1. What is the difference between SQL and DBMS?

SQL is a language used to interact with databases.

DBMS is software used to store, retrieve, and manage data in databases.

Feature	SQL	DBMS
Definition	Language	Software
Usage	Used to query databases	Manages data storage & operations
Example	SELECT * FROM users	MySQL, Oracle, PostgreSQL

🔹 **2. What are the different types of SQL statements?**

1. **DDL (Data Definition Language)** – CREATE, ALTER, DROP
2. **DML (Data Manipulation Language)** – INSERT, UPDATE, DELETE
3. **DQL (Data Query Language)** – SELECT
4. **TCL (Transaction Control Language)** – COMMIT, ROLLBACK
5. **DCL (Data Control Language)** – GRANT, REVOKE

🔹 **3. What is the difference between WHERE and HAVING clause?**

- WHERE: Used to filter **rows before** grouping.
- HAVING: Used to filter **groups after** aggregation.

Example:

sql

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SELECT department, COUNT(*)

FROM employees

WHERE salary > 30000

GROUP BY department

HAVING COUNT(*) > 5;

🔹 **4. What is normalization? Why is it needed?**

Normalization is the process of organizing data to avoid redundancy and improve data integrity.

Benefits:

- Removes duplicate data
- Reduces update anomalies
- Saves storage

🔹 **5. Explain 1NF, 2NF, and 3NF.**

- **1NF:** Atomic values (no repeating groups)
- **2NF:** 1NF + no partial dependency
- **3NF:** 2NF + no transitive dependency

🔹 **6. What is a primary key and foreign key?**

- **Primary Key**: Uniquely identifies each record. Cannot be null.
- **Foreign Key**: References a primary key in another table. Maintains referential integrity.

🔹 **7. What is a JOIN in SQL? Types of JOINs?**

A JOIN combines rows from two or more tables.

Types:

- INNER JOIN
- LEFT JOIN
- RIGHT JOIN

- FULL OUTER JOIN
- CROSS JOIN

Example:

sql

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SELECT e.name, d.name

FROM employees e

JOIN departments d ON e.dept_id = d.id;

🔹 8. What is the difference between DELETE, TRUNCATE and DROP?

Command	Removes	Rollback	Affects structure
DELETE	Specific rows	Yes	No
TRUNCATE	All rows	No	No
DROP	Entire table	No	Yes

🔹 9. What is a subquery?

A query within another query.

Example:

sql

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SELECT name

FROM employees

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

🔹 10. What is indexing in SQL?

Indexing improves the speed of data retrieval.

Types:

- Single-column index
- Composite index
- Unique index

Syntax:

sql

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CREATE INDEX idx_name ON employees(name);

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

Feature	CHAR	VARCHAR
Fixed or Variable	Fixed-length	Variable-length
Storage	Allocates full length	Uses only required length
Padding	Pads with spaces	No padding

Example:

sql

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CHAR(10): 'abc '

VARCHAR(10): 'abc'

🔹 **12. What is a constraint in SQL?**

Constraints are rules applied to columns to enforce data integrity.

Types:

- NOT NULL – disallow nulls
- UNIQUE – all values must be unique
- PRIMARY KEY
- FOREIGN KEY
- CHECK – condition validation
- DEFAULT – sets a default value

🔹 13. What is a view in SQL?

A **view** is a virtual table created using a SQL SELECT query.

Syntax:

sql

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CREATE VIEW emp_dept AS

SELECT e.name, d.name

FROM employees e JOIN departments d ON e.dept_id = d.id;

🔹 14. What is a stored procedure?

A stored procedure is a group of SQL statements stored in the database and executed together.

Example:

sql

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CREATE PROCEDURE GetEmployee()

AS

BEGIN

  SELECT * FROM employees;

END;

Call using:

sql

CopyEdit

EXEC GetEmployee;

🔹 15. What is a trigger in SQL?

A **trigger** is an automatic action performed in response to certain events on a table (INSERT, UPDATE, DELETE).

Example:

sql

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CREATE TRIGGER before_insert

BEFORE INSERT ON employees

FOR EACH ROW

BEGIN

SET NEW.created_at = NOW();

END;

🔹 16. What is a transaction in SQL?

