

Top 80 SQL interview questions and answers



1. What is SQL?

- **Answer:** SQL (Structured Query Language) is a standard programming language used for managing and manipulating relational databases.
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2. What is a primary key?

- **Answer:** A primary key is a field (or combination of fields) that uniquely identifies each record in a table. It cannot contain **NULL** values and must have unique entries.
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3. What is a foreign key?

- **Answer:** A foreign key is a field (or combination of fields) in one table that refers to the primary key in another table, establishing a relationship between the two tables.
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4. What are constraints in SQL?

- **Answer:** Constraints are rules applied to table columns to enforce data integrity. Common constraints include:
 - **PRIMARY KEY:** Uniquely identifies each record.
 - **FOREIGN KEY:** Enforces referential integrity.
 - **UNIQUE:** Ensures all values in a column are distinct.
 - **CHECK:** Ensures that values in a column satisfy a specific condition.
 - **NOT NULL:** Ensures a column cannot have **NULL** values.
 - **DEFAULT:** Specifies a default value for a column.
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5. Write a query to retrieve all records from a table named **employees**.

```
SELECT * FROM employees;
```

- **Answer:** This query selects and displays all columns and rows from the **employees** table.



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6. What is the difference between **DELETE** and **TRUNCATE**?

- **Answer:**
 - **DELETE:** Removes rows from a table based on a condition. It can be rolled back (transaction-safe) and triggers can be invoked.
 - **TRUNCATE:** Removes all rows from a table, resetting the identity column. It is faster but cannot be rolled back and does not invoke triggers.

7. How do you find the maximum salary from an **employees** table?

```
SELECT MAX(salary) FROM employees;
```

- **Answer:** This query returns the highest salary from the **employees** table.

8. Write a query to fetch the second-highest salary from the **employees** table.

```
SELECT MAX(salary) FROM employees  
WHERE salary < (SELECT MAX(salary) FROM employees);
```

- **Answer:** The subquery finds the maximum salary, and the outer query finds the highest salary that is less than that value (i.e., the second-highest salary).

9. What is a **JOIN**? Explain its types.

- **Answer:** A **JOIN** clause is used to combine rows from two or more tables based on a related column. Types of joins:
 - **INNER JOIN:** Returns rows with matching values in both tables.
 - **LEFT JOIN:** Returns all rows from the left table and matching rows from the right.
 - **RIGHT JOIN:** Returns all rows from the right table and matching rows from the left.



- **FULL JOIN:** Returns rows when there is a match in either table.
 - **CROSS JOIN:** Returns the Cartesian product of both tables.
-

10. Write a query to fetch employee names and department names using **JOIN**.

```
SELECT e.name, d.department_name
FROM employees e
JOIN departments d
ON e.department_id = d.id;
```

- **Answer:** This query joins the `employees` table with the `departments` table based on the `department_id`, displaying employee names and their corresponding department names.
-

11. What is a **GROUP BY** clause in SQL?

- **Answer:** The **GROUP BY** clause groups rows with the same values into summary rows. It is commonly used with aggregate functions like `COUNT()`, `SUM()`, `AVG()`, etc.
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12. Write a query to count employees in each department.

```
SELECT department_id, COUNT(*)
FROM employees
GROUP BY department_id;
```

- **Answer:** This query groups employees by `department_id` and counts the number of employees in each department.
-

13. What is the difference between **WHERE** and **HAVING** clauses?

- **Answer:**

- **WHERE:** Filters rows before grouping (applies to individual rows).
 - **HAVING:** Filters groups after the **GROUP BY** clause (applies to aggregate functions).
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14. Write a query to fetch departments with more than 5 employees.

```
SELECT department_id, COUNT(*)  
FROM employees  
GROUP BY department_id  
HAVING COUNT(*) > 5;
```

- **Answer:** The query counts employees in each department and returns departments with more than 5 employees.
-

15. Explain **UNION** and **UNION ALL**.

- **Answer:**
 - **UNION:** Combines results of two or more **SELECT** statements and removes duplicates.
 - **UNION ALL:** Combines results and keeps all duplicates.
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16. What is a subquery in SQL?

- **Answer:** A subquery is a query nested within another query. It is used to retrieve data that will be passed into the outer query.
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17. Write a query to find all employees whose salary is greater than the average salary.

```
SELECT *  
FROM employees  
WHERE salary > (SELECT AVG(salary) FROM employees);
```


- **Answer:** This query selects all employees with a salary higher than the average salary of all employees.
-

18. What is the difference between **INNER JOIN** and **OUTER JOIN**?

- **Answer:**
 - **INNER JOIN:** Returns rows with matching values in both tables.
 - **OUTER JOIN** (Left/Right/Full): Returns matching rows plus non-matching rows from one or both tables.
-

19. Write a query to fetch the current date in SQL.

```
SELECT CURRENT_DATE;
```

- **Answer:** This query retrieves the current date from the database.
-

20. What is indexing in SQL?

- **Answer:** Indexing improves the speed of data retrieval by creating a data structure (index) on one or more columns of a table.
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21. What is normalization? Explain its types (1NF, 2NF, 3NF, BCNF).

