



## LAB ASSIGNMENT REPORT

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**Course Code:** CSE-2201, Database Management Systems – I

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## **Football Database:**

The football database that I created keeps track of the matches, scorers, teams, players, managers from different leagues of any football season. It only keeps track of one season of matches. By using queries on the relations, we can find the scorers in a certain match, the number of goals by a certain player, players that play for a certain country or team etc. The database is implemented on the PostGreSQL database.

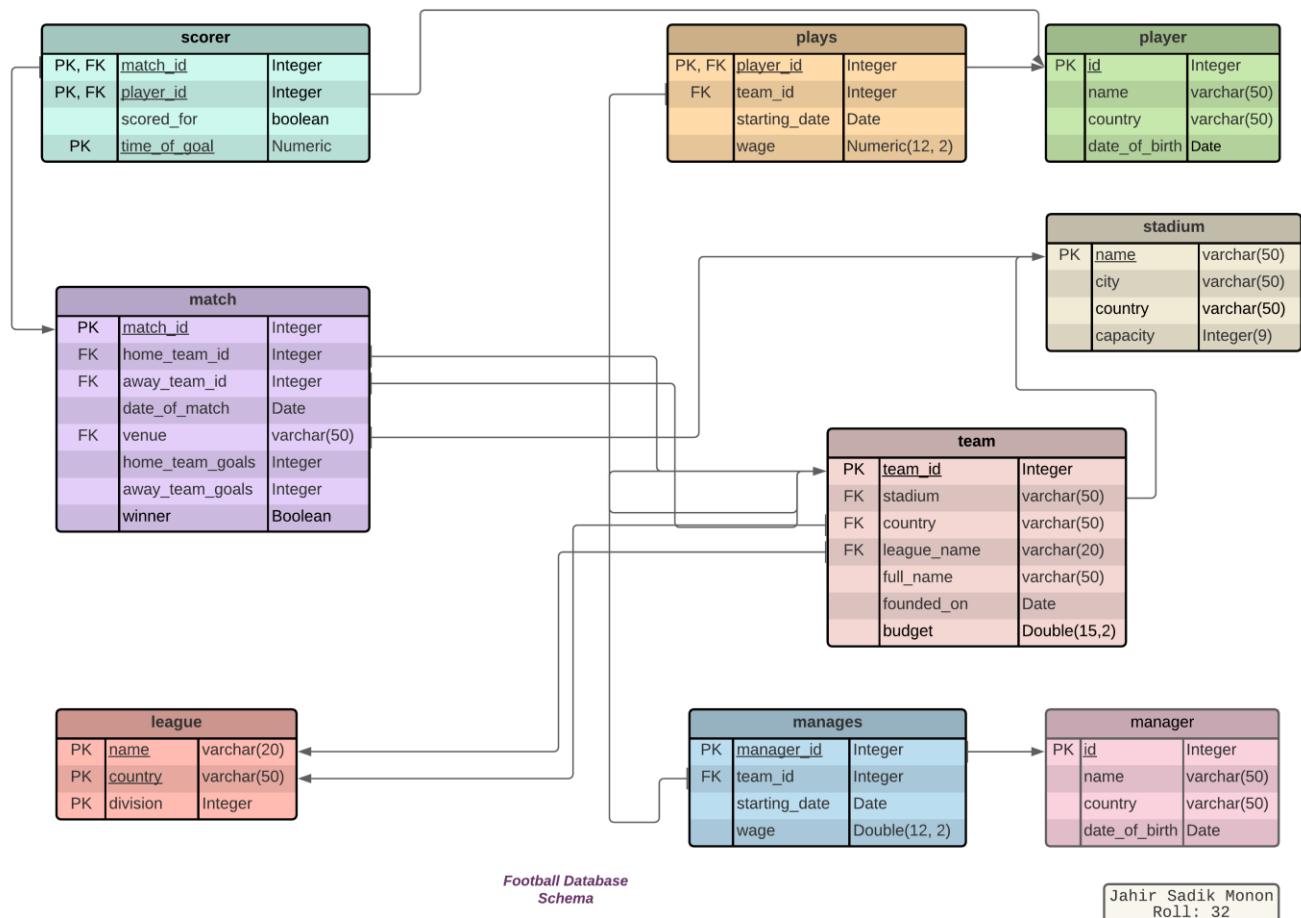
In the database, each league is associated with a name and the country the league is from and other information. Each stadium has attributes name, capacity and location information. The tables player and manager stores the inherent properties of a player or manager whereas the plays and manages tables stores the information about where the player plays or which team the manager manages. Separate tables plays & manages were created because there is no total participation, meaning a player or manager might not play for or manage any team at some point. The team table has all the attributes necessary to describe a team, where the primary key is team id. The team ids were used in the table match to store information about matches between two different teams. The scorer table keeps track of which player scores in which match using the player id and match id.

