



Data Base Systems Mini Project

A report submitted to the

Department of Electrical and Information Engineering
Faculty of Engineering
University of Ruhuna Sri Lanka

On 9th of April 2024

In completing an assignment for the module

EE4350 Data Base systems

By:

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Chapter 1 - Requirement Analysis

1.1. Functional Requirements

All of the program's desired operations are incorporated step-by-step in accordance with this chapter. This database accomplishes the following things in order to do that.

- Data retrieval
- Ability to alter the database's content at any time
- Capable of completing potential data gaps or missing data
- Capability to edit data that has already been entered into the database
- The ability to add comments to data when the data is incomplete or ambiguous.
- The capacity to provide data with enhanced performance

This schema is created to represent the sport league and all the needed and maximum number of entities of this schema have been covered. They are league, team, player, sponsor, league sponsor, team sponsor, referee, venue, game, game team, game referee, player stat, team stat.. All the needed data for the schema shown in this database.

1.2. DATA REQUIREMENTS

The attributes of each entity are shown below

League

- League_ID
- League_name
- Sport
- Start_date
- End_date
- Location

Team

- Team_ID
- Team_name
- League_ID
- City

Player

- Player_ID

- First_name
- Last_name
- Team_ID
- Birthday
- Position
- Jersey_number

Sponser:

- Sponser_ID
- Company_name
- Contact_number
- Email
- Category

League_Sponser:

- League_ID
- Sponsor_ID

Team_Sponser:

- Team_ID
- Sponsor_ID

Referee:

- Referee_ID
- First_name
- Last_name
- Contact_number

Venue:

- Venue_ID
- Venue_name
- Capacity
- Country

Game:

- Game_ID
- Venue_ID
- Winning_Team_ID

Game_Team:

- Game_ID
- Team_ID
- Winner_flag

Game_Refree:

- Game_ID
- Refree_ID

Player_Stat:

- Match_ID
- Player_ID
- Goals
- Assists

Team_Stat:

- Match_ID
- Team_ID
- Goals_for
- Goals_against

Also, we are included some important entities and relationships.

They are,

- Weak entities
 - Recursive relationship
-
- ✓ Weak entities

There are two weak entities in our ER diagram shown, and we have shown them using a double-line rectangle. Player stat is one of them. It depends on the player entity. The player stat entity does not have a key either. Therefore, we have considered player stat as a weak entity. Another weak entity we have considered is the team stat entity. It does not have a key, and it also totally depends on the team entity. So, we consider team stat to be a weak entity.

- ✓ Recursive relationship

Here, we have considered the relationship between the team leader and the members as a recursive relationship as it exist between the same entity. A leader will lead the team, means that he alone will represent each and every one of the team. Therefore, this is a recursive relationship.

Chapter 2 - Conceptual Design

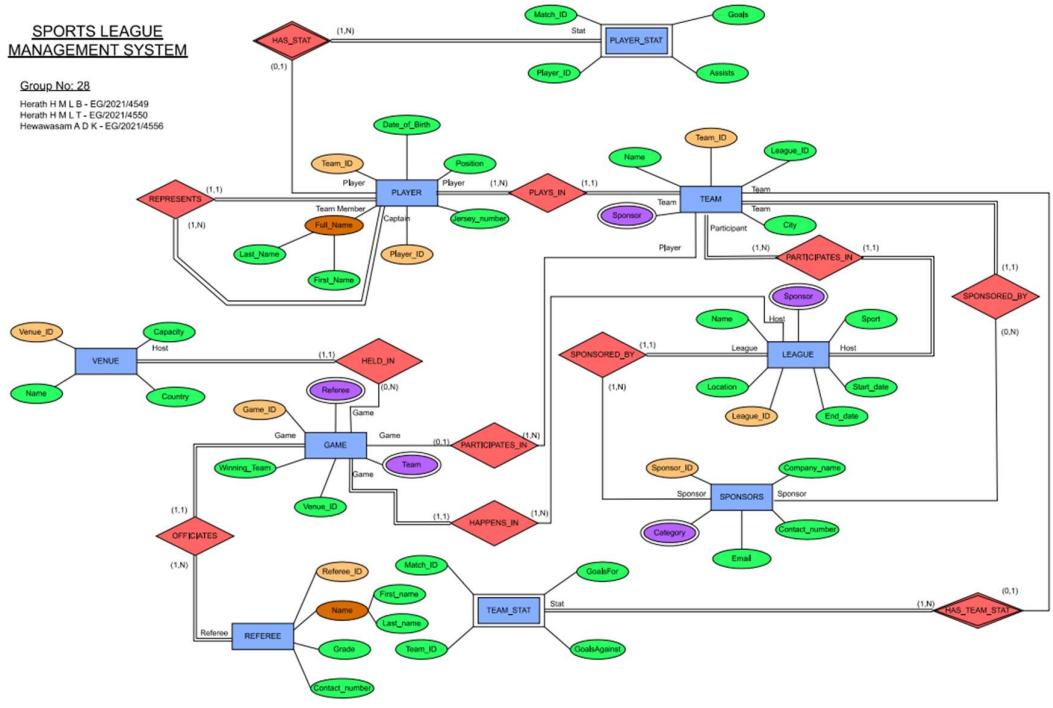


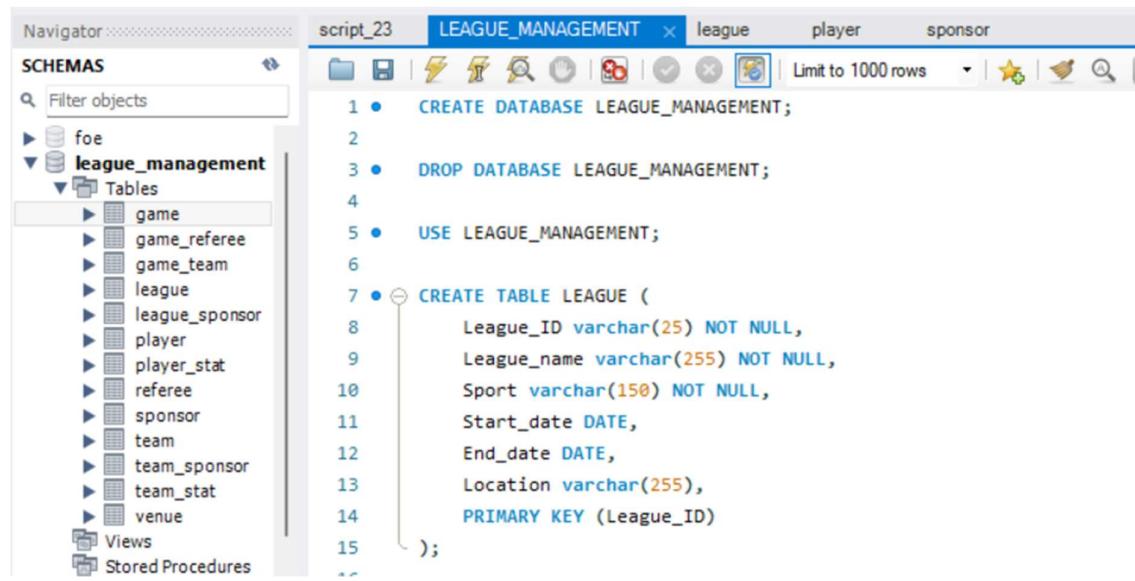
Figure 2.1:ER diagram of the league management database management system

Chapter 3 - Implementation

In this chapter, all the screenshots of implemented database model are included.

3.1. TABLE IMPLEMENTATION

❖ Create table League

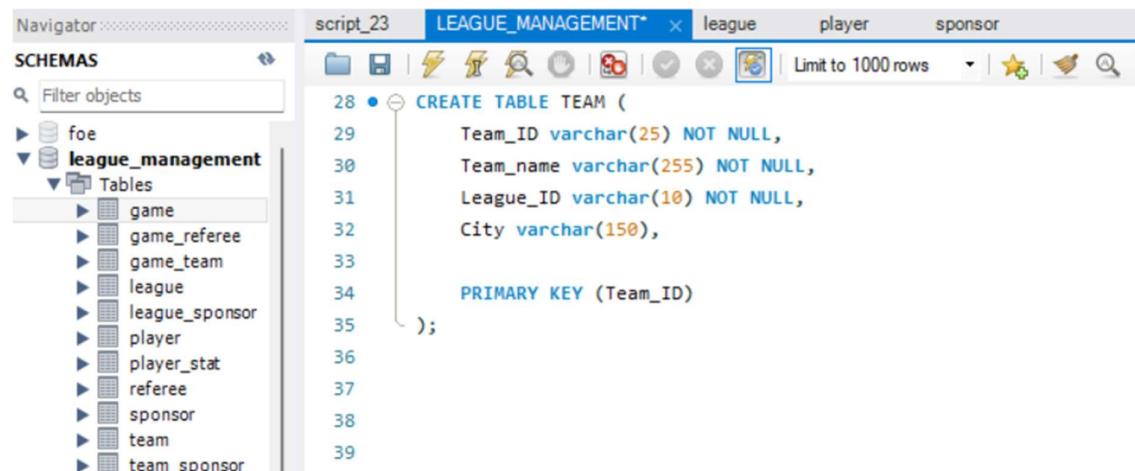


The screenshot shows a database management interface with a left sidebar labeled 'Navigator' containing 'SCHEMAS' and 'script_23'. Under 'SCHEMAS', there are two databases: 'foe' and 'league_management'. The 'league_management' schema is expanded to show its tables: game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, team, team_sponsor, team_stat, and venue. Below these are 'Views' and 'Stored Procedures'. On the right, the main area is titled 'script_23' and 'LEAGUE_MANAGEMENT'. It contains the following SQL code:

```
1 ● CREATE DATABASE LEAGUE_MANAGEMENT;
2
3 ● DROP DATABASE LEAGUE_MANAGEMENT;
4
5 ● USE LEAGUE_MANAGEMENT;
6
7 ● CREATE TABLE LEAGUE (
8     League_ID varchar(25) NOT NULL,
9     League_name varchar(255) NOT NULL,
10    Sport varchar(150) NOT NULL,
11    Start_date DATE,
12    End_date DATE,
13    Location varchar(255),
14    PRIMARY KEY (League_ID)
15 );
```

Figure 3.1: Create League Table.

❖ Create table Team



The screenshot shows a database management interface with a left sidebar labeled 'Navigator' containing 'SCHEMAS' and 'script_23'. Under 'SCHEMAS', there are two databases: 'foe' and 'league_management'. The 'league_management' schema is expanded to show its tables: game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, team, and team_sponsor. Below these are 'Views' and 'Stored Procedures'. On the right, the main area is titled 'script_23' and 'LEAGUE_MANAGEMENT'. It contains the following SQL code:

```
28 ● CREATE TABLE TEAM (
29     Team_ID varchar(25) NOT NULL,
30     Team_name varchar(255) NOT NULL,
31     League_ID varchar(10) NOT NULL,
32     City varchar(150),
33
34     PRIMARY KEY (Team_ID)
35 );
36
37
38
39
```

Figure 3.2: Create Team Table.

