61 A - Relational Database

ICT702 Introduction to the Relational Database Assessment 2 (National School of Sciences)

A

Report

On

Revolutionizing Professional Football League Management

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Case Study

Title: Revolutionizing Professional Football League Management

Introduction:

The administration of football leagues of varying levels involves complex coordination of clubs, players, matches, finance and the audience development. This study focuses on a broad-based management system created with an intention to assist the Premier League top Football League in streamlining operations, working more effective and finally providing a world class fan's experience.

Background:

The English Premier League is considered one of the greatest and the most highly viewed football leagues this planet has ever witnessed, which brings together the best of the clubs with football fans holding to their hearts. Nonetheless, supervising a sizeable league comes with some difficulties, for example, the matter of scheduling the fixtures, the loading of the players, the obedience to the management of broadcast rights, the selling of tickets, and dealing with the allocation of revenue. Realizing the necessity for a centre edition as well as an integrated way, the authority of the English premier level starts with a journey to design comprehensively a league management system.

Database Design:

Entity-Relationship (ER) model describing a Professional Football League Management System. It deals with the entities like Club, Player, Match, Stadium, Manager, Ticket, and Injury together with the attribution and relations that each naming can contain. Every entity usually has its primary key (PK) and attributes. Thus, the crow’s foot diagram connects different entities among themselves depending on their relations. The diagram displays the database structure visually and indicate there that entities are relate with each other through foreign key (FK) constraints. This ER diagram provides the basis for the design and layout of the database schema for the football team management system, ensuring the proper arrangement and maintenance of data.