## **Schemas and Attributes:**

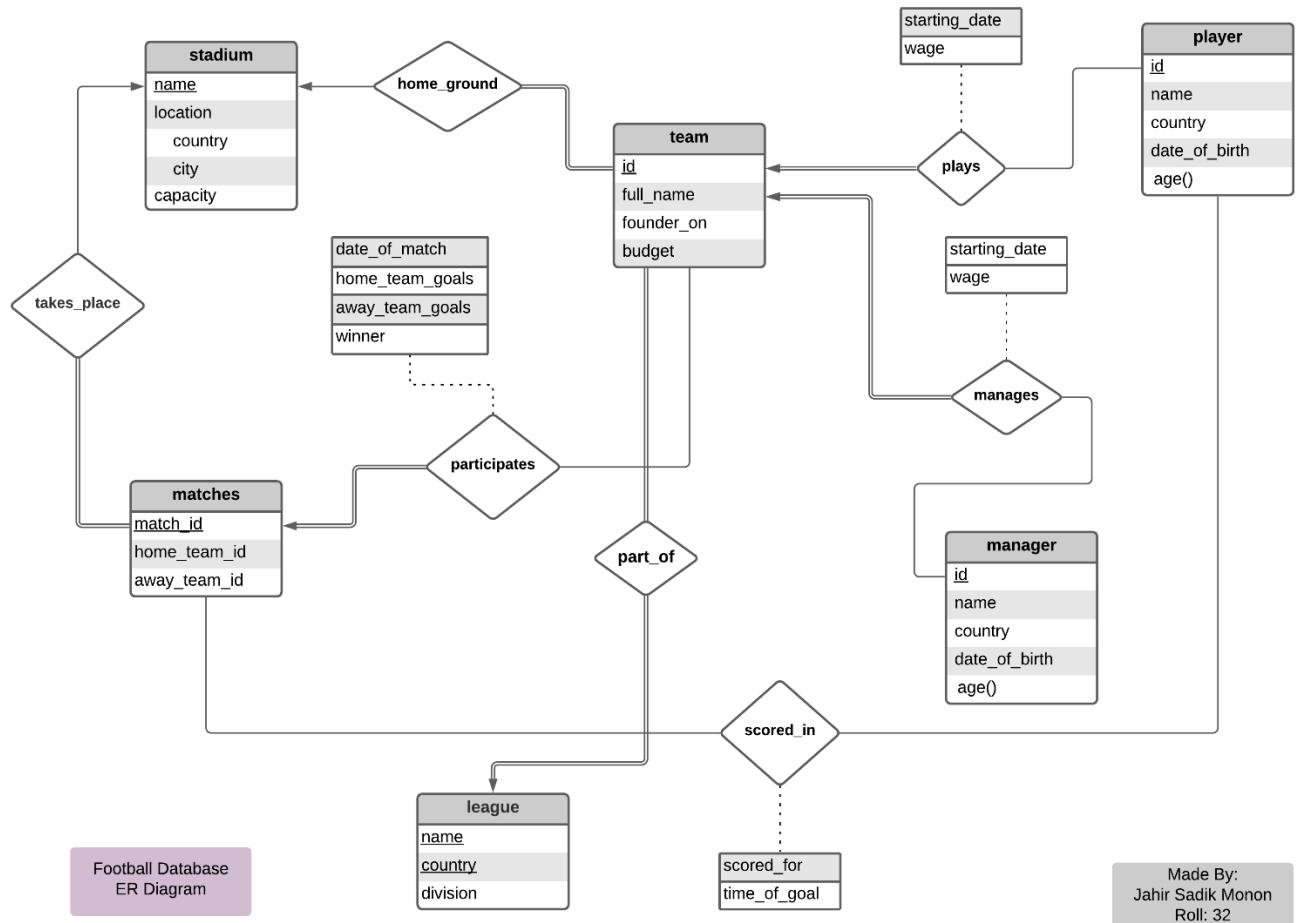
The schemas that I needed for my database are –