❖ Create table Player

The screenshot shows the MySQL Workbench interface. The left pane displays the Navigator with the SCHEMAS section expanded, showing the 'league_management' schema with its tables: game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, team, and team_sponsor. The right pane shows a script editor titled 'script_23' under the 'LEAGUE_MANAGEMENT*' connection. The code is as follows:

```
52
53 • CREATE TABLE PLAYER (
54     Player_ID varchar(25) NOT NULL,
55     First_name varchar(100) NOT NULL,
56     Last_name varchar(100) NOT NULL,
57     Team_ID varchar(25) NOT NULL,
58     Birthday DATE NOT NULL,
59     Position varchar(100),
60     Jersey_number int,
61     PRIMARY KEY (Player_ID)
62 );
63
```

Figure 3.3: Create Table Player.

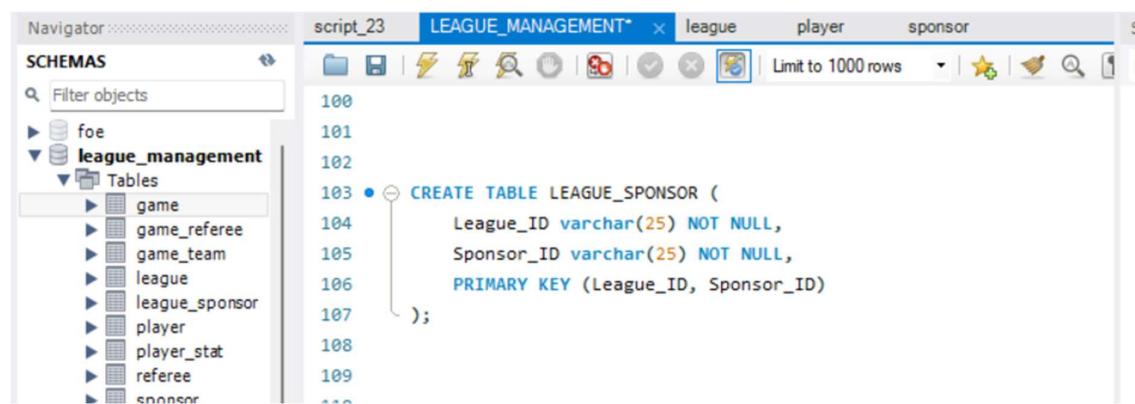
❖ Create table Sponsor

The screenshot shows the MySQL Workbench interface. The left pane displays the Navigator with the SCHEMAS section expanded, showing the 'league_management' schema with its tables: game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, team, and team_sponsor. The right pane shows a script editor titled 'script_23' under the 'LEAGUE_MANAGEMENT*' connection. The code is as follows:

```
76     ('P8', 'Kylian', 'Mbappe', 'T5', '1998-12-20', 'Forward', 7);
77
78 • CREATE TABLE SPONSOR (
79     Sponsor_ID varchar(25) NOT NULL,
80     Company_name varchar(255) NOT NULL,
81     Contact_number varchar(50),
82     Email varchar(255),
83     Category varchar(50),
84     -- FOREIGN KEY (League_ID) REFERENCES LEAGUE(League_ID),
85     -- FOREIGN KEY (Sponsor_ID) REFERENCES SPONSOR(Sponsor_ID),
86     PRIMARY KEY (Sponsor_ID)
87 );
```

Figure 3.4: Create Table Sponsor.

❖ Create league_sponser

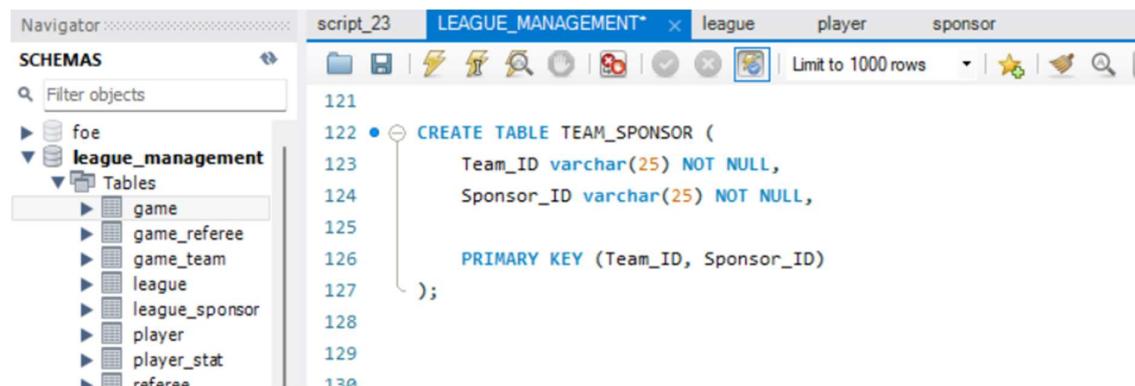


The screenshot shows the MySQL Workbench interface with the 'script_23' tab selected. In the left pane, the 'league_management' schema is expanded, showing various tables like game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, and sponsor. The right pane displays the SQL code for creating the 'LEAGUE_SPONSOR' table:

```
100  
101  
102  
103 • CREATE TABLE LEAGUE_SPONSOR (  
104     League_ID varchar(25) NOT NULL,  
105     Sponsor_ID varchar(25) NOT NULL,  
106     PRIMARY KEY (League_ID, Sponsor_ID)  
107 );  
108  
109  
110
```

Figure 3.5: Create Table League_Sponsor.

❖ Create table team_sponser

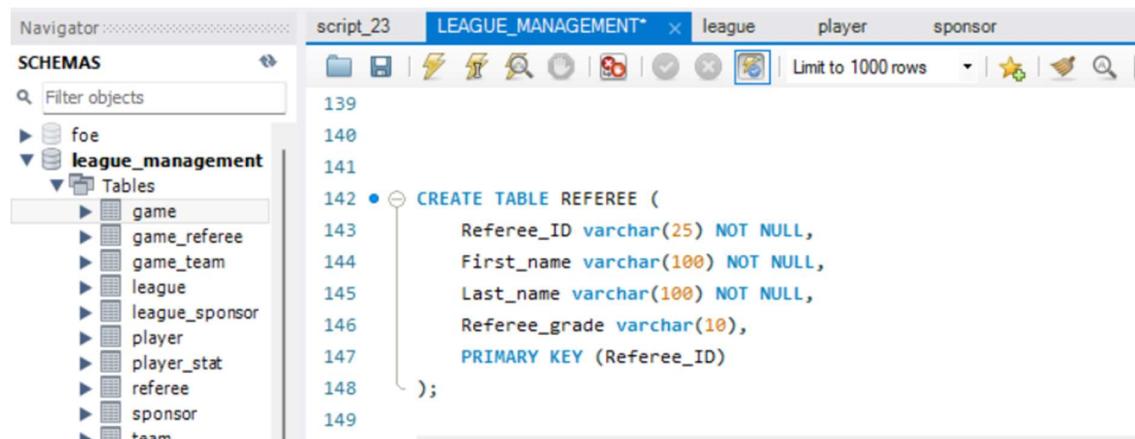


The screenshot shows the MySQL Workbench interface with the 'script_23' tab selected. In the left pane, the 'league_management' schema is expanded, showing tables like game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, and team. The right pane displays the SQL code for creating the 'TEAM_SPONSOR' table:

```
121  
122 • CREATE TABLE TEAM_SPONSOR (  
123     Team_ID varchar(25) NOT NULL,  
124     Sponsor_ID varchar(25) NOT NULL,  
125     PRIMARY KEY (Team_ID, Sponsor_ID)  
126 );  
127  
128  
129  
130
```

Figure 3.6: Create Table Team_Sponsor.

❖ Create table referee



The screenshot shows the MySQL Workbench interface with the 'script_23' tab selected. In the left pane, the 'league_management' schema is expanded, showing tables like game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, and team. The right pane displays the SQL code for creating the 'REFEREE' table:

```
139  
140  
141  
142 • CREATE TABLE REFEREE (  
143     Referee_ID varchar(25) NOT NULL,  
144     First_name varchar(100) NOT NULL,  
145     Last_name varchar(100) NOT NULL,  
146     Referee_grade varchar(10),  
147     PRIMARY KEY (Referee_ID)  
148 );  
149
```

Figure 3.7: Create Table Referee.

❖ Create table venue

The screenshot shows the MySQL Workbench interface. The left pane displays the Navigator with the SCHEMAS section expanded, showing the 'league_management' schema which contains tables like game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, and team. The right pane shows a script named 'script_23' under the 'LEAGUE_MANAGEMENT*' tab. The code for creating the VENUE table is visible, starting from line 163 and ending at line 174. The table has columns for Venue_ID (varchar(25) NOT NULL), Venue_name (varchar(255) NOT NULL), Capacity (int NOT NULL), and Country (varchar(100)), with Venue_ID as the primary key.

```
163  
164  
165 • CREATE TABLE VENUE (  
166     Venue_ID varchar(25) NOT NULL,  
167     Venue_name varchar(255) NOT NULL,  
168     Capacity int NOT NULL,  
169     Country varchar(100),  
170     PRIMARY KEY (Venue_ID)  
171 );  
172  
173  
174
```

Figure 3.8: Create Table Venue.

❖ Create table game

The screenshot shows the MySQL Workbench interface. The left pane displays the Navigator with the SCHEMAS section expanded, showing the 'league_management' schema which contains tables like game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, and sponsor. The right pane shows a script named 'script_23' under the 'LEAGUE_MANAGEMENT*' tab. The code for creating the GAME table is visible, starting from line 190 and ending at line 199. The table has columns for Game_ID (varchar(25) NOT NULL), Venue_ID (varchar(25) NOT NULL), and Winning_Team_ID (varchar(25) DEFAULT NULL), with Game_ID as the primary key.

```
190  
191  
192 • CREATE TABLE GAME (  
193     Game_ID varchar(25) NOT NULL,  
194     Venue_ID varchar(25) NOT NULL,  
195     Winning_Team_ID varchar(25) DEFAULT NULL,  
196     PRIMARY KEY (Game_ID)  
197 );  
198  
199
```

Figure 3.9: Create Table Game.

