

SQL Assignment 1

1. What is a relational database management system (RDBMS)?

What are the advantages of a database management system over a file system?

Ans-

- RDBMS stands for **Relational Database Management Systems**. It is basically a program that allows us to create, delete, and update a relational database.
- A relational database is a database system that stores and retrieves data in a tabular format organized in the form of rows and columns.
- It is a smaller subset of DBMS which was designed by E.F Codd in the 1970s. The major DBMS like SQL, My-SQL, ORACLE is all based on the principles of relational DBMS.
- Relational Database Management Systems maintains data integrity by simulating the following features:
 - **Entity Integrity:** No two records of the database table can be completely duplicated.
 - **Referential Integrity:** Only the rows of those tables can be deleted which are not used by other tables. Otherwise, it may lead to data inconsistency.
 - **User-defined Integrity:** Rules defined by the users based on confidentiality and access.
 - **Domain integrity:** The columns of the database tables are enclosed within some structured limits, based on default values, type of data, or ranges
- **Advantages of a database management system over a file system?**
- A File Management system is a DBMS that allows access to single files or tables at a time. In a File System, data is directly stored in a set of files. It contains **flat files** that have no relation to other files (when only one table is stored in a single file, then this file is known as a **flat-file**)
- **Data redundancy and inconsistency –**
Redundancy is the concept of repetition of data i.e. each data may have more than a single copy. The file system cannot control the redundancy of data as each user defines and maintains the needed files for a specific application to run.
- There may be a possibility that two users are maintaining the data of the same file for different applications. Hence changes made by one user do not reflect in files used by second users, which leads to inconsistency of data.

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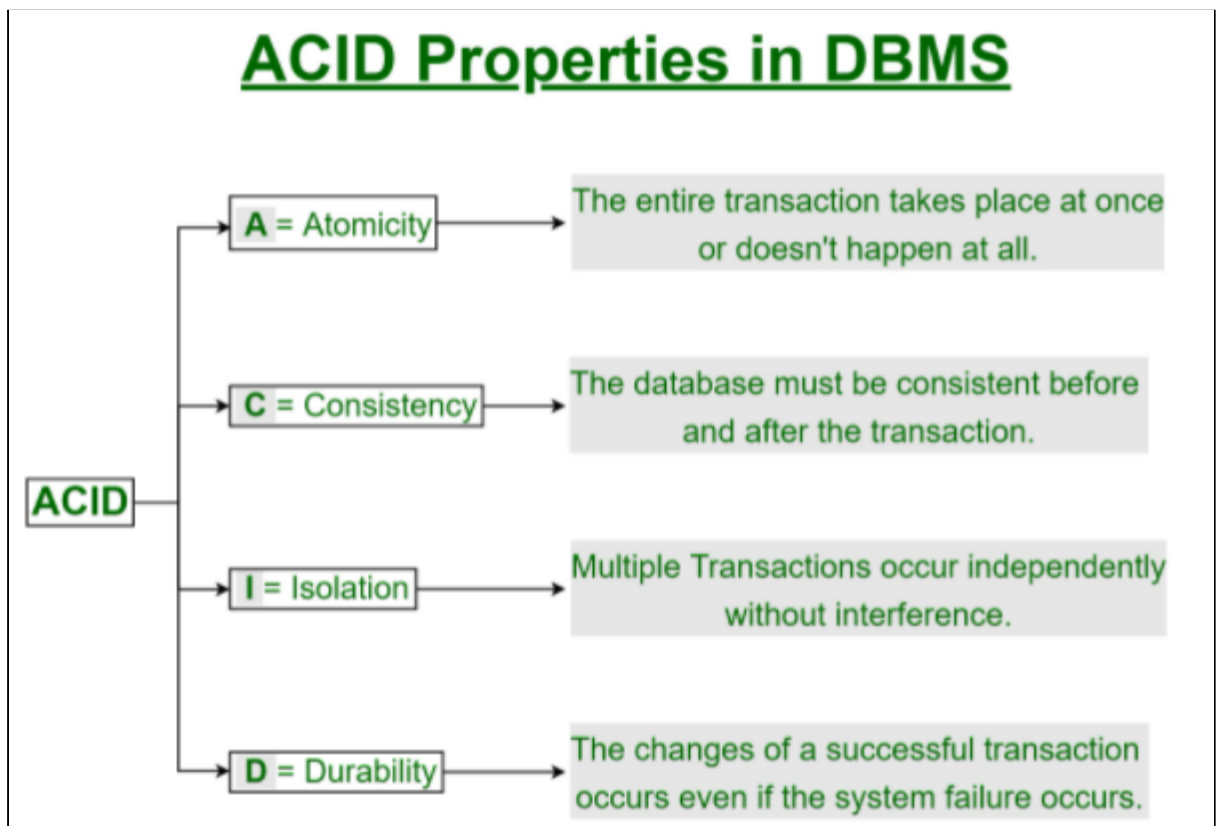
- Whereas DBMS controls redundancy by maintaining a single repository of data that is defined once and is accessed by many users. As there is no or less redundancy, data remains consistent.
- **Data sharing –**
File system does not allow sharing of data or sharing is too complex. Whereas in DBMS, data can be shared easily due to a centralized system.
- **Data concurrency –**
Concurrent access to data means more than one user is accessing the same data at the same time. Anomalies occur when changes made by one user get lost because of changes made by another user.
- File system does not provide any procedure to stop anomalies. Whereas DBMS provides a locking system to stop anomalies to occur.
- **Data searching –**
For every search operation performed on the file system, a different application program has to be written. While DBMS provides inbuilt searching operations. A user only has to write a small query to retrieve data from the database.
- **Data integrity –**
There may be cases when some constraints need to be applied to the data before inserting it into the database. The file system does not provide any procedure to check these constraints automatically. Whereas DBMS maintains data integrity by enforcing user-defined constraints on data by itself.
- **System crashing –**
In some cases, systems might have crashed due to various reasons. It is a bane in the case of file systems because once the system crashes, there will be no recovery of the data that's been lost. A DBMS will have the recovery manager which retrieves the data making it another advantage over file systems.
- **Data security –**
A file system provides a password mechanism to protect the database but how long can the password be protected? No one can guarantee that. This doesn't happen in the case of DBMS. DBMS has specialized features that help provide shielding to its data.