- **League** (name, country, division)
- **Stadium** (name, city, country, capacity)
- **Manager** (id, name, country, date\_of\_birth)
- **Player** (id, name, country, date\_of\_birth)
- **Team** (team\_id, stadium, country, league\_name, full\_name, founded\_on, budget)
- **Plays** (player\_id, team\_id, starting\_date, wage)
- **Manages** (id, team\_id, starting\_date, wage)
- **Matches** (match\_id, home\_team\_id, away\_team\_id, date\_of\_match, venue, home\_team\_goals, away\_team\_goals, winner)
- **Scorer** (match\_id, player\_id, time\_of\_goal, scored\_for)

## The Schema Diagram:



## The ER Diagram:



## Snapshots of DDL Statements:

Creation of the 9 tables –

```
1  -- create player table
2  CREATE TABLE player(
3      id SERIAL,
4      name varchar(50) NOT NULL,
5      country varchar(50),
6      date_of_birth DATE NOT NULL,
7          CONSTRAINT player_pKey PRIMARY KEY(id)
8  );
9
10
11 -- create manager table
12 CREATE TABLE manager(
13     id SERIAL,
14     name varchar(50) NOT NULL,
15     country varchar(50),
16     date_of_birth DATE NOT NULL,
17         CONSTRAINT manager_pKey PRIMARY KEY(id)
18 );
19
20
21 -- create stadium table
22 CREATE TABLE stadium(
23     name varchar(50),
24     city varchar(50) NOT NULL,
25     country varchar(50) NOT NULL,
26     capacity INT
27         CONSTRAINT stadium_capacity_constraint CHECK (capacity > 0),
28         CONSTRAINT stadium_pKey PRIMARY KEY(name)
29 );
30
31
32 -- create league table
33 CREATE TABLE league(
34     name varchar(20) NOT NULL,
35     country varchar(50),
36     division INT NOT NULL
37         CONSTRAINT league_division_constraint CHECK (division >= 1 and division <= 10),
38         CONSTRAINT league_pKey PRIMARY KEY (name, country)
39 );
40
41
```

```

41
42 -- create team table
43 CREATE TABLE team(
44     id SERIAL,
45     stadium_name varchar(50) NOT NULL,
46     league_name varchar(20) NOT NULL,
47     country varchar(50) NOT NULL,
48     full_name varchar(70) NOT NULL UNIQUE,
49     founded_on DATE,
50     budget NUMERIC(15, 2)
51         CONSTRAINT team_budget_constraint CHECK (budget >= 0),
52         CONSTRAINT team_pKey PRIMARY KEY (id),
53         CONSTRAINT team_stadium_fKey FOREIGN KEY(stadium_name) REFERENCES stadium(name)
54             ON DELETE SET NULL
55             ON UPDATE CASCADE,
56         CONSTRAINT team_league_fKey FOREIGN KEY(league_name, country) REFERENCES league(name, country)
57             ON DELETE SET NULL
58             ON UPDATE CASCADE
59 );
60
61
62 -- create plays table
63 CREATE TABLE plays(
64     player_id SERIAL NOT NULL,
65     team_id SERIAL NOT NULL,
66     starting_date DATE,
67     wage NUMERIC(10, 2)
68         CONSTRAINT plays_wage_constraint CHECK (wage >= 0),
69         CONSTRAINT plays_pKey PRIMARY KEY(player_id),
70         CONSTRAINT plays_playerID_fKey FOREIGN KEY(player_id) REFERENCES player(id)
71             ON DELETE CASCADE
72             ON UPDATE CASCADE,
73         CONSTRAINT plays_teamID_fKey FOREIGN KEY(team_id) REFERENCES team(id)
74             ON DELETE SET NULL
75             ON UPDATE CASCADE
76 );
77
78
79 -- create manages table
80 CREATE TABLE manages(
81     manager_id SERIAL NOT NULL,
82     team_id SERIAL NOT NULL,
83     starting_date DATE,
84     wage NUMERIC(10, 2)
85         CONSTRAINT manages_wage_constraint CHECK (wage >= 0),
86         CONSTRAINT manages_pKey PRIMARY KEY (manager_id),
87         CONSTRAINT manages_managerID_fkey FOREIGN KEY(manager_id) REFERENCES manager(id)
88             ON DELETE CASCADE
89             ON UPDATE CASCADE,
90         CONSTRAINT manages_teamID_fKey FOREIGN KEY(team_id) REFERENCES team(id)
91             ON DELETE SET NULL
92             ON UPDATE CASCADE
93 );
94
95
96 -- create matches table
97 CREATE TABLE matches(
98     match_id SERIAL,
99     home_team_id SERIAL NOT NULL,
100    away_team_id SERIAL NOT NULL,
101    date_of_match DATE,
102    venue varchar(50),
103    home_team_goals INT
104        CONSTRAINT matches_home_team_goal_constraint CHECK (home_team_goals >= 0),
105    away_team_goals INT
106        CONSTRAINT matches_away_team_goal_constraint CHECK (away_team_goals >= 0),
107    winner INT NOT NULL
108        CONSTRAINT matches_winner_constraint CHECK ((winner>=0) and (winner<=2)), -- 1 if home team wins, 2 if away team wins, 0 if draw
109        CONSTRAINT matches_pKey PRIMARY KEY(match_id),
110        CONSTRAINT matches_homeID_fKey FOREIGN KEY(home_team_id) REFERENCES team(id)
111            ON DELETE No Action
112            ON UPDATE CASCADE,
113        CONSTRAINT matches_awayID_fKey FOREIGN KEY(away_team_id) REFERENCES team(id)
114            ON DELETE No Action
115            ON UPDATE CASCADE,
116        CONSTRAINT matches_venue_fKey FOREIGN KEY(venue) REFERENCES stadium(name)
117            ON DELETE No Action
118            ON UPDATE CASCADE
119 );
120