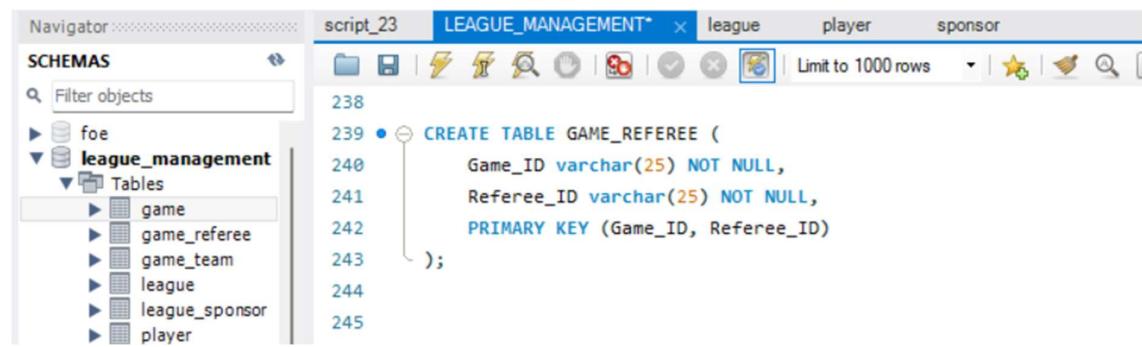
❖ Create table game_team

The screenshot shows the MySQL Workbench interface. The left pane displays the Navigator with the SCHEMAS section expanded, showing the 'league_management' schema which contains tables like game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, and sponsor. The right pane shows a script named 'script_23' under the 'LEAGUE_MANAGEMENT*' tab. The code for creating the GAME_TEAM table is visible, starting from line 211 and ending at line 219. The table has columns for Game_ID (varchar(25) NOT NULL), Team_ID (varchar(25) NOT NULL), and Winner_flag (BOOLEAN DEFAULT NULL), with a primary key consisting of Game_ID and Team_ID.

```
211  
212  
213 • CREATE TABLE GAME_TEAM (  
214     Game_ID varchar(25) NOT NULL,  
215     Team_ID varchar(25) NOT NULL,  
216     Winner_flag BOOLEAN DEFAULT NULL,  
217     PRIMARY KEY (Game_ID, Team_ID)  
218 );  
219
```

Figure 3.10: Create Table Game_Team.

❖ Create table game_referee



The screenshot shows the MySQL Workbench interface with the 'script_23' tab selected. The left pane displays the 'SCHEMAS' tree, with 'league_management' expanded to show its tables: game, game_referee, game_team, league, league_sponsor, player, referee, sponsor, team, team_sponsor, team_stat, and venue. The right pane shows the SQL code for creating the 'GAME_REFEREE' table:

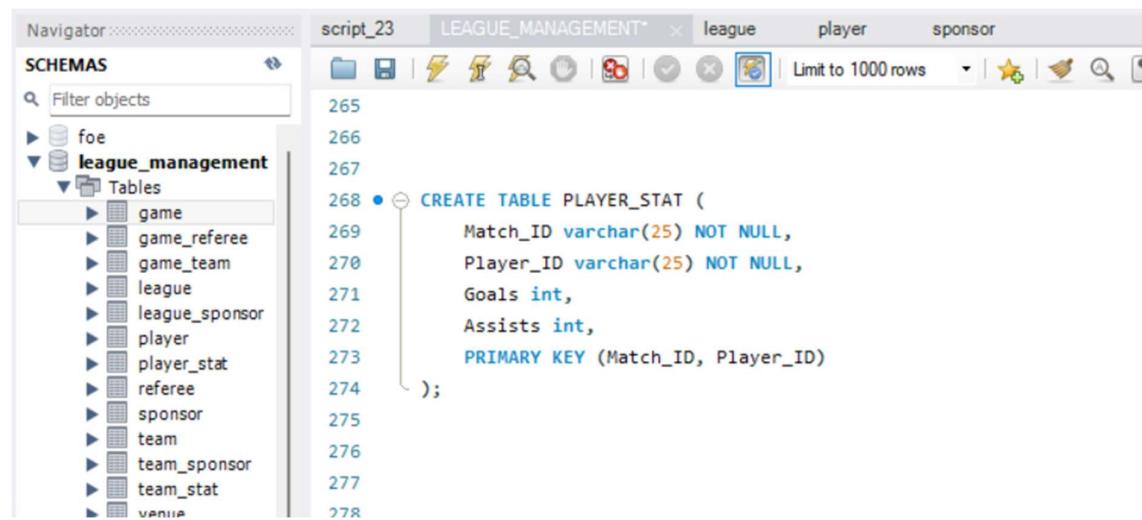
```

238 • CREATE TABLE GAME_REFEREE (
239     Game_ID varchar(25) NOT NULL,
240     Referee_ID varchar(25) NOT NULL,
241     PRIMARY KEY (Game_ID, Referee_ID)
242 );
243
244
245

```

Figure 3.11: Create Table Game_Referee.

❖ Create player_stat



The screenshot shows the MySQL Workbench interface with the 'script_23' tab selected. The left pane displays the 'SCHEMAS' tree, with 'league_management' expanded to show its tables: game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, team, team_sponsor, team_stat, and venue. The right pane shows the SQL code for creating the 'PLAYER_STAT' table:

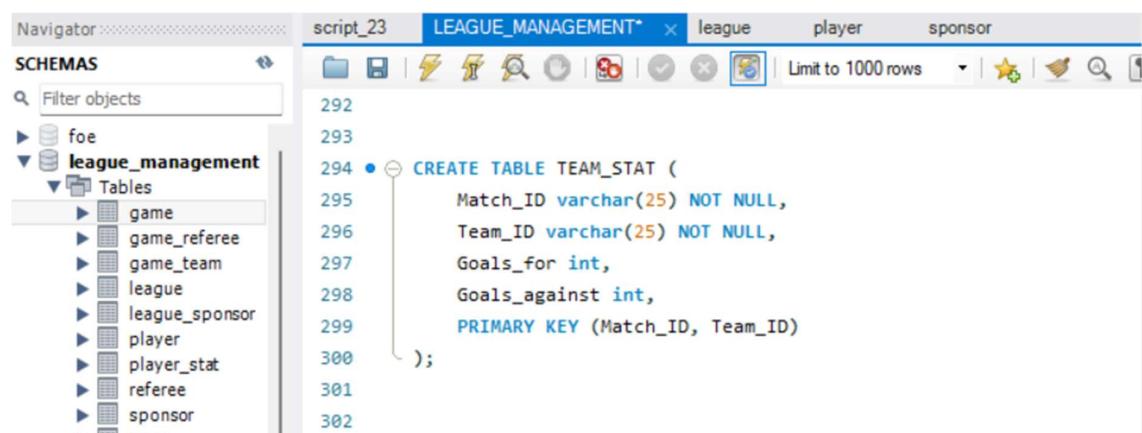
```

265
266
267
268 • CREATE TABLE PLAYER_STAT (
269     Match_ID varchar(25) NOT NULL,
270     Player_ID varchar(25) NOT NULL,
271     Goals int,
272     Assists int,
273     PRIMARY KEY (Match_ID, Player_ID)
274 );
275
276
277
278

```

Figure 3.12: Create Table Player_Stat.

❖ Create team_stat



The screenshot shows the MySQL Workbench interface with the 'script_23' tab selected. The left pane displays the 'SCHEMAS' tree, with 'league_management' expanded to show its tables: game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, team, team_sponsor, team_stat, and venue. The right pane shows the SQL code for creating the 'TEAM_STAT' table:

```

292
293
294 • CREATE TABLE TEAM_STAT (
295     Match_ID varchar(25) NOT NULL,
296     Team_ID varchar(25) NOT NULL,
297     Goals_for int,
298     Goals_against int,
299     PRIMARY KEY (Match_ID, Team_ID)
300 );
301
302

```

Figure 3.13: Create Table Team_Stat.

3.2. CREATING FOREIGN KEY CONSTRAINT

The screenshot shows a database interface with the following details:

- Schemas:** league_management
- Tables:** game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, team, team_sponsor, team_stat, venue
- Script Content (script_23):**

```

274 • ALTER TABLE team
275 ADD CONSTRAINT FK_TEAM
276 FOREIGN KEY (League_ID) REFERENCES LEAGUE(League_ID) ON delete cascade on update cascade;
277
278 • ALTER TABLE player
279 ADD CONSTRAINT FK_PLAYER
280 FOREIGN KEY (Team_ID) REFERENCES TEAM(Team_ID) ON delete cascade on update cascade;
281
282 • ALTER TABLE league_sponsor
283 ADD CONSTRAINT FK_LEAGUE_SPONSER1
284 FOREIGN KEY (League_ID) REFERENCES LEAGUE(League_ID) ON delete cascade on update cascade;
285
286 • ALTER TABLE league_sponsor
287 ADD CONSTRAINT FK_LEAGUE_SPONSER2
288 FOREIGN KEY (Sponsor_ID) REFERENCES SPONSOR(Sponsor_ID) ON delete cascade on update cascade;
289
290 • ALTER TABLE team_sponsor
291 ADD constraint FK_TEAM_SPONSER1
292 FOREIGN KEY (Team_ID) REFERENCES TEAM(Team_ID) ON delete cascade on update cascade;
293
294 • ALTER TABLE team_sponsor
295 ADD constraint FK_TEAM_SPONSER2
296 FOREIGN KEY (Sponsor_ID) REFERENCES SPONSOR(Sponsor_ID) ON delete cascade on update cascade;
297
298 • ALTER TABLE game
299 ADD constraint FK_GAME
300 FOREIGN KEY (Venue_ID) REFERENCES VENUE(Venue_ID) ON delete cascade on update cascade;
301

```
- Table: game**
- Columns:**
 - Game_ID (PK)
 - Venue_ID (PK)
 - Winning_Team_ID (PK)
- Related Tables:** venue

Figure 3.14: Create Foreign Key Constraints - I.

The screenshot shows a database interface with the following details:

- Schemas:** league_management
- Tables:** game, game_referee, game_team, league, league_sponsor, player, player_stat, referee, sponsor, team, team_sponsor, team_stat, venue
- Script Content (script_23):**

```

301
302 • ALTER TABLE game_team
303 ADD constraint FK_GAME_TEAM1
304 FOREIGN KEY (Game_ID) REFERENCES GAME(Game_ID) ON delete cascade on update cascade;
305
306 • ALTER TABLE game_team
307 ADD constraint FK_GAME_TEAM2
308 FOREIGN KEY (Team_ID) REFERENCES TEAM(Team_ID) ON delete cascade on update cascade;
309
310 • ALTER TABLE game_referee
311 ADD constraint FK_GAME_REFREE1
312 FOREIGN KEY (Game_ID) REFERENCES GAME(Game_ID) ON delete cascade on update cascade;
313
314 • ALTER TABLE game_referee
315 ADD constraint FK_GAME_REFREE2
316 FOREIGN KEY (Referee_ID) REFERENCES REFEREE(Referee_ID) ON delete cascade on update cascade;
317
318 • ALTER TABLE player_stat
319 ADD constraint FK_PLAYER_STAT1
320 FOREIGN KEY (Match_ID) REFERENCES GAME(Game_ID) ON delete cascade on update cascade;
321
322 • ALTER TABLE player_stat
323 ADD constraint FK_PLAYER_STAT2
324 FOREIGN KEY (Player_ID) REFERENCES PLAYER(Player_ID)ON delete cascade on update cascade;
325
326 • ALTER TABLE team_stat
327 ADD constraint FK_TEAM_STAT1
328 FOREIGN KEY (Match_ID) REFERENCES GAME(Game_ID) ON delete cascade on update cascade;
329

```
- Table: game**
- Columns:**
 - Game_ID (PK)
 - Venue_ID (PK)
 - Winning_Team_ID (PK)
- Related Tables:** venue (Venue_ID), Target

Figure 3.15: Create Foreign Key Constraints - II.

3.3. INSERTING DATA FOR TABLES

```
mysql> USE LEAGUE_MANAGEMENT;
Database changed
mysql> SHOW TABLES;
+-----+
| Tables_in_league_management |
+-----+
| game
| game_referee
| game_team
| league
| league_sponsor
| player
| player_stat
| referee
| sponsor
| team
| team_sponsor
| team_stat
| venue
+-----+
13 rows in set (0.00 sec)
```

Figure 3.16: Tables in the League_Management_System.

