Description of Database

Explanations of data and SQL Code used to implement database

Domain Description

The chosen domain is related to Football. What it basically has is that it has some leagues played all over Europe and associated with them are the teams that participate in them thus, the players playing for those teams. Along side to this, there are certain attributes for each od these which combined with separate tables for each lead to the creation of a database system for Football implemented in MySQL. However, certainly, the data in the database could have been much better but is bare minimum enough to understand the concepts which is discussed as follows:

The four entities are:

League

Team

Manager

Player

1 : 1 Binary Relationships:

Managed_By – Between Team and Manager --- Like a coach of a sports team.

Is_Captain_Of – Between Player and Team --- Like a Team Leader of a group of people.

1 : N Binary Relationships:

Plays_For – Between Player and Team --- Like an Employee works for an Employer, a player plays for a team or organization, to put simply.

M : N Binary Relationships:

Participates_In – Between Team and League --- Like Technical Varsities(Educational) participate in region-based hackathons or competitions like MLH Hachathons, etc.

Recursive Relationships:

Captaincy – From Player to Player --- Like a team leader to a group of same type of people.

Weak Entity Type:

Player_Stats → Has a weak relationship, Has_Stats, between Player(Parent entity) and Player_Stats(weak, itself).

Attributes:

League – *League_ID, LName, Country* --- These specify a unique ID to refer to each of the league, its respective name and the country that league belongs to or is played in or originated from(maybe).

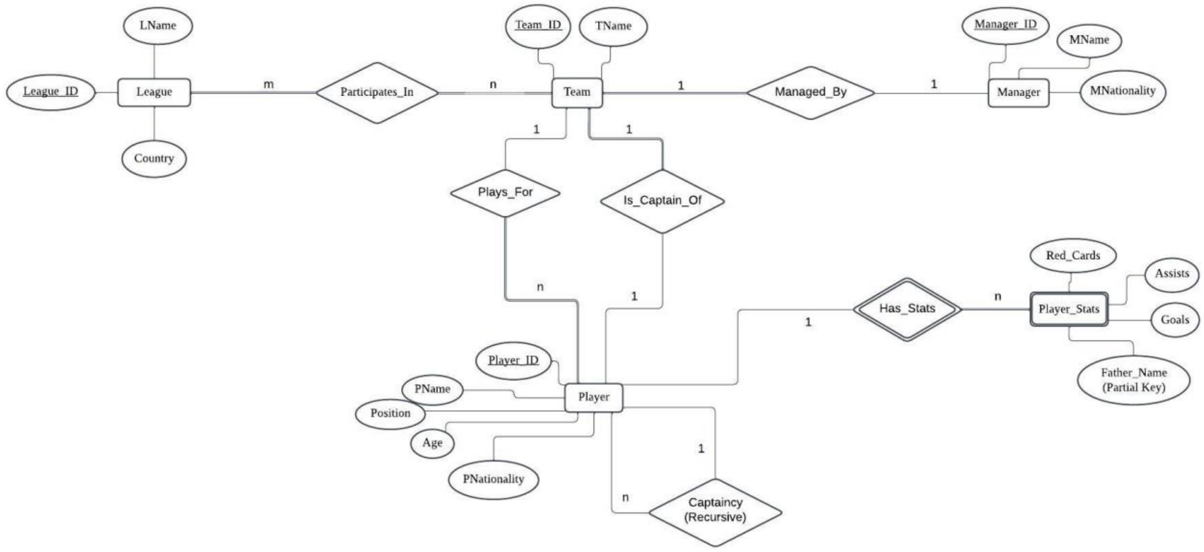
Team – *Team_ID, TName* --- Specify a unique ID for each team to refer easily and independently and of course, the name of the respective team.

Manager – *Manager_ID, MName, MNationality* --- Specify the unique ID for each of the managers of each team, their name and their nationality.

Player – *Player_ID, PName, Position, Age, PNationality* --- Specify a unique player ID for each player along with their names, the position they play at, their age and their nationality.

Player_Stats – *Father_Name, Goals, Assists, Red_Cards* --- Specify the partial key as Father_Name telling that this entity is dependent on Player, the statistics of the player's gameplay, mainly the goals scored, assists provided and the red cards given.

Entity - Relationship Diagram for the Database

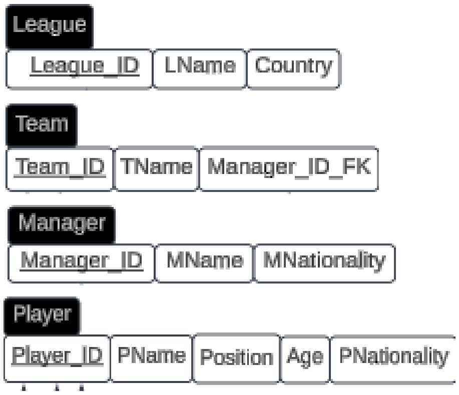


Mapping to Relational Schema to Relational tables

(The underlined attributes are the Primary Keys.)

1) Mapping of Regular/Strong Entity Types:

There are 3 regular entity types – League, Team, Player, and Manager. They are independent in themselves. Thus, their relational schema is as follows:



League

League_ID	LName	Country

Team

Team_ID	TName	Manager_ID_FK

Manager

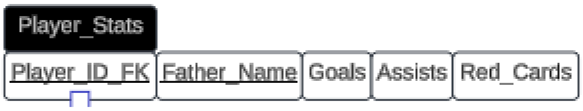
Manager_ID	MName	MNationality

Player

Player_ID	PName	Position	Age	PNationality

2) Mapping of Weak Entity Types:

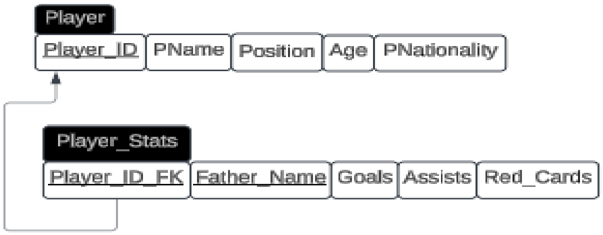
There is only 1 weak entity type – Player_Stats. It depends on the Player entity type as its parent/identity type. Because it is a weak entity type, it will refer the primary key of its identity entity type i.e., Player_ID as Foreign Key and store those in Player_ID_FK column. Thus, this foreign key referred along with the partial key, Father_Name, form the Primary Key for the Player_Stats table. The final relational schema for the same is as follows:



Player_Stats

Player_ID_FK	Father_Name	Goals	Assists	Red_Cards

The schema with proper referring is (not part of this step ig):



