SQL Statements (DDL, DML, DCL, DQL, TCL)

SQL statements are categorized into five different types based on their functionality. Each category serves a different purpose when interacting with a database. The main categories are DDL (Data Definition Language), DML (Data Manipulation Language), DCL (Data Control Language), DQL (Data Query Language), and TCL (Transaction Control Language).

1. DDL (Data Definition Language)

DDL statements are used to define, modify, and manage the structure of database objects like tables, indexes, and schemas. These commands do not manipulate data but change the structure of the database.

Common DDL Commands:

- CREATE: Creates new database objects like tables, indexes, or databases.
- Example: `CREATE TABLE Employees (ID INT, Name VARCHAR(100));`
- ALTER: Modifies an existing database object, such as adding a column to a table.
- Example: `ALTER TABLE Employees ADD Age INT;`
- DROP: Deletes database objects like tables, indexes, or databases permanently.
- Example: `DROP TABLE Employees;`
- TRUNCATE: Deletes all rows from a table but keeps the table structure intact.
- Example: `TRUNCATE TABLE Employees;`
- RENAME: Changes the name of a database object like a table.
- Example: `RENAME TABLE Employees TO Staff;`

When and Why DDL is Used:

- When: DDL is used when setting up or altering the structure of the database. It's essential in the database design phase and when modifying or cleaning up a database.
- Why: It helps create and define the database schema, ensuring that data is stored in an organized and optimized manner.

2. DML (Data Manipulation Language)

DML statements are used to manipulate data stored in database tables. These commands insert, update, delete, and retrieve records from a database.

Common DML Commands:

- INSERT: Adds new records into a table.
- Example: `INSERT INTO Employees (ID, Name, Age) VALUES (1, 'John', 30);`
- UPDATE: Modifies existing records in a table.
- Example: `UPDATE Employees SET Age = 31 WHERE ID = 1;`
- DELETE: Removes records from a table (but the structure of the table remains intact).
- Example: `DELETE FROM Employees WHERE ID = 1;`

When and Why DML is Used:

- When: DML is used during day-to-day operations to manage and manipulate the data stored in the database.
- Why: It allows users to add, modify, or remove data as needed for business operations and analysis.

3. DCL (Data Control Language)

DCL statements manage access control and permissions in a database. They determine who can access or manipulate the data.

Common DCL Commands:

- GRANT: Gives a user or role specific permissions to perform actions on database objects.
- Example: `GRANT SELECT ON Employees TO user1;`
- REVOKE: Removes previously granted permissions from a user or role.
- Example: `REVOKE SELECT ON Employees FROM user1;`

When and Why DCL is Used:

- When: DCL is used when managing user access, ensuring data security, and controlling who can perform which operations on the database.
- Why: To safeguard data and ensure only authorized personnel can access, manipulate, or manage specific aspects of the database.

4. DQL (Data Query Language)

DQL consists mainly of the SELECT statement, which is used to query or retrieve data from a database. It's one of the most frequently used SQL operations.

Common DQL Command:

- SELECT: Retrieves data from one or more tables. It allows filtering, sorting, and grouping of the data.
- Example: `SELECT Name, Age FROM Employees WHERE Age > 30;`

When and Why DQL is Used:

- When: DQL is used whenever you need to fetch data for analysis, reporting, or business operations.
- Why: It enables data analysts, developers, and database administrators to query the database to retrieve specific information needed for decision-making or analysis.

5. TCL (Transaction Control Language)

TCL statements manage transactions within a database, ensuring the integrity and consistency of data. Transactions allow a set of operations to be executed as a single unit, where either all or none of the operations are completed.

Common TCL Commands:

- COMMIT: Permanently saves the changes made by a transaction.
- Example: `COMMIT;`
- ROLLBACK: Reverts the changes made by a transaction in case of an error or if changes are not needed.
- Example: `ROLLBACK;`
- SAVEPOINT: Sets a point within a transaction to which you can later roll back if necessary.
- Example: `SAVEPOINT sp1;`
- SET TRANSACTION: Defines properties of a transaction like isolation level.
- Example: `SET TRANSACTION ISOLATION LEVEL SERIALIZABLE;`

When and Why TCL is Used:

- When: TCL is used in operations that require multiple DML statements to execute as a single transaction, especially when data consistency is critical (like financial transactions).
- Why: It helps ensure data integrity and prevents data corruption in the event of an error or system failure by controlling how transactions are executed and saved.

Summary of SQL Statement Categories:

Type	Purpose	Common Commands	Usage
DDL	Defines database structure	`CREATE`, `ALTER`, `DROP`, `TRUNCATE`	Used when creating, modifying, or deleting database objects
DML	Manipulates data	`INSERT`, `UPDATE`, `DELETE`	Used for adding, updating, and deleting data
DCL	Controls access to data	`GRANT`, `REVOKE`	Used to manage user permissions and access control
DQL	Queries data	`SELECT`	Used to retrieve data for analysis and reporting
TCL	Manages transactions	`COMMIT`, `ROLLBACK`, `SAVEPOINT`, `SET TRANSACTION`	Used to ensure data integrity and consistency across operations