A **transaction** is a sequence of operations performed as a single unit.

Properties (ACID):

- **Atomicity**
- **Consistency**
- **Isolation**
- **Durability**

Commands:

sql

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BEGIN;

UPDATE account SET balance = balance - 100 WHERE id = 1;

UPDATE account SET balance = balance + 100 WHERE id = 2;

COMMIT;

🔹 17. What is the difference between UNION and UNION ALL?

- UNION: Removes duplicates
- UNION ALL: Includes duplicates

Example:

sql

CopyEdit

SELECT name FROM employees

UNION

SELECT name FROM managers;

🔹 18. What is denormalization?

Denormalization is the process of adding redundancy to improve read performance (opposite of normalization).

Used in:

- Reporting
- Analytical databases
- Data Warehouses

🔹 **19. What is the difference between clustered and non-clustered index?**

Feature	Clustered Index	Non-Clustered Index
Order	Sorts data physically	Logical pointer to data
Count	One per table	Multiple per table
Performance	Faster for range queries	Faster for random lookups

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🔹 **20. What is the difference between EXISTS and IN?**

- **IN**: compares a value to a list
- **EXISTS**: checks for existence of rows in a subquery

Example using EXISTS:

sql

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```
SELECT name
FROM employees e
WHERE EXISTS (
 SELECT 1 FROM departments d WHERE d.id = e.dept_id
);
```

21. What is normalization? Why is it important?

Normalization is the process of organizing data to reduce redundancy and improve data integrity.

Normal Forms:

- **1NF:** Atomic columns (no repeating groups)
- **2NF:** 1NF + no partial dependency

- **3NF:** 2NF + no transitive dependency

Example:
Before normalization:

EmpID Name Dept1 Dept2

After 1NF:

EmpID Name Dept

🔹 22. What is a subquery in SQL?

A **subquery** is a query nested inside another query.

Example:

sql

CopyEdit

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

🔹 23. What are aggregate functions in SQL?

Aggregate functions perform a calculation on a set of values and return a single value.

Common functions:

- COUNT()
- SUM()
- AVG()
- MIN()
- MAX()

Example:

sql

CopyEdit

SELECT COUNT(*) FROM employees;

🔹 **24. What is the difference between DELETE, TRUNCATE, and DROP?**

Operation	Description	Rollback	Affects Structure
DELETE	Removes rows (with WHERE)	Yes	No
TRUNCATE	Removes all rows	No	No
DROP	Deletes table structure	No	Yes

🔹 **25. What is a primary key? Can a table have multiple primary keys?**

- **Primary Key**: Uniquely identifies each row.
- Only **one primary key** per table (can be composite).

Example:

sql

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```
CREATE TABLE student (
 id INT PRIMARY KEY,
 name VARCHAR(50)
);
```

🔹 **26. What is a foreign key?**

A **foreign key** links one table to another.

Example:

sql

CopyEdit

```
CREATE TABLE orders (
 id INT,
 customer_id INT,
 FOREIGN KEY (customer_id) REFERENCES customers(id)
);
```

🔹 **27. What is a self join?**

A **self join** joins a table with itself.

Example:

sql

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```
SELECT A.name, B.name
FROM employees A, employees B
WHERE A.manager_id = B.id;
```

🔹 **28. What is an alias in SQL?**

An **alias** is a temporary name for a table or column.

Example:

sql

CopyEdit

```
SELECT e.name AS employee_name
FROM employees e;
```

🔹 **29. What is the difference between HAVING and WHERE?**

- **WHERE**: Filters rows **before** aggregation

- **HAVING**: Filters groups **after** aggregation

Example:

sql

CopyEdit

SELECT dept, COUNT(*)

FROM employees

GROUP BY dept

HAVING COUNT(*) > 5;

🔹 30. What is indexing in SQL?

Index improves the speed of data retrieval.

Types:

- **Primary Index**
- **Unique Index**
- **Composite Index**
- **Full-Text Index**

Example:

sql

CopyEdit

CREATE INDEX idx_name ON employees(name);