Player

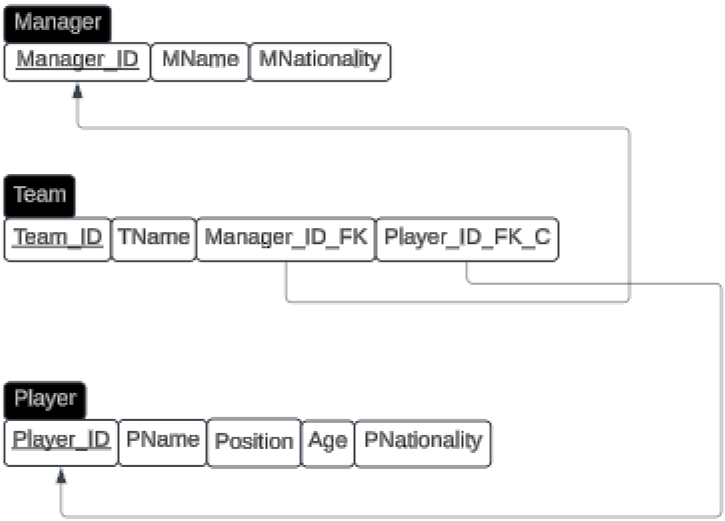
Player_ID	PName	Position	Age	PNationality

Player_Stats

Player_ID_FK	Father_Name	Goals	Assists	Red_Cards

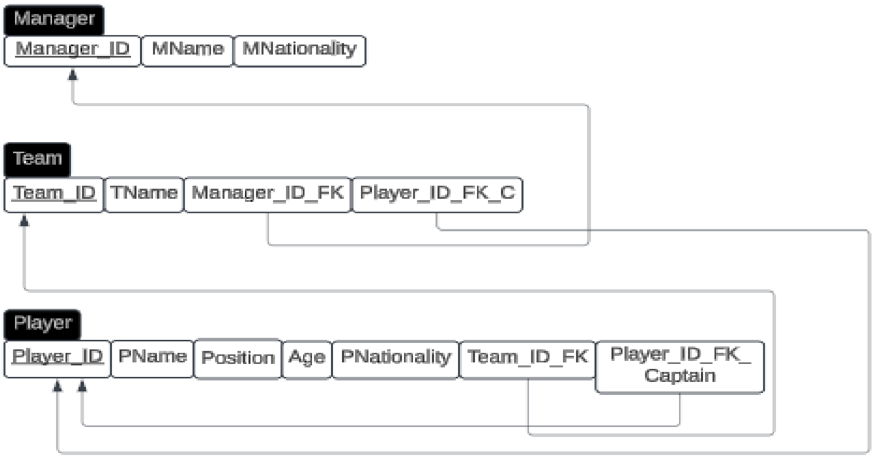
3) Mapping of Binary 1:1 Relation Types:

Team is the common entity type with total participation in its side and the other sides of the Managed_By and Is_Cptain_Of relationships are partial participation. Thus, considering Team entity as S, we will be referring Manager_ID and Player_ID as FKs in the columns, Manager_ID_FK and Player_ID_FK_C, considering entity types – Manager and Player – as R. This is the FK (2 Relations) approach. Thus, the relational schema will be:



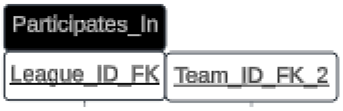
4) Mapping of Binary 1: N Relationship Types:

2 are this type of relationships. Plays_For and Captaincy relations. Each of these have their N-side at Player entity type thus, considering it as S. Now, the other 1-side of the 2 relations will be considered as R entity types. Hence, for these regular 1:N binary relations, include PKs of Team and Player itself as FKs of the Player table. The final schema is:

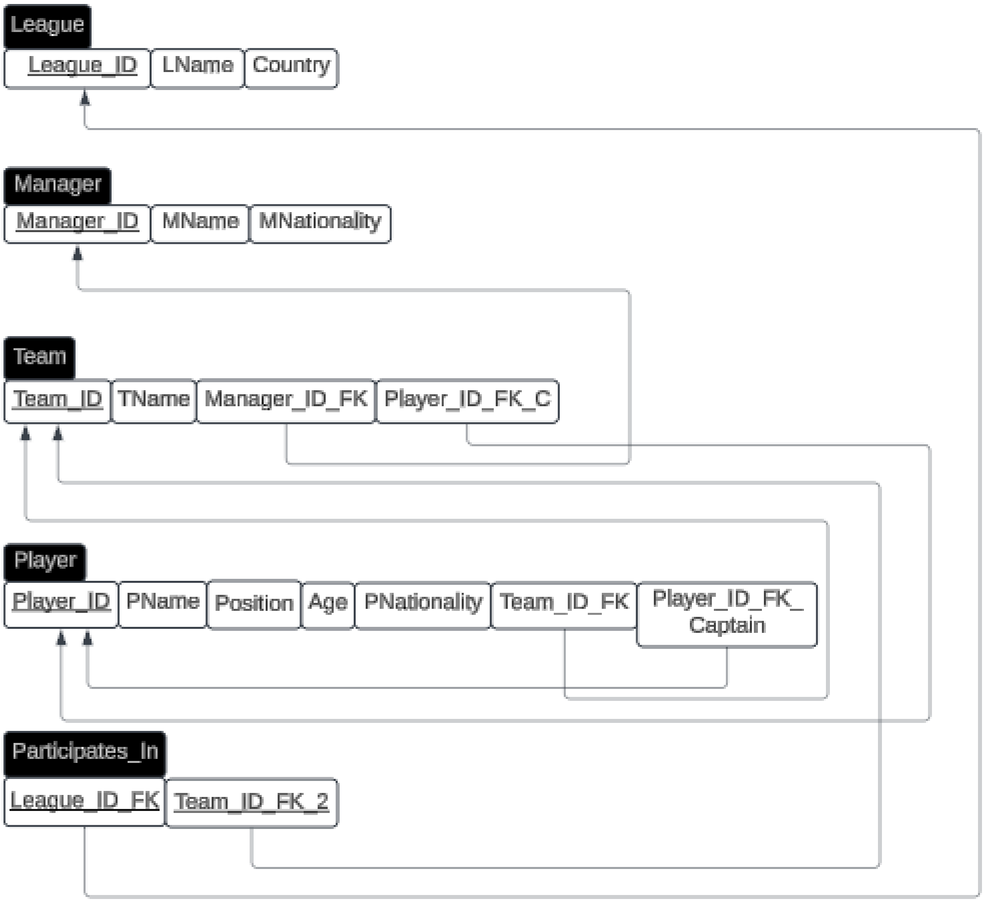


5) Mapping of Binary M:N Relationship Types:

There is 1 M:N relation between league and team. A new relation, S, is created to represent this M:N relation. This S relation is called Participates_In which is ultimately the table. In this, the PKs of the participating entity types is included as FKs of this new relation, S. These PKs are stored in League_ID_FK and Team_ID_FK_2 columns respectively. The schema is then like:



The referring part can be shown as(Though not a part of this step ig):



