FOURTH SEMESTER (CBCSS–UG) DEGREE EXAMINATION APRIL 2024

BCA4B05 / BCS4B05 — DATABASE MANAGEMENT SYSTEM AND RDBMS

Time: Two and HalfHours

Maximum: 80 Marks

Section A – Short Answer Type Questions

(Each question carries 2 marks. Ceiling: 20 marks)

List the advantages and applications of DBMS.
Advantages:

- Data redundancy control
- Data consistency
- Improved data sharing and security
- Data integrity
- Backup and recovery options

Applications:
- Banking systems
- Online shopping platforms
- Airlines and railway reservation systems
- University databases
- Hospital management systems

Define instances and schemas of database.
Instance: The set of data stored in the database at a particular moment.
Schema: The structure or design of the database, describing tables, fields, relationships, and constraints.

What are the different Relationship Sets? Explain.

- **One-to-One:** One entity is related to only one entity of another set.
- **One-to-Many:** One entity is related to many entities of another set.

- **Many-to-One:** Many entities are related to one entity of another set.
- **Many-to-Many:** Many entities are related to many entities of another set.

Define i) Super key ; ii) Candidate key.

- **Super Key:** A set of one or more attributes that uniquely identifies a record in a table.
- **Candidate Key:** A minimal super key; no proper subset can uniquely identify a tuple.

What are domain constraints?

- **Domain constraints** specify the permissible values for an attribute.
- For example, an age column may be constrained to accept only **positive integers**.

Explain about multi-valued dependencies.

- A **multi-valued dependency** occurs when one attribute in a table determines multiple values of another attribute independently of other attributes.
- It exists in cases requiring **Fourth Normal Form (4NF)**.

Define views.

- A **view** is a virtual table based on the result of an SQL query.
- It does **not store data physically** but presents data from one or more tables.

Explain deadlock and advisory lock.

- **Deadlock**: A situation where two or more transactions are waiting for each other to release locks, causing a cycle of dependencies.

- **Advisory Lock**: A user-defined lock that is cooperative; it does not enforce locking but relies on **application logic**.

What is meant by REVOKE? How is it applied?

- **REVOKE** is an SQL command used to take back privileges granted to a user.

Example:

```
sql REVOKE SELECT ON Students FROM user1;
```

What is the need for triggers?

- **Triggers** automate tasks such as **validation**, **logging**, or **enforcing rules** before or after operations like **INSERT**, **UPDATE**, or **DELETE**.

How to lock Table-level?

- Table-level locking can be done using commands like:

```
sql LOCK TABLE table_name IN [SHARE | EXCLUSIVE] MODE;
```

How to use IN operator in SQL? Explain.

- The **IN operator** is used to match a value against a list.

Example:

```
sql SELECT * FROM Students WHERE Department IN ('CS', 'IT');
```

Section B – Short Essay Type Questions

(Each question carries 5 marks. Ceiling: 30 marks)

What do you mean by Database Independence? Explain Three Schema Architecture.
Database Independence allows changes in one schema level without affecting others.

Three Schema Architecture:
- **External Level:** User views
- **Conceptual Level:** Logical structure
- **Internal Level:** Physical storage

List the different set operations. Explain each with examples.

- **UNION**: Combines results of two queries.
- **INTERSECT**: Returns common rows.
- **EXCEPT / MINUS**: Returns rows from the first query not found in the second.

Example:

```
sql SELECT name FROM A UNION SELECT name FROM B;
```

Explain about different types of integrity constraints.

- **Domain Constraint** – Valid values for a column
- **Entity Integrity** – Primary key can't be NULL
- **Referential Integrity** – Foreign key must refer to existing primary key
- **Unique Constraint** – Prevents duplicate values
- **Not Null Constraint** – Ensures value is not NULL

Define Second and Fifth Normal Form.

- **2NF (Second Normal Form)**: Removes partial dependencies; table should be in 1NF and all non-key attributes fully dependent on primary key.
- **5NF (Fifth Normal Form)**: Removes join dependencies; ensures that the relation can't be further decomposed without losing data.

What is Decomposition? What is the purpose of Decomposition in database?
Decomposition is the process of breaking a relation into smaller relations to eliminate redundancy and anomalies.

Purpose:
* Improve design
* Remove redundancy
* Prevent update, insert, and delete anomalies

Which are the modes of lock? Explain. Explain two-phase locking.
Lock Modes:

- **Shared (S) Lock**
- **Exclusive (X) Lock**

Two-Phase Locking:
* **Growing Phase**: Locks acquired, no release.
* **Shrinking Phase**: Locks released, no new locks allowed.

Ensures **serializability**.

Write about triggers and its operations in detail.
Triggers are stored procedures executed automatically in response to events on a table.

Operations:
* **BEFORE INSERT/UPDATE/DELETE**

* **AFTER INSERT/UPDATE/DELETE**

Used for validation, enforcing business rules, audit logs, etc.

Example:

```
sql CREATE TRIGGER before_insert BEFORE INSERT ON Students FOR EACH ROW BEGIN
-- Logic END;
```

Section C – Essay Type Questions

(Answer any one question. 10 marks)

Explain different relational database anomalies in a database. (5 marks)

- **Insertion Anomaly**: Difficulty adding data due to absence of other data.
- **Update Anomaly**: Inconsistent data after updates.
- **Deletion Anomaly**: Deletion of data leads to unintended loss of additional data.

b. List different data models and explain each. (5 marks)

- **Hierarchical Model**: Tree-like structure.
- **Network Model**: Graph-like structure with multiple parent-child.
- **Relational Model**: Data in tables with rows and columns.
- **Object-Oriented Model**: Stores objects as in programming languages.
- **Entity-Relationship Model**: Graphical representation of entities and relationships.

What Does Database Concurrency Mean? When a lost update problem occurs, how can the problems be avoided? (6 marks)

Database Concurrency: Allows multiple users to access the database simultaneously.

Lost Update Problem: Occurs when two transactions read and update the same data, and one update is lost.

Solutions:
* Two-Phase Locking
* Timestamp ordering
* Optimistic Concurrency Control

b. What are the disadvantages of file-processing system? (4 marks)

- Data redundancy
- Lack of data security
- Difficult in concurrent access
- Inconsistency and integrity issues
- No centralized control