- **Answer:** Normalization is the process of organizing data to reduce redundancy and improve data integrity. Forms:
 - **1NF:** Eliminate duplicate columns and create tables for related data.
 - **2NF:** Remove partial dependencies (columns depend on a part of a composite key).
 - **3NF:** Remove transitive dependencies (non-key columns depend on other non-key columns).
 - **BCNF:** A stricter version of 3NF where every determinant must be a candidate key.
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22. What is denormalization?

- **Answer:** Denormalization is the process of combining normalized tables to improve performance at the cost of introducing redundancy.
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23. Write a query to add a new column `email` to the `employees` table.

```
ALTER TABLE employees ADD COLUMN email VARCHAR(255);
```

- **Answer:** This query adds a new `email` column to the `employees` table.
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24. What is a stored procedure in SQL?

- **Answer:** A stored procedure is a set of SQL statements that can be stored in the database and executed as a program to perform a specific task.
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25. Write a basic stored procedure to fetch all employees.

```
CREATE PROCEDURE GetAllEmployees()  
BEGIN  
    SELECT * FROM employees;  
END;
```

- **Answer:** This procedure retrieves all records from the `employees` table when executed.
-

26. What are triggers in SQL?

- **Answer:** Triggers are special procedures that are automatically executed (or "triggered") in response to certain events (INSERT, UPDATE, DELETE) on a table.
-

- **Answer:** Aggregate functions perform calculations on a set of values and return a single value. Examples include:
 - `COUNT()`: Counts the number of rows.
 - `SUM()`: Sums up a numeric column.
 - `AVG()`: Calculates the average of a numeric column.
 - `MAX()`: Returns the maximum value.
 - `MIN()`: Returns the minimum value.
-

32. Write a query to calculate the total salary for each department.

```
SELECT department_id, SUM(salary)
FROM employees
GROUP BY department_id;
```

- **Answer:** This query sums the salaries for each department, grouping by `department_id`.
-

33. Explain the `DISTINCT` keyword in SQL.

- **Answer:** The `DISTINCT` keyword is used to return unique values from a column, eliminating duplicate entries from the result set.
-

34. Write a query to find distinct job titles from the `employees` table.

```
SELECT DISTINCT job_title FROM employees;
```

- **Answer:** This query retrieves unique job titles from the `employees` table.
-

35. What are the ACID properties in SQL?

- **Answer:** ACID properties ensure reliable processing of database transactions:

- **Atomicity:** Ensures that all parts of a transaction are completed successfully or none at all.
 - **Consistency:** Ensures the database remains in a valid state before and after the transaction.
 - **Isolation:** Ensures transactions do not affect each other's execution.
 - **Durability:** Ensures that once a transaction is committed, it remains permanent, even in the event of a failure.
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36. What is a transaction in SQL?

- **Answer:** A transaction is a sequence of one or more SQL operations treated as a single unit of work, ensuring data integrity.
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37. Explain COMMIT, ROLLBACK, and SAVEPOINT.

- **Answer:**
 - **COMMIT:** Saves all changes made during the current transaction.
 - **ROLLBACK:** Undoes changes made during the current transaction, restoring the database to its previous state.
 - **SAVEPOINT:** Sets a point within a transaction to which you can later roll back.
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38. Write a query to start a transaction, update a record, and commit it.

```
START TRANSACTION;  
UPDATE employees SET salary = 60000 WHERE id = 1;  
COMMIT;
```

- **Answer:** This sequence starts a transaction, updates an employee's salary, and commits the change.
-

39. What is a CASE statement in SQL?

- **Answer:** A **CASE** statement is used to perform conditional logic in SQL queries, allowing different outputs based on specified conditions.

40. Write a query using **CASE** to categorize employees by salary.

```
SELECT name,  
       CASE  
         WHEN salary > 50000 THEN 'High'  
         WHEN salary BETWEEN 30000 AND 50000 THEN 'Medium'  
         ELSE 'Low'  
       END AS salary_category  
FROM employees;
```

- **Answer:** This query categorizes employees based on their salary levels.

41. Explain **NULL** values in SQL.

- **Answer:** **NULL** represents the absence of a value in a database. It is not equivalent to zero or an empty string and is treated differently in comparisons.

42. Write a query to fetch records where email is **NULL**.

```
SELECT * FROM employees WHERE email IS NULL;
```

- **Answer:** This query retrieves all employees whose email address is not provided (i.e., is **NULL**).

43. What is the **COALESCE** function in SQL?

- **Answer:** The **COALESCE** function returns the first non-NULL value in a list of expressions.