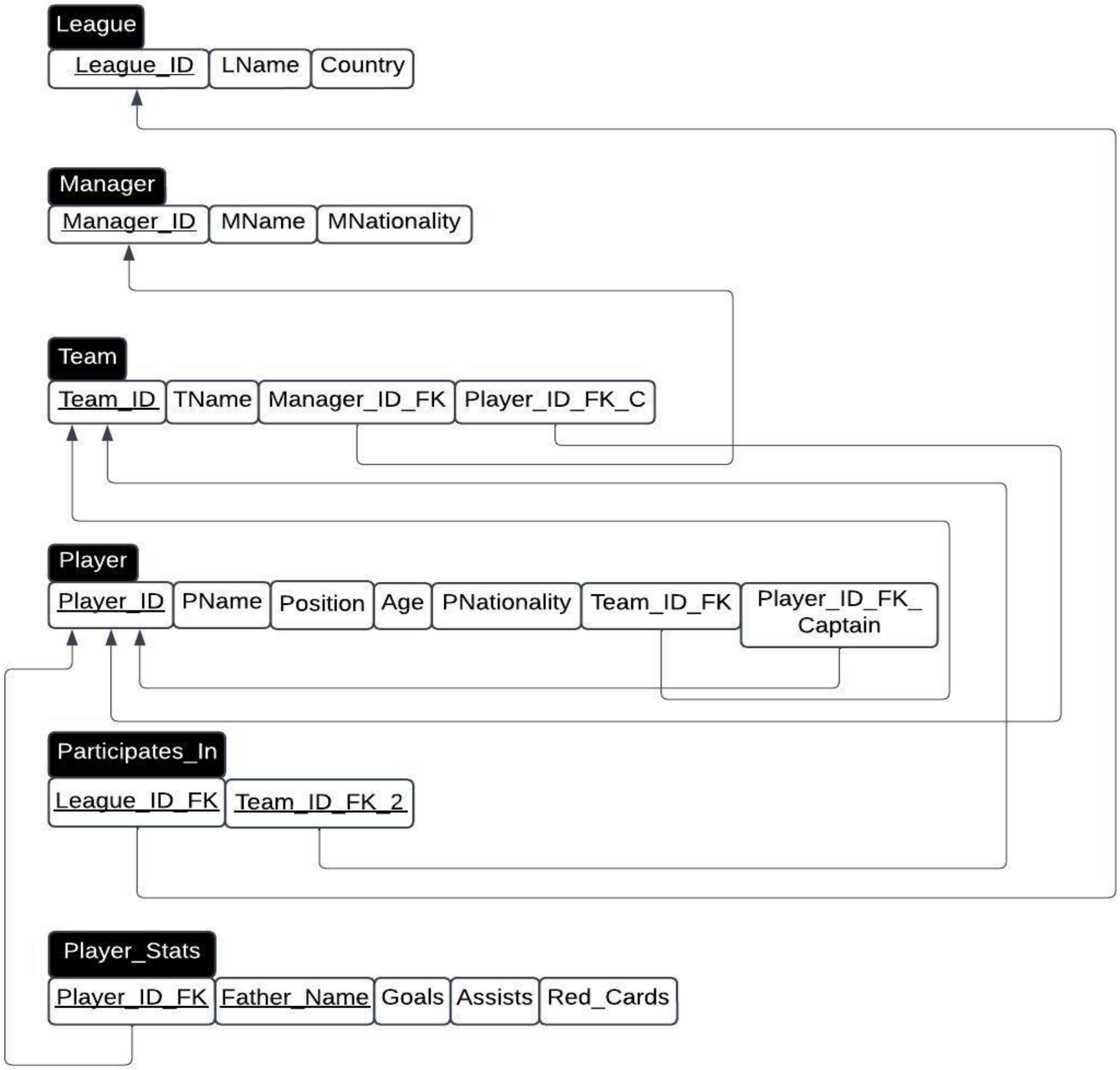
6) **Mapping of Multivalued Attributes:**

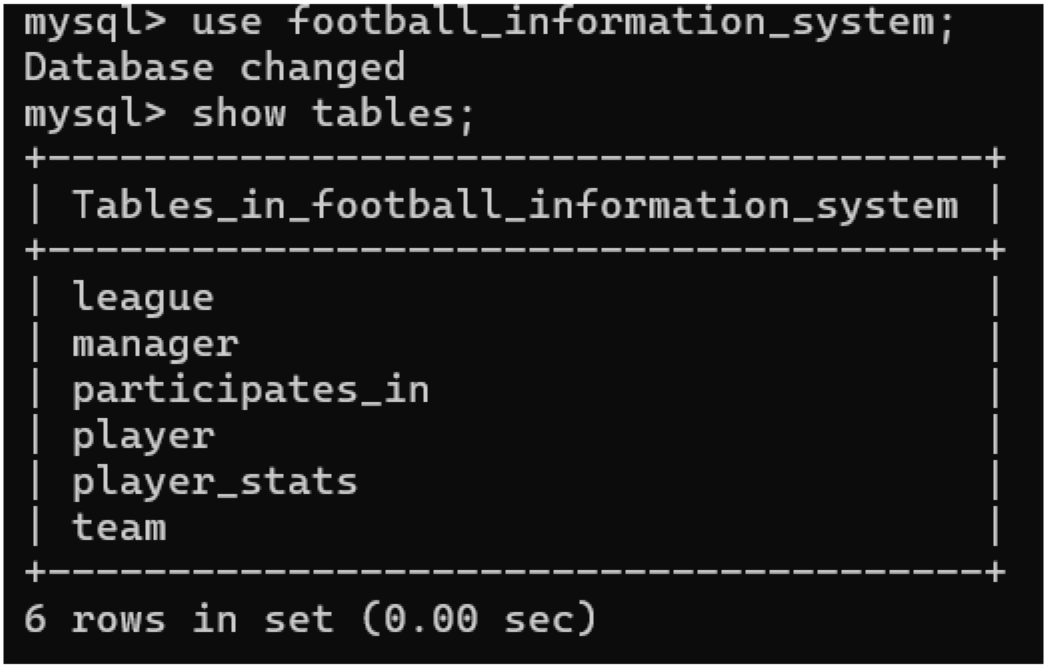
There are no multivalued attributes in this database.

7) **Mapping of N-ary Relationship types:**

Similarly, there are no such relationships that involve more than 2 entity types in it i.e., no N-ary relationships are there in this database.

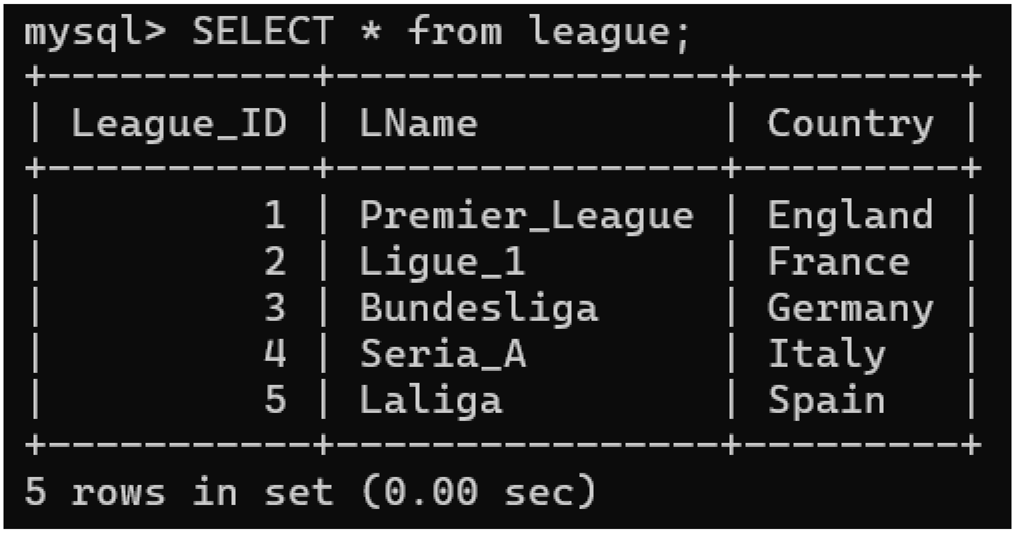
Therefore, after the complete relational mapping, the final full relational schema is:


League
League_ID LName Country
Manager
Manager_ID MName MNationality
Team
Team_ID TName Manager_ID_FK Player_ID_FK_C
Player
Player_ID PName Position Age PNationality Team_ID_FK Player_ID_FK_ Captain
Participates_In
League_ID_FK Team_ID_FK_2
Player_Stats
Player_ID_FK Father_Name Goals Assists Red_Cards

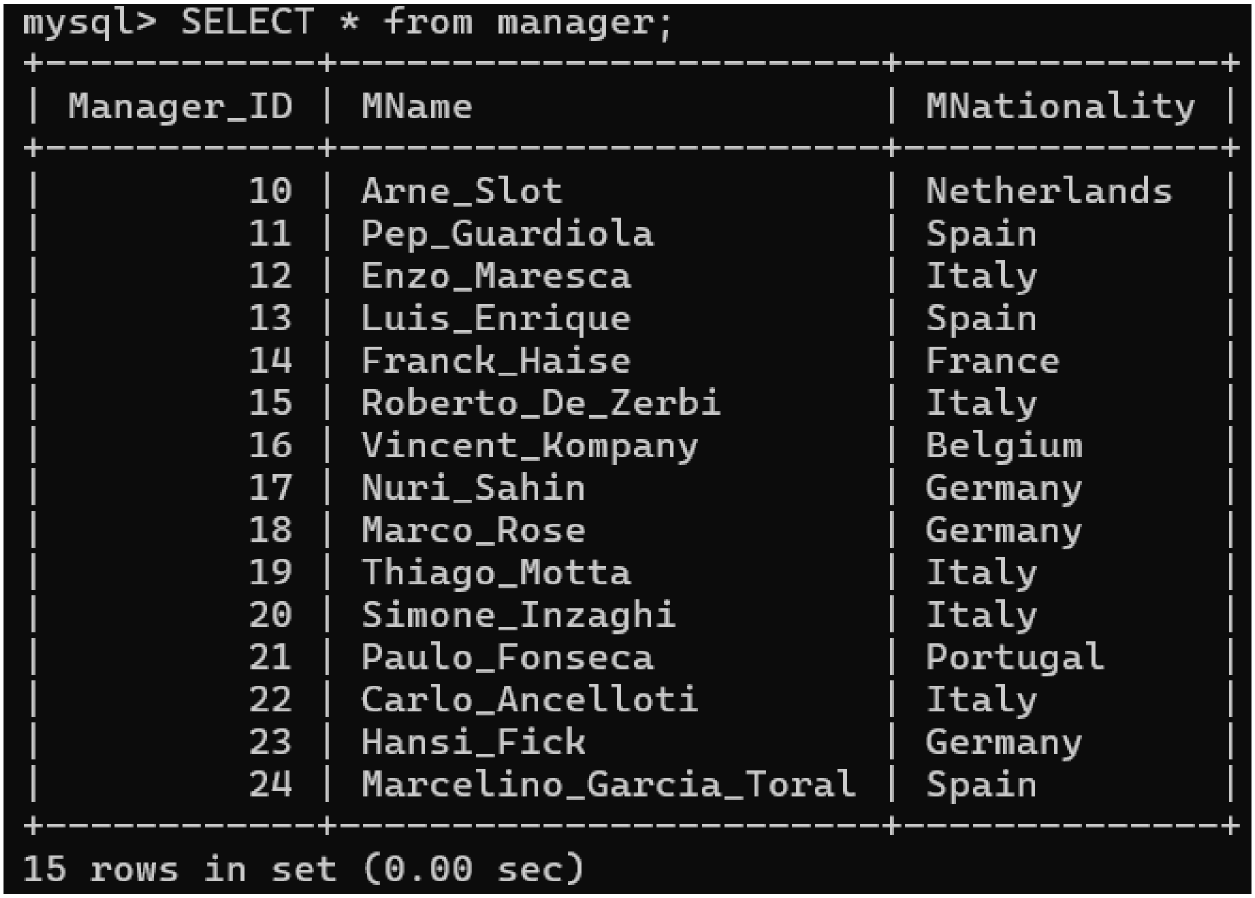


```
mysql> use football_information_system;
Database changed
mysql> show tables;
+--------------------------------------+
| Tables_in_football_information_system |
+--------------------------------------+
| league                                |
| manager                               |
| participates_in                       |
| player                                |
| player_stats                          |
| team                                  |
+--------------------------------------+
6 rows in set (0.00 sec)
```

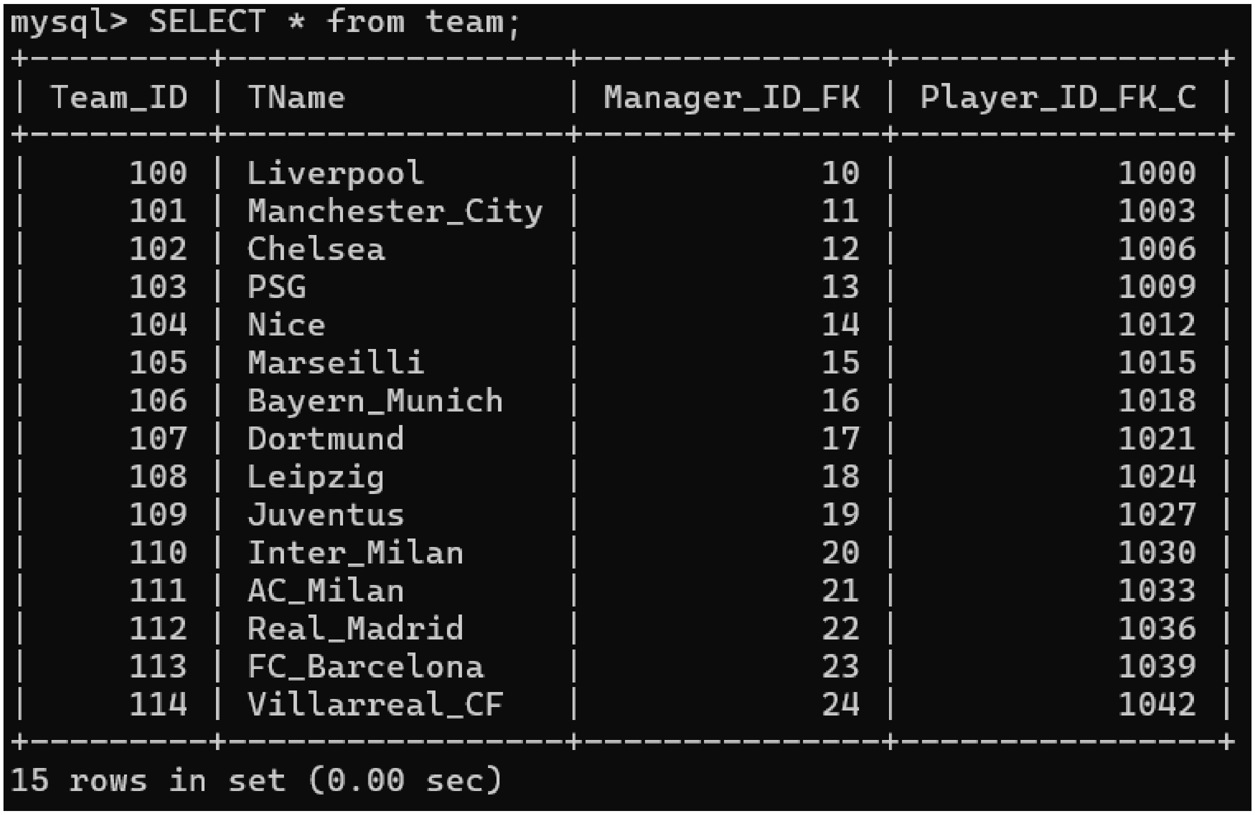
Correspondingly, the mapped relational tables can be shown as follows (in some sense):