✓ TABLE LEAGUE

```
mysql> INSERT INTO LEAGUE VALUES
    -> ('L1', 'Premier League', 'Football', '2023-08-10', '2024-05-25', 'England'),
    -> ('L2', 'La Liga', 'Football', '2023-08-15', '2024-05-24', 'Spain'),
    -> ('L3', 'Serie A', 'Football', '2023-08-18', '2024-05-26', 'Italy'),
    -> ('L4', 'Bundesliga', 'Football', '2023-08-16', '2024-05-25', 'Germany'),
    -> ('L5', 'Ligue 1', 'Football', '2023-08-09', '2024-05-24', 'France'),
    -> ('L6', 'Eredivisie', 'Football', '2023-08-09', '2024-05-23', 'Netherlands');
Query OK, 6 rows affected (0.07 sec)
Records: 6  Duplicates: 0  Warnings: 0
|
mysql>
```

Figure 3.17: Inserting Values to League Table.

✓ TABLE TEAM

```
mysql> INSERT INTO TEAM VALUES
    -> ('T1', 'Manchester United', 'L1', 'Manchester'),
    -> ('T2', 'Real Madrid', 'L1', 'Madrid'),
    -> ('T3', 'Juventus', 'L1', 'Turin'),
    -> ('T4', 'Bayern Munich', 'L1', 'Munich'),
    -> ('T5', 'Paris Saint-Germain', 'L1', 'Paris'),
    -> ('T6', 'Ajax', 'L1', 'Amsterdam'),
    -> ('T7', 'Barcelona', 'L2', 'Barcelona'),
    -> ('T8', 'Atletico Madrid', 'L2', 'Madrid'),
    -> ('T9', 'Inter Milan', 'L2', 'Milan'),
    -> ('T10', 'AC Milan', 'L2', 'Milan'),
    -> ('T11', 'Liverpool', 'L2', 'Liverpool'),
    -> ('T12', 'Manchester City', 'L2', 'Manchester');
Query OK, 12 rows affected (0.02 sec)
Records: 12  Duplicates: 0  Warnings: 0
```

Figure 3.18: Inserting Values to Team Table.

✓ PLAYER

```
mysql> INSERT INTO PLAYER VALUES
-> ('P1', 'Cristiano', 'Ronaldo', 'T2', '1980-02-05', 'Forward', 7),
-> ('P2', 'Lionel', 'Messi', 'T5', '1987-06-24', 'Forward', 10),
-> ('P3', 'Neymar', 'Jr.', 'T5', '1992-02-05', 'Forward', 11),
-> ('P4', 'Robert', 'Lewandowski', 'T7', '1988-08-21', 'Forward', 9),
-> ('P5', 'Mohamed', 'Salah', 'T11', '1992-06-15', 'Forward', 8),
-> ('P6', 'Kevin', 'De Bruyne', 'T12', '1991-06-28', 'Midfielder', 17),
-> ('P7', 'Virgil', 'van Dijk', 'T11', '1991-07-08', 'Defender', 4),
-> ('P8', 'Kylian', 'Mbappe', 'T5', '1998-12-20', 'Forward', 7);
Query OK, 8 rows affected (0.02 sec)
Records: 8  Duplicates: 0  Warnings: 0
```

Figure 3.19: Inserting Values to Player Table.

✓ SPONSOR

```
mysql> INSERT INTO SPONSOR VALUES
-> ('S1', 'Nike', '123-456-7890', 'info@nike.com', 'Apparel'),
-> ('S2', 'Adidas', '987-654-3210', 'info@adidas.com', 'Apparel'),
-> ('S3', 'Pepsi', '456-789-0123', 'info@pepsi.com', 'Beverage'),
-> ('S4', 'Coca-Cola', '789-012-3456', 'infor@coca-cola.com', 'Beverage');
Query OK, 4 rows affected (0.01 sec)
Records: 4  Duplicates: 0  Warnings: 0
```

Figure 3.20: Inserting Values to Sponsor Table.

✓ LEAGUE_SPONSOR

```
mysql> INSERT INTO LEAGUE_SPONSOR VALUES
-> ('L1', 'S1'),
-> ('L1', 'S3'),
-> ('L2', 'S2'),
-> ('L2', 'S4');
Query OK, 4 rows affected (0.01 sec)
Records: 4  Duplicates: 0  Warnings: 0

mysql> |
```

Figure 3.21: Inserting Values to League_Sponsor Table.

✓ TEAM_SPONSOR

```
mysql> INSERT INTO TEAM_SPONSOR VALUES
-> ('T1', 'S1'),
-> ('T2', 'S2'),
-> ('T3', 'S3'),
-> ('T4', 'S4');
Query OK, 4 rows affected (0.01 sec)
Records: 4  Duplicates: 0  Warnings: 0
```

Figure 3.22: Inserting Values to Team_Sponsor Table.

✓ REFREE

```
mysql> INSERT INTO REFEREE VALUES
    -> ('R1', 'Michael', 'Oliver', 'A'),
    -> ('R2', 'Felix', 'Brych', 'B'),
    -> ('R3', 'Bjorn', 'Kuipers', 'A'),
    -> ('R4', 'Antonio', 'Mateu', 'C'),
    -> ('R5', 'Daniele', 'Orsato', 'B'),
    -> ('R6', 'Clement', 'Turpin', 'A'),
    -> ('R7', 'Artur', 'Dias', 'C'),
    -> ('R8', 'Ovidiu', 'Hategan', 'B');
Query OK, 8 rows affected (0.02 sec)
Records: 8  Duplicates: 0  Warnings: 0
```

Figure 3.23: Inserting Values to Referee Table.

✓ VENUE

```
mysql> INSERT INTO VENUE VALUES
    -> ('V1', 'Old Trafford', 74879, 'England'),
    -> ('V2', 'Santiago Bernabeu', 81044, 'Spain'),
    -> ('V3', 'Allianz Arena', 75000, 'Germany'),
    -> ('V4', 'Camp Nou', 99354, 'Spain'),
    -> ('V5', 'Anfield', 53394, 'England'),
    -> ('V6', 'San Siro', 80018, 'Italy'),
    -> ('V7', 'Parc des Princes', 48662, 'France'),
    -> ('V8', 'Johan Cruyff Arena', 54891, 'Netherlands'),
    -> ('V9', 'Signal Iduna Park', 81365, 'Germany'),
    -> ('V10', 'Emirates Stadium', 60260, 'England');
Query OK, 10 rows affected (0.02 sec)
Records: 10  Duplicates: 0  Warnings: 0

mysql> |
```

Figure 3.24: Inserting Values to Venue Table.

✓ GAME

```
mysql> INSERT INTO GAME VALUES
    -> ('G1', 'V1', 'T1'),
    -> ('G2', 'V2', 'T4'),
    -> ('G3', 'V4', 'T5'),
    -> ('G4', 'V6', 'T7'),
    -> ('G5', 'V8', 'T10'),
    -> ('G6', 'V7', 'T11');
Query OK, 6 rows affected (0.02 sec)
Records: 6  Duplicates: 0  Warnings: 0

mysql> |
```

Figure 3.25: Inserting Values to Game Table.

GAME_REFREE

```
mysql> INSERT INTO GAME_REFEREE VALUES
-> ('G1', 'R1'),
-> ('G1', 'R4'),
-> ('G2', 'R3'),
-> ('G2', 'R8'),
-> ('G3', 'R6'),
-> ('G3', 'R2'),
-> ('G4', 'R1'),
-> ('G4', 'R7'),
-> ('G5', 'R6'),
-> ('G5', 'R5'),
-> ('G6', 'R3'),
-> ('G6', 'R7');
Query OK, 12 rows affected (0.01 sec)
Records: 12  Duplicates: 0  Warnings: 0
mysql> |
```

Figure 3.26: Inserting Values to Game_Referee Table.

✓ PLAYER_STAT

```
mysql> INSERT INTO PLAYER_STAT VALUES
-> ('G1', 'P1', 3, 0),
-> ('G3', 'P2', 3, 2),
-> ('G3', 'P3', 1, 1),
-> ('G3', 'P8', 2, 0),
-> ('G4', 'P4', 2, 0),
-> ('G6', 'P5', 2, 1),
-> ('G6', 'P7', 1, 0),
-> ('G6', 'P6', 1, 1);
Query OK, 8 rows affected (0.01 sec)
Records: 8  Duplicates: 0  Warnings: 0
mysql> |
```

Figure 3.27: Inserting Values to Player_Stat.

✓ TEAM_STAT

```
mysql> INSERT INTO TEAM_STAT VALUES
-> ('G1', 'T1', 4, 3),
-> ('G1', 'T2', 3, 4),
-> ('G2', 'T3', 1, 3),
-> ('G2', 'T4', 3, 1),
-> ('G3', 'T5', 6, 2),
-> ('G3', 'T6', 2, 6),
-> ('G4', 'T7', 3, 2),
-> ('G4', 'T8', 2, 3),
-> ('G5', 'T9', 1, 2),
-> ('G5', 'T10', 2, 1),
-> ('G6', 'T11', 4, 3),
-> ('G6', 'T12', 3, 4);
Query OK, 12 rows affected (0.01 sec)
Records: 12  Duplicates: 0  Warnings: 0
```

```
mysql> |
```

Figure 3.28: Inserting Values to Team_Stat Table.

3.4. UPDATE AND DELETE

- LEAGUE

```
mysql> update league
      -> set League_name = 'Serie B' WHERE League_ID ='L3';
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> update league
      -> set League_name = 'Ligue 2' WHERE League_ID ='L5';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> select * FROM LEAGUE;
+-----+-----+-----+-----+-----+-----+
| League_ID | League_name | Sport | Start_date | End_date | Location |
+-----+-----+-----+-----+-----+-----+
| L1 | Premier League | Football | 2023-08-10 | 2024-05-25 | England
| L2 | La Liga | Football | 2023-08-15 | 2024-05-24 | Spain
| L3 | Serie B | Football | 2023-08-18 | 2024-05-26 | Italy
| L4 | Bundesliga | Football | 2023-08-16 | 2024-05-25 | Germany
| L5 | Ligue 2 | Football | 2023-08-09 | 2024-05-24 | France
| L6 | Eredivisie | Fotoball | 2023-08-09 | 2024-05-23 | Netherlands
+-----+-----+-----+-----+-----+-----+
6 rows in set (0.00 sec)
```

Figure 3.29: Updating League Table.