```

```

121
122  -- create scorer table
123 ▼ CREATE TABLE scorer(
124      match_id SERIAL,
125      player_id SERIAL,
126      scored_for boolean, -- true if scored for home, false if scored for away
127      time_of_goal NUMERIC(4,2)
128          CONSTRAINT scorer_time_of_goal_constraint check (time_of_goal >= 0 and time_of_goal <= 130),
129      CONSTRAINT scorer_pKey PRIMARY KEY (match_id, player_id, time_of_goal),
130 ▼      CONSTRAINT scorer_matchID_fKey FOREIGN KEY(match_id) REFERENCES matches(match_id)
131          ON DELETE No Action
132          ON UPDATE CASCADE,
133 ▼      CONSTRAINT scorer_playerID_fKey FOREIGN KEY(player_id) REFERENCES player(id)
134          ON DELETE No Action
135          ON UPDATE CASCADE
136 );

```

The insertion of data<sup>1</sup> -

```

1  -- ALL league DATA
2  INSERT INTO league VALUES
3      ('La Liga', 'Spain', 1);
4  INSERT INTO league VALUES
5      ('EPL', 'England', 1);
6  INSERT INTO league VALUES
7      ('Bundesliga', 'Germany', 1);
8  INSERT INTO league VALUES
9      ('Serie A', 'Italy', 1);
10 INSERT INTO league VALUES
11     ('Ligue 1', 'France', 1);
12 INSERT INTO league VALUES
13     ('Segunda División', 'Spain', 2);
14 INSERT INTO league VALUES
15     ('English Championship', 'England', 2);
16
17 -- VIEW league DATA
18 select * from league
19
20
21
22 -- ALL stadium DATA
23 INSERT INTO stadium VALUES
24     ('San Mamés', 'Bilbao', 'Spain', 53289);
25 INSERT INTO stadium VALUES
26     ('Santiago Bernabéu Stadium', 'Madrid', 'Spain', 81044);
27 INSERT INTO stadium VALUES
28     ('Camp Nou', 'Barcelona', 'Spain', 99354);
29 INSERT INTO stadium VALUES
30     ('Wanda Metropolitano Stadium', 'Madrid', 'Spain', 68456);
31 INSERT INTO stadium VALUES
32     ('Ramon Sanchez-Pizjuán Stadium', 'Sevilla', 'Spain', 43883);
33 INSERT INTO stadium VALUES
34     ('Estadio de la Cerámica', 'Villarreal', 'Spain', 23500);

