Structured Query Language (SQL): A Comprehensive Document

SQL (Structured Query Language) is a powerful, standardized programming language used to manage relational databases. It allows you to communicate with a database to perform tasks like retrieving data, updating records, and managing the database structure.

SQL commands are primarily categorized into four groups:-----1. Data Definition Language (DDL)

DDL commands are used to define, modify, and drop database structures (schemas, tables, indexes, etc.).

Command	Purpose	Usage Example
CREATE	Used to create a new database, table, index, or view.	`CREATE TABLE Employees (EmployeeID INT, LastName VARCHAR(255), Department VARCHAR(255));`
ALTER	Used to modify the structure of an existing database object, such as adding, deleting, or modifying columns in a table.	`ALTER TABLE Employees ADD Email VARCHAR(255);`
DROP	Used to delete an entire database, table, index, or view. All data and structure are permanently removed.	`DROP TABLE Employees;`
TRUNCATE	Used to delete all records from a table, including all spaces allocated for the records, but keeps the table structure intact. It's faster than `DELETE` for removing all rows.	`TRUNCATE TABLE Employees;`
RENAME	Used to change the name of an existing database object (e.g., a table or column).	`ALTER TABLE Employees RENAME TO Staff;`

-----2. Data Manipulation Language (DML)

DML commands are used to manage the data within schema objects. They allow you to insert, retrieve, modify, and delete data.

Command	Purpose	Usage Example
SELECT	Used to retrieve data from a database. This is the most frequently used SQL command.	`SELECT LastName, Department FROM Employees WHERE Department = 'Sales';`
INSERT INTO	Used to add new rows of data into a table.	`INSERT INTO Employees (EmployeeID, LastName, Department) VALUES (101, 'Smith', 'Marketing');`
UPDATE	Used to modify existing data within a table.	`UPDATE Employees SET Department = 'IT' WHERE EmployeeID = 101;`
DELETE FROM	Used to remove one or more rows (records) from a table.	`DELETE FROM Employees WHERE EmployeeID = 101;`

-----3. Data Control Language (DCL)

DCL commands are used to control access and permissions to the data in the database.

Command	Purpose	Usage Example
GRANT	Gives a user permission (access rights) to an object in the database.	`GRANT SELECT, INSERT ON Employees TO user_name;`
REVOKE	Removes a user's permissions on an object in the database.	`REVOKE INSERT ON Employees FROM user_name;`

-----4. Transaction Control Language (TCL)

TCL commands are used to manage transactions in the database. A transaction is a sequence of SQL statements that are executed as a single logical unit.

Command	Purpose	Usage Example
COMMIT	Makes all changes performed in the current transaction permanent.	`COMMIT;`
ROLLBACK	Undoes all changes from the last `COMMIT` or `ROLLBACK`. It reverts the database to the last saved state.	`ROLLBACK;`
SAVEPOINT	Creates a point within a transaction to which you can later roll back.	`SAVEPOINT my_savepoint;`

-----Key Clauses and Operators

These clauses are often used in conjunction with DML commands, particularly **SELECT**.

Clause/Operator	Purpose	Used With	Usage Example
WHERE	Filters records to return only those that fulfill a specified condition.	SELECT, UPDA… ▾	`SELECT * FROM Employees WHERE Salary > 50000;`
ORDER BY	Sorts the result set by one or more columns (ascending `ASC` or descending `DESC`).	SELECT ▾	`SELECT * FROM Employees ORDER BY LastName ASC;`
GROUP BY	Groups rows that have the same values in specified columns into summary rows (often used with aggregate functions).	SELECT ▾	`SELECT Department, COUNT(*) FROM Employees GROUP BY Department;`
HAVING	Filters groups based on a specified condition (used with `GROUP BY`).	SELECT ▾	`SELECT Department, COUNT(*) FROM Employees GROUP`

			`BY Department HAVING COUNT(*) > 5;`
JOIN	Combines rows from two or more tables based on a related column between them (e.g., `INNER JOIN`, `LEFT JOIN`, `RIGHT JOIN`).	SELECT ▾	`SELECT E.LastName, D.DivisionName FROM Employees E INNER JOIN Divisions D ON E.DivisionID = D.DivisionID;`
AS	Gives a table or column a temporary alternative name (an alias).	SELECT ▾	`SELECT LastName AS Surname FROM Employees;`
DISTINCT	Returns only unique values in the specified column.	SELECT ▾	`SELECT DISTINCT Department FROM Employees;`

Conclusion

SQL is an indispensable language for anyone working with data and relational databases. Its categorized structure into DDL, DML, DCL, and TCL provides a clear framework for managing database schema, manipulating data, controlling access, and ensuring transaction integrity. Mastering SQL, including its key clauses and operators, is fundamental for data retrieval, analysis, and efficient database management.