- TEAM

```
mysql> UPDATE TEAM
      -> SET Team_name = 'DD Milan' where Team_ID = 'T10';
Query OK, 0 rows affected (0.00 sec)
Rows matched: 1  Changed: 0  Warnings: 0

mysql> UPDATE TEAM
      -> SET Team_name = 'Djaxit' where Team_ID = 'T6';
Query OK, 0 rows affected (0.00 sec)
Rows matched: 1  Changed: 0  Warnings: 0

mysql> DELETE FROM TEAM WHERE TEAM_ID ='T3';
Query OK, 1 row affected (0.00 sec)

mysql> SELECT * FROM TEAM;
+-----+-----+-----+-----+
| Team_ID | Team_name | League_ID | City |
+-----+-----+-----+-----+
| T1 | Manchester United | L1 | Manchester
| T10 | DD Milan | L2 | Milan
| T11 | Liverpool | L2 | Liverpool
| T12 | Manchester City | L2 | Manchester
| T2 | Real Madrid | L1 | Madrid
| T4 | Bayern Munich | L1 | Munich
| T5 | Paris Saint-German | L1 | Paris
| T6 | Djaxit | L1 | Amsterdam
| T7 | Barcelona | L2 | Barcelona
| T8 | Atletico Madrid | L2 | Madrid
| T9 | Inter Milan | L2 | Milan
+-----+-----+-----+-----+
11 rows in set (0.00 sec)
```

Figure 3.30: Updating Team Table.

- PLAYER

```

mysql> UPDATE PLAYER
-> SET First_name = 'Simon' where Player_ID = 'P2';
Query OK, 0 rows affected (0.00 sec)
Rows matched: 1 Changed: 0 Warnings: 0

mysql> UPDATE PLAYER
-> SET First_name = 'Dijkki' where Player_ID = 'P7';
Query OK, 0 rows affected (0.00 sec)
Rows matched: 1 Changed: 0 Warnings: 0

mysql> DELETE FROM PLAYER WHERE PLAYER_ID ='P8';
Query OK, 0 rows affected (0.00 sec)

mysql> SELECT * FROM PLAYER;
+-----+-----+-----+-----+-----+-----+-----+
| Player_ID | First_name | Last_name | Team_ID | Birthday | Position | Jersey_number |
+-----+-----+-----+-----+-----+-----+-----+
| P1 | Cristiano | Ronaldo | T2 | 1980-02-05 | Forward | 7 |
| P2 | Simon | Messi | T5 | 1987-06-24 | Forward | 10 |
| P3 | Neymar | Jr. | T5 | 1992-02-05 | Forward | 11 |
| P4 | Robert | Lewandowski | T7 | 1988-08-02 | Forward | 9 |
| P5 | Mohamed | Salah | T11 | 1992-06-15 | Forward | 8 |
| P6 | Kevin | De Bruyne | T12 | 1991-06-28 | Midfielder | 17 |
| P7 | Dijkki | van Dijk | T11 | 1991-07-08 | Defender | 4 |
+-----+-----+-----+-----+-----+-----+-----+
7 rows in set (0.00 sec)

```

Figure 3.31: Updating Player Table.

- SPONSER

```

mysql> update sponsor
-> SET Contact_number = '546-789-1354' where Sponsor_ID = 'S2';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1 Changed: 1 Warnings: 0

mysql> update sponsor
-> SET Contact_number = '522-789-1225' where Sponsor_ID = 'S3';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1 Changed: 1 Warnings: 0

mysql> DELETE FROM SPONSOR WHERE Sponsor_ID ='S7';
Query OK, 1 row affected (0.00 sec)

mysql> SELECT * FROM SPONSOR;
+-----+-----+-----+-----+-----+
| Sponsor_ID | Company_name | Contact_number | Email | Category |
+-----+-----+-----+-----+-----+
| S1 | Nike | 123-456-7890 | info@nike.com | Apparel |
| S2 | Adidas | 546-789-1354 | info@adidas.com | Apparel |
| S3 | Pepsi | 522-789-1225 | info@pepsi.com | Beverage |
| S4 | Coca-Cola | 789-012-3456 | info@coca-cola.com | Beverage |
| S5 | Necto | 125-456-7846 | info@necto.com | Beverage |
| S6 | Fanta | 125-456-8547 | info@fanta.com | Beverage |
+-----+-----+-----+-----+-----+
6 rows in set (0.00 sec)

```

Figure 3.32: Updating Sponsor Table.

- REFEREE

```

mysql> UPDATE REFEREE
      -> SET First_name ='Frankie' where Referee_ID ='R8';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> UPDATE REFEREE
      -> SET First_name ='Eshan' where Referee_ID ='R7';
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> delete from referee where Referee_ID = 'R6';
Query OK, 1 row affected (0.00 sec)

mysql> SELECT * FROM REFEREE;
+-----+-----+-----+-----+
| Referee_ID | First_name | Last_name | Contact_number |
+-----+-----+-----+-----+
| R1          | Michael    | Oliver    | A
| R2          | Felix      | Brych     | B
| R3          | Bjorn      | Kuipers   | A
| R4          | Antonio   | Mateu     | C
| R5          | Daniele   | Orsato    | B
| R7          | Eshan      | Dias      | C
| R8          | Frankie   | Hategan   | B
+-----+-----+-----+-----+
7 rows in set (0.00 sec)

```

Figure 3.33: Updating Referee Table.

- VENUE

```

mysql> UPDATE VENUE
      -> SET Capacity='80000' where Venue_ID ='V1';
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> UPDATE VENUE
      -> SET Capacity='60500' where Venue_ID ='V2';
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> delete from venue where Venue_ID ='V9';
Query OK, 1 row affected (0.00 sec)

mysql> SELECT * FROM VENUE;
+-----+-----+-----+-----+
| Venue_ID | Venue_name        | Capacity | Country |
+-----+-----+-----+-----+
| V1        | Old Trafford       | 80000    | England
| V10       | Emirates Stadium   | 60260    | England
| V2        | Santiago Bernabeu | 60500    | Spain
| V3        | Allianz Arena      | 75000    | Germany
| V4        | Camp Nou           | 99354    | Spain
| V5        | Anfield             | 53394    | England
| V6        | San Siro            | 80018    | Italy
| V7        | Parc des Princes   | 48662    | France
| V8        | Johan Cruyff Arena | 54891    | Netherlands
+-----+-----+-----+-----+
9 rows in set (0.00 sec)

```

Figure 3.34: Updating Venue Table.

- GAME

```

mysql> UPDATE GAME
      -> SET Venue_ID='V10' WHERE GAME_ID ='G7';
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> UPDATE GAME
      -> SET Venue_ID='V3' WHERE GAME_ID ='G6';
Query OK, 0 rows affected (0.00 sec)
Rows matched: 1  Changed: 0  Warnings: 0

mysql> DELETE FROM GAME WHERE GAME_ID ='G5';
Query OK, 1 row affected (0.01 sec)

mysql> SELECT * FROM GAME;
+-----+-----+-----+
| Game_ID | Venue_ID | Winning_Team_ID |
+-----+-----+-----+
| G1      | V1       | T1           |
| G2      | V2       | T4           |
| G3      | V4       | T5           |
| G4      | V6       | T7           |
| G6      | V3       | T11          |
| G7      | V10      | T8           |
+-----+-----+-----+
6 rows in set (0.00 sec)

```

Figure 3.35: Updating Game Table.

- GAME_TEAM

```

mysql> UPDATE game_team
      -> set WINNER_FLAG ='0' WHERE GAME_ID='G2';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> UPDATE game_team
      -> set WINNER_FLAG ='0' WHERE GAME_ID='G6';
Query OK, 1 row affected (0.00 sec)
Rows matched: 2  Changed: 1  Warnings: 0

mysql> delete from game_team where team_id ='T12';
Query OK, 1 row affected (0.00 sec)

mysql> SELECT * FROM GAME_TEAM;
+-----+-----+-----+
| Game_ID | Team_ID | Winner_flag |
+-----+-----+-----+
| G1      | T1       |      1      |
| G1      | T2       |      0      |
| G2      | T4       |      0      |
| G3      | T5       |      1      |
| G3      | T6       |      0      |
| G4      | T7       |      1      |
| G4      | T8       |      0      |
| G6      | T11      |      0      |
+-----+-----+-----+
8 rows in set (0.00 sec)

```

Figure 3.36: Updating Game_Team Table.

- PLAYER_STAT

```
mysql> UPDATE PLAYER_STAT
      -> SET GOALS='2' WHERE PLAYER_ID='P3';
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> UPDATE PLAYER_STAT
      -> SET GOALS='2' WHERE PLAYER_ID='P6';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> DELETE FROM PLAYER_STAT WHERE PLAYER_ID='P7';
Query OK, 1 row affected (0.00 sec)

mysql> SELECT * FROM PLAYER_STAT;
+-----+-----+-----+-----+
| Match_ID | Player_ID | Goals | Assists |
+-----+-----+-----+-----+
| G1       | P1        | 3     | 0      |
| G3       | P2        | 3     | 2      |
| G3       | P3        | 2     | 1      |
| G4       | P4        | 2     | 0      |
| G6       | P5        | 2     | 1      |
| G6       | P6        | 2     | 1      |
+-----+-----+-----+-----+
6 rows in set (0.00 sec)
```

Figure 3.37: Updating Player_Stat Table.

- TEAM_STAT

```
mysql> update team_stat
      -> set goals_for ='4' where team_id='T2'
      -> ;
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> update team_stat
      -> set goals_for ='4' where team_id='T4';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> delete from team_stat where team_id='T12';
Query OK, 1 row affected (0.01 sec)

mysql> SELECT * FROM TEAM_STAT;
+-----+-----+-----+-----+
| Match_ID | Team_ID | Goals_for | Goals_against |
+-----+-----+-----+-----+
| G1       | T1      | 4          | 3            |
| G1       | T2      | 4          | 4            |
| G2       | T4      | 4          | 1            |
| G3       | T5      | 6          | 2            |
| G3       | T6      | 2          | 6            |
| G4       | T7      | 3          | 2            |
| G4       | T8      | 2          | 3            |
| G6       | T11     | 4          | 3            |
+-----+-----+-----+-----+
8 rows in set (0.00 sec)
```

Figure 3.38: Updating Team_Stat Table.

Chapter 4 - Transactions

- Select Operation

```
mysql> SELECT First_name, Last_name, Jersey_number
-> FROM PLAYER
-> WHERE First_name = 'Lionel';
+-----+-----+-----+
| First_name | Last_name | Jersey_number |
+-----+-----+-----+
| Lionel    | Messi     |          10 |
+-----+-----+-----+
1 row in set (0.00 sec)
```

Figure 4.1: The SELECT Operation.

- Project Operation

```
mysql> SELECT Team_ID, Team_name, City
-> FROM TEAM;
+-----+-----+-----+
| Team_ID | Team_name      | City       |
+-----+-----+-----+
| T1      | Manchester United | Manchester |
| T10     | AC Milan          | Milan      |
| T11     | Liverpool         | Liverpool  |
| T12     | Manchester City   | Manchester |
| T13     | Sparksquad        | Chatumi    |
| T14     | Arrow              | Chatthum   |
| T2      | Real Madrid       | Madrid     |
| T3      | Juventus          | Turin     |
| T4      | Bayern Munich     | Munich    |
| T5      | Paris Saint-German | Paris     |
| T6      | Ajax               | Amsterdam |
| T7      | Barcelona         | Barcelona |
| T8      | Atletico Madrid   | Madrid    |
| T9      | Inter Milan       | Milan     |
+-----+-----+-----+
14 rows in set (0.00 sec)
```

Figure 4.2: The PROJECT Operation.