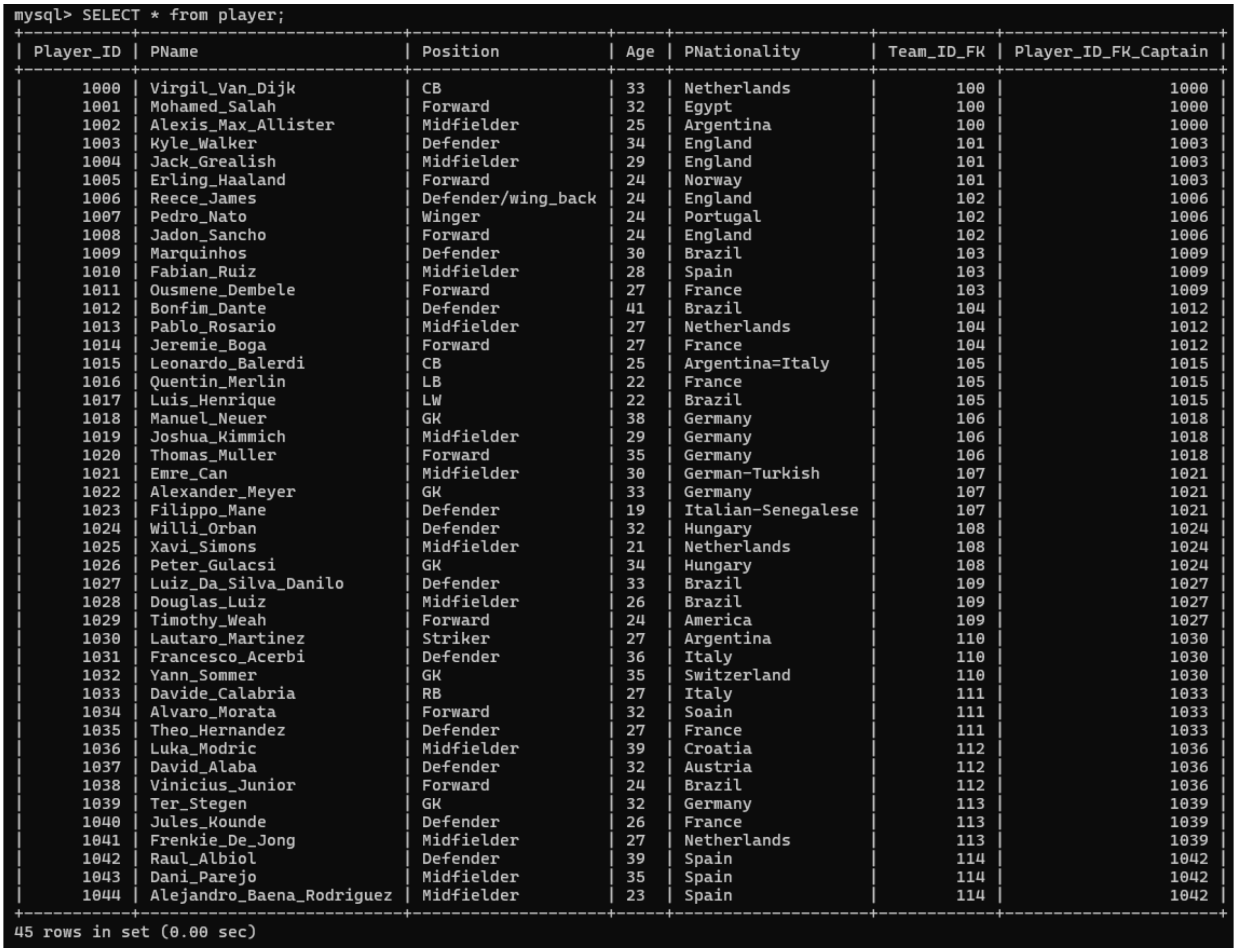
```
mysql> SELECT * from league;
+-----------+----------------+---------+
| League_ID | LName          | Country |
+-----------+----------------+---------+
|         1 | Premier_League | England |
|         2 | Ligue_1        | France  |
|         3 | Bundesliga     | Germany |
|         4 | Seria_A        | Italy   |
|         5 | Laliga         | Spain   |
+-----------+----------------+---------+
5 rows in set (0.00 sec)
```



