

Basic ADBMS Concepts

1. **Q: What is ADBMS?**

A: ADBMS stands for Advanced Database Management System, which extends traditional DBMS concepts with advanced functionalities like distributed databases, object-oriented databases, data warehousing, and NoSQL databases.

2. **Q: Differentiate between DBMS and ADBMS.**

A: DBMS focuses on basic database operations, while ADBMS incorporates advanced features like distributed databases, data replication, and complex data structures.

3. **Q: What is a distributed database?**

A: A distributed database is a collection of data stored at different physical locations, which can be accessed and managed as a single logical database.

4. **Q: What is data fragmentation?**

A: Data fragmentation is the process of breaking a database into smaller pieces (fragments) to be stored at different locations.

5. **Q: Explain horizontal and vertical fragmentation.**

A: Horizontal fragmentation splits rows of a table, while vertical fragmentation splits columns.

Normalization and Design

6. **Q: What is normalization?**

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

7. **Q: Define 1NF, 2NF, and 3NF.**

A:

- 1NF: Removes duplicate columns; each column contains atomic values.
- 2NF: Achieves 1NF and removes partial dependencies.
- 3NF: Achieves 2NF and removes transitive dependencies.

8. **Q: What is denormalization?**

A: Denormalization is the process of adding redundancy to improve database read performance.

9. **Q: What is a surrogate key?**

A: A surrogate key is a unique, system-generated identifier used as a primary key.

10. **Q: Define functional dependency.**

A: A functional dependency occurs when one attribute uniquely determines another attribute.

SQL and Query Execution

Q: Write a query to find the second highest salary from a table.

A:

```
SELECT MAX(salary)
```

```
FROM employee
```

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

11.

12. **Q: What is the difference between **HAVING** and **WHERE**?**

A: **WHERE** filters rows before grouping, while **HAVING** filters groups after grouping.

13. **Q: What is a self-join?**

A: A self-join is a join where a table is joined with itself.

Q: How do you create a view in SQL?

A:

```
CREATE VIEW view_name AS
```

```
SELECT column1, column2 FROM table_name;
```

14.

15. **Q: What are indexes in SQL?**

A: Indexes are database structures that improve the speed of data retrieval.

Transactions and Concurrency

16. **Q: What is a transaction?**

A: A transaction is a sequence of database operations executed as a single logical unit.

17. **Q: Explain ACID properties.**

A:

- **Atomicity:** Transactions are all-or-nothing.
- **Consistency:** Transactions bring the database from one valid state to another.
- **Isolation:** Transactions do not interfere with each other.
- **Durability:** Committed transactions are permanent.

18. **Q: What is a deadlock?**

A: A deadlock occurs when two or more transactions are waiting for each other's resources indefinitely.

19. **Q: Explain the two-phase locking protocol.**

A: It ensures serializability by having two phases: growing (locks are acquired) and shrinking (locks are released).

20. **Q: What is a dirty read?**

A: A dirty read occurs when a transaction reads uncommitted data from another transaction.

Advanced SQL

Q: Write a query to find employees who earn more than the average salary.

A:

SELECT *

FROM employee

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

21.

22. **Q: What is the purpose of GROUP BY?**

A: **GROUP BY** groups rows sharing a property and allows aggregate functions like SUM, AVG, etc.

23. **Q: Differentiate between INNER JOIN and OUTER JOIN.**

A: **INNER JOIN** returns matching rows, while **OUTER JOIN** includes unmatched rows

with **NULL**.

24. Q: What is a trigger in SQL?

A: A trigger is a stored procedure that automatically executes in response to certain events.

25. Q: What is a stored procedure?

A: A stored procedure is a precompiled set of SQL statements stored in the database.

PL/SQL and Programming

26. Q: What is the difference between a procedure and a function in PL/SQL?

A: A procedure does not return a value, while a function returns a value.

Q: Write a PL/SQL block to display employee details.

A:

```
BEGIN
```

```
FOR rec IN (SELECT * FROM employee) LOOP
```

```
    DBMS_OUTPUT.PUT_LINE(rec.emp_name || ' - ' || rec.salary);
```

```
END LOOP;
```

```
END;
```

27.

28. Q: What is an exception in PL/SQL?

A: An exception is an error condition in PL/SQL that can be handled using exception-handling blocks.

29. Q: Explain the **MERGE statement.**

A: The **MERGE** statement performs **INSERT**, **UPDATE**, or **DELETE** based on a condition.