- Cartesian product

mysql> SELECT * FROM PLAYER CROSS JOIN TEAM;											
Player_ID	First_name	Last_name	Team_ID	Birthday	Position	Jersey_number	Team_ID	Team_name	League_ID	City	
P9	Mary	Jenny	T6	1980-03-06	Forward	6	T1	Manchester United	L1	Manchester	
P8	Kylian	Mbappe	T5	1998-12-20	Forward	7	T1	Manchester United	L1	Manchester	
P7	Virgil	van Dijk	T11	1991-07-08	Defender	8	T1	Manchester United	L1	Manchester	
P6	Kevin	De Bruyne	T12	1991-06-28	Midfielder	9	T1	Manchester United	L1	Manchester	
P5	Mohamed	Salah	T11	1992-06-15	Forward	10	T1	Manchester United	L1	Manchester	
P4	Robert	Lewandowski	T7	1988-08-02	Forward	11	T1	Manchester United	L1	Manchester	
P3	Neymar	Jr.	T5	1992-02-05	Forward	12	T1	Manchester United	L1	Manchester	
P2	Lionel	Messi	T5	1987-06-24	Forward	13	T1	Manchester United	L1	Manchester	
P10	Nice	Jenni	T7	1980-03-08	Forward	14	T1	Manchester United	L1	Manchester	
P1	Cristiano	Ronaldo	T2	1980-02-05	Forward	15	T1	Manchester United	L1	Manchester	
P9	Mary	Jenny	T6	1980-03-06	Forward	16	T10	AC Milan	L2	Milan	
P8	Kylian	Mbappe	T5	1998-12-20	Forward	17	T10	AC Milan	L2	Milan	
P7	Virgil	van Dijk	T11	1991-07-08	Defender	18	T10	AC Milan	L2	Milan	
P6	Kevin	De Bruyne	T12	1991-06-28	Midfielder	19	T10	AC Milan	L2	Milan	
P5	Mohamed	Salah	T11	1992-06-15	Forward	20	T10	AC Milan	L2	Milan	
P4	Robert	Lewandowski	T7	1988-08-02	Forward	21	T10	AC Milan	L2	Milan	
P3	Neymar	Jr.	T5	1992-02-05	Forward	22	T10	AC Milan	L2	Milan	
P2	Lionel	Messi	T5	1987-06-24	Forward	23	T10	AC Milan	L2	Milan	
P10	Nice	Jenni	T7	1980-03-08	Forward	24	T10	AC Milan	L2	Milan	
P1	Cristiano	Ronaldo	T2	1980-02-05	Forward	25	T10	AC Milan	L2	Milan	
P9	Mary	Jenny	T6	1980-03-06	Forward	26	T11	Liverpool	L2	Liverpool	
P8	Kylian	Mbappe	T5	1998-12-20	Forward	27	T11	Liverpool	L2	Liverpool	
P7	Virgil	van Dijk	T11	1991-07-08	Defender	28	T11	Liverpool	L2	Liverpool	
P6	Kevin	De Bruyne	T12	1991-06-28	Midfielder	29	T11	Liverpool	L2	Liverpool	
P5	Mohamed	Salah	T11	1992-06-15	Forward	30	T11	Liverpool	L2	Liverpool	
P4	Robert	Lewandowski	T7	1988-08-02	Forward	31	T11	Liverpool	L2	Liverpool	
P3	Neymar	Jr.	T5	1992-02-05	Forward	32	T11	Liverpool	L2	Liverpool	
P2	Lionel	Messi	T5	1987-06-24	Forward	33	T11	Liverpool	L2	Liverpool	
P10	Nice	Jenni	T7	1980-03-08	Forward	34	T11	Liverpool	L2	Liverpool	
P1	Cristiano	Ronaldo	T2	1980-02-05	Forward	35	T11	Liverpool	L2	Liverpool	
P9	Mary	Jenny	T6	1980-03-06	Forward	36	T12	Manchester City	L2	Manchester	
P8	Kylian	Mbappe	T5	1998-12-20	Forward	37	T12	Manchester City	L2	Manchester	
P7	Virgil	van Dijk	T11	1991-07-08	Defender	38	T12	Manchester City	L2	Manchester	
P6	Kevin	De Bruyne	T12	1991-06-28	Midfielder	39	T12	Manchester City	L2	Manchester	
P5	Mohamed	Salah	T11	1992-06-15	Forward	40	T12	Manchester City	L2	Manchester	
P4	Robert	Lewandowski	T7	1988-08-02	Forward	41	T12	Manchester City	L2	Manchester	
P3	Neymar	Jr.	T5	1992-02-05	Forward	42	T12	Manchester City	L2	Manchester	
P2	Lionel	Messi	T5	1987-06-24	Forward	43	T12	Manchester City	L2	Manchester	
P10	Nice	Jenni	T7	1980-03-08	Forward	44	T12	Manchester City	L2	Manchester	
P1	Cristiano	Ronaldo	T2	1980-02-05	Forward	45	T12	Manchester City	L2	Manchester	
P9	Mary	Jenny	T6	1980-03-06	Forward	46	T13	Sparksquad	L1	Chathumi	
P8	Kylian	Mbappe	T5	1998-12-20	Forward	47	T13	Sparksquad	L1	Chathumi	
P7	Virgil	van Dijk	T11	1991-07-08	Defender	48	T13	Sparksquad	L1	Chathumi	
P6	Kevin	De Bruyne	T12	1991-06-28	Midfielder	49	T13	Sparksquad	L1	Chathumi	
P5	Mohamed	Salah	T11	1992-06-15	Forward	50	T13	Sparksquad	L1	Chathumi	
P4	Robert	Lewandowski	T7	1988-08-02	Forward	51	T13	Sparksquad	L1	Chathumi	
P3	Neymar	Jr.	T5	1992-02-05	Forward	52	T13	Sparksquad	L1	Chathumi	
P2	Lionel	Messi	T5	1987-06-24	Forward	53	T13	Sparksquad	L1	Chathumi	
P10	Nice	Jenni	T7	1980-03-08	Forward	54	T13	Sparksquad	L1	Chathumi	
P1	Cristiano	Ronaldo	T2	1980-02-05	Forward	55	T13	Sparksquad	L1	Chathumi	
P9	Mary	Jenny	T6	1980-03-06	Forward	56	T14	Arrow	L1	Chathum	
P8	Kylian	Mbappe	T5	1998-12-20	Forward	57	T14	Arrow	L1	Chathum	
P7	Virgil	van Dijk	T11	1991-07-08	Defender	58	T14	Arrow	L1	Chathum	
P6	Kevin	De Bruyne	T12	1991-06-28	Midfielder	59	T14	Arrow	L1	Chathum	
P5	Mohamed	Salah	T11	1992-06-15	Forward	60	T14	Arrow	L1	Chathum	
P4	Robert	Lewandowski	T7	1988-08-02	Forward	61	T14	Arrow	L1	Chathum	
P3	Neymar	Jr.	T5	1992-02-05	Forward	62	T14	Arrow	L1	Chathum	
P2	Lionel	Messi	T5	1987-06-24	Forward	63	T14	Arrow	L1	Chathum	
P10	Nice	Jenni	T7	1980-03-08	Forward	64	T14	Arrow	L1	Chathum	
P1	Cristiano	Ronaldo	T2	1980-02-05	Forward	65	T14	Arrow	L1	Chathum	
P9	Mary	Jenny	T6	1980-03-06	Forward	66	T2	Real Madrid	L1	Madrid	
P8	Kylian	Mbappe	T5	1998-12-20	Forward	67	T2	Real Madrid	L1	Madrid	

