceptual schema without affecting external schemas (user views). | Ability to change the internal schema without affecting the conceptual schema. |
| **Level Affected** | Between conceptual and external levels. | Between internal and conceptual levels. |
| **What Changes?** | Modifications to tables, relationships, or constraints (e.g., adding/removing entities or attributes). | Changes in file structures, storage devices, or access methods (e.g., indexing, hashing). |
| **Impact on Users** | Applications not using the modified schema remain unaffected. | No impact on application programs or user queries. |
| **Purpose** | Protects applications from changes in the logical database design. | Protects the database design from changes in physical storage. |
| **Complexity** | Harder to achieve (may require view definitions). | Easier to achieve (handled by the DBMS). |
| **Example** | Adding a phone\_number column to a Student table without breaking existing apps that don’t use this field. | Switching from B-tree to hash indexing for faster searches without altering table structures. |

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1. Construct an ER diagram for a university using all possible components like different types of entities, attributes, relationship etc and convert it into a database schema.
2. List the roles of Database administrator. Explain different types of Database user.

A database user is an individual, application, or system that interacts with a database to perform operations such as storing, retrieving, updating, or managing data. Each user is typically assigned specific access rights and privileges based on their role to ensure security and proper data management.

Database users can be categorized based on their level of interaction with the database system:

1. End Users:

End users are database users who interact with database by issuing commands from a terminal through predefined application programs to perform functions like create, retrieve, modify and delete. Example: Bank tellers using an interface to access customer accounts

1. Application Programmers:

Application programmers are database users who develop applications that interact with the database using programming languages and APIs like Access, FoxPro, COBOL, etc. These application programs are used by end users to operate on data. Example: Developers creating e-commerce websites that connect to product databases.

1. Database Administrators (DBAs):

DBAs are database users who maintains the database description in original form. It is responsible for overall control of the database system. Example: Database managers ensuring that the product database runs smoothly, securely, and efficiently—supporting developers, customers, and business operations.

The responsibilities of a DBA are:

1. **Schema definition and modification:**

The creation and modification of the original description of the database structure and the way that structure is reflected by the files of the physical database.

1. **Storage structure and access method definition:**

The DBA determines how data is physically stored on disk, including file organization, portioning and tablespace management. The DBA also chooses the best access methods for query efficiency through indexing strategies like B-tree, hashmap, bitmaps.

1. **Granting authorization for data access:**

Granting access to the database to different users.

1. **Routine maintenance:**

Making backup copies of the database and repairing damage to the database due to hardware or software failures or misuse.

1. List the steps to draw E-R diagrams and Design E-R diagram for Education Portal
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