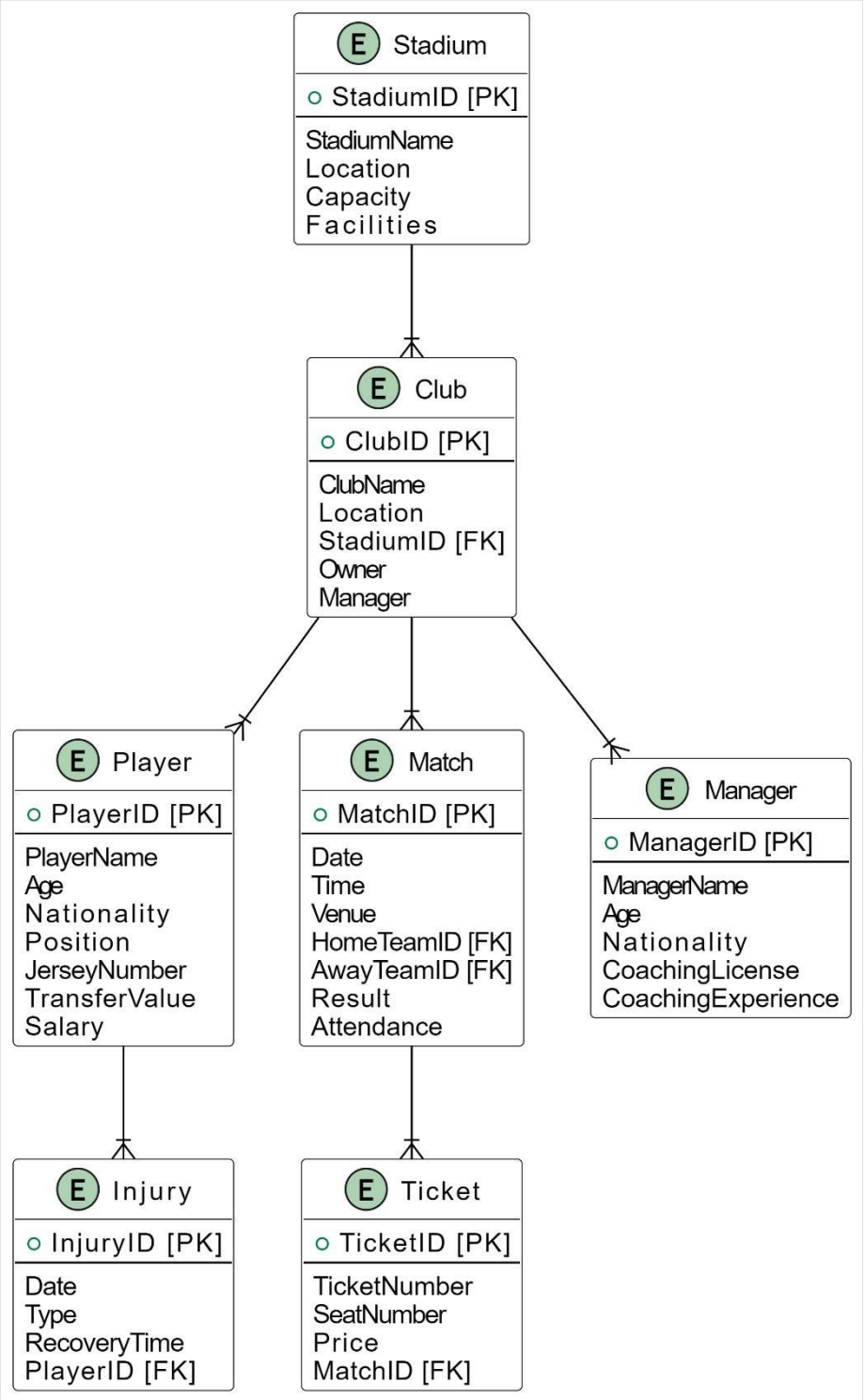

Figure 1: Database Design Football League Management System

Entity-Relationship (ER)Diagram

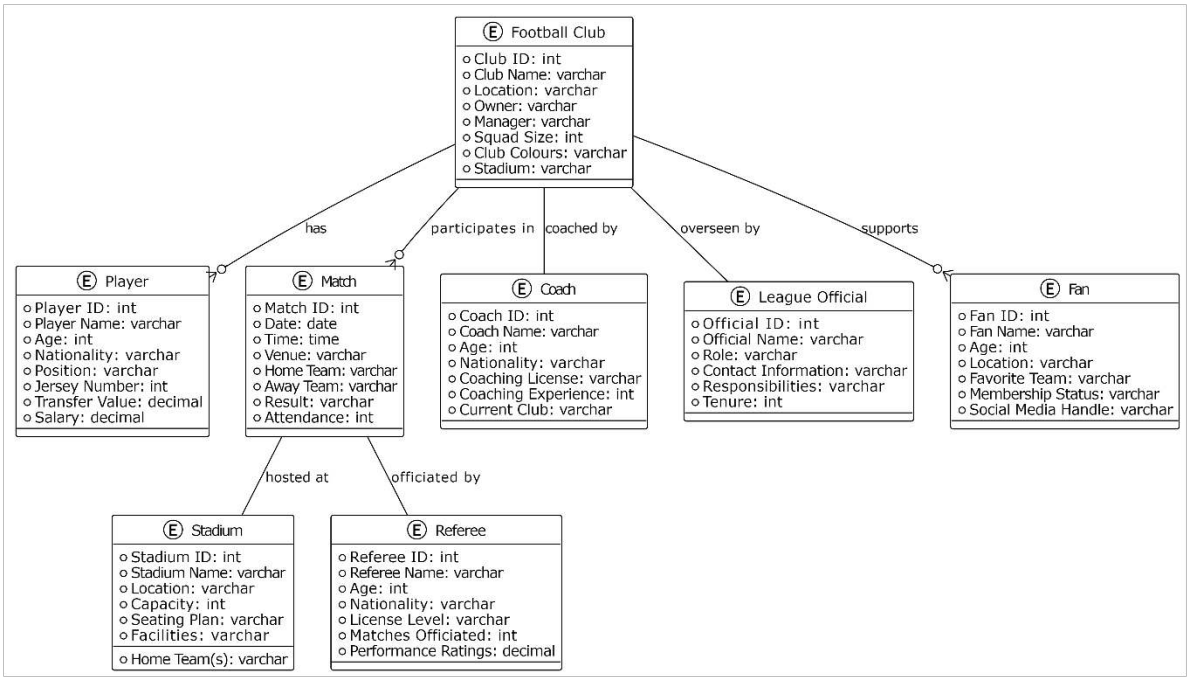

Figure 2: ER Diagram

Implementation:

PLMS has been exclusively engineered for the Premier League management system and it is a result of the long association of technology specialists, club management and football stakeholders. The system's features and functionalities were tailored to address key areas of league management:

