Stored Procedures

A stored procedure is a set of structured SQL statements that are stored and executed within a database management system (DBMS). It allows developers to encapsulate database logic into reusable and executable units. Stored procedures are widely used in modern database systems to improve performance, security, and maintainability of database operations.

A stored procedure is a precompiled collection of one or more SQL statements that can be executed by calling its name. It can accept input parameters, return output parameters, and perform complex operations such as data manipulation, validation, and conditional processing.

Stored procedures are created and saved in the database. Once created, they can be executed multiple times without rewriting the SQL code. The database engine parses, compiles, and optimizes the procedure once, which improves execution speed during subsequent calls.

Features of Stored Procedures:

- Accept input and output parameters
- Support conditional statements (IF, ELSE)
- Support loops (WHILE, FOR)
- Can handle transactions
- Allow error handling
- Can return result sets

Example of a Stored Procedure:

```
CREATE PROCEDURE GetStudentDetails
    @StudentId INT
AS
BEGIN
    SELECT * FROM Students
    WHERE StudentID = @StudentId;
END;
```

Execution: EXEC GetStudentDetails 101;

Advantages of Stored Procedures:

1. Improved Performance – Precompiled execution reduces processing time.
2. Enhanced Security – Direct access to tables can be restricted.
3. Code Reusability – Same procedure can be used multiple times.
4. Reduced Network Traffic – Only procedure calls are sent, not full SQL queries.
5. Better Maintainability – Business logic is centralized in the database.

Disadvantages of Stored Procedures:

- Difficult to debug compared to application code
- Database-dependent (less portable across DBMS)
- Can increase load on the database server
- Requires specialized SQL knowledge

SQL Query	Stored Procedure
Executed line by line	Precompiled
Written every time	Written once
Less secure	More secure
No control structures	Supports logic and flow

Applications of Stored Procedures

- Banking systems
- Inventory management
- Payroll systems
- Large-scale enterprise applications
- Data validation and reporting systems

Stored procedures play a crucial role in database-driven applications by improving performance, security, and efficiency. They help manage complex database operations in a structured and reusable manner. Despite some limitations, stored procedures remain an essential component of relational database systems.