GENERAL

sql query based interview questions and answers

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SQL Query Based Interview Questions and Answers

When you're preparing for a data centric role—whether it's a data analyst, business intelligence developer, database administrator, or software engineer—SQL interview questions are almost inevitable. SQL (Structured Query Language) is the lingua franca of relational databases, and employers expect candidates to demonstrate not only a theoretical grasp of the language but also the practical ability to write efficient, maintainable queries.

In this comprehensive guide, we'll walk through the most common SQL interview questions, ranging from beginner concepts to advanced performance tuning. Each question will be paired with a detailed answer, including sample code snippets, explanations, and real world tips. By the end, you'll have a robust study resource that covers the breadth and depth of SQL knowledge that hiring managers look for.

Why SQL Interview Questions Matter

SQL is more than just a language; it's the backbone of data retrieval, manipulation, and management. Interview questions around SQL evaluate several key skills:

- Logical thinking: Crafting a query to solve a business problem requires breaking down requirements into atomic operations.
- Performance awareness: Understanding how indexes, query plans, and data distribution affect execution time.
- Data modeling insight: Knowing how tables relate, how normalization affects query complexity, and how to design efficient schemas.
- Problem solving under pressure: Demonstrating the ability to troubleshoot unexpected results or optimize slow queries.

Mastering these areas will not only help you ace the interview but also excel in your day to day role.

Types of SQL Interview Questions

Interviewers typically structure SQL questions into several categories. Understanding these categories helps you focus your study and anticipate what might come up.

1. Basic SQL Syntax and Operations

These questions test foundational knowledge of SELECT, WHERE, GROUP BY, HAVING, ORDER BY, and basic operators.

2. Joins and Subqueries

Questions in this area evaluate how you combine data from multiple tables and how you use correlated or non correlated subqueries.

3. Aggregation, Window Functions, and Set Operations

Here, you'll be asked to write queries that use SUM, COUNT, AVG, RANK, ROW_NUMBER, UNION, INTERSECT, etc.

4. Data Manipulation Language (DML)

INSERT, UPDATE, DELETE, MERGE, and transaction control statements fall into this category.

5. Performance Tuning and Query Optimization

These questions probe your understanding of execution plans, indexing strategies, and how to rewrite queries for better performance.

6. Advanced Topics

Stored procedures, triggers, views, CTEs, recursive queries, and database design principles are often covered here.

7. Real World Scenarios

Interviewers may present a business problem and ask you to write a query or explain how you would solve it, testing your ability to translate requirements into SQL.

Sample SQL Interview Questions and Answers

Below is a curated list of 25 high value SQL interview questions. For each, we provide a concise answer, sample code, and a brief explanation of why the question is important.

1. What is the difference between INNER JOIN and LEFT JOIN?

Answer: An INNER JOIN returns only rows that have matching values in both tables. A LEFT JOIN (or LEFT OUTER JOIN) returns all rows from the left table and matching rows from the right table; if there's no match, NULLs are returned for the right table's columns.

```
-- Example
SELECT a.id, b.name
FROM Orders a
LEFT JOIN Customers b ON a.customer_id = b.id;
```

Understanding join types is fundamental because incorrect joins can lead to data loss or duplication.

2. Explain the purpose of the GROUP BY clause and give an example.

Answer:GROUP BY aggregates rows that share a specified column value, allowing aggregate functions (SUM, COUNT, AVG, etc.) to operate on each group.

```
SELECT customer_id, COUNT(*) AS orders_count
FROM Orders
GROUP BY customer_id;
```

Use GROUP BY when you need summarized data, such as sales totals per region.

3. How do you remove duplicate rows from a table?

Answer: There are several approaches, but a common method is to create a temporary table without duplicates and replace the original. Example in SQL Server:

```
WITH CTE AS (
    SELECT *, ROW_NUMBER() OVER (PARTITION BY column1, column2 ORDER BY (SELECT NULL)) AS rn
```

```
    FROM dbo.MyTable
)
DELETE FROM CTE WHERE rn > 1;
```

Alternatively, use SELECT DISTINCT or drop and recreate the table.

4. What is a subquery, and when would you use one?

Answer:A subquery is a query nested inside another query. Use it when you need to compute a value or filter based on a derived result set.

```
SELECT name
FROM Employees
WHERE department_id = (
    SELECT id FROM Departments WHERE name = "Engineering"
);
```

Subqueries can be correlated or non correlated. They are handy for complex filtering but can impact performance.