```

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<sup>1</sup> Only a portion of the data insertions are shown as there are too many

```

32
33 -- ALL team DATA (Budget in Euro)
34 INSERT INTO team VALUES
35     ('9001', 'Santiago Bernabéu Stadium', 'La Liga', 'Spain', 'Real Madrid C.F.', '1902-3-2', 169610000);
36 INSERT INTO team VALUES
37     ('9002', 'Camp Nou', 'La Liga', 'Spain', 'Barcelona', '1899-11-29', 169074000);
38 INSERT INTO team VALUES
39     ('9003', 'Wanda Metropolitano Stadium', 'La Liga', 'Spain', 'Atletico Madrid', '1903-4-26', 61716000);
40 INSERT INTO team VALUES
41     ('9004', 'Ramon Sanchez-Pizjuan Stadium', 'La Liga', 'Spain', 'Sevilla', '1890-1-25', 31069000);
42 INSERT INTO team VALUES
43     ('9005', 'Estadio de la Cerámica', 'La Liga', 'Spain', 'Villarreal CF', '1923-3-10', 29636000);
44 INSERT INTO team VALUES
45     ('9006', 'Anoeta Stadium', 'La Liga', 'Spain', 'Real Sociedad', '1909-9-7', 14175000);
46 INSERT INTO team VALUES
47     ('9007', 'Nuevo Estadio de Los Cármenes', 'La Liga', 'Spain', 'Granada', '1931-4-14', 4929000);
48 INSERT INTO team VALUES
49     ('9008', 'Coliseum Alfonso Pérez', 'La Liga', 'Spain', 'Getafe', '1983-7-8', 4868000);
50 INSERT INTO team VALUES
51     ('9009', 'Mestalla Stadium', 'La Liga', 'Spain', 'Valencia', '1919-3-18', 59704000);
52 INSERT INTO team VALUES
53     ('9010', 'El Sadar Stadium', 'La Liga', 'Spain', 'Osasuna', '1920-10-24', 3915000);
54 INSERT INTO team VALUES
55     ('9011', 'San Mamés', 'La Liga', 'Spain', 'Athletic Club', '1998-1-1', 16649000);
56 INSERT INTO team VALUES
57     ('9012', 'Estadi Ciutat de València', 'La Liga', 'Spain', 'Levante', '1909-9-9', 7388000);
58 INSERT INTO team VALUES
59     ('9013', 'José Zorrilla Stadium', 'La Liga', 'Spain', 'Valladolid', '1928-6-20', 2772000);
60 INSERT INTO team VALUES
61     ('9014', 'Ipurua Municipal Stadium', 'La Liga', 'Spain', 'Eibar', '1940-11-30', 4837000);
62 INSERT INTO team VALUES
63     ('9015', 'Estadio Benito Villamarín', 'La Liga', 'Spain', 'Betis', '1907-9-12', 14450000);
64 INSERT INTO team VALUES
65     ('9016', 'Mendizorrotza Stadium', 'La Liga', 'Spain', 'Alaves', '1921-1-23', 3978000);
66 INSERT INTO team VALUES
67     ('9017', 'Estadio de Balaídos', 'La Liga', 'Spain', 'Celta Vigo', '1923-8-23', 10593000);
68 INSERT INTO team VALUES
69     ('9018', 'Estadio Municipal de Butarque', 'La Liga', 'Spain', 'Leganes', '1928-6-23', 4178000);
70 INSERT INTO team VALUES
71     ('9019', 'Son Moix', 'La Liga', 'Spain', 'Mallorca', '1916-3-5', 2046000);
72 INSERT INTO team VALUES
73     ('9020', 'RCDE Stadium', 'La Liga', 'Spain', 'Espanyol', '1900-10-13', 9386000);

```

```

145 -- All manager data
146 INSERT INTO manager VALUES
147     ('9001', 'Zinedine Zidane', 'France', '1972-6-23');
148 INSERT INTO manager VALUES
149     ('9002', 'Ronald Koeman', 'Netherlands', '1963-3-21');
150 INSERT INTO manager VALUES
151     ('9003', 'Diego Simeone', 'Argentina', '1970-4-28');
152 INSERT INTO manager VALUES
153     ('9004', 'Julen Lopetegui', 'Spain', '1966-8-28');
154 INSERT INTO manager VALUES
155     ('9005', 'Unai Emery', 'Spain', '1972-6-23');
156 INSERT INTO manager VALUES
157     ('9006', 'Imanol Alguacil', 'Spain', '1972-6-23');
158 INSERT INTO manager VALUES
159     ('9007', 'Diego Martínez', 'Spain', '1972-6-23');
160 INSERT INTO manager VALUES
161     ('9008', 'Pepe Bordalás', 'Spain', '1972-6-23');
162 INSERT INTO manager VALUES
163     ('9009', 'Javi Gracia', 'Spain', '1972-6-23');

