Functions in SQL are predefined or user-defined operations that perform calculations, manipulate data, or return specific results based on inputs. They are often used in SQL queries to simplify complex operations or improve code readability.

**Types of Functions in SQL**

SQL functions can be broadly categorized into two main types:

1. **Built-in Functions**
2. **User-defined Functions**

**1. Built-in Functions**

SQL provides a wide variety of built-in functions. These are further classified into:

**a. Aggregate Functions**

Aggregate functions perform calculations on multiple rows of data and return a single result.

| **Function** | **Description** | **Example** |
| --- | --- | --- |
| AVG() | Returns the average value of a numeric column. | SELECT AVG(salary) FROM employees; |
| SUM() | Returns the total sum of a numeric column. | SELECT SUM(sales) FROM orders; |
| COUNT() | Returns the number of rows. | SELECT COUNT(\*) FROM products; |
| MAX() | Returns the maximum value in a column. | SELECT MAX(price) FROM products; |
| MIN() | Returns the minimum value in a column. | SELECT MIN(price) FROM products; |

**b. String Functions**

String functions are used to manipulate text strings.

| **Function** | **Description** | **Example** |
| --- | --- | --- |
| UPPER() | Converts a string to uppercase. | SELECT UPPER(name) FROM customers; |
| LOWER() | Converts a string to lowercase. | SELECT LOWER(name) FROM customers; |
| CONCAT() | Concatenates two or more strings. | SELECT CONCAT(first\_name, ' ', last\_name); |
| SUBSTRING() | Extracts a substring from a string. | SELECT SUBSTRING(name, 1, 3) FROM customers; |
| LENGTH() | Returns the length of a string. | SELECT LENGTH(name) FROM customers; |
| TRIM() | Removes leading/trailing spaces from a string. | SELECT TRIM(' hello '); |

**c. Date and Time Functions**

Date functions are used to work with date and time values.

| **Function** | **Description** | **Example** |
| --- | --- | --- |
| GETDATE() | Returns the current date and time. | SELECT GETDATE(); |
| DATEADD() | Adds a specified interval to a date. | SELECT DATEADD(day, 10, GETDATE()); |
| DATEDIFF() | Returns the difference between two dates. | SELECT DATEDIFF(day, '2023-01-01', '2025-01-16'); |
| FORMAT() | Formats a date/time value. | SELECT FORMAT(GETDATE(), 'yyyy-MM-dd'); |
| YEAR() | Extracts the year from a date. | SELECT YEAR(order\_date) FROM orders; |
| MONTH() | Extracts the month from a date. | SELECT MONTH(order\_date) FROM orders; |
| DAY() | Extracts the day from a date. | SELECT DAY(order\_date) FROM orders; |

**d. Mathematical Functions**

Mathematical functions are used to perform mathematical operations.

| **Function** | **Description** | **Example** |
| --- | --- | --- |
| ABS() | Returns the absolute value. | SELECT ABS(-10); |
| ROUND() | Rounds a number to a specified precision. | SELECT ROUND(123.456, 2); |
| CEILING() | Rounds a number up to the nearest integer. | SELECT CEILING(4.2); |
| FLOOR() | Rounds a number down to the nearest integer. | SELECT FLOOR(4.8); |
| POWER() | Returns a number raised to a power. | SELECT POWER(2, 3); |
| SQRT() | Returns the square root of a number. | SELECT SQRT(16); |

**2. User-defined Functions**

A **user-defined function (UDF)** is a custom function created by the user to perform specific tasks.

**Types of UDFs:**

* **Scalar Functions**: Return a single value (e.g., a number or string).
* **Table-Valued Functions**: Return a table.