5. Explain the difference between WHERE and HAVING clauses.

Answer:WHERE filters rows before aggregation; HAVING filters groups after aggregation. HAVING can only be used with aggregate functions.

```
SELECT department_id, COUNT(*) AS employee_count
FROM Employees
GROUP BY department_id
HAVING COUNT(*) > 10;
```

6. What is a window function? Provide an example.

Answer: Window functions perform calculations across a set of table rows that are related to the current row. They don’t collapse rows like aggregation functions.

```
SELECT employee_id, salary,
      RANK() OVER (ORDER BY salary DESC) AS salary_rank
FROM Employees;
```

Window functions are powerful for running totals, moving averages, and ranking.

7. Describe the concept of normalization and why it matters.

Answer: Normalization is the process of organizing database tables to reduce redundancy and improve data integrity. Common normal forms include 1NF, 2NF, 3NF, and BCNF.

Normalized schemas reduce anomalies during inserts, updates, and deletes, leading to more reliable data.

8. How do you create an index, and what impact does it have on queries?

Answer: An index speeds up data retrieval by providing a quick lookup mechanism. Example in MySQL:

```
CREATE INDEX idx_customer_lastname ON Customers(last_name);
```

Indexes improve SELECT performance but can slow down INSERT, UPDATE, and DELETE operations because the index must also be updated.

9. Explain the difference between UNION and UNION ALL.

Answer:UNION removes duplicate rows between result sets; UNION ALL retains all duplicates. UNION ALL is faster because it skips the duplicate elimination step.

10. What is a transaction, and why are ACID properties important?

Answer:A transaction is a unit of work that is either fully applied or fully rolled back. ACID stands for Atomicity, Consistency, Isolation, Durability. These properties ensure reliable, predictable database behavior.

11. Write a query to find the second highest salary in an Employees table.

Answer: There are multiple ways. One common approach uses a subquery:

```
SELECT MAX(salary) AS second_highest
FROM Employees
WHERE salary
```

Alternatively, use window functions:

```
SELECT DISTINCT salary
FROM (
    SELECT salary, DENSE_RANK() OVER (ORDER BY salary DESC) AS rnk
    FROM Employees
) AS ranked
WHERE rnk = 2;
```

12. How would you identify slow queries in your database?

Answer: Use built in monitoring tools like EXPLAIN or EXPLAIN ANALYZE to view execution plans. In MySQL, enable the slow query log; in PostgreSQL, use the pg_stat_statements extension.

13. What is a CTE (Common Table Expression), and why would you use it?

Answer:A CTE is a named temporary result set that you can reference within a SELECT, INSERT, UPDATE, or DELETE statement. It improves readability and can be recursive.

```
WITH RecentOrders AS (
    SELECT *
    FROM Orders
    WHERE order_date >= CURRENT_DATE - INTERVAL ''30 days''
)
SELECT *
FROM RecentOrders
```

```
WHERE total > 1000;
```

14. Explain the difference between INNER JOIN and FULL OUTER JOIN.

Answer:FULL OUTER JOIN returns all rows from both tables, with NULLs where there is no match. It is useful when you need to see unmatched records from either side.

15. How do you prevent SQL injection attacks?

Answer: Use parameterized queries or prepared statements. Never concatenate user input directly into SQL strings.

```
-- Example in Python with psycopg2
cursor.execute("SELECT * FROM Users WHERE username = %s", (username,))
```

16. Write a query to calculate the cumulative sum of sales per month.

Answer: Use a window function:

```
SELECT month, sales,
SUM(sales) OVER (ORDER BY month ROWS BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW) AS cumulative_sales
FROM MonthlySales;
```

17. What is a deadlock, and how can you mitigate it?

Answer:A deadlock occurs when two or more transactions wait indefinitely for each other to release locks. Mitigation strategies include:

- Consistently ordering resource access.
- Using shorter transactions.
- Reducing lock granularity.
- Implementing retry logic.

18. Describe the difference between VARCHAR and CHAR.

Answer:CHAR is a fixed-length string; if the data is shorter, the remaining space is padded with blanks. VARCHAR is variable-length and stores only the data plus a small overhead. Use CHAR for fixed-size data like country codes; use VARCHAR for variable-length text.

19. How would you write a query to pivot data (turn rows into columns)?

Answer: In SQL Server, use the PIVOT operator; in other databases, use conditional aggregation.

```
SELECT country,
    SUM(CASE WHEN year = 2020 THEN sales ELSE 0 END) AS sales_2020,
    SUM(CASE WHEN year = 2021 THEN sales ELSE 0 END) AS sales_2021
FROM Sales
```

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