30. Q: What is a cursor in PL/SQL?

A: A cursor is a pointer to a result set of a query.

NoSQL and New Technologies

31. Q: What is NoSQL?

A: NoSQL refers to non-relational databases designed for scalability and unstructured data.

32. Q: Name some types of NoSQL databases.

A: Document-based (MongoDB), Key-value (Redis), Column-family (Cassandra), and Graph (Neo4j).

33. Q: What is CAP theorem?

A: CAP theorem states that a distributed system can only guarantee two of the following: Consistency, Availability, and Partition tolerance.

34. Q: Differentiate between MongoDB and MySQL.

A: MongoDB is schema-less and document-based, while MySQL is a relational database with a fixed schema.

35. Q: What is sharding in NoSQL?

A: Sharding is the process of splitting data into smaller pieces for horizontal scaling.

Data Warehousing and Mining

36. Q: What is a data warehouse?

A: A data warehouse is a centralized repository of integrated data from multiple sources, designed for analysis and reporting.

37. Q: What is OLAP?

A: Online Analytical Processing (OLAP) enables multidimensional analysis of data.

38. Q: What is a star schema?

A: A star schema is a data warehouse schema with a central fact table connected to dimension tables.

39. Q: What is data mining?

A: Data mining involves discovering patterns and insights from large datasets.

40. Q: Name some common data mining techniques.

A: Classification, clustering, association rule mining, and regression.

Security and Miscellaneous

41. Q: What is SQL injection?

A: SQL injection is a code injection technique used to exploit vulnerabilities in SQL query execution.

42. Q: How can you prevent SQL injection?

A: Use parameterized queries, stored procedures, and input validation.

43. Q: What is database replication?

A: Database replication involves copying and maintaining database instances across multiple locations.

44. Q: What is a role in database security?

A: A role is a collection of permissions that can be granted to users.

45. Q: What is data masking?

A: Data masking hides sensitive data to protect it from unauthorized access.

Practical Scenarios

46. Q: How would you optimize a slow-running query?

A: Use indexes, avoid SELECT *, rewrite subqueries, and analyze execution plans.

47. Q: Explain the purpose of a database checkpoint.

A: A checkpoint saves the current state of the database to ensure recovery after a crash.

48. Q: What is the difference between TRUNCATE and DELETE?

A: TRUNCATE removes all rows quickly without logging, while DELETE allows row-specific deletions and logging.

49. Q: What is the use of the EXPLAIN command?

A: The EXPLAIN command displays the execution plan of a query.

50. Q: How do you back up a database?

A: Use database-specific commands or tools like mysqldump (MySQL) or pg_dump (PostgreSQL).

Parallel Database Systems

1. What is a parallel database system?

A parallel database system uses multiple processors and storage devices to perform database operations simultaneously for better performance and scalability.

2. What are the types of parallelism in databases?

- **Inter-query parallelism:** Executes multiple queries concurrently.
- **Intra-query parallelism:** Executes a single query using multiple processors.
- **Intra-operation parallelism:** Parallel execution within an operation like sorting.
- **Inter-operation parallelism:** Parallel execution of different operations in a query.

3. What is partitioning in parallel databases?

Partitioning divides a database table into smaller parts to distribute the data across multiple nodes for parallel processing.

4. What are the types of partitioning?

- Horizontal Partitioning
- Vertical Partitioning
- Hash Partitioning
- Range Partitioning

5. Name a key advantage of parallel databases.

Improved query performance due to distributed workload across processors.

6. What is a shared-nothing architecture?

A parallel database architecture where each node has its own processor, memory, and disk, ensuring no shared resources among nodes.

7. What challenges are associated with parallel databases?

- Data skew
- Communication overhead
- Fault tolerance

8. How is load balancing achieved in parallel databases?

By evenly distributing data and queries across processors to prevent bottlenecks.

Distributed Database Systems

9. What is a distributed database?

A distributed database is a database where data is stored across multiple locations connected by a network.

10. What are the components of a distributed database system?

- Database nodes
- Network
- Distributed DBMS

11. What are the types of distributed databases?

- Homogeneous distributed database
- Heterogeneous distributed database

12. What is data fragmentation?

Breaking down a database into smaller fragments to store them at different locations.

13. What are the types of data fragmentation?

- Horizontal fragmentation
- Vertical fragmentation
- Mixed fragmentation

14. Define data replication in distributed databases.

Data replication involves copying data to multiple locations to ensure availability and fault tolerance.