- **Fixture Scheduling**: PLMS utilizes sophisticated algorithms to generate fixture schedules that consider various factors such as team availability, stadium availability, broadcast requirements, and logistical considerations. The system allows for real-time adjustments to accommodate unforeseen circumstances.
- **Player Registrations and Transfers**: The system has a centralized player registration module whereby clubs can add players, submit transfer requests, keep track of player movements, and many more activities are easily done by the system. The system is responsible for eliminating the verification process by implementing the league rules and submission of transfer requests on time.
- **Financial Management**: PLMS is an avenue that extends its hand to help the football club effectively manage its resources, including broadcasting rights, sponsorship deals, selling of merchandise, and ticket sales. Financial reports and analytics are

tools placed at the disposal of on-league officials in the budgeting, forecasting and revenue sharing processes.

- **Performance Analytics**: The system makes use of performance-analytics tools to allow the data of games be captured and analysed, players' and teams' statistics to be gathered and performance metrics to be monitored. Besides giving us premonitions about the player shape, trends in tactics and the balance of competition, Dashboards of advanced analytics empower the clubs and the coaches to take realistic and informed decisions
- **Fan Engagement:** For the PLMS, there is an exclusive fan engagement platform designed for fan's enjoyment where the fans can view live match updates, video highlights, news posts, polls, and soccer related social media hashtags just at one click. The platform boosts communication between fans, which further builds identity within the audience.

Results:

The implementation of the Premier League Management System has yielded significant benefits for the league, clubs, stakeholders, and fans.

- **Operational Efficiency**: PLMS has simplified league operations through the system which reduced overload work of the administrators, and eliminated manual errors automating processes and ended transiting documents. It facilitated the co-operation between league officials, club administrators and broadcasters.
- **Transparency and Compliance**: The regime provides the above-mentioned standards, also observes the league's regulations, rules, and goals of financial fair play. Such procedures as automatic trails and data verification enhance trust, accuracy and give control over administration.
- **Data-Driven Decision-Making:** PLMS provides various decision-making tools which enables clubs as well as league officials to act, develop programs, and identify talents, as well as player recruitment and performance optimization.
- **Fan Experience:** The fan engagement platform has enhanced the fan experience by providing personalized content, interactive features, and seamless access to football-related information, fostering greater fan loyalty and engagement.

Entities Name:

The Entities Name of the Premier League Management System are as follows:

1. Football Clubs
2. Players
3. Matches
4. Stadiums
5. Coaches
6. Referees
7. League Officials
8. Fans
9. Broadcasters
10. Sponsors
11. Merchandise
12. Medical Staff
13. Training Facilities
14. Ticketing Services
15. Financial Institutions

Attributes:

The Attributes of the Premier League Management System are as follows:

1. Football Clubs:

- Club Name
- Location
- Owner
- Manager
- Squad Size
- Club Colours
- Stadium

2. Players:

- Player Name
- Age
- Nationality
- Position
- Jersey Number
- Transfer Value
- Salary

3. Matches:

- Match ID
- Date
- Time
- Venue
- Home Team
- Away Team
- Result
- Attendance

4. Stadiums:

- Stadium Name
- Location
- Capacity
- Seating Plan
- Facilities
- Home Team(s)

5. Coaches:

- Coach Name
- Age
- Nationality
- Coaching License
- Coaching Experience
- Current Club

6. Referees:

- Referee Name
- Age
- Nationality
- License Level
- Matches Officiated
- Performance Ratings

7. League Officials:

- Official Name

- Role
- Contact Information
- Responsibilities
- Tenure

8. Fans:

- Fan Name
- Age
- Location
- Favorite Team
- Membership Status
- Social Media Handle

9. Broadcasters:

- Broadcasting Company
- Coverage Rights
- Schedule
- Commentary Team
- Viewership Ratings

10. Sponsors:

- Sponsor Name
- Sponsorship Level
- Contract Duration
- Sponsorship Benefits
- Financial Contribution

11. Merchandise:

- Product Name
- Description
- Price
- Availability
- Sales Figures

12. Medical Staff:

- Medical Team Name
- Team Members
- Qualifications

- Role
- Injury Records

13. Training Facilities:

- Facility Name
- Location
- Equipment
- Staff
- Services Offered

14. Ticketing Services:

- Ticketing Company
- Ticket Categories
- Pricing
- Booking System
- Sales Records

15. Financial Institutions:

- Bank Name
- Account Details
- Transactions
- Financial Statements
- Investment Portfolio

Entity Relations:

The relations between the entities are as follows:

1. Football Clubs:

- Identity of a club as a one-to-many relationship with the team (a club is only a N-to-1 relationship with its players)
- One of such relations being - many-to-one with stadiums (a stadium could be a home venue for many club teams at the same time).
- Many clubs can take part in the many matches (one match can be participated by several clubs, and one club can be viewed in multiple games).