```

```
206 -- ALL manages DATA
207 INSERT INTO manages VALUES
208     ('9001', '9001', '2016-1-4', 196333.85);
209 INSERT INTO manages VALUES
210     ('9002', '9002', '2020-1-6', 146293.85);
211 INSERT INTO manages VALUES
212     ('9003', '9003', '2010-8-12', 216339.85);
213 INSERT INTO manages VALUES
214     ('9004', '9004', '2020-1-6', 120303.95);
215 INSERT INTO manages VALUES
216     ('9005', '9005', '2019-10-27', 34333.81);
217 INSERT INTO manages VALUES
218     ('9006', '9006', '2018-11-4', 96333.89);
219 INSERT INTO manages VALUES
220     ('9007', '9007', '2020-3-16', 74133.15);
221 INSERT INTO manages VALUES
222     ('9008', '9008', '2017-4-15', 76397.45);
223 INSERT INTO manages VALUES
224     ('9009', '9009', '2016-8-12', 46363.85);
225 INSERT INTO manages VALUES
226     ('9010', '9010', '2019-5-6', 16331.85);
227 INSERT INTO manages VALUES
228     ('9011', '9011', '2017-10-22', 16732.35);
229 INSERT INTO manages VALUES
230     ('9012', '9012', '2019-9-20', 19393.78);
231 INSERT INTO manages VALUES
232     ('9013', '9013', '2013-7-14', 19673.85);
```

```
268 -- ALL player AND plays DATA
269
270 -- real madrid
271 INSERT INTO player VALUES
272     ('90011', 'Thibaut Courtois', 'Belgium', '1992-5-11');
273 INSERT INTO plays VALUES
274     ('90011', '9001', '2014-9-16', 192660);
275
276 INSERT INTO player VALUES
277     ('90012', 'Raphael Varane', 'France', '1992-5-11');
278 INSERT INTO plays VALUES
279     ('90012', '9001', '2014-9-16', 162660);
280
281 INSERT INTO player VALUES
282     ('90013', 'Sergio Ramos', 'Spain', '1992-5-11');
283 INSERT INTO plays VALUES
284     ('90013', '9001', '2014-9-16', 292660);
285
286 INSERT INTO player VALUES
287     ('90014', 'Casemiro', 'Brazil', '1992-5-11');
288 INSERT INTO plays VALUES
289     ('90014', '9001', '2014-9-16', 112660);
```

```

438 -- matches data
439 select * from team
440
441 -- 2019-08-16. Athletic Club,1-0,Barcelona,47693,San Mamés,Carlos del Cerro
442 INSERT INTO matches VALUES
443     (1, 9011, 9002, '2019-08-16', 'San Mamés', 1, 0, 1);
444 INSERT INTO player VALUES
445     ('90111', 'Aritz Aduriz', 'Spain', '1989-8-11');
446 INSERT INTO plays VALUES
447     ('90111', '9011', '2018-7-1', 123920);
448 INSERT INTO scorer VALUES
449     (1, '90111', 'true', 89);
450 --2019-08-17,17:00 (21:00),Celta Vigo,0.8,1-3,1.7,Real Madrid
451 INSERT INTO matches VALUES
452     (2, 9017, 9001, '2019-08-17', 'Estadio de Balaídos', 1, 3, 2);
453 INSERT INTO player VALUES
454     ('90171', 'Losada', 'Spain', '1996-8-11');
455 INSERT INTO plays VALUES
456     ('90171', '9017', '2011-7-1', 10020);
457 INSERT INTO scorer VALUES
458     (2, '90171', 'true', 91);
459 INSERT INTO player VALUES
460     ('900110', 'Lucas Vasquez', 'Spain', '1997-8-11');
461 INSERT INTO plays VALUES
462     ('900110', '9001', '2012-7-1', 90020);
463 INSERT INTO scorer VALUES
464     (2, '900110', 'false', 80);
465 INSERT INTO scorer VALUES
466     (2, '90015', 'false', 61);
467 INSERT INTO scorer VALUES
468     (2, '90019', 'false', 12);
469
470 -- Atlético Madrid vs. Getafe Match Report - Sunday August 18, 2019
471 INSERT INTO matches VALUES
472     (3, 9003, 9008, '2019-08-18', 'Wanda Metropolitano Stadium', 1, 0, 1);
473 INSERT INTO player VALUES
474     ('900310', 'Alvaro Morata', 'Spain', '1995-8-11');
475 INSERT INTO plays VALUES
476     ('900310', '9003', '2019-7-1', 290020);
477 INSERT INTO scorer VALUES
478     (3, '900310', 'true', 56);