Figure 4.3: The CARTESIAN PRODUCT - I

P8	Kylian Mbappe	T5	1998-12-20	Forward	7	T2	Real Madrid	L1	Madrid
P7	Virgil van Dijk	T11	1991-07-08	Defender	4	T2	Real Madrid	L1	Madrid
P6	Kevin De Bruyne	T12	1991-06-28	Midfielder	17	T2	Real Madrid	L1	Madrid
P5	Mohamed Salah	T11	1992-06-15	Forward	8	T2	Real Madrid	L1	Madrid
P4	Robert Lewandowski	T7	1988-08-02	Forward	9	T2	Real Madrid	L1	Madrid
P3	Neymar Jr.	T5	1992-02-05	Forward	11	T2	Real Madrid	L1	Madrid
P2	Lionel Messi	T5	1987-06-24	Forward	10	T2	Real Madrid	L1	Madrid
P10	Nice Jennis	T7	1980-03-08	Forward	5	T2	Real Madrid	L1	Madrid
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T2	Real Madrid	L1	Madrid
P9	Mary Jenny	T6	1980-03-06	Forward	6	T3	Juventus	L1	Turin
P8	Kylian Mbappe	T5	1998-12-20	Forward	7	T3	Juventus	L1	Turin
P7	Virgil van Dijk	T11	1991-07-08	Defender	4	T3	Juventus	L1	Turin
P6	Kevin De Bruyne	T12	1991-06-28	Midfielder	17	T3	Juventus	L1	Turin
P5	Mohamed Salah	T11	1992-06-15	Forward	8	T3	Juventus	L1	Turin
P4	Robert Lewandowski	T7	1988-08-02	Forward	9	T3	Juventus	L1	Turin
P3	Neymar Jr.	T5	1992-02-05	Forward	11	T3	Juventus	L1	Turin
P2	Lionel Messi	T5	1987-06-24	Forward	10	T3	Juventus	L1	Turin
P10	Nice Jennis	T7	1980-03-08	Forward	5	T3	Juventus	L1	Turin
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T3	Juventus	L1	Turin
P9	Mary Jenny	T6	1980-03-06	Forward	6	T4	Bayern Munich	L1	Munich
P8	Kylian Mbappe	T5	1998-12-20	Forward	7	T4	Bayern Munich	L1	Munich
P7	Virgil van Dijk	T11	1991-07-08	Defender	4	T4	Bayern Munich	L1	Munich
P6	Kevin De Bruyne	T12	1991-06-28	Midfielder	17	T4	Bayern Munich	L1	Munich
P5	Mohamed Salah	T11	1992-06-15	Forward	8	T4	Bayern Munich	L1	Munich
P4	Robert Lewandowski	T7	1988-08-02	Forward	9	T4	Bayern Munich	L1	Munich
P3	Neymar Jr.	T5	1992-02-05	Forward	11	T4	Bayern Munich	L1	Munich
P2	Lionel Messi	T5	1987-06-24	Forward	10	T4	Bayern Munich	L1	Munich
P10	Nice Jennis	T7	1980-03-08	Forward	5	T4	Bayern Munich	L1	Munich
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T4	Bayern Munich	L1	Munich
P9	Mary Jenny	T6	1980-03-06	Forward	6	T5	Paris Saint-German	L1	Paris
P8	Kylian Mbappe	T5	1998-12-20	Forward	7	T5	Paris Saint-German	L1	Paris
P7	Virgil van Dijk	T11	1991-07-08	Defender	4	T5	Paris Saint-German	L1	Paris
P6	Kevin De Bruyne	T12	1991-06-28	Midfielder	17	T5	Paris Saint-German	L1	Paris
P5	Mohamed Salah	T11	1992-06-15	Forward	8	T5	Paris Saint-German	L1	Paris
P4	Robert Lewandowski	T7	1988-08-02	Forward	9	T5	Paris Saint-German	L1	Paris
P3	Neymar Jr.	T5	1992-02-05	Forward	11	T5	Paris Saint-German	L1	Paris
P2	Lionel Messi	T5	1987-06-24	Forward	10	T5	Paris Saint-German	L1	Paris
P10	Nice Jennis	T7	1980-03-08	Forward	5	T5	Paris Saint-German	L1	Paris
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T5	Paris Saint-German	L1	Paris
P9	Mary Jenny	T6	1980-03-06	Forward	6	T6	Ajax	L1	Amsterdam
P8	Kylian Mbappe	T5	1998-12-20	Forward	7	T6	Ajax	L1	Amsterdam
P7	Virgil van Dijk	T11	1991-07-08	Defender	4	T6	Ajax	L1	Amsterdam
P6	Kevin De Bruyne	T12	1991-06-28	Midfielder	17	T6	Ajax	L1	Amsterdam
P5	Mohamed Salah	T11	1992-06-15	Forward	8	T6	Ajax	L1	Amsterdam
P4	Robert Lewandowski	T7	1988-08-02	Forward	9	T6	Ajax	L1	Amsterdam
P3	Neymar Jr.	T5	1992-02-05	Forward	11	T6	Ajax	L1	Amsterdam
P2	Lionel Messi	T5	1987-06-24	Forward	10	T6	Ajax	L1	Amsterdam
P10	Nice Jennis	T7	1980-03-08	Forward	5	T6	Ajax	L1	Amsterdam
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T6	Ajax	L1	Amsterdam
P9	Mary Jenny	T6	1980-03-06	Forward	6	T7	Barcelona	L2	Barcelona
P8	Kylian Mbappe	T5	1998-12-20	Forward	7	T7	Barcelona	L2	Barcelona
P7	Virgil van Dijk	T11	1991-07-08	Defender	4	T7	Barcelona	L2	Barcelona
P6	Kevin De Bruyne	T12	1991-06-28	Midfielder	17	T7	Barcelona	L2	Barcelona
P5	Mohamed Salah	T11	1992-06-15	Forward	8	T7	Barcelona	L2	Barcelona
P4	Robert Lewandowski	T7	1988-08-02	Forward	9	T7	Barcelona	L2	Barcelona
P3	Neymar Jr.	T5	1992-02-05	Forward	11	T7	Barcelona	L2	Barcelona
P2	Lionel Messi	T5	1987-06-24	Forward	10	T7	Barcelona	L2	Barcelona
P10	Nice Jennis	T7	1980-03-08	Forward	5	T7	Barcelona	L2	Barcelona
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T7	Barcelona	L2	Barcelona
P9	Mary Jenny	T6	1980-03-06	Forward	6	T8	Atletico Madrid	L2	Madrid
P8	Kylian Mbappe	T5	1998-12-20	Forward	7	T8	Atletico Madrid	L2	Madrid
P7	Virgil van Dijk	T11	1991-07-08	Defender	4	T8	Atletico Madrid	L2	Madrid
P6	Kevin De Bruyne	T12	1991-06-28	Midfielder	17	T8	Atletico Madrid	L2	Madrid
P5	Mohamed Salah	T11	1992-06-15	Forward	8	T8	Atletico Madrid	L2	Madrid
P4	Robert Lewandowski	T7	1988-08-02	Forward	9	T8	Atletico Madrid	L2	Madrid
P3	Neymar Jr.	T5	1992-02-05	Forward	11	T8	Atletico Madrid	L2	Madrid
P2	Lionel Messi	T5	1987-06-24	Forward	10	T8	Atletico Madrid	L2	Madrid
P10	Nice Jennis	T7	1980-03-08	Forward	5	T8	Atletico Madrid	L2	Madrid
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T8	Atletico Madrid	L2	Madrid

Figure 4.4: The CARTESIAN PRODUCT - II.

P10	Nice Jennis	T7	1980-03-08	Forward	5	T8	Atletico Madrid	L2	Madrid
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T8	Atletico Madrid	L2	Madrid
P9	Mary Jenny	T6	1980-03-06	Forward	6	T9	Inter Milan	L2	Milan
P8	Kylian Mbappe	T5	1998-12-20	Forward	7	T9	Inter Milan	L2	Milan
P7	Virgil van Dijk	T11	1991-07-08	Defender	4	T9	Inter Milan	L2	Milan
P6	Kevin De Bruyne	T12	1991-06-28	Midfielder	17	T9	Inter Milan	L2	Milan
P5	Mohamed Salah	T11	1992-06-15	Forward	8	T9	Inter Milan	L2	Milan
P4	Robert Lewandowski	T7	1988-08-02	Forward	9	T9	Inter Milan	L2	Milan
P3	Neymar Jr.	T5	1992-02-05	Forward	11	T9	Inter Milan	L2	Milan
P2	Lionel Messi	T5	1987-06-24	Forward	10	T9	Inter Milan	L2	Milan
P10	Nice Jennis	T7	1980-03-08	Forward	5	T9	Inter Milan	L2	Milan
P1	Cristiano Ronaldo	T2	1980-02-05	Forward	7	T9	Inter Milan	L2	Milan

140 rows in set (0.00 sec)

Figure 4.5: The CARTESIAN PRODUCT - III.

Creating a user view

```
mysql> CREATE VIEW PlayerTeamView AS
-> SELECT P.Player_ID, P.First_name, P.Last_name, T.Team_name, P.Position
-> FROM PLAYER P
-> INNER JOIN TEAM T ON P.Team_ID = T.Team_ID;
Query OK, 0 rows affected (0.01 sec)

mysql> SELECT * FROM PlayerTeamView;
+-----+-----+-----+-----+-----+
| Player_ID | First_name | Last_name | Team_name | Position |
+-----+-----+-----+-----+-----+
| P1        | Cristiano | Ronaldo   | Real Madrid | Forward |
| P10       | Nice       | Jennis    | Barcelona   | Forward |
| P2        | Lionel     | Messi     | Paris Saint-German | Forward |
| P3        | Neymar     | Jr.       | Paris Saint-German | Forward |
| P4        | Robert     | Lewandowski | Barcelona | Forward |
| P5        | Mohamed    | Salah     | Liverpool   | Forward |
| P6        | Kevin      | De Bruyne  | Manchester City | Midfielder |
| P7        | Virgil     | van Dijk   | Liverpool   | Defender |
| P8        | Kylian     | Mbappe    | Paris Saint-German | Forward |
| P9        | Mary       | Jenny     | Ajax       | Forward |
+-----+-----+-----+-----+-----+
10 rows in set (0.01 sec)
```

Figure 4.6: Creating USER VIEWS.

- Renaming Operation

```
mysql> SELECT
-> T.Team_name AS 'Team Name',
-> L.League_name AS 'League Name'
-> FROM TEAM T
-> INNER JOIN LEAGUE L ON T.League_ID = L.League_ID;
+-----+-----+
| Team Name | League Name |
+-----+-----+
| Manchester United | Premier League |
| Sparksquad | Premier League |
| Arrow | Premier League |
| Real Madrid | Premier League |
| Juventus | Premier League |
| Bayern Munich | Premier League |
| Paris Saint-German | Premier League |
| Ajax | Premier League |
| AC Milan | La Liga |
| Liverpool | La Liga |
| Manchester City | La Liga |
| Barcelona | La Liga |
| Atletico Madrid | La Liga |
| Inter Milan | La Liga |
+-----+-----+
14 rows in set (0.00 sec)
```

Figure 4.7: Operation Renaming.

- Aggregation (Average function)

```
mysql> SELECT AVG(Goals_for) AS 'Average Goals per Match' FROM TEAM_STAT;
+-----+
| Average Goals per Match |
+-----+
| 2.8333 |
+-----+
1 row in set (0.00 sec)
```

Figure 4.8: Aggregation (Average).

- Like key word

```
mysql> SELECT *
-> FROM PLAYER
-> WHERE Last_name LIKE 'R%';
+-----+-----+-----+-----+-----+
| Player_ID | First_name | Last_name | Team_ID | Birthday   | Position | Jersey_number |
+-----+-----+-----+-----+-----+
| P1       | Cristiano | Ronaldo  | T2      | 1980-02-05 | Forward  | 7          |
+-----+-----+-----+-----+-----+
1 row in set (0.00 sec)
```

Figure 4.9: Using LIKE Keyword.

✓ Complex Queries

- Union

```
mysql> SELECT Player_ID, First_name, Last_name FROM PLAYER
      -> UNION
      -> SELECT Sponsor_ID, Company_name, NULL FROM SPONSOR;
+-----+-----+-----+
| Player_ID | First_name | Last_name |
+-----+-----+-----+
| P1        | Cristiano | Ronaldo   |
| P10       | Nice       | Jennis    |
| P2        | Lionel     | Messi     |
| P3        | Neymar     | Jr.       |
| P4        | Robert     | Lewandowski |
| P5        | Mohamed    | Salah     |
| P6        | Kevin      | De Bruyne |
| P7        | Virgil     | van Dijk  |
| P8        | Kylian     | Mbappe   |
| P9        | Mary       | Jenny    |
| S1        | Nike       | NULL     |
| S2        | Adidas     | NULL     |
| S3        | Pepsi      | NULL     |
| S4        | Coca-Cola  | NULL     |
| S5        | Necto      | NULL     |
| S6        | Fanta      | NULL     |
+-----+-----+-----+
16 rows in set (0.01 sec)
```

Figure 4.10: Union.

- Intersection

```
mysql> SELECT Player_ID, First_name, Last_name FROM PLAYER
      -> INTERSECT
      -> SELECT Sponsor_ID, Company_name, NULL FROM SPONSOR;
Empty set (0.00 sec)
```

Figure 4.11: Intersection.

- Set Difference

```
mysql> SELECT Player_ID, First_name, Last_name FROM PLAYER EXCEPT SELECT Sponsor_ID, Company_name, NULL FROM SPONSOR;
+-----+-----+-----+
| Player_ID | First_name | Last_name |
+-----+-----+-----+
| P1        | Cristiano | Ronaldo   |
| P2        | Lionel     | Messi     |
| P3        | Neymar     | Jr.       |
| P4        | Robert     | Lewandowski |
| P5        | Mohamed    | Salah     |
| P6        | Kevin      | De Bruyne |
| P7        | Virgil     | van Dijk  |
| P8        | Kylian     | Mbappe   |
+-----+-----+-----+
8 rows in set (0.00 sec)

mysql> |
```

Figure 4.12: Set Difference.

- Division

```
mysql> SELECT l.League_name AS Division,
    ->           COUNT(*) AS Total_Games_Played,
    ->           AVG(v.Capacity) AS Average_Attendance
    ->   FROM GAME g
    -> INNER JOIN VENUE v ON g.Venue_ID = v.Venue_ID
    -> , LEAGUE l
    -> WHERE NOT EXISTS (
    ->   SELECT 1
    ->   FROM TEAM t
    ->   LEFT JOIN GAME_TEAM gt ON t.Team_ID = gt.Team_ID
    ->   WHERE t.League_ID = l.League_ID -- Match league with teams
    ->   AND gt.Game_ID IS NULL -- Ensure no game entries for the team
    -> )
    -> GROUP BY l.League_name;
+-----+-----+-----+
| Division | Total_Games_Played | Average_Attendance |
+-----+-----+-----+
| Premier League | 6 | 73141.3333 |
| La Liga | 6 | 73141.3333 |
| Serie A | 6 | 73141.3333 |
| Bundesliga | 6 | 73141.3333 |
| Ligue 1 | 6 | 73141.3333 |
| Eredivisie | 6 | 73141.3333 |
+-----+-----+-----+
6 rows in set (0.00 sec)

mysql> |
```

Figure 4.13: Division.

