Normalization Analysis of EventRegistrationDB

1. Introduction

In our EventRegistrationDB, we have carefully structured the tables to maintain data integrity, reduce redundancy, and optimize performance. To ensure this, we examined the database normalization up to Boyce-Codd Normal Form (BCNF). This document thoroughly analyzes each level of normalization applied to our database: 1NF, 2NF, 3NF, and BCNF.

The database consists of the following main tables:

- Users
- Events
- Registrations
- Payments

We will now explore how each table adheres to the rules of different normal forms.

2. First Normal Form (1NF)

A relation is in 1NF if:

- All attributes contain only atomic (indivisible) values.
- Each record is unique.

In our EventRegistrationDB:

- All fields in Users, Events, Registrations, and Payments contain atomic values.
- There are no repeating groups or arrays.
- Every record is uniquely identified using primary keys like user_id, event_id, etc.

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Therefore, we confirm that our database is in First Normal Form.

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3. Second Normal Form (2NF)

A relation is in 2NF if:

- It is in 1NF.

- Every non-prime attribute is fully functionally dependent on the whole primary key.

In our database:

- Registrations table uses a composite key (user_id, event_id).

- Attributes like registration_date, status depend fully on both user_id and event_id, not partially.

- No partial dependencies exist in the other tables as well since they have single-column primary keys.

Thus, our database satisfies Second Normal Form.

4. Third Normal Form (3NF)

A relation is in 3NF if:

- It is in 2NF.

- It contains no transitive dependencies (i.e., non-prime attributes do not depend on other non-prime attributes).

In our tables:

- Users table: name, email, role depend only on user_id.

- Events table: name, venue, start_time, etc. depend only on event_id.

- Registrations and Payments tables follow similar structure with no transitive dependencies.

Hence, we confirm our database is in Third Normal Form.

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5. Boyce-Codd Normal Form (BCNF)

A relation is in BCNF if:

- It is in 3NF.

- For every non-trivial functional dependency X -> Y, X is a superkey.

In our EventRegistrationDB:

- All functional dependencies have superkeys on the left-hand side.

- No anomalies exist due to alternate candidate keys.

Therefore, we affirm that our database is also in Boyce-Codd Normal Form.

We have effectively designed our database schema with normalization principles in mind, ensuring data consistency, minimizing redundancy, and maintaining integrity across all operations.