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**Data and Database Management System**

**Module 7 - Codd's Rule for Relational DBMS**

**What are Codd's Rules in RDBMS?**

Codd's Rules are a set of **13 guidelines** proposed by Dr. E. F. Codd in 1970 to define what a true **Relational Database Management System (RDBMS)** should follow.

They help ensure that the database system is reliable, consistent, and follows the principles of the **relational model**.

Note: Although they're called **12 rules**, there are actually **13**, because they are numbered from Rule 0 to Rule 12.

**Rule 0: Foundation Rule**

**Explanation:**

A database system must manage data using only relational techniques. It must be able to store and manipulate data using tables (relations).

**Example:**

If the system uses only rows and columns (tables) and not files or hardcoded data structures, it satisfies this rule.

**Rule 1: Information Rule**

**All data must be stored in tables (relations).**

- **Explanation:** Every piece of data, whether numbers, text, or dates, is stored in rows and columns (tables). Nothing is stored outside tables.

- **Software Dev Application:**

When building a CRM or inventory system, all data (like customers, products, orders) is saved in tables. This helps maintain uniformity and makes querying easy using SQL.

**Rule 2: Guaranteed Access Rule**

**Every data item must be retrievable using table name, column name, and primary key.**

- **Explanation:** To find any specific data, you need to know the table it's in, the column name, and a unique key (primary key).

- **Software Dev Application:**

In a web app, to get a user's email, you use something like:

```
SELECT email FROM users WHERE user_id = 123;
```

This ensures you can directly and efficiently access the needed data.

**Rule 3: Systematic Treatment of Null Values**

**The DBMS must support nulls (missing/unknown values) uniformly.**

- **Explanation:** Sometimes data is missing or not applicable. The database should have a standard way to represent this, called NULL.

- **Software Dev Application:**

In an employee management system, if an employee's middle name is not

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provided, the system stores NULL instead of an empty string, so queries know the data is missing.

**Rule 4: Dynamic Online Catalog Based on the Relational Model**

The database metadata (data about data) is stored in tables and can be queried.

- **Explanation:** Information about the tables, columns, and constraints is stored as tables themselves and can be accessed using normal queries.

- **Software Dev Application:**

Developers can write scripts to automatically read database schema or generate reports, helping with database maintenance and migration.

**Rule 5: Comprehensive Data Sublanguage Rule**

There must be at least one language that supports all database operations like defining, updating, and querying data.

- **Explanation:** SQL is an example— you can create tables, insert data, modify, delete, and query all with one language.

- **Software Dev Application:**

Backend developers use SQL to perform all operations, ensuring the app can create and manage data seamlessly.

**Rule 6: View Updating Rule**

All views (virtual tables) must be updatable if they represent data that can be updated.

- **Explanation:** If you create a view (like a filtered or joined table), you should still be able to update data through that view.

- **Software Dev Application:**

An admin panel may show a filtered list of users, and when editing a user's info in that view, changes should reflect in the underlying tables.

**Rule 7: High-Level Insert, Update, and Delete**

The DBMS must support set-based operations, not just one row at a time.

- **Explanation:** You can add, modify, or remove multiple rows with a single command.

- **Software Dev Application:**

A bulk upload feature in an app can insert hundreds of records at once with a single SQL statement instead of one-by-one.

**Rule 8: Physical Data Independence**

Changes to physical storage (like file format or indexing) should not affect application programs.

- **Explanation:** Developers don't need to change their code if the database storage method changes.

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• **Software Dev Application:**

If the DBA changes the index structure to speed up queries, the app keeps working without any code change.

**Rule 9: Logical Data Independence**

Changes to logical structure (like adding new columns) should not affect applications that don't use those changes.

• **Explanation:** You can modify the table design without breaking existing programs that don't rely on the changes.

• **Software Dev Application:**

Adding a new column "last\_login\_time" to the users table won't affect modules that don't use that data.

**Rule 10: Integrity Independence**

Integrity rules (like primary keys, foreign keys) must be stored in the database and managed by the DBMS.

• **Explanation:** The DBMS enforces data validity, so applications don't have to.

• **Software Dev Application:**

The database prevents inserting a user with duplicate user\_id, ensuring data consistency automatically.

**Rule 11: Distribution Independence**

The database should work the same whether it's stored on one machine or distributed across multiple servers.

• **Explanation:** Users and apps don't need to know where the data physically resides.

• **Software Dev Application:**

In a cloud app, data might be distributed geographically but accessed seamlessly through the same queries.

**Rule 12: Non-Subversion Rule**

No way should exist to bypass the relational rules and manipulate data directly.

• **Explanation:** All data access must go through the relational language (like SQL), not through hidden paths.

• **Software Dev Application:**

Security is maintained because all data manipulation is controlled, preventing unauthorized access or changes.

**Assignment**

Q1. Which rule says that every piece of data must be stored in rows and columns?

- A) Rule 0
- B) Rule 1 - Information Rule

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- C) Rule 2 - Access Rule  
D) Rule 5 - Sublanguage Rule

Q2. What does Rule 6 (View Updating Rule) state?

- A) Views cannot be changed  
B) Views must always be read-only  
C) Updatable views should allow data changes  
D) Views must not show NULL values

Q3. Your school stores student records in a table. You search for a student's email by knowing their roll number. Which Codd's rule is used here?

Q4. A developer added a new column "profile\_picture" to the student table. Old applications still work without crashing. Which rule is shown here?

