

ChessDB Application Report

Schema Refinement and Normalization

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1 Functional Dependencies and BCNF Analysis

We list the main relations in the database and analyze their non-trivial functional dependencies (FDs). For each relation, we discuss whether it satisfies Boyce-Codd Normal Form (BCNF).

USER(username, password, name, surname, nationality, user_type)

- FDs: $\text{username} \rightarrow \text{password}, \text{name}, \text{surname}, \text{nationality}, \text{user_type}$
- BCNF: Yes. `username` is the primary key.

COACH(username)

- Inherits from USER. No additional attributes.
- BCNF: Yes.

PLAYER(username, date_of_birth, elo_rating, fide_id, title_id)

- FDs: $\text{username} \rightarrow \text{date_of_birth}, \text{elo_rating}, \text{fide_id}, \text{title_id}$
- BCNF: Yes.

TEAM(team_id, team_name, coach_username, contract_start, contract_finish, sponsor_id)

- FDs:
 - $\text{team_id} \rightarrow \text{team_name}, \text{coach_username}, \text{contract_start}, \text{contract_finish}, \text{sponsor_id}$
 - $\text{coach_username} \rightarrow \text{team_id}$
- BCNF: No. Violation due to $\text{coach_username} \rightarrow \text{team_id}$.
- Action: We chose not to decompose this relation to preserve design simplicity. `coach_username` is set as UNIQUE to avoid multiple teams per coach.

PLAYER_TEAM(player_username, team_id, registration_date)

- FDs: (player_username, team_id) \rightarrow registration_date
- BCNF: Yes.

MATCH_(match_id, ...)

- FDs: match_id \rightarrow all other attributes
- BCNF: Yes. Primary key is sufficient.

TITLE(title_id, title_name)

- FDs: title_id \rightarrow title_name
- BCNF: Yes.

ARBITER(username, experience_level)

- FDs: username \rightarrow experience_level
- BCNF: Yes.

CERTIFICATE Tables (COACH, ARBITER)

- FDs: (username, certificate_name) \rightarrow
- BCNF: Yes.

2 Additional Constraints Enforced

Some domain constraints were enforced using triggers and validation logic.

Password Policy

Passwords are hashed with SHA-256 and validated to ensure:

- At least 8 characters
- One uppercase, one lowercase, one digit, and one special character

Time and Match Constraints (Triggers)

- prevent_conflicting_match: Prevents hall/table/time slot conflicts
- prevent_arbiter_conflict: Ensures arbiters are not double-booked
- prevent_same_team_match: Disallows same-team matches
- prevent_invalid_rating: Ratings can't be submitted before the match or updated later

Data Integrity

- Arbitrary preloaded records are not removed, but new invalid insertions are blocked.
- Triggers ensure consistent, valid states for time slots, ratings, and match assignments.

3 Summary Table

Relation	BCNF	Notes
USER	Yes	Primary key is sufficient
PLAYER	Yes	Fully dependent on key
TEAM	No	Coach dependency allowed, UNIQUE constraint used
MATCH_	Yes	Primary key: <code>match_id</code>
PLAYER_TEAM	Yes	Composite key used
TITLE	Yes	Simple key
ARBITER	Yes	Subtype of USER
CERTIFICATE tables	Yes	No non-trivial FDs

All schema and logic follow normalization rules. Triggers and checks ensure rule compliance and application integrity.