DB FOOTBALL NORMALIZATION

1NF and 2NF

1) **First Normal Form (1NF)**

Objective:
Eliminate repeating groups and ensure atomicity.

Steps:

1. Ensure each table has a **primary key**.
2. Make sure each column contains **only atomic (indivisible)** values.
3. Remove **repeating groups** or arrays from the columns.
4. Ensure each record is **unique** and identifiable.

2) **Second Normal Form (2NF)**

Objective:
Eliminate partial dependencies.

Precondition:
Table must already be in **1NF**.

Steps:

1. Identify all **composite primary keys**.
2. Remove any **non-prime attributes** (non-key attributes) that depend **only on part** of the composite key.
3. Move these attributes to a **new table**, and link it back using a **foreign key**.
4. Ensure all **non-key attributes** depend on the **entire primary key**.

Table : Universal table

- **Attributes:**

  stadium_id, stadium_name, stadium_capacity, stadium_image, stadium_avg_attendance, stadium_city, stadium_year_built, coach_id, coach_first_name, coach_last_name, coach_age, coach_nationality, coach_prev_trophies, coach_experience, team_id, team_name, team_prev_prem_titles, team_fans, team_badge, team_points, team_founded_year, player_id, player_jersey_number, player_age, player_first_name, player_last_name, player_face_icon, player_position, player_nationality, player_birth_date, player_preferred_foot, match_id, match_date, match_home_score, match_away_score, match_home_possession, match_away_possession, lineup_is_starter, lineup_position_played, event_id, event_event_type, event_minute, event_is_own_goal, stat_minutes_played, stat_goals, stat_assists, stat_shots, stat_shots_on_target

- **Functional Dependency:**

  stadium_id ->
  stadium_name,stadium_capacity,stadium_image,stadium_avg_attendance,stadium_city,stadium_year_built
  coach_id ->
  coach_first_name,coach_last_name,coach_age,coach_nationality,coach_prev_trophies,coach_experience
  team_id ->
  team_name,team_prev_prem_titles,team_fans,team_badge,team_points,team_founded_year,coach_id,stadium_id
  player_id ->
  player_jersey_number,player_age,player_first_name,player_last_name,player_face_icon,player_position,player_nationality,player_birth_date,player_preferred_foot,team_id
  match_id ->
  match_id,match_date,match_home_score,match_away_score,match_home_possession,match_away_possession,team_id
  match_id,player_id -> lineup_is_starter,lineup_position_played
  match_id,player_id -> event_event_type,event_minute,event_is_own_goal
  match_id,player_id ->
  stat_minutes_played,stat_goals,stat_assists,stat_shots,stat_shots_on_target

3 NF

Objective:
Eliminate transitive dependencies.

Precondition:
Table must be in **2NF**.

Steps:

1. Identify **transitive dependencies**, where non-key attributes depend on other non-key attributes.
2. Move these transitively dependent attributes to a **new table**.
3. Keep only those non-key attributes that are **directly dependent** on the primary key.
4. Ensure that every non-key attribute is **non-transitively** dependent on the primary key.

Table 1: Player Statistics

- **Attributes:**
  match_id, player_id, stat_shots_on_target, stat_shots, stat_assists, stat_goals, stat_minutes_played, lineup_position_played, lineup_is_starter
- **Functional Dependency:**
  {match_id, player_id} → {stat_shots_on_target, stat_shots, stat_assists, stat_goals, stat_minutes_played, lineup_position_played, lineup_is_starter}

Table 2: Match Events

- **Attributes:**
  player_id, match_id, event_id, event_event_type, event_minute, event_is_own_goal
- **Functional Dependency:**
  {event_id} → {match_id, player_id, event_event_type, event_minute, event_is_own_goal}

Table 3: Stadium Information

- **Attributes:**
  stadium_id, stadium_year_built, stadium_city, stadium_avg_attendance, stadium_capacity, stadium_name, stadium_image
- **Functional Dependency:**
  {stadium_id} → {stadium_year_built, stadium_city, stadium_avg_attendance, stadium_capacity, stadium_name, stadium_image}

Table 4: Coach Information

- **Attributes:**
  coach_id, coach_experience, coach_prev_trophies, coach_nationality, coach_age, coach_last_name, coach_first_name
- **Functional Dependency:**
  {coach_id} → {coach_experience, coach_prev_trophies, coach_nationality, coach_age, coach_last_name, coach_first_name}