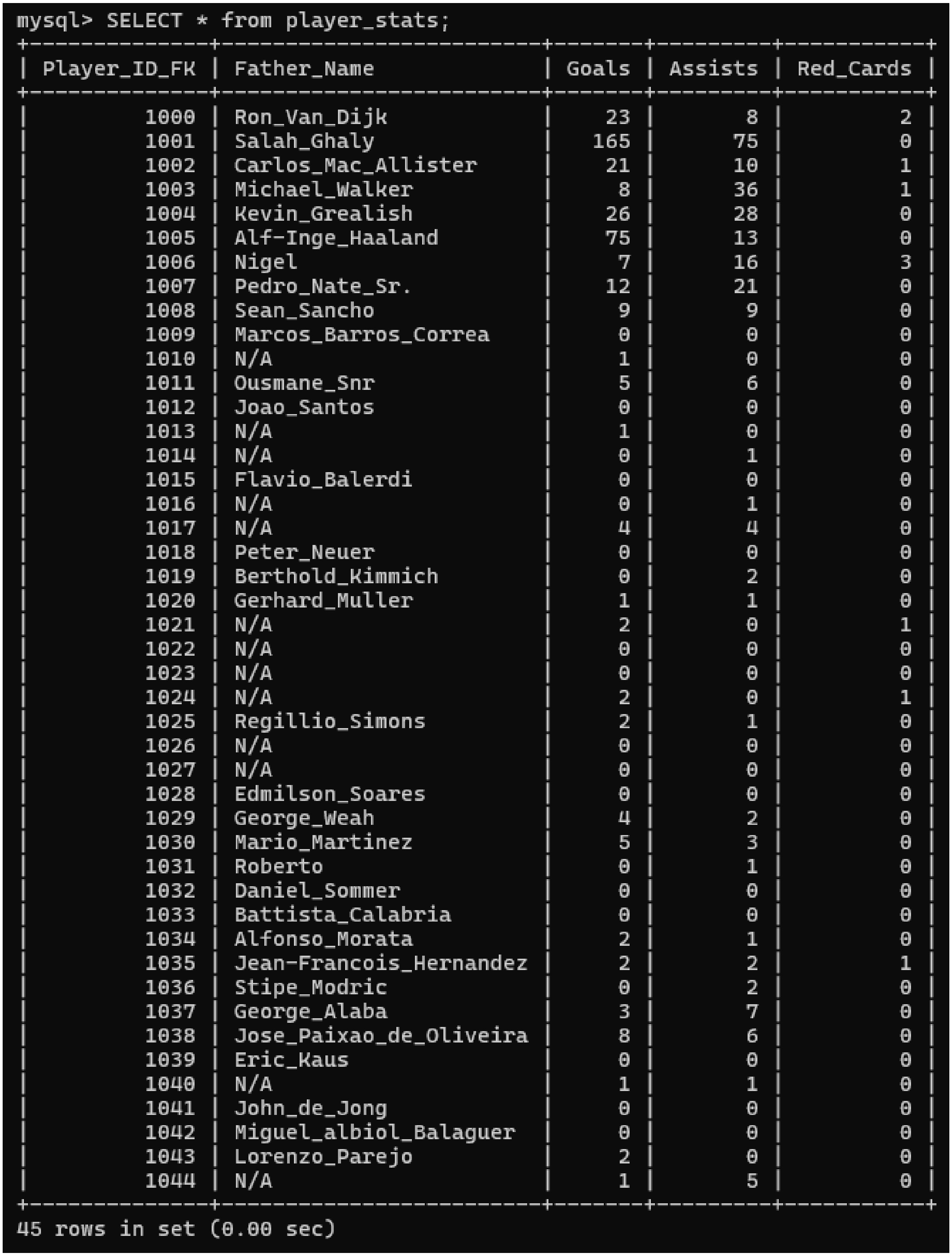
```
mysql> SELECT * from manager;
+------------+------------------------+--------------+
| Manager_ID | MName                  | MNationality |
+------------+------------------------+--------------+
|         10 | Arne_Slot              | Netherlands  |
|         11 | Pep_Guardiola          | Spain        |
|         12 | Enzo_Maresca           | Italy        |
|         13 | Luis_Enrique           | Spain        |
|         14 | Franck_Haise           | France       |
|         15 | Roberto_De_Zerbi       | Italy        |
|         16 | Vincent_Kompany        | Belgium      |
|         17 | Nuri_Sahin             | Germany      |
|         18 | Marco_Rose             | Germany      |
|         19 | Thiago_Motta           | Italy        |
|         20 | Simone_Inzaghi         | Italy        |
|         21 | Paulo_Fonseca          | Portugal     |
|         22 | Carlo_Ancelloti        | Italy        |
|         23 | Hansi_Fick             | Germany      |
|         24 | Marcelino_Garcia_Toral | Spain        |
+------------+------------------------+--------------+
15 rows in set (0.00 sec)
```