2. Players:

- The relation of the entity of one football club (one player belongs to that club) is many-to-one.
- Many-to-many relationship with Matches (a player can take part in more matches at a time, and a match might involve more than one player).

3. Matches:

- A stadium has been a choice of hosting site for an event where several players are performing at once.
- Match between clubs, as a single case, also a many -to-many relation (that all matches relate to exactly two clubs).
- One-to-many relation with Referees (if it is about the match and it has one or more referees).

4. Stadiums:

- Many-to-one relation with Matches (a stadium takes teams to be in multiple matches at a time)
- One-to-Many relation with Football Clubs: (E.g. a stadium is the home venue for one or more clubs).

5. Coaches:

- Many-to-one relation with Football Clubs (a coach belongs to one club)
- One-to-many relation with Players (a coach can manage multiple players)

6. Referees:

- One-to-many relation with Matches (a referee officiates in multiple matches)
- Many-to-one relation with Matches (a match has one or more referees)

7. League Officials:

- One-to-many relation with Football Clubs (an official oversees multiple clubs)
- One-to-many relation with Matches (an official supervises multiple matches)

8. Fans:

- Many-to-one relation with Football Clubs (a fan supports one club)
- Many-to-many relation with Matches (a fan can attend multiple matches, and a match can have multiple fans)

9. Broadcasters:

- One-to-many relation with Matches (a broadcaster covers multiple matches)
- One-to-many relation with Football Clubs (a broadcaster may have broadcasting rights for multiple clubs)

10. Sponsors:

- Many-to-many relation with Football Clubs (a sponsor can sponsor multiple clubs, and a club can have multiple sponsors)
- Many-to-many relation with Matches (a sponsor can sponsor multiple matches, and a match can have multiple sponsors)

11. Merchandise:

- Many-to-one relation with Football Clubs (merchandise is associated with one club)
- Many-to-many relation with Fans (a fan can purchase multiple merchandise items, and a merchandise item can be bought by multiple fans)

12. Medical Staff:

- Many-to-one relation with Football Clubs (medical staff works for one club)
- One-to-many relation with Players (medical staff treats multiple players)

13. Training Facilities:

- One-to-many relation with Football Clubs (a training facility is used by one or more clubs)
- One-to-many relation with Coaches (a training facility is managed by one coach)

14. Ticketing Services:

- One-to-many relation with Matches (ticketing services handle ticket sales for multiple matches)
- Many-to-many relation with Fans (a fan can purchase tickets for multiple matches, and a match can have multiple ticket buyers)

15. Financial Institutions:

- One-to-many relation with Football Clubs (a financial institution manages accounts for multiple clubs)
- One-to-many relation with Sponsors (financial institutions process sponsorship payments for multiple sponsors)

Weak and String Entity:

The Premier League Management System case study, here are the weak and strong entities:

Strong Entities:

1. Player:

- Attributes: ID, Player name, age, nationality, position, Jersey no., transfer value, salary.
- Independence: The collectibles item type can be uniquely identified either by the name or a player ID.
- Explanation: The team has these traits, and they may show on the table as a Player ID or Name, which will distinguish them from each other in the system. Although entities' independent existence is set off from other object and they are autonomously affected (they can be managed, transferred or analysed independently), they are, however, fixed based on their identification feature.

2. Match:

- Attributes: ID, Date, Time, Venue, Home Team, Away Team, End Result, Audience.
- Independence: It works by we create for each match special internal ID like match Date.
- Explanation: Every match may happen to have certain individual features (Venue, Home Team, Result, etc.), which provide it with the system's capacity to function as an independent entity. Games displayed can be made depending on necessity, hosted, and analysed without depending on third-party entities for face representation.

3. Stadium:

- Attributes: ID of Stadium, Name of Stadium, Location of Stadium, Capacity of Stadium, Facilities in Stadium.

