

Bihar Engineering University, Patna

B.Tech. 5th Semester Examination, 2023

Course: B.Tech.

Code: 105502

Subject: Database Management Systems

Time: 03 Hours

Full Marks: 70

Instructions:-

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

Q.1 Choose the correct answer to the following (Any seven questions only):

[2 × 7 = 14]

- (a) Which of the following is not a key property of a database?
(i) Redundancy (ii) Consistency
(iii) Integrity (iv) Security
- (b) Which SQL command is used to retrieve data from a database?
(i) FETCH (ii) EXTRACT
(iii) SELECT (iv) SEARCH
- (c) What is a view in a database?
(i) A virtual table based on the result of a SQL query
(ii) A physical table containing data
(iii) A table created temporarily during database operations
(iv) A table that stores metadata information
- (d) Which SQL command is used to retrieve data from multiple tables?
(i) JOIN (ii) MERGE
(iii) COMBINE (iv) LINK
- (e) What is a foreign key in a relational database?
(i) A key that uniquely identifies each row in a table
(ii) A key that references the primary key of another table
(iii) A key that is composed of multiple columns
(iv) A key that is used for encryption
- (f) Which of the following SQL statements is used to add a new column to an existing table?
(i) ALTER TABLE (ii) MODIFY TABLE
(iii) ADD COLUMN (iv) UPDATE TABLE
- (g) What is the purpose of indexing in a database?
(i) To ensure data integrity (ii) To reduce redundancy
(iii) To improve query performance (iv) To enforce referential integrity
- (h) Which normalization form is based on the transitive dependency?
(i) First Normal Form (1NF) (ii) Second Normal Form (2NF)
(iii) Third Normal Form (3NF) (iv) BCNF
- (i) Which SQL command removes (or deletes) a relation from the database?
(i) DELETE (ii) REMOVE
(iii) DROP (iv) ROLLBACK
- (j) In an ER diagram, what does a double diamond represent?
(i) A mandatory relationship (ii) A weak relationship
(iii) A derived attribute (iv) A strong relationship

Q.2 (a) Define a database and explain its role in modern information systems. Discuss the advantages of using a database over traditional file-based systems. [7]

(b) Design an Entity-Relationship (ER) diagram for the university database system. The database should store information about students, courses, instructors, departments, and enrollment details. Include appropriate entities, attributes, relationships, and cardinality constraints in your ER diagram. Additionally, explain the rationale behind your design decisions and discuss any assumptions made during the design process. [7]

- Q.3** (a) Describe the concept of integrity constraints in a relational database. Explain different types of integrity constraints using examples. [7]
- (b) Explain the concept of candidate keys in the relational model. Discuss the significance of identifying candidate keys during the database design process. How candidate keys differ from primary keys and foreign keys in a relational database? [7]
- Q.4** Consider a database schema for a university with the following relations:
 Student (StudentID, Name, GPA)
 Course (CourseID, Title, Department)
 Enrollment (EnrollmentID, StudentID, CourseID, Grade)
 Professor (ProfessorID, Name, Department)
- (a) Define relational algebra and discuss its significance in database management systems. [2]
- (b) Discuss the selection operation in relational algebra. Provide an example query using the selection operation on the Student relation to retrieve students with a GPA greater than 3.5. [3]
- (c) Describe the projection operation in relational algebra. Provide an example query using the projection operation to retrieve only the names of students from the Student relation. [3]
- (d) Explain the join operation in relational algebra, including its various types. Provide an example query using the join operation to find the names of students along with the titles of courses they are enrolled in. [4]
- (e) Write the advantages and limitations of relational algebra as a formal language for querying relational databases compared to SQL. [2]
- Q.5** (a) Why normalization is essential in database design? Explain the concept of first normal form (1NF), second normal form (2NF), and third normal form (3NF) with an example. [10]
- (b) Give a relation R(P, Q, R, S, T, U) and a set of Functional Dependency $FD = \{ PQ \rightarrow R, R \rightarrow S, Q \rightarrow PT \}$. Calculate the candidate key/keys in the above relation R using a given set of FDs. [4]
- Q.6** (a) Explain the following SQL statements with an example. [8]
 i). Update ii). Select iii). Alter iv). Group by
- (b) Explain various aggregate functions in SQL with an example. [6]
- Q.7** (a) What is concurrency control? Explain the two-phase locking protocol with an example. [7]
- (b) What is database Recovery? Explain 'shadow paging' in detail. [7]
- Q.8** (a) Explain the concept of dynamic multilevel indexing using B+ trees and discuss its advantages over other indexing methods. [7]
- (b) Define serializability in database scheduling and explain its importance. Describe conflict serializability and view serializability with examples. How can you test if a schedule is serializable? [7]
- Q.9** Write a short note on the following: [3½×4=14]
 (a) Authentication in database
 (b) SQL injection
 (c) Distributed databases
 (d) Query optimization