- Inner join

```
mysql> select
    -> P.First_name,
    -> P.Last_name,
    -> T.Team_name
    -> FROM PLAYER P
    -> INNER JOIN TEAM T ON P.Team_ID = T.Team_ID;
+-----+-----+-----+
| First_name | Last_name | Team_name |
+-----+-----+-----+
| Cristiano | Ronaldo | Real Madrid
| Nice | Jennis | Barcelona
| Lionel | Messi | Paris Saint-German
| Neymar | Jr. | Paris Saint-German
| Robert | Lewandowski | Barcelona
| Mohamed | Salah | Liverpool
| Kevin | De Bruyne | Manchester City
| Virgil | van Dijk | Liverpool
| Kylian | Mbappe | Paris Saint-German
| Mary | Jenny | Ajax
+-----+-----+-----+
10 rows in set (0.00 sec)
```

Figure 4.14: INNER JOIN.

- Natural join

```
mysql> SELECT * FROM PLAYER NATURAL JOIN TEAM;
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Team_ID | Player_ID | First_name | Last_name | Birthday | Position | Jersey_number | Team_name | League_ID | City |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| T2      | P1       | Cristiano | Ronaldo   | 1980-02-05 | Forward   | 7          | Real Madrid | L1        | Madrid   |
| T7      | P10      | Nice       | Jennis    | 1980-03-08 | Forward   | 5          | Barcelona   | L2        | Barcelona |
| T5      | P2       | Lionel     | Messi     | 1987-06-24 | Forward   | 10         | Paris Saint-German | L1        | Paris    |
| T5      | P3       | Neymar     | Jr.       | 1992-02-05 | Forward   | 11         | Paris Saint-German | L1        | Paris    |
| T7      | P4       | Robert     | Lewandowski | 1988-08-02 | Forward   | 9          | Barcelona   | L2        | Barcelona |
| T11     | P5       | Mohamed    | Salah     | 1992-06-15 | Forward   | 8          | Liverpool   | L2        | Liverpool |
| T12     | P6       | Kevin      | De Bruyne  | 1991-06-28 | Midfielder | 17         | Manchester City | L2        | Manchester |
| T11     | P7       | Virgil     | van Dijk   | 1991-07-08 | Defender   | 4          | Liverpool   | L2        | Liverpool |
| T5      | P8       | Kylian     | Mbappe    | 1998-12-20 | Forward   | 7          | Paris Saint-German | L1        | Paris    |
| T6      | P9       | Mary       | Jenny     | 1988-03-06 | Forward   | 6          | Ajax        | L1        | Amsterdam |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
10 rows in set (0.00 sec)
```

Figure 4.15: NATURAL JOIN.

- Left Outer Join

```
mysql> SELECT P.First_name, P.Last_name, COALESCE(T.Team_name, 'No Team') AS Team_name
-> FROM PLAYER P
-> LEFT OUTER JOIN TEAM T ON P.Team_ID = T.Team_ID;
+-----+-----+-----+
| First_name | Last_name | Team_name |
+-----+-----+-----+
| Cristiano | Ronaldo | Real Madrid |
| Nice       | Jennis  | Barcelona   |
| Lionel     | Messi   | Paris Saint-German |
| Neymar     | Jr.     | Paris Saint-German |
| Robert     | Lewandowski | Barcelona |
| Mohamed    | Salah   | Liverpool   |
| Kevin      | De Bruyne | Manchester City |
| Virgil     | van Dijk  | Liverpool   |
| Kylian     | Mbappe  | Paris Saint-German |
| Mary       | Jenny   | Ajax        |
+-----+-----+-----+
10 rows in set (0.00 sec)
```

Figure 4.16: LEFT OUTER JOIN.

- Right outer join

```
mysql> SELECT COALESCE(P.First_name, 'No Player') AS First_name, COALESCE(P.Last_name, 'No Player') AS Last_name, T.Team_name
   -> FROM PLAYER P
   -> RIGHT OUTER JOIN TEAM T ON P.Team_ID = T.Team_ID;
+-----+-----+-----+
| First_name | Last_name | Team_name |
+-----+-----+-----+
| No Player | No Player | Manchester United
| No Player | No Player | AC Milan
| Mohamed | Salah | Liverpool
| Virgil | van Dijk | Liverpool
| Kevin | De Bruyne | Manchester City
| No Player | No Player | Sparksquad
| No Player | No Player | Arrow
| Cristiano | Ronaldo | Real Madrid
| No Player | No Player | Juventus
| No Player | No Player | Bayern Munich
| Lionel | Messi | Paris Saint-German
| Neymar | Jr. | Paris Saint-German
| Kylian | Mbappe | Paris Saint-German
| Mary | Jenny | Ajax
| Nice | Dennis | Barcelona
| Robert | Lewandowski | Barcelona
| No Player | No Player | Atletico Madrid
| No Player | No Player | Inter Milan
+-----+-----+-----+
18 rows in set (0.00 sec)
```

Figure 4.17: RIGHT OUTER JOIN.

- Full Outer join

```
mysql> (SELECT
   -> COALESCE(T.Team_ID, 'No ID') AS Team_ID,
   -> COALESCE(T.Team_name, 'No Team') AS
   -> Team_name
   -> FROM TEAM T
   -> LEFT JOIN TEAM_SPONSOR TS ON T.Team_ID =
   -> TS.Team_ID)
   -> UNION
   -> (SELECT
   -> COALESCE(T.Team_ID, 'No ID') AS Team_ID,
   -> COALESCE(T.Team_name, 'No Team') AS
   -> Team_name
   -> FROM TEAM T
   -> RIGHT JOIN TEAM_SPONSOR TS ON T.Team_ID = TS.Team_ID);
+-----+-----+
| Team_ID | Team_name |
+-----+-----+
| T1      | Manchester United
| T10     | AC Milan
| T11     | Liverpool
| T12     | Manchester City
| T13     | Sparksquad
| T14     | Arrow
| T2      | Real Madrid
| T3      | Juventus
| T4      | Bayern Munich
| T5      | Paris Saint-German
| T6      | Ajax
| T7      | Barcelona
| T8      | Atletico Madrid
| T9      | Inter Milan
+-----+-----+
14 rows in set (0.00 sec)
```

Figure 4.18: FULL OUTER JOIN.

- Outer union

```
mysql> (SELECT Player_ID, First_name, Last_name FROM PLAYER)
-> UNION
-> (SELECT Sponsor_ID, Company_name, NULL FROM SPONSOR);
+-----+-----+-----+
| Player_ID | First_name | Last_name |
+-----+-----+-----+
| P1        | Cristiano | Ronaldo
| P10       | Nice       | Jennis
| P2        | Lionel    | Messi
| P3        | Neymar    | Jr.
| P4        | Robert    | Lewandowski
| P5        | Mohamed   | Salah
| P6        | Kevin     | De Bruyne
| P7        | Virgil    | van Dijk
| P8        | Kylian   | Mbappe
| P9        | Mary      | Jenny
| S1        | Nike      | NULL
| S2        | Adidas    | NULL
| S3        | Pepsi    | NULL
| S4        | Coca-Cola | NULL
| S5        | Necto    | NULL
| S6        | Fanta    | NULL
+-----+-----+-----+
16 rows in set (0.00 sec)
```

Figure 4.19: OUTER UNION.

- Nested query -1

```
mysql> SELECT Team_ID, Team_name
-> FROM TEAM
-> WHERE Team_ID IN (
->   SELECT Team_ID
->     FROM TEAM_SPONSOR
->     INTERSECT
->   SELECT Team_ID
->     FROM PLAYER);
+-----+-----+
| Team_ID | Team_name |
+-----+-----+
| T2      | Real Madrid |
+-----+-----+
1 row in set (0.00 sec)
```

Figure 4.20: Nested Query - I.

- Nested query 2

```
mysql> SELECT AVG(Goals) AS Average_Goals
-> FROM PLAYER_STAT
-> WHERE Match_ID IN (
->   SELECT Game_ID
->     FROM GAME_TEAM
->   WHERE Team_ID IN (
->     SELECT Team_ID
->       FROM TEAM
->     WHERE League_ID = 'L1'
->   )
-> );
+-----+
| Average_Goals |
+-----+
|      2.2500 |
+-----+
1 row in set (0.01 sec)
```

Figure 4.21: Nested Query - II.

- Nested query -3

```
mysql> SELECT *
->   FROM PLAYER
-> WHERE Player_ID IN (
->   SELECT Player_ID
->     FROM PLAYER_STAT
->     GROUP BY Player_ID
->     HAVING AVG(Goals) > (
->       SELECT AVG(Goals)
->         FROM PLAYER_STAT));
+-----+-----+-----+-----+-----+-----+-----+
| Player_ID | First_name | Last_name | Team_ID | Birthday | Position | Jersey_number |
+-----+-----+-----+-----+-----+-----+-----+
| P1        | Cristiano | Ronaldo  | T2      | 1980-02-05 | Forward  |      7 |
| P2        | Lionel    | Messi    | T5      | 1987-06-24 | Forward  |     10 |
| P5        | Mohamed   | Salah    | T11    | 1992-06-15 | Forward  |      8 |
| P8        | Kylian    | Mbappe  | T5      | 1998-12-20 | Forward  |      7 |
+-----+-----+-----+-----+-----+-----+-----+
4 rows in set (0.00 sec)
```

Figure 4.22: Nested Query - III.

Chapter 5 - Tuning

The tuning of a query may be determined by comparing the amount of data accessed in the explanation table before and after an appropriate index was established. If the number of rows accessed decreases after an index is established, we may say that the query is tuned correctly. All of the screenshots in the list below satisfy that criterion. The following steps are utilized in query optimization for each difficult query to ensure a clear understanding.

- Remove any externally built indexes that are currently present in utilized tables. o
- After creating a proper index, display the number of accessed rows. (using EXPLAIN command)
- Display the number of rows accessed before creating a suitable index. (using EXPLAIN command)
- Display table indexes before creating a suitable index. (using SHOW INDEX command)
- Show table indexes after constructing an appropriate index. (using SHOW INDEX command)

➤ Union tuning

```
mysql> show index from league;
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Table | Non_unique | Key_name | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment | Visible | Expression |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| league |          0 | PRIMARY |          1 | League_ID | A           |          1 |          0 |      YES |    NULL | BTREE        |          |          | YES     |    NULL   |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
1 row in set (0.01 sec)
```

➤ Inner Join tuning

➤ Left outer join tuning

➤ Right outer join tuning

➤ Outer union tuning

➤ Division tuning

➤ Nested query 3 tuning

➤ Intersection tuning

➤ Set difference tuning

➤ Tuning nested query 1