15. What are the advantages of distributed databases?

- Improved reliability
- Faster data access
- Scalability

16. What are the challenges of distributed databases?

- Data consistency
- Communication failures
- Complex query optimization

17. Explain CAP theorem in distributed databases.

The CAP theorem states that a distributed system can achieve at most two of the following three properties: Consistency, Availability, and Partition Tolerance.

18. What is a two-phase commit protocol (2PC)?

A protocol ensuring transaction atomicity in distributed databases by using two phases: prepare and commit.

Object-Relational Database Management Systems (ORDBMS)

19. What is ORDBMS?

ORDBMS combines the features of relational databases with object-oriented programming, allowing complex data types and object behavior.

20. What are the key features of ORDBMS?

- Support for complex data types
- Inheritance
- User-defined types (UDTs)
- Extensibility

21. How does ORDBMS differ from RDBMS?

ORDBMS supports objects, user-defined data types, and methods, whereas RDBMS supports only predefined data types.

22. Name an example of ORDBMS software.

PostgreSQL.

23. What is a user-defined type (UDT)?

A custom data type created by users in ORDBMS to model real-world entities.

24. What is the role of inheritance in ORDBMS?

It allows new types or classes to inherit properties and methods from existing types.

25. What are the advantages of ORDBMS?

- Better handling of complex data
- Object-oriented capabilities
- Backward compatibility with RDBMS

Object-Oriented Database Management Systems (OODBMS)

26. What is OODBMS?

OODBMS stores data as objects, similar to object-oriented programming, supporting inheritance, polymorphism, and encapsulation.

27. What are the key features of OODBMS?

- Object identity
- Complex objects

- Encapsulation
- Inheritance
- Polymorphism

28. What is object identity in OODBMS?

Every object in OODBMS has a unique identifier that does not change over its lifetime.

29. How does OODBMS differ from ORDBMS?

OODBMS is purely object-oriented, while ORDBMS combines relational and object-oriented features.

30. What are the advantages of OODBMS?

- Seamless integration with object-oriented programming
- Better handling of complex data structures
- Faster access to objects

31. Name some examples of OODBMS.

ObjectDB, db4o, Versant.

32. What are the disadvantages of OODBMS?

- Lack of standardization
- Steep learning curve

Data Warehousing

33. What is a data warehouse?

A data warehouse is a centralized repository that stores historical data from multiple sources for analytical purposes.

34. What are the characteristics of a data warehouse?

- Subject-oriented
- Integrated
- Non-volatile
- Time-variant

35. What are the components of a data warehouse?

- Data sources
- ETL process (Extract, Transform, Load)
- Data storage
- Query and reporting tools

36. What is ETL in data warehousing?

ETL stands for Extract, Transform, Load, which is the process of extracting data from sources, transforming it into a suitable format, and loading it into the data warehouse.

37. What is a fact table?

A central table in a data warehouse containing quantitative data (measures) for analysis.

38. What is a dimension table?

A table in a data warehouse containing descriptive attributes related to the fact table.

39. What are the types of schemas in a data warehouse?

- Star schema
- Snowflake schema
- Galaxy schema

40. What are the advantages of a data warehouse?

- Improved decision-making
 - High query performance
 - Consolidation of data
-

Online Analytical Processing (OLAP)**41. What is OLAP?**

OLAP (Online Analytical Processing) enables multidimensional analysis of data stored in a data warehouse.

42. What are the types of OLAP systems?

- ROLAP (Relational OLAP)
- MOLAP (Multidimensional OLAP)
- HOLAP (Hybrid OLAP)

43. What is a data cube?

A data cube is a multi-dimensional array of data used in OLAP for analysis.

44. What is slicing in OLAP?

Slicing selects a single dimension from the data cube for analysis.

45. What is dicing in OLAP?

Dicing creates a sub-cube by selecting multiple dimensions and ranges.

46. What is drill-down in OLAP?

Drill-down allows users to navigate from summarized data to more detailed data.

47. What is roll-up in OLAP?

Roll-up summarizes data by climbing up a hierarchy or combining dimensions.

48. What is the difference between OLAP and OLTP?

- OLAP is designed for analytical queries, while OLTP is for transactional queries.
- OLAP deals with historical data; OLTP handles real-time data.

49. Name some OLAP tools.

- Tableau
- Microsoft Power BI
- IBM Cognos

50. What are the challenges in OLAP?

- Handling large volumes of data
- Maintaining data cube performance