44. Write a query using **COALESCE** to handle **NULL** values in a column.

```
SELECT name, COALESCE(email, 'No Email') AS email_address
FROM employees;
```

- **Answer:** This query replaces `NULL` email values with the string 'No Email'.
-

45. What is the difference between `COUNT(*)` and `COUNT(column_name)`?

- **Answer:** `COUNT(*)` counts all rows in a table, including `NULL` values, while `COUNT(column_name)` counts only non-`NULL` values in the specified column.
-

46. What is the difference between `CHAR` and `VARCHAR` in SQL?

- **Answer:**
 - `CHAR`: Fixed-length string data type. If the string is shorter than the specified length, it is padded with spaces.
 - `VARCHAR`: Variable-length string data type. It uses only the necessary space for the string's length, plus one or two bytes for length information.
-

47. Write a query to update an employee's salary by 10% where the salary is below 30,000.

```
UPDATE employees
SET salary = salary * 1.10
WHERE salary < 30000;
```

- **Answer:** This query increases the salary of employees earning less than 30,000 by 10%.
-

48. What is a recursive query?

- **Answer:** A recursive query is a query that references itself. It is often used to handle hierarchical data, such as organizational structures.

49. Write a recursive query to get a hierarchical structure of employees and their managers.

```
WITH RECURSIVE EmployeeHierarchy AS (  
    SELECT id, name, manager_id  
    FROM employees  
    WHERE manager_id IS NULL  
    UNION ALL  
    SELECT e.id, e.name, e.manager_id  
    FROM employees e  
    INNER JOIN EmployeeHierarchy eh  
    ON e.manager_id = eh.id  
)  
SELECT * FROM EmployeeHierarchy;
```

- **Answer:** This recursive query generates a hierarchy of employees based on their managers.

50. Explain the **EXISTS clause in SQL.**

- **Answer:** The **EXISTS** clause is used to check for the existence of rows returned by a subquery. It returns **TRUE** if the subquery returns one or more rows.

51. What is the purpose of the **LIMIT clause in SQL?**

- **Answer:** The **LIMIT** clause is used to specify the maximum number of records to return in the result set. It helps in pagination and controlling output size.

52. Write a query to retrieve the top 5 highest salaries from the **employees table.**

```
SELECT DISTINCT salary
```

```
FROM employees  
ORDER BY salary DESC  
LIMIT 5;
```

- **Answer:** This query selects the top 5 unique highest salaries from the `employees` table.
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53. What is a composite key?

- **Answer:** A composite key is a combination of two or more columns in a table that together uniquely identify a record. It is used when a single column is not sufficient to uniquely identify rows.
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54. Explain the `ALTER TABLE` command.

- **Answer:** The `ALTER TABLE` command is used to modify an existing table structure, allowing changes such as adding, dropping, or modifying columns and constraints.
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55. Write a query to drop a column named `address` from the `employees` table.

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ALTER TABLE employees DROP COLUMN address;
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- **Answer:** This query removes the `address` column from the `employees` table.
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```
SELECT department_id, AVG(salary)
FROM employees
GROUP BY department_id;
```

- **Answer:** This query calculates the average salary for each department by grouping records based on `department_id`.
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60. What is a **CROSS JOIN**?

- **Answer:** A **CROSS JOIN** produces the Cartesian product of two tables, meaning every row from the first table is combined with every row from the second table.
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61. Write a query to perform a **CROSS JOIN** between **employees** and **departments**.

```
SELECT * FROM employees CROSS JOIN departments;
```

- **Answer:** This query returns all combinations of rows from the `employees` and `departments` tables.
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62. What is a SQL injection?

- **Answer:** SQL injection is a security vulnerability that occurs when an attacker can manipulate a SQL query by injecting malicious input through user input fields, potentially allowing unauthorized access to the database.
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63. How can you prevent SQL injection?

- **Answer:** To prevent SQL injection:
 - Use prepared statements or parameterized queries.
 - Validate and sanitize user inputs.
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64. What is a database view? Can it be updated?

- **Answer:** A database view is a virtual table based on a SQL query that can simplify complex queries. While some views are updatable, updates depend on the complexity of the underlying query. Simple views that directly map to a single table can usually be updated.
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65. What is the difference between `RANK()` and `DENSE_RANK()`?

- **Answer:**
 - `RANK()`: Assigns a rank to each row within a partition, with gaps in the ranking for ties.
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66. Write a query to use `RANK()` to rank employees by salary.

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SELECT name, salary, RANK() OVER (ORDER BY salary DESC) AS salary_rank
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- **Answer:** This query ranks employees based on their salaries, with the highest salary getting rank 1.
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69. Write a query using a CTE to find employees with salaries greater than the average.

```
WITH AvgSalary AS (  
    SELECT AVG(salary) AS avg_salary FROM employees  
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SELECT * FROM employees  
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- **Answer:** This query uses a CTE to calculate the average salary and then selects employees earning more than that average.
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70. What are SQL data types? Give examples.

- **Answer:** SQL data types specify the kind of data that can be stored in a column. Examples include:
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ORDER BY employee_count DESC;
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- **Answer:** Stored functions are similar to stored procedures but return a single value. They can be used in SQL statements just like built-in functions.
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78. Write a simple stored function to calculate the annual salary.

```
CREATE FUNCTION CalculateAnnualSalary(monthly_salary DECIMAL(10,2))  
RETURNS DECIMAL(10,2)  
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