- Independence: Identification by items like Stadium ID or Name exclusively is another distinguishing feature.
- Explanation: However, each stadium has its own features comprising of specifics such as the location, capacity and facilities, what might grant it unique as compared to the rest. Stations are located at metro stations in the metropolitan system and they can be accessed automatically, reserved or analyzed without depending on some other units for identification.

4. Club:

- Attributes: Club ID, Name, Location, Stadium ID, Owner, Manager, Coordinator, Fan Clubs.
- Independence: Could have unspoken characteristics which clubs could be distinguished with their Club ID or name.
- Explanation: A football club is a group which occupies a significant space in a round system. In every club this feature is the same and it is can be named, located, possess a stadium, ownership, and manager that distinguishes it from another club. Along with the features as Club ID or Name, the system can be set up in a way that it provides a single key value across the system for the full distinction of one club from another. Clubs manifest themselves separately from the encasing league structure they exist within and can compete in matches, sign players and engage in different activities without relying on other members or authorities in order to be noticed. Therefore, management model intends to appropriate Club entity within the System of Professional Football League.

These entities are strong because they have inherent attributes that uniquely identify them and do not rely on other entities for their existence.

Weak Entities:

1. Ticket:

- Attributes: Number of Ticket, Seat Number, Price
- Dependency: Keeps Favor of the Match subject for identification.
- Explanation: For tickets, an entity is not strong because those attributes like Ticket Number or Seat Number cannot identify a ticket uniquely. The particular of this dance derives from the relationship that it creates with

audience. To illustrate, a ticket can be associated with a single game, although the same number may be used by multiple tickets that belong to different matches. Thus, Ticket enterprise has a relationship with Match entity for the same purpose i.e. identification.

2. Injury:

- Attributes: Injury ID, Onset Date, Nature, Duration of Recovery.
- Dependency: Using the Player class for identification is the priority for this particular contest.
- Explanation: An injured player is the disadvantaged one in this case since it cannot be determined as the unique entity when attributes like Injury ID or Type are not given. The pain, fragility and misery were personified by the one who got hurt. For instance, identical Injury ID or Type can be a characteristic of several injuries that are definitely an essential factor belonging to various players. Consequently, the Injury object deeps on the Player object for its specific solution.

3. Ticket Purchase:

- Attributes: ID of purchases, records date, quantity, price in total.
- Dependency: Rely on the Ticket entity's information for the recognition.
- Explanation: Ticketing purchasing can be another weak link in the system since the process is modelled as well. Nevertheless, with each ticket combinations such as Purchase ID, Purchase Date, Total Price, and Quantity attributing to a specific ticket, it can not be precisely identified without considering the tickets themselves. An individual single purchase transaction may comprise several tickets which will be indexed to a particular match. Consequently, the Ticket Sales software relies on the Ticket class for identification.

4. Match Attendance:

- Attributes: ID Attendance , Date, Match ID, Spectator Count
- Dependency: Relying upon the Match entity for identification.
- Explanation: Match attendance tracking is also referred to as a weak entity in the system. Every record of attendance may have the attributes like Attendance ID, Date, and Spectator Count, but it cannot be uniquely identified without

referencing the match it is connected to. Multiple attendance records may have a common Attendance ID or Date but represent different matches. Hence, the Match Attendance is identified through the Match entity.

These weak entities do not have inherent attributes that uniquely identify them, and their existence depends on the corresponding strong entities through foreign key relationships.

Cardinalities and Connectivity:

Cardinality and connectivity describe the relationship between entities in a database model. The cardinalities and connectivity for the entities within a Professional Football League Management System:

1. Cardinality:

- Cardinality indicates the number of two entities that may be associated with one another in a relationship if refer to the class of one entity then the maximum number of the member of another entity which you can add to the class is called the cardinality. It specifies how numerous entities that belong to the either side is it possible to link to those belonging to the another side.

2. Connectivity:

- Connectivity is the way of interaction or participation in a relationship. It determines whether or not a relational entity does or does not have to participate (full participant or none).

Now, we must identify the cardinalities and connectivity within the entities `relations` relationships.

1. Player - Club Relationship:

- Cardinality: Many-to-one (or Many)
- Connectivity: Mandatory on the "Many" side (each player must belong to a club), optional on the "One" side (a club may or may not have players).

