



Football Championship Database

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Contents

1	Functionality of the Database (User Perspective)	2
1.1	League & Season Management	2
1.2	Teams & Home Stadiums	2
1.3	Persons, Roles (ISA) & Contracts	2
1.4	Match Scheduling & Statistics	2
1.5	Goals & Assists	3
1.6	Ticketing & Venue Entry	3
1.7	Seasonal Rankings & Reports	3
1.8	Consistency & Business Rules (Selected)	3
2	ER Diagram of the Miniworld (with ISA)	4
3	User Interactions with the Database System	5
4	Cardinalities of the Conceptual Model	8

1 Functionality of the Database (User Perspective)

This database supports the end-to-end management of a football league by organizing and updating information on **leagues, seasons, teams, persons (players, coaches, referees, staff), contracts, stadiums, matches, goals, assists, tickets, match statistics, and seasonal rankings**. It provides both operational workflows (scheduling, ticketing, contracting) and analytical views (statistics, rankings, histories), while enforcing key consistency rules derived from the conceptual ER model.

1.1 League & Season Management

- Maintain basic **League** information (name, country) and associated **Seasons** (start_year, end_year).
- Each season belongs to exactly one league; users can browse historical seasons within a league.

1.2 Teams & Home Stadiums

- Maintain **Team** profiles (name, city, founded_year).
- Assign a default **home Stadium** (name, city, location, capacity); by default, home fixtures are scheduled there, while neutral venues remain possible when explicitly chosen.

1.3 Persons, Roles (ISA) & Contracts

- Consolidate all people in a unified **Person** registry (ID, name), specialized via an ISA hierarchy into **Player, Coach, Referee**, and **Staff**, each with role-specific attributes (e.g., player position/number, coach license_type, referee level, staff role).
- Manage **Contracts** linking Person and Team with validity windows (start/end dates), supporting creation, update, termination, and historical queries.

1.4 Match Scheduling & Statistics

- Schedule **Match** fixtures (date, home/away teams, venue) within a season; record final scores (home_score, away_score).

- Record a single **MatchStats** entry per match (e.g., possession home/away, shots home/away).

1.5 Goals & Assists

- Register **Goals** (minute_scored, is_penalty) and, when applicable, an **Assist** (minute_assisted) attached to the goal.
- Aggregated goals determine the official match score for the home/away sides.

1.6 Ticketing & Venue Entry

- Sell **Tickets** for a match hosted at a specific stadium; manage seat/section, price, purchase status.
- Support venue entry workflows (ticket validation), ensuring seat uniqueness per match and capacity adherence.

1.7 Seasonal Rankings & Reports

- Maintain **Ranking** per (Team, Season): position, points, matches_played, goals_for, goals_against.
- Provide standings, match reports, and player/club statistics across seasons for analytical and historical views.

1.8 Consistency & Business Rules (Selected)

- **Contracts:** For a given time instant, a player/coach must not hold overlapping active contracts for multiple teams in the same role; team assignment at match time is derived from contract validity.
- **Scheduling:** A team (and stadium) cannot be double-booked at overlapping times; home and away must be different teams.
- **Scoring:** The sum of goals recorded for each side equals the match's final score; assists (if present) belong to a specific goal and occur no later than the goal minute.
- **Statistics:** Match statistics use non-negative values and reasonable bounds (e.g., possession near 100% total with tolerance).

3 User Interactions with the Database System

User Action	Inputs / UI	System Output / State Change	Illegal Input / Error Handling
Create / Update League & Season	League name, country; Season start_year, end_year	League created/updated; Season linked to League; history queries enabled	Invalid year range; duplicate Season within same League → reject
Team CRUD & set Home Stadium	Team (name, city, founded_year); choose default Stadium	Team stored/updated; relation “uses as home” established	Unknown Stadium; negative founded_year; duplicate Team name in League → reject
Register Person (ISA)	Person basics (ID, name); subtype attrs: Player (position, number), Coach (license_type), Referee (level), Staff (role)	Person stored; subtype row created; visible in rosters/search	Duplicate person ID; missing subtype attributes → reject
Create / Terminate Contract	Person, Team, start_date, end_date, role	Contract created or terminated; history kept	Overlapping contracts for same person/role; start \geq end → reject
Appoint / Change Head Coach	Team, Coach, validity window	Coach “manages” Team for window; previous coach closed	Two head coaches overlap in time; invalid license_type → reject
Player Transfer (Team assignment by contract)	Player, new Team, contract dates	Player’s active team switches per contract validity	Contract gap at match time; overlapping team contracts → reject

