Aggregate functions in SQL are built-in functions that perform a calculation on a set of values and return a single value. They are often used in conjunction with the GROUP BY clause to summarize data grouped by specific criteria. These functions ignore NULL values except for the COUNT(\*) function.

**Common Aggregate Functions**

1. **COUNT()**
   * Returns the number of rows or non-NULL values in a column.
   * Example:
   * SELECT COUNT(\*) FROM employees; -- Total number of rows
   * SELECT COUNT(salary) FROM employees; -- Rows where salary is not NULL
2. **SUM()**
   * Calculates the total sum of a numeric column.
   * Example:
   * SELECT SUM(salary) FROM employees; -- Total of all salaries
3. **AVG()**
   * Calculates the average value of a numeric column.
   * Example:
   * SELECT AVG(salary) FROM employees; -- Average salary
4. **MIN()**
   * Returns the smallest value in a column.
   * Example:
   * SELECT MIN(salary) FROM employees; -- Lowest salary
5. **MAX()**
   * Returns the largest value in a column.
   * Example:
   * SELECT MAX(salary) FROM employees; -- Highest salary
6. **VARIANCE() and STDDEV()** (database-specific)
   * Calculate the variance and standard deviation of numeric data, respectively.

**Usage with GROUP BY**

Aggregate functions are commonly used with the GROUP BY clause to summarize data for each group.

Example:

SELECT department\_id, AVG(salary) AS average\_salary

FROM employees

GROUP BY department\_id;

This query calculates the average salary for each department.

**Notes**

* When used without a GROUP BY clause, aggregate functions operate on the entire dataset.
* They are often combined with filtering clauses like HAVING to further refine results:
* SELECT department\_id, SUM(salary) AS total\_salary
* FROM employees
* GROUP BY department\_id
* HAVING SUM(salary) > 100000;

These functions are essential for summarizing and analyzing data in SQL queries.