2. Match - Stadium Relationship:

- Cardinality: One-to-one (or one)

- Connectivity: Mandatory on both sides (each match must have a stadium, and each stadium must host matches).

3. Match - Referee Relationship:

- Cardinality: Many-to-many (or Many)
- Connectivity: Optional on both sides (a match may have multiple referees, and a referee may officiate in multiple matches).

4. Club - Manager Relationship:

- Cardinality: One-to-one (or one)
- Connectivity: Mandatory on the "One" side (each club must have a manager), optional on the "One" side (a manager may or may not manage a club).

5. Ticket - Match Relationship:

- Cardinality: Many-to-one (or Many)
- Connectivity: Mandatory on the "Many" side (each ticket must correspond to a match), optional on the "One" side (a match may or may not have tickets sold for it).

6. Injury - Player Relationship:

- Cardinality: Many-to-one (or Many)
- Connectivity: Mandatory on the "Many" side (each injury must be suffered by a player), optional on the "One" side (a player may or may not have injuries).

These cardinalities and connectivity definitions help in designing the database schema and understanding the relationships between entities within the Professional Football League Management System.

Optional and Mandatory Relationships

Optional and mandatory relationships refer to the participation of entities in a relationship. The optional and mandatory relationships within a Professional Football League Management System:

1. Optional Relationship:

- A secondary relationship, which may be called a non-participation or partial participation, means that one side of the relationship may be not connected with another side of the relationship. On the other hand, contribution to the relationship is no

longer a must.

- Example: When it comes to Referee Assigning and Scheduling, there may or may not be matches assigned to referees. Some matches could have more than 1 referee, but there could be some which have no referee assigned. Therefore, partners can either be in the referees' relationship or not.

2. Mandatory Relationship:

- A compulsory relationship apart from the full participation and commitment likewise depicts only on one side either a partner or the entity in the relationship must necessarily be connected with another similar to side. Specifically, much of the time, involvement in the connection is compulsory.
- Example: A Club relationship manager will be assigned to every club, which will be separated by sub-groups and teams from managers. In order for the club to function effectively, every club must have a person steering its functioning and (coach or) its players. So, the involvement of clubs in manager-club relationships becomes growth booster.

The additional examples of optional and mandatory relationships within the Professional Football League Management System:

Optional Relationships:

- **Ticket: Match:** A match may or may not have tickets to be sold. Some matches might be sold out while others might end up with unsold tickets. As a result, participation in matches of partnership with tickets is conditioned.
- **Injury: Player's Relationship:** A player could be either injured or uninjured while playing their career. Sports do lead to injuries, but not every player is going to suffer from them. Hence, the involvement of players in an injury-related relationship is up to them.

Mandatory Relationships:

- **Match: Stadium:** The crutch of every game is a stadium that it is played in. Sit-downs of the game should be at a particular point. Accordantly, the mechanisms for matches affecting the bonding with stadiums need to be deployed.
- **Club: Player Belonging:** There is no option other than to be a club member for each player. Players are transferred from one club to another upon being signed for their teams in competitions. Consequently, sharing of feelings and thoughts between them

and the clubs is an essential thing.

Primary and Foreign key:

Primary Key:

- One of the most popular data structures used for efficient accessing and retrieving data is the primary key that is a unique identifier for each record (row) in a table. It guarantees that each record in the table is labelled in such a way that it is easy to find a specific data even in a large number of records. Its main function is to keep the integrity of data in the table and to allow to operate on it. The main attribute, key, is of major importance for data integrity and sole data type which can defined only.
- Example: For Football League Management System, the "Player ID" approach can be the most significant number in "Players" table. Every player is entitled to an ID which will be assigned as the Player ID's throughout the table. Consequently, every player will find themselves identified in a more individualized manner.

Foreign Key:

- A foreign key forms a link between two tables in a database and it is a column or set of columns which can be a primary key of another table. It reflects a connection between the details of the table and another table's data. The foreign key in one table relates to the primary key in another table which form a relationship between them and their tables.
- Example: There is "The Matches" table in a Professional Football League Management System, with which the "Home Team ID" and "Away Team ID" attributes can act as the foreign keys. These characteristics will be on a one-to-foreign relationship where the "Records id" referenced the primary key "Club ID" from the "Clubs" table to link the clubs and matches.