**Basic SQL Questions:**

1. **What is SQL?**
   * SQL (Structured Query Language) is a standard programming language specifically designed for managing and manipulating relational databases.
2. **What are the different types of SQL commands?**
   * SQL commands are categorized into:
     + **DDL (Data Definition Language):** CREATE, ALTER, DROP
     + **DML (Data Manipulation Language):** SELECT, INSERT, UPDATE, DELETE
     + **DCL (Data Control Language):** GRANT, REVOKE
     + **TCL (Transaction Control Language):** COMMIT, ROLLBACK, SAVEPOINT
3. **What is a primary key?**
   * A primary key is a unique identifier for a record in a table. It ensures that each record is unique and cannot contain NULL values.
4. **What is a foreign key?**
   * A foreign key is a column or set of columns that establishes a link between the data in two tables. It is a reference to a primary key in another table.
5. **What is a JOIN? Name different types of JOINs.**
   * A JOIN is a SQL operation used to combine rows from two or more tables based on a related column.
     + **INNER JOIN**
     + **LEFT JOIN (or LEFT OUTER JOIN)**
     + **RIGHT JOIN (or RIGHT OUTER JOIN)**
     + **FULL JOIN (or FULL OUTER JOIN)**
     + **CROSS JOIN**
     + **SELF JOIN**
6. **What is normalization? Explain different normal forms.**
   * Normalization is the process of organizing data in a database to reduce redundancy and improve data integrity.
     + **1NF (First Normal Form):** Ensures that the values in each column are atomic.
     + **2NF (Second Normal Form):** Meets all the requirements of 1NF and removes subsets of data that apply to multiple rows of a table.
     + **3NF (Third Normal Form):** Meets all the requirements of 2NF and removes columns that are not dependent on the primary key.
     + **BCNF (Boyce-Codd Normal Form):** A stronger version of 3NF.
7. **What is a SQL index?**
   * An index is a database object that improves the speed of data retrieval operations on a table at the cost of additional space and maintenance overhead.

**Intermediate SQL Questions:**

1. **What is a subquery? Explain the types of subqueries.**
   * A subquery is a query within another query.
     + **Single-row subquery:** Returns a single row.
     + **Multi-row subquery:** Returns multiple rows.
     + **Correlated subquery:** References a column from the outer query.
     + **Non-correlated subquery:** Independent of the outer query.
2. **What is the difference between WHERE and HAVING clauses?**
   * **WHERE** is used to filter rows before any groupings are made.
   * **HAVING** is used to filter groups after the GROUP BY clause.
3. **What is a stored procedure?**
   * A stored procedure is a precompiled collection of SQL statements and optional control-of-flow statements, stored under a name and processed as a unit.
4. **Explain the difference between UNION and UNION ALL.**
   * **UNION** combines the results of two or more SELECT statements and removes duplicate rows.
   * **UNION ALL** combines the results of two or more SELECT statements and includes duplicate rows.
5. **What is a trigger in SQL?**
   * A trigger is a special kind of stored procedure that automatically executes in response to certain events on a particular table or view.
6. **What is the difference between DELETE, TRUNCATE, and DROP commands?**
   * **DELETE:** Removes rows from a table based on a condition. It can be rolled back.
   * **TRUNCATE:** Removes all rows from a table without logging individual row deletions. It cannot be rolled back in some databases.
   * **DROP:** Deletes the entire table or database structure and cannot be rolled back.
7. **What are aggregate functions? Provide examples.**
   * Aggregate functions perform a calculation on a set of values and return a single value.
     + Examples: COUNT(), SUM(), AVG(), MIN(), MAX()

**Advanced SQL Questions:**

1. **What is a CTE (Common Table Expression)?**
   * A CTE is a temporary result set that you can reference within a SELECT, INSERT, UPDATE, or DELETE statement.

WITH CTE AS (

SELECT column1, column2

FROM table

WHERE condition

)

SELECT \*

FROM CTE;

1. **How do you optimize a SQL query?**
   * Techniques include:
     + Using indexes effectively
     + Avoiding unnecessary columns in SELECT statements
     + Using joins instead of subqueries where appropriate
     + Ensuring proper normalization
     + Analyzing and rewriting complex queries
2. **What is the difference between OLTP and OLAP databases?**
   * **OLTP (Online Transaction Processing):** Used for transactional systems, supports a large number of short online transactions.
   * **OLAP (Online Analytical Processing):** Used for analytical systems, supports complex queries to analyze large amounts of data.
3. **What are window functions? Provide examples.**
   * Window functions perform calculations across a set of table rows related to the current row.
     + Examples: ROW\_NUMBER(), RANK(), DENSE\_RANK(), NTILE(), LEAD(), LAG(), SUM() OVER(), AVG() OVER()

SELECT column,

ROW\_NUMBER() OVER (PARTITION BY column ORDER BY column) AS row\_num

FROM table;

1. **Explain the concept of indexing and its types.**
   * Indexing improves the speed of data retrieval operations on a table. Types include:
     + **Clustered index:** Determines the physical order of data in a table.
     + **Non-clustered index:** Does not alter the physical order of data and maintains a separate structure.
2. **What is database partitioning?**
   * Partitioning is the process of dividing a database into smaller, more manageable pieces without altering its logical structure. Types include:
     + **Horizontal partitioning:** Dividing rows into partitions.
     + **Vertical partitioning:** Dividing columns into partitions.
3. **Describe the ACID properties of a transaction.**
   * **Atomicity:** Ensures that all operations within a transaction are completed successfully or none at all.
   * **Consistency:** Ensures that the database remains in a consistent state before and after the transaction.
   * **Isolation:** Ensures that transactions are isolated from each other.
   * **Durability:** Ensures that once a transaction is committed, it remains so, even in the event of a system failure.

**Practical SQL Problems:**

1. **Write a SQL query to find the second highest salary from the Employees table.**

SELECT MAX(salary) AS SecondHighestSalary

FROM Employees

WHERE salary < (SELECT MAX(salary) FROM Employees);

1. **Write a SQL query to fetch the employees who joined in the year 2020.**

SELECT \*

FROM Employees

WHERE YEAR(joining\_date) = 2020;

1. **Given a table Orders, write a SQL query to find the total sales for each product.**

SELECT product\_id, SUM(sales\_amount) AS total\_sales

FROM Orders

GROUP BY product\_id;

1. **Write a SQL query to find all customers who have never placed an order.**

SELECT c.customer\_id, c.customer\_name

FROM Customers c

LEFT JOIN Orders o ON c.customer\_id = o.customer\_id

WHERE o.order\_id IS NULL;

1. **Write a SQL query to fetch the top 3 highest salaries from the Employees table.**

SELECT salary

FROM Employees

ORDER BY salary DESC

LIMIT 3;

1. **Write a SQL query to delete duplicate rows from a table.**

DELETE FROM table\_name

WHERE id NOT IN (

SELECT MIN(id)

FROM table\_name

GROUP BY column1, column2, ...);