# Database Management Systems

**Database Basics:**

1. What is a database?
2. Define DBMS and its role.
3. Differentiate between DBMS and RDBMS.
4. Explain the ACID properties in the context of databases.
5. What is normalization, and why is it important?
6. Define denormalization and its advantages.
7. Explain the concept of data integrity.
8. Differentiate between primary key and foreign key.

**Relational Database Concepts:**

1. What is a relation in a relational database?
2. Define a tuple and attribute in the context of a relation.
3. Explain the difference between a candidate key and a primary key.
4. Describe the purpose of the UNIQUE constraint.
5. What is a composite key?
6. Explain the concept of a foreign key and its role in maintaining referential integrity.
7. Define the terms "super key," "candidate key," and "primary key."

**SQL Queries:**

1. Write a SQL query to retrieve all columns from a table named "employees."
2. Explain the differences between the SQL commands SELECT, INSERT, UPDATE, and DELETE.
3. What is the purpose of the GROUP BY clause in SQL?
4. Describe the purpose of the HAVING clause in SQL.
5. Explain the difference between INNER JOIN and LEFT JOIN.
6. Write a SQL query to find the second-highest salary in a table named "salaries."
7. How is the SQL ORDER BY clause used?
8. What is the purpose of the SQL DISTINCT keyword?
9. Explain the use of the SQL LIKE operator.

**Database Design:**

1. What is the process of database normalization?
2. Describe the advantages and disadvantages of denormalization.
3. What is ER modeling, and how is it used in database design?
4. Explain the concept of functional dependency.
5. Define the terms "first normal form" and "second normal form."
6. How do you eliminate duplicate data in a database?

**Transactions and Concurrency Control:**

1. What is a database transaction?
2. Explain the ACID properties of transactions.
3. Describe the concept of isolation levels in database transactions.
4. How does locking help in managing concurrent transactions?
5. What is a deadlock in the context of databases?
6. Explain the role of the COMMIT and ROLLBACK statements in transactions.

**Indexing and Query Optimization:**

1. Define database indexing.
2. What is the purpose of a clustered index?
3. Explain the concept of query optimization.
4. Describe the advantages and disadvantages of indexing.
5. How does indexing impact the performance of SELECT queries?
6. What is the difference between a primary index and a secondary index?

**Data Security and Integrity:**

1. Explain the importance of data integrity in a database.
2. What is the purpose of the CHECK constraint in SQL?
3. Describe the concept of database views and their role in security.
4. How can you secure sensitive data in a database?
5. Define the terms "authentication" and "authorization" in the context of databases.
6. What is role-based access control (RBAC)?

**NoSQL Databases:**

1. Compare and contrast SQL and NoSQL databases.
2. What are the key characteristics of a NoSQL database?
3. Explain the CAP theorem and its relevance to NoSQL databases.
4. Describe the types of NoSQL databases.
5. What is eventual consistency in NoSQL databases?

**Database Connectivity:**

1. Explain the concept of ODBC and JDBC.
2. What is the purpose of a database connection pool?
3. Describe the role of a database driver in connectivity.
4. How do you handle connection pooling in a web application?

**Data Warehousing:**

1. Define data warehousing.
2. Explain the difference between OLAP and OLTP.
3. What is a star schema in data warehousing?
4. Describe the purpose of data marts.
5. Explain the concept of ETL (Extract, Transform, Load) in data warehousing.

**Backup and Recovery:**

1. Why is database backup essential?
2. Describe the different types of database backups.
3. Explain the concept of point-in-time recovery.
4. What is a transaction log, and how is it used in recovery?
5. Describe the steps involved in restoring a database.

**Data Modeling:**

1. What is a conceptual data model?
2. Explain the difference between a logical and a physical data model.
3. Define the terms "entity," "attribute," and "relationship" in data modeling.
4. How is normalization related to data modeling?
5. Explain the purpose of a data dictionary in data modeling.

**Data Mining and Business Intelligence:**

1. Define data mining and its applications.
2. Explain the role of business intelligence in decision-making.
3. What is a data warehouse, and how does it support business intelligence?
4. Describe the concept of data cubes in data warehousing.

**Distributed Databases:**

1. What is a distributed database?
2. Explain the advantages and challenges of distributed databases.
3. Describe the concept of transparency in distributed databases.
4. How does replication enhance fault tolerance in distributed databases?

**Data Compression and Encryption:**

1. Why is data compression used in databases?
2. Explain the concept of data encryption.
3. Describe the differences between symmetric and asymmetric encryption.
4. How does encryption contribute to database security?

**XML and JSON in Databases:**

1. What is the purpose of XML in databases?
2. Describe the structure of a JSON document.
3. How are XML and JSON used for data interchange in databases?
4. Explain the concept of XPath in the context of XML.

**Cloud Databases:**

1. What are the advantages of using cloud databases?
2. Explain the concept of database as a service (DBaaS).
3. Describe the challenges and considerations of migrating to a cloud database.

**Emerging Trends in Databases:**

1. Explain the concept of blockchain in databases.
2. What is the role of machine learning in database management?
3. Describe the impact of IoT on database systems.
4. How does edge computing influence database architecture?

**Case-Based Questions:**

1. Given a scenario, design a database schema to represent the information efficiently.
2. Discuss the considerations for choosing between a relational and a NoSQL database for a specific application.
3. Explain how you would optimize a slow-performing SQL query.
4. Describe a situation where database transactions and concurrency control are crucial.
5. Given a business requirement, discuss the steps involved in designing a data warehouse.