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2. In a database management system, explain the ACID properties.

Ans-

- A transaction(a set of tasks into a single execution unit) is a single logical unit of work that accesses and possibly modifies the contents of a database. Transactions access data using read and write operations.
- In order to maintain consistency in a database, before and after the transaction, certain properties are followed. These are called ACID properties(Atomicity, Consistency, Isolation, and Durability)



- **Atomicity** each transaction is considered as one unit and either run to completion or is not executed at all. It involves the following two operations.
- **Abort**: If a transaction aborts, changes made to the database are not visible.
- **Commit**: If a transaction commits, changes made are visible.
- Atomicity is also known as the '**All or nothing rule**'.
- **Consistency** means that integrity constraints must be maintained so that the database is consistent before and after the transaction.
- It refers to the correctness of a database. For example:-
- The total amount before and after the transaction must be maintained.
- Total **before T occurs** = $500 + 200 = 700$.
- Total **after T occurs** = $400 + 300 = 700$.

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- Therefore, the database is **consistent**. Inconsistency occurs in case Let **T1** completes but **T2** fails. As a result, T is incomplete.
- **Isolation** of this property ensures that multiple transactions can occur concurrently without leading to the inconsistency of the database state. Transactions occur independently without interference.
- **Durability** his property ensures that once the transaction has completed execution, the updates and modifications to the database are stored in and written to disk and they persist even if a system failure occurs.
- The **ACID** properties, in totality, provide a mechanism to ensure the correctness and consistency of a database in a way such that each transaction is a group of operations that acts as a single unit, produces consistent results, acts in isolation from other operations and updates that it makes are durably stored.

3. Explain the concept of normalization.

Ans-

- Normalization is the process of reducing a complex data structure into its simplest, most stable structure to minimize redundancy.
- Normalization is defined as "an analytic technique used to produce a correct relational database design.
- normalization is a procedure for eliminating redundancy in the Data Model by means of applying restrictive rules. Elimination of data redundancy in the tables of the Data Model helps enforce referential integrity of the data in the database.
- The normalization process is applied to the tables in the Data Model.
- Normalization is hierarchically classified into **numeric forms**, with the most common being **first**, **second**, and **third normal forms**. Each level of normalization is more restrictive than the previous.
- The first three hierarchical levels of normalization are:-
- **First Normal Form**-Repeating groups of data columns in tables have been eliminated such that data is organized into atomic units.
- **Second Normal Form**-Data is in first normal form, and redundancy on primary key fields has been eliminated such that column values are wholly dependent on the primary key field.
- **Third Normal Form**-Data is in second normal form, and each column is not dependent on any other non-key column.

4. Explain the many types of query languages used in relational databases. DQL, DML, DCL, and DDL are some examples.

Ans-

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- SQL commands are mainly categorized into four categories:
 - DDL – Data Definition Language
 - DQL – Data Query Language
 - DML – Data Manipulation Language
 - DCL – Data Control Language
- **Data Definition Language** actually consists of the SQL commands that can be used to define the database schema. DDL is a set of SQL commands used to **create**, **modify**, and **delete** database structures but not data.
- **List of DDL commands:**
 - **CREATE:** This command is used to create the database or its objects (like table, index, function, views, store procedure, and triggers).
 - **DROP:** This command is used to delete objects from the database.
 - **ALTER:** This is used to alter the structure of the database.
 - **TRUNCATE:** This is used to remove all records from a table, including all spaces allocated for the records are removed.
 - **COMMENT:** This is used to add comments to the data dictionary.
 - **RENAME:** This is used to rename an object existing in the database.

5. What is the difference between the main key and a composite key? Give instances of how primary key and composite are used.

Ans-

- A **PRIMARY KEY** constraint uniquely identifies each record in a table.
- A Primary keys column must contain unique values and cannot have null values.
- A table can have only **one primary key**, which may consist of single or multiple columns.
- A **COMPOSITE KEY** is a combination of two or more columns in a table that can be used to uniquely identify each row in the table when the columns are combined uniqueness is guaranteed, but when it is taken individually it does not guarantee uniqueness.
- The columns that make up a composite key can be of different data types.
- So basically, the primary key becomes the composite key when more than one column is used to uniquely identify each row in the table.
- Let's take an example, In this example, we have made the composite key as the combination of two columns as **roll number** and **mobile number** because all the rows of the table student can be uniquely

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identified by this composite key.

rollNumber	name	class	section	mobile
1	AMAN	FOURTH	B	9988774455
2	JOHN	FIRST	A	9988112233
3	TOM	FOURTH	B	9988777755
4	RICHARD	SECOND	C	9955663322

6. Create a table with a primary key, a column default value, and a column unique constraint in SQL.

Ans-

```
CREATE TABLE persons (  
  id INT NOT NULL PRIMARY KEY,  
  name VARCHAR(30) NOT NULL,  
  birth_date DATE,  
  phone VARCHAR(15) NOT NULL UNIQUE  
);
```

id	name	birth_date	phone
1	Akshay	02.10.1990	8697097926
2	Shubham	23.12.1994	8799551387