# SQL Server

## 1. What is Microsoft SQL Server?

Microsoft SQL Server is a **Relational Database Management System (RDBMS)** developed by Microsoft. Its primary function is to store and retrieve data as requested by other software applications. It can run on a single machine or across a network.

The system uses **Transact-SQL (T-SQL)** as its primary query language, which is Microsoft's proprietary extension of the standard SQL (Structured Query Language).

## 2. Core Components

SQL Server is not just a database engine; it's a comprehensive data platform that includes several key services:

- **Database Engine:** The core service responsible for storing, processing, and securing data. It handles transactions, locking, and concurrency.
- **SQL Server Integration Services (SSIS):** A platform for building high-performance data integration and Extract, Transform, Load (ETL) solutions.
- **SQL Server Analysis Services (SSAS):** Provides data analysis and business intelligence capabilities, allowing users to create and manage multidimensional data cubes (OLAP) and tabular models.
- **SQL Server Reporting Services (SSRS):** A server-based reporting platform used to create, manage, and deliver a wide variety of interactive and printed reports.

## 3. Common SQL Server Editions

SQL Server comes in several editions tailored for different needs:

- **Enterprise:** The premium, full-featured edition designed for large-scale, mission-critical applications. It includes advanced features for high availability, security, and performance.

- **Standard:** Provides core database capabilities, reporting, and analytics for mid-tier applications and data marts. It has fewer features and lower capacity limits than Enterprise.
- **Express:** A free, entry-level edition ideal for learning, development, and small-scale applications. It has significant limitations on database size, memory, and CPU usage.
- **Developer:** A free, full-featured edition (identical to Enterprise) licensed only for non-production development and testing environments.

## 4. Key Concepts in SQL Server

- **Database:** A structured collection of data. It contains objects like tables, views, stored procedures, and functions.
- **Table:** The primary object for storing data, organized into rows (records) and columns (attributes).
- **Schema:** A container for database objects. It helps in organizing objects and managing permissions. The default schema is dbo (database owner).
- **T-SQL (Transact-SQL):** The language used to interact with the database. It includes:
    - **DDL (Data Definition Language):** Commands like CREATE, ALTER, DROP (to define database structure).
    - **DML (Data Manipulation Language):** Commands like SELECT, INSERT, UPDATE, DELETE (to query and modify data).
    - **DCL (Data Control Language):** Commands like GRANT, REVOKE (to manage permissions).
- **Stored Procedure:** A pre-compiled set of one or more T-SQL statements saved in the database. It improves performance, security, and reusability.
- **Index:** A data structure that improves the speed of data retrieval operations on a database table at the cost of slower writes and increased storage space.

## 5. Common T-SQL Command Examples

Here are practical examples of the most frequently used Transact-SQL commands for daily database operations.

### A. Data Manipulation Language (DML) - Working with Data

Assume we have a table named Employees with columns: EmployeeID, FirstName, LastName, and Department.

**1. SELECT (Querying Data)** *To retrieve all employees from the 'Sales' department:*

SQL

```sql
SELECT EmployeeID, FirstName, LastName
FROM Employees
WHERE Department = 'Sales';
```

**2. INSERT (Adding New Data)** *To add a new employee record to the table:*

SQL

```sql
INSERT INTO Employees (EmployeeID, FirstName, LastName, Department)
VALUES (101, 'John', 'Doe', 'Marketing');
```

**3. UPDATE (Modifying Existing Data)** *To change an existing employee's department:*

SQL

```sql
UPDATE Employees
SET Department = 'Human Resources'
WHERE EmployeeID = 101;
```

**4. DELETE (Removing Data)** *To remove an employee's record from the table:*

```sql
DELETE FROM Employees
WHERE EmployeeID = 101;
```

**B. Data Definition Language (DDL) - Defining Database Structure**

**1. CREATE TABLE** *To create a new table to store product information:*

```sql
CREATE TABLE Products (
    ProductID INT PRIMARY KEY,
    ProductName VARCHAR(100) NOT NULL,
    Price DECIMAL(10, 2),
    DateAdded DATETIME DEFAULT GETDATE()
);
```

**2. ALTER TABLE** *To add a new column for 'StockQuantity' to the Products table:*

```sql
ALTER TABLE Products
ADD StockQuantity INT;
```

**3. DROP TABLE** *To completely delete the Products table and all its data (use with caution):*

```sql
DROP TABLE Products;
```

**C. Stored Procedures and Joins**

**1. CREATE STORED PROCEDURE** *To create a reusable command that gets employees by department:*

SQL

```sql
CREATE PROCEDURE sp_GetEmployeesByDept
    @DeptName VARCHAR(50)
AS
BEGIN
    SELECT EmployeeID, FirstName, LastName
    FROM Employees
    WHERE Department = @DeptName
    ORDER BY LastName;
END;
```

To use (execute) this procedure:

SQL

```sql
EXEC sp_GetEmployeesByDept @DeptName = 'Sales';
```

**2. JOIN (Combining Data from Multiple Tables)** *Assume we have a second table Departments (DeptName, Manager). To get a list of employees and their managers:*

SQL

```sql
SELECT
    e.FirstName,
    e.LastName,
    d.Manager
FROM
    Employees AS e
INNER JOIN
    Departments AS d ON e.Department = d.DeptName;
```