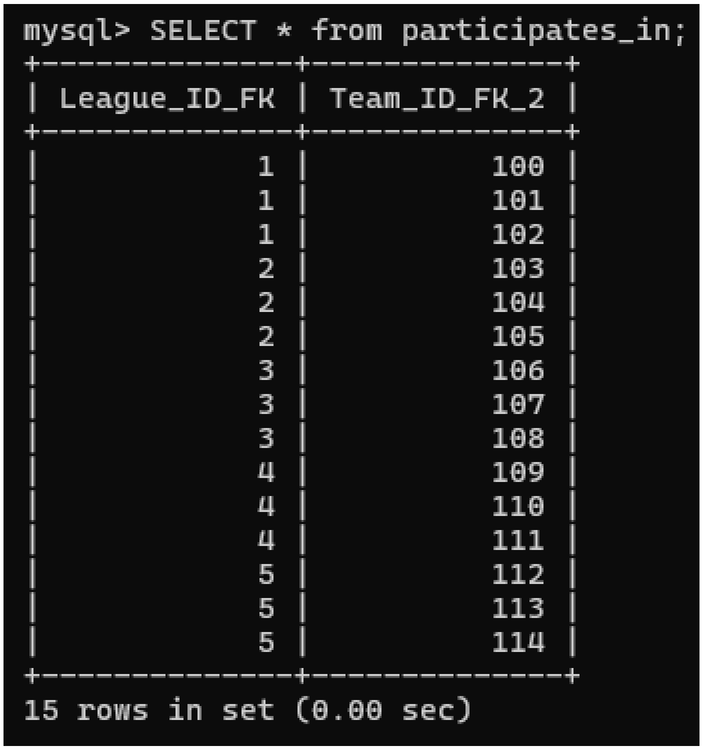
```
mysql> SELECT * from team;
+---------+-----------------+---------------+----------------+
| Team_ID | TName           | Manager_ID_FK | Player_ID_FK_C |
+---------+-----------------+---------------+----------------+
|     100 | Liverpool       |            10 |           1000 |
|     101 | Manchester_City |            11 |           1003 |
|     102 | Chelsea         |            12 |           1006 |
|     103 | PSG             |            13 |           1009 |
|     104 | Nice            |            14 |           1012 |
|     105 | Marseilli       |            15 |           1015 |
|     106 | Bayern_Munich   |            16 |           1018 |
|     107 | Dortmund        |            17 |           1021 |
|     108 | Leipzig         |            18 |           1024 |
|     109 | Juventus        |            19 |           1027 |
|     110 | Inter_Milan     |            20 |           1030 |
|     111 | AC_Milan        |            21 |           1033 |
|     112 | Real_Madrid     |            22 |           1036 |
|     113 | FC_Barcelona    |            23 |           1039 |
|     114 | Villarreal_CF   |            24 |           1042 |
+---------+-----------------+---------------+----------------+
15 rows in set (0.00 sec)
```



```
mysql> SELECT * from player;
+-----------+---------------------------+--------------------+-----+--------------------+------------+----------------------+
| Player_ID | PName                     | Position           | Age | PNationality       | Team_ID_FK | Player_ID_FK_Captain |
+-----------+---------------------------+--------------------+-----+--------------------+------------+----------------------+
|      1000 | Virgil_Van_Dijk           | CB                 | 33  | Netherlands        |        100 |                 1000 |
|      1001 | Mohamed_Salah             | Forward            | 32  | Egypt              |        100 |                 1000 |
|      1002 | Alexis_Max_Allister       | Midfielder         | 25  | Argentina          |        100 |                 1000 |
|      1003 | Kyle_Walker               | Defender           | 34  | England            |        101 |                 1003 |
|      1004 | Jack_Grealish             | Midfielder         | 29  | England            |        101 |                 1003 |
|      1005 | Erling_Haaland            | Forward            | 24  | Norway             |        101 |                 1003 |
|      1006 | Reece_James               | Defender/wing_back | 24  | England            |        102 |                 1006 |
|      1007 | Pedro_Nato                | Winger             | 24  | Portugal           |        102 |                 1006 |
|      1008 | Jadon_Sancho              | Forward            | 24  | England            |        102 |                 1006 |
|      1009 | Marquinhos                | Defender           | 30  | Brazil             |        103 |                 1009 |
|      1010 | Fabian_Ruiz               | Midfielder         | 28  | Spain              |        103 |                 1009 |
|      1011 | Ousmene_Dembele           | Forward            | 27  | France             |        103 |                 1009 |
|      1012 | Bonfim_Dante              | Defender           | 41  | Brazil             |        104 |                 1012 |
|      1013 | Pablo_Rosario             | Midfielder         | 27  | Netherlands        |        104 |                 1012 |
|      1014 | Jeremie_Boga              | Forward            | 27  | France             |        104 |                 1012 |
|      1015 | Leonardo_Balerdi          | CB                 | 25  | Argentina=Italy    |        105 |                 1015 |
|      1016 | Quentin_Merlin            | LB                 | 22  | France             |        105 |                 1015 |
|      1017 | Luis_Henrique             | LW                 | 22  | Brazil             |        105 |                 1015 |
|      1018 | Manuel_Neuer              | GK                 | 38  | Germany            |        106 |                 1018 |
|      1019 | Joshua_Kimmich            | Midfielder         | 29  | Germany            |        106 |                 1018 |
|      1020 | Thomas_Muller             | Forward            | 35  | Germany            |        106 |                 1018 |
|      1021 | Emre_Can                  | Midfielder         | 30  | German-Turkish     |        107 |                 1021 |
|      1022 | Alexander_Meyer           | GK                 | 33  | Germany            |        107 |                 1021 |
|      1023 | Filippo_Mane              | Defender           | 19  | Italian-Senegalese |        107 |                 1021 |
|      1024 | Willi_Orban               | Defender           | 32  | Hungary            |        108 |                 1024 |
|      1025 | Xavi_Simons               | Midfielder         | 21  | Netherlands        |        108 |                 1024 |
|      1026 | Peter_Gulacsi             | GK                 | 34  | Hungary            |        108 |                 1024 |
|      1027 | Luiz_Da_Silva_Danilo      | Defender           | 33  | Brazil             |        109 |                 1027 |
|      1028 | Douglas_Luiz              | Midfielder         | 26  | Brazil             |        109 |                 1027 |
|      1029 | Timothy_Weah              | Forward            | 24  | America            |        109 |                 1027 |
|      1030 | Lautaro_Martinez          | Striker            | 27  | Argentina          |        110 |                 1030 |
|      1031 | Francesco_Acerbi          | Defender           | 36  | Italy              |        110 |                 1030 |
|      1032 | Yann_Sommer               | GK                 | 35  | Switzerland        |        110 |                 1030 |
|      1033 | Davide_Calabria           | RB                 | 27  | Italy              |        111 |                 1033 |
|      1034 | Alvaro_Morata             | Forward            | 32  | Soain              |        111 |                 1033 |
|      1035 | Theo_Hernandez            | Defender           | 27  | France             |        111 |                 1033 |
|      1036 | Luka_Modric               | Midfielder         | 39  | Croatia            |        112 |                 1036 |
|      1037 | David_Alaba               | Defender           | 32  | Austria            |        112 |                 1036 |
|      1038 | Vinicius_Junior           | Forward            | 24  | Brazil             |        112 |                 1036 |
|      1039 | Ter_Stegen                | GK                 | 32  | Germany            |        113 |                 1039 |
|      1040 | Jules_Kounde              | Defender           | 26  | France             |        113 |                 1039 |
|      1041 | Frenkie_De_Jong           | Midfielder         | 27  | Netherlands        |        113 |                 1039 |
|      1042 | Raul_Albiol               | Defender           | 39  | Spain              |        114 |                 1042 |
|      1043 | Dani_Parejo               | Midfielder         | 35  | Spain              |        114 |                 1042 |
|      1044 | Alejandro_Baena_Rodriguez | Midfielder         | 23  | Spain              |        114 |                 1042 |
+-----------+---------------------------+--------------------+-----+--------------------+------------+----------------------+
45 rows in set (0.00 sec)
```



```
mysql> SELECT * from player_stats;
+--------------+-------------------------+-------+---------+-----------+
| Player_ID_FK | Father_Name             | Goals | Assists | Red_Cards |
+--------------+-------------------------+-------+---------+-----------+
|         1000 | Ron_Van_Dijk            |    23 |       8 |         2 |
|         1001 | Salah_Ghaly             |   165 |      75 |         0 |
|         1002 | Carlos_Mac_Allister     |    21 |      10 |         1 |
|         1003 | Michael_Walker          |     8 |      36 |         1 |
|         1004 | Kevin_Grealish          |    26 |      28 |         0 |
|         1005 | Alf-Inge_Haaland        |    75 |      13 |         0 |
|         1006 | Nigel                   |     7 |      16 |         3 |
|         1007 | Pedro_Nate_Sr.          |    12 |      21 |         0 |
|         1008 | Sean_Sancho             |     9 |       9 |         0 |
|         1009 | Marcos_Barros_Correa    |     0 |       0 |         0 |
|         1010 | N/A                     |     1 |       0 |         0 |
|         1011 | Ousmane_Snr             |     5 |       6 |         0 |
|         1012 | Joao_Santos             |     0 |       0 |         0 |
|         1013 | N/A                     |     1 |       0 |         0 |
|         1014 | N/A                     |     0 |       1 |         0 |
|         1015 | Flavio_Balerdi          |     0 |       0 |         0 |
|         1016 | N/A                     |     0 |       1 |         0 |
|         1017 | N/A                     |     4 |       4 |         0 |
|         1018 | Peter_Neuer             |     0 |       0 |         0 |
|         1019 | Berthold_Kimmich        |     0 |       2 |         0 |
|         1020 | Gerhard_Muller          |     1 |       1 |         0 |
|         1021 | N/A                     |     2 |       0 |         1 |
|         1022 | N/A                     |     0 |       0 |         0 |
|         1023 | N/A                     |     0 |       0 |         0 |
|         1024 | N/A                     |     2 |       0 |         1 |
|         1025 | Regillio_Simons         |     2 |       1 |         0 |
|         1026 | N/A                     |     0 |       0 |         0 |
|         1027 | N/A                     |     0 |       0 |         0 |
|         1028 | Edmilson_Soares         |     0 |       0 |         0 |
|         1029 | George_Weah             |     4 |       2 |         0 |
|         1030 | Mario_Martinez          |     5 |       3 |         0 |
|         1031 | Roberto                 |     0 |       1 |         0 |
|         1032 | Daniel_Sommer           |     0 |       0 |         0 |
|         1033 | Battista_Calabria       |     0 |       0 |         0 |
|         1034 | Alfonso_Morata          |     2 |       1 |         0 |
|         1035 | Jean-Francois_Hernandez |     2 |       2 |         1 |
|         1036 | Stipe_Modric            |     0 |       2 |         0 |
|         1037 | George_Alaba            |     3 |       7 |         0 |
|         1038 | Jose_Paixao_de_Oliveira |     8 |       6 |         0 |
|         1039 | Eric_Kaus               |     0 |       0 |         0 |
|         1040 | N/A                     |     1 |       1 |         0 |
|         1041 | John_de_Jong            |     0 |       0 |         0 |
|         1042 | Miguel_albiol_Balaguer  |     0 |       0 |         0 |
|         1043 | Lorenzo_Parejo          |     2 |       0 |         0 |
|         1044 | N/A                     |     1 |       5 |         0 |
+--------------+-------------------------+-------+---------+-----------+
45 rows in set (0.00 sec)
```



```
mysql> SELECT * from participates_in;
+--------------+--------------+
| League_ID_FK | Team_ID_FK_2 |
+--------------+--------------+
|            1 |          100 |
|            1 |          101 |
|            1 |          102 |
|            2 |          103 |
|            2 |          104 |
|            2 |          105 |
|            3 |          106 |
|            3 |          107 |
|            3 |          108 |
|            4 |          109 |
|            4 |          110 |
|            4 |          111 |
|            5 |          112 |
|            5 |          113 |
|            5 |          114 |
+--------------+--------------+
15 rows in set (0.00 sec)
```

