# 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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## 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.