Table 5: Team Information

- **Attributes:**
  team_id, stadium_id, coach_id, team_founded_year, team_points, team_badge, team_prev_prem_titles, team_name, team_fans
- **Functional Dependency:**
  {team_id} → {coach_id, stadium_id, team_founded_year, team_points, team_badge, team_prev_prem_titles, team_name}

Table 6: Player Information

- **Attributes:**
  player_id, team_id, player_preferred_foot, player_birth_date, player_nationality, player_position, player_face_icon, player_last_name, player_first_name, player_age, player_jersey_number
- **Functional Dependency:**
  {player_id} → {team_id, player_preferred_foot, player_birth_date, player_nationality, player_position, player_face_icon, player_last_name, player_first_name, player_age, player_jersey_number}

Table 7: Match Information

- **Attributes:**
  match_id, team_id, match_away_possession, match_home_possession, match_home_score, match_away_score, match_date
- **Functional Dependency:**
  {match_id} → {team_id, match_away_possession, match_home_possession, match_home_score, match_away_score, match_date}

BCNF

Objective:
Every determinant must be a candidate key.

Precondition:
Table must be in **3NF**.

Steps:

1. Identify all **functional dependencies** in the table.
2. For each functional dependency $X \rightarrow Y$, check if X is a **super key**.
3. If X is **not a super key**, the table violates BCNF.
4. Decompose the table into two or more tables such that:
    - Each table conforms to **BCNF rules**.
    - The **original information** is preserved (lossless decomposition).
    - **Dependencies are preserved** wherever possible.

Table 1: Event

- **Attributes**:
    - *player_id*
    - *match_id*
    - *event_id*
    - *event_event_type*
    - *event_minute*
    - *event_is_own_goal*
- **Functional Dependencies**:
    - *event_id → match_id, player_id, event_event_type, event_minute, event_is_own_goal*

Table 2: Match

- **Attributes**:
    - *match_id*
    - *team_id*
    - *match_date*
    - *match_home_score*
    - *match_away_score*
    - *match_home_possession*
    - *match_away_possession*
- **Functional Dependencies**:

- *match_id → team_id, match_date, match_home_score, match_away_score, match_home_possession, match_away_possession*

Table 3: Player

- **Attributes**:
  - *player_id*
  - *player_jersey_number*
  - *player_age*
  - *player_first_name*
  - *player_last_name*
  - *player_face_icon*
  - *player_position*
  - *player_nationality*
  - *player_birth_date*
  - *player_preferred_foot*
  - *Team_id*
- **Functional Dependencies**:
  - *player_id → player_jersey_number, player_age, player_first_name, player_last_name, player_face_icon, player_position, player_nationality, player_birth_date, player_preferred_foot, team_id*

Table 4: Player Stats

- **Attributes**:
  - *match_id*
  - *player_id*
  - *lineup_is_starter*
  - *lineup_position_played*
  - *stat_minutes_played*
  - *stat_goals*
  - *stat_assists*
  - *stat_shots*
  - *stat_shots_on_target*
- **Functional Dependencies**:
  - *match_id, player_id → lineup_is_starter, lineup_position_played, stat_minutes_played, stat_goals, stat_assists, stat_shots, stat_shots_on_target*

Table 5: Stadium

- **Attributes**:
    - *stadium_id*
    - *stadium_name*
    - *stadium_capacity*
    - *stadium_image*
    - *stadium_avg_attendance*
    - *stadium_city*
    - *stadium_year_built*

- **Functional Dependencies**:
    - *stadium_id → stadium_name, stadium_capacity, stadium_image, stadium_avg_attendance, stadium_city, stadium_year_built*

Table 6: Coach

- **Attributes**:
    - *coach_id*
    - *coach_first_name*
    - *coach_last_name*
    - *coach_age*
    - *coach_nationality*
    - *coach_prev_trophies*
    - *coach_experience*
- **Functional Dependencies**:
    - *coach_id → coach_first_name, coach_last_name, coach_age, coach_nationality, coach_prev_trophies, coach_experience*

Table 7: Team

- **Attributes**:
    - *team_id*
    - *coach_id*
    - *stadium_id*
    - *team_name*
    - *team_prev_prem_titles*
    - *team_fans*

- *team_badge*
- *team_points*
- *team_founded_year*
- **Functional Dependencies**:
    - ***t****eam_id → stadium_id ,coach _id ,team name, team_prev_prem_titles, team_fans, team_badge, team_points, team_founded_year*

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