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User Action	Inputs / UI	System Output / State Change	Illegal Input / Error Handling
Plan Match (Schedule)	Season, date/time, home Team, away Team, Stadium	Match record created in Season; defaults to home Stadium unless overridden	Home = Away; team or stadium double-booked at overlapping times → reject
Enter Match Statistics	poss_home/away, shots_home/away, foulsH/A	One MatchStats row created/updated and linked to Match	Negative values; possession not near 100% total (beyond tolerance); match not found → reject
Record Goal	Match, scoring Player, minute, is_penalty	Goal stored; aggregates into Match home/away totals	Player not belonging to participating side at match time; minute exceeds duration → reject
Record Assist	Goal id, assisting Player, minute_assisted	Assist linked to Goal; analytics updated	Assist minute > goal minute; assisting Player not on scoring side → reject
Sell Ticket (Seat / Section)	Match, section, seat_number, price	Ticket created; seat reserved; capacity accounted	Seat already sold for this match; total sold > stadium capacity → reject
Validate Entry (Gate)	Ticket scan (match + seat)	purchase_status updated (entered); audit log	Ticket not for this match/stadium; invalid/duplicate scan → deny entry
Update Standings	Submit final score / confirm goals	Ranking row for (Team, Season) updated: points, matches_played, GF/GA	Sum of recorded goals ≠ submitted score; season/team missing → reject

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User Action	Inputs / UI	System Output / State Change	Illegal Input / Error Handling
Reports & Queries	Filters by league/season/team/ player/referee/stadium	Standings, fixtures, match reports, top scorers/assists	No data found → friendly “no results” notice

4 Cardinalities of the Conceptual Model

The following list specifies the cardinalities of the main relationships in the Football Championship Database:

1. **Team_Member ISA Hierarchy**

Team_Member (1) —is a— (1) Player / Coach / Referee / Staff

2. **Player–Team Relationship**

Player (1...M) —Plays for— (1...1) Team ((one or many) to one)

3. **Team_Member–Contract Relationship**

Team_Member (1...1) —Has contract— (1...1) Contract (one to one)

4. **Team–Contract Relationship**

Team (1...1) —Offers— (1...M) Contract (one to (one or many))

5. **League–Season Relationship**

League (1...M) —Organize— (1...M) Season ((one or many) to (one or many))

6. **Match–Season Relationship**

Match (1...M) —Played in— (1...1) Season ((one or many) to one)

7. **Ticket–Stadium Relationship**

Ticket (1...1) —Enter— (1...1) Stadium (one to one)

8. **Team–Ranking Relationship**

Team (1...1) —Appears in— (1...M) Ranking (one to (one or many))

9. **Team–Stadium Relationship**

Team (1...1) —Uses as Home— (1...1) Stadium (one to one)

10. **Coach–Team Relationship**

Coach (1...1) —Manages— (1...1) Team (one to one)

11. **Team–Match Relationship**

Team (1...1) —Plays as a team— (1...M) Match (one to (one or many))

12. Player–Goal Relationship

Player (1...1) —Scores— (0...M) Goal (one to (zero or many))

Note: A player can have 0 goals.

13. Stadium–Match Relationship

Stadium (1...1) —Hosts— (1...M) Match (one to (one or many))

14. Match–MatchStats Relationship

Match (1...1) —Has— (1...1) MatchStats (one to one)

15. Match–Goal Relationship

Match (1...1) —Includes— (0...M) Goal (one to (zero or many))

Note: A match can have 0 goals.

16. Match–Assist Relationship

Match (1...1) —Includes— (0...M) Assist (one to (zero or many))

Note: A match can have 0 assists.

17. Player–Assist Relationship

Player (1...1) —Pass— (0...M) Assist (one to (zero or many))

Note: A player can have 0 assists.

18. Referee–Match Relationship

Referee (1...1) —Officiates— (1...M) Match (one to (one or many))