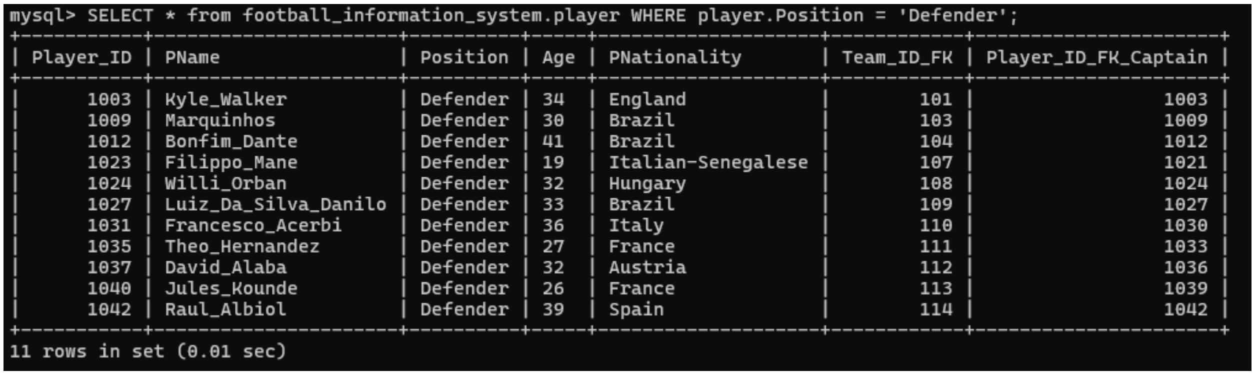
Explanation of Code of Database

See the SQL text file submitted with this report. It has all the explanations with the code there itself. I hope it will help. It is the place where all code has been explained.

However, Insertions are done by explicitly specifying values for each attribute in the table using the VALUES clause.

The constraints mainly used are: PRIMARY KEY, FOREIGN KEY, NOT NULL, ON DELETE NO ACTION & ON UPDATE NO ACTION with their usual meanings: unique identifier, data integrity & consistency, no null value taking attributes, and the actions to be taken when some deletions or updations are made in the referred data in the parent tables.

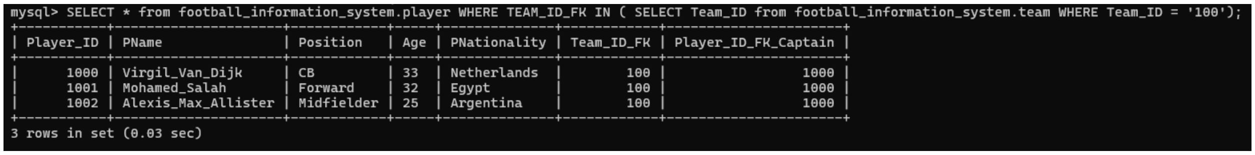
SQL Query for querying an entity type for all those entities which have a specific attribute.



```
mysql> SELECT * from football_information_system.player WHERE player.Position = 'Defender';
+-----------+----------------------+----------+-----+--------------------+------------+----------------------+
| Player_ID | PName                | Position | Age | PNationality       | Team_ID_FK | Player_ID_FK_Captain |
+-----------+----------------------+----------+-----+--------------------+------------+----------------------+
|      1003 | Kyle_Walker          | Defender | 34  | England            |        101 |                 1003 |
|      1009 | Marquinhos           | Defender | 30  | Brazil             |        103 |                 1009 |
|      1012 | Bonfim_Dante         | Defender | 41  | Brazil             |        104 |                 1012 |
|      1023 | Filippo_Mane         | Defender | 19  | Italian-Senegalese |        107 |                 1021 |
|      1024 | Willi_Orban          | Defender | 32  | Hungary            |        108 |                 1024 |
|      1027 | Luiz_Da_Silva_Danilo | Defender | 33  | Brazil             |        109 |                 1027 |
|      1031 | Francesco_Acerbi     | Defender | 36  | Italy              |        110 |                 1030 |
|      1035 | Theo_Hernandez       | Defender | 27  | France             |        111 |                 1033 |
|      1037 | David_Alaba          | Defender | 32  | Austria            |        112 |                 1036 |
|      1040 | Jules_Kounde         | Defender | 26  | France             |        113 |                 1039 |
|      1042 | Raul_Albiol          | Defender | 39  | Spain              |        114 |                 1042 |
+-----------+----------------------+----------+-----+--------------------+------------+----------------------+
11 rows in set (0.01 sec)
```

Above is the SQL query to query all players who play at a Defender Position.

An SQL query for two entity types, E1 and E2, where there is a 1:N relationship R between E1 and E2, all the E2 entities that have relationship R with a specific E1 entity.



```
mysql> SELECT * from football_information_system.player WHERE TEAM_ID_FK IN ( SELECT Team_ID from football_information_system.team WHERE Team_ID = '100');
+-----------+---------------------+------------+-----+--------------+------------+----------------------+
| Player_ID | PName               | Position   | Age | PNationality | Team_ID_FK | Player_ID_FK_Captain |
+-----------+---------------------+------------+-----+--------------+------------+----------------------+
|      1000 | Virgil_Van_Dijk     | CB         | 33  | Netherlands  |        100 |                 1000 |
|      1001 | Mohamed_Salah       | Forward    | 32  | Egypt        |        100 |                 1000 |
|      1002 | Alexis_Max_Allister | Midfielder | 25  | Argentina    |        100 |                 1000 |
+-----------+---------------------+------------+-----+--------------+------------+----------------------+
3 rows in set (0.03 sec)
```

Above is the SQL query for querying player table (N side) using team table(1 side) through the relationship Plays_for which can be understood from the foreign key, Team_ID_FK used.