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| **SESSION** | **APRIL 2025** |
| **PROGRAM** | **BACHELOR OF COMPUTER APPLICATIONS (BCA)** |
| **SEMESTER** | **3** |
| **COURSE CODE & NAME** | **DCA2102 DATABASE MANAGEMENT SYSTEM** |
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**Set – I**

**Q1. a. Differentiate between the levels of the three-schema architecture of DBMS.**

**b. What do you mean by cardinality? Explain the different types of cardinalities in RDBMS? 5+2+3**

**Ans 1.**

**a. Levels of the Three-Schema Architecture of DBMS**

**Three-Schema Architecture**

The three-schema architecture is a widely accepted framework in database management that separates the database system into three different layers—internal, conceptual, and external. This layered structure enhances data abstraction, provides better security, and supports data independence.

Internal Level

The internal level, also known as the physical schema, describes how the data is physically

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**Q2. Define the concepts of Entity Integrity Constraint and Referential Integrity Constraint. Analyse their significance in maintaining database consistency and illustrate each with appropriate examples. 5+5**

**Ans 2.**

**Entity Integrity and Referential Integrity Constraints**

**Entity Integrity Constraint**

The entity integrity constraint ensures that every table in a relational database has a primary key, and that this key must not contain null values. The primary key uniquely identifies each record in the table, making it critical for distinguishing one row from another.

For instance, consider a STUDENTS table where StudentID is the primary key. Entity

**Q3. Organize the SQL features of RDBMS based on their role in ensuring data consistency and transactional integrity, and analyse how each contributes to fulfilling the ACID properties.es 5+5**

**Ans 3.**

**SQL Features of RDBMS and Their Role in Data Consistency and Transactional Integrity**

**SQL Features in RDBMS**

Structured Query Language (SQL) is the standard language used in relational database management systems (RDBMS) for managing and manipulating data. It provides a set of powerful features that help ensure data consistency, integrity, and reliable transaction processing. These features include Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL), and Transaction Control Language (TCL).

**Set – II**

**4. Demonstrate the use of various relational algebra operations by applying them to sample relations and illustrating the output for each operation. 5+5**

**Ans 4.**

**Relational Algebra Operations with Sample Relations and Outputs**

**Relational Algebra**

Relational algebra is a formal system for manipulating relations in a relational database. It provides a set of operations to retrieve, combine, and manipulate data stored in tables (relations). These operations form the foundation of query languages like SQL. The primary operations include selection, projection, union, set difference, Cartesian product, and join.

**Sample Relations for Illustration**

Let us consider two sample relations:

**Q5. What do you mean by Normalization? Explain the different Normal Forms with the help of a suitable example. 2+8**

**Ans 5.**

**Normalization and Different Normal Forms**

**Normalization**

Normalization is a systematic approach used in database design to reduce redundancy and dependency by organizing fields and table relationships. Its main objective is to divide larger tables into smaller, manageable, and related ones while ensuring that data remains logically stored and consistently retrievable. It simplifies updates, deletions, and insertions while maintaining data integrity.

**First Normal Form (1NF)**

A relation is in First Normal Form when all its attributes contain only atomic values, meaning

**Q6. Examine various query optimization techniques and heuristics and assess their influence on query execution cost and system performance in large databases. 2+6+2**

**Ans 6.**

**Query Optimization Techniques and Their Impact on Performance**

**Query Optimization**

Query optimization is a critical function in a database management system that focuses on improving the efficiency of SQL query execution. The objective is to reduce the response time and cost associated with accessing and manipulating data. As databases grow larger, poorly written or unoptimized queries can significantly impact performance.

**Heuristic-Based Optimization**

Heuristic optimization involves applying **predefined rules** or techniques to rewrite a query