```

```

956
957 INSERT INTO player VALUES
958     ('1111', 'Zinedine Zidane', 'France', '1972-6-23');
959 INSERT INTO player VALUES
960     ('2222', 'Prothito Shovon Majumder Turno', 'Bangladesh', '1999-8-8');
961 INSERT INTO player VALUES
962     ('3333', 'Jawad Habib', 'Bangladesh', '1999-2-24');
963 INSERT INTO player VALUES
964     ('99919', 'Jahir Sadik Monon', 'Bangladesh', '1999-1-22');
965 INSERT INTO plays VALUES
966     ('99919', '9001', '2021-4-9', 100);
967 INSERT INTO player VALUES
968     ('4444', 'Ronaldinho', 'Brazil', '1980-3-21');
969 INSERT INTO player VALUES
970     ('5555', 'Johan Cruyff', 'Netherlands', '1947-4-25');

```

## **Snapshots of instances (data of the populated tables):**

### 1. league table instances

Data Output		Scratch Pad	
	name [PK] character varying (20)	country [PK] character varying (50)	division integer
1	La Liga	Spain	1
2	EPL	England	1
3	Bundesliga	Germany	1
4	Seria A	Italy	1
5	Ligue 1	France	1
6	Segunda División	Spain	2
7	English Championship	England	2

### 2. manager table instances

Data Output		Scratch Pad	
	id [PK] integer	name character varying (50)	country character varying (50)
1	9001	Zinedine Zidane	France
2	9002	Ronald Koeman	Netherlands
3	9003	Diego Simeone	Argentina
4	9004	Julen Lopetegui	Spain
5	9005	Unai Emery	Spain
6	9006	Imanol Alguacil	Spain
7	9007	Diego Martínez	Spain
8	9008	Pepe Bordalás	Spain
9	9009	Javi Gracia	Spain
10	9010	Jagoba Arrasate	Spain
11	9011	Marcelino	Spain
12	9012	Paco López	Spain
13	9013	Sergio	Spain
14	9014	José Luis Mendilibar	Spain
15	9015	Manuel Pellegrini	Spain
16	9016	Javier Calleja	Spain

\* (only a portion of the instances are shown)

### 3. manages table instances

	Data Output	Scratch Pad		
	<b>id</b> [PK] integer	<b>team_id</b> integer	<b>starting_date</b> date	<b>wage</b> numeric (10,2)
1	9001	9001	2016-01-04	196333.85
2	9002	9002	2020-01-06	146293.85
3	9003	9003	2010-08-12	216339.85
4	9004	9004	2020-01-06	120303.95
5	9005	9005	2019-10-27	34333.81
6	9006	9006	2018-11-04	96333.89
7	9007	9007	2020-03-16	74133.15
8	9008	9008	2017-04-15	76397.45
9	9009	9009	2016-08-12	46363.85
10	9010	9010	2019-05-06	16331.85
11	9011	9011	2017-10-22	16732.35
12	9012	9012	2019-09-20	19393.78
13	9013	9013	2013-07-14	19673.85
14	9014	9014	2011-04-26	276323.96
15	9015	9015	2019-05-09	16333.85
16	9016	9016	2019-02-01	68386.35
17	9017	9017	2019-11-09	97636.77
18	9018	9018	2019-12-11	17279.12

\* (only a portion of the instances are shown)

#### 4. matches table instances

Data Output		Scratch Pad						
	match_id [PK] integer	home_team_id integer	away_team_id integer	date_of_match date	venue character varying (50)	home_team_goals integer	away_team_goals integer	winner integer
1	1	9011	9002	2019-08-16	San Mamés	1	0	1
2	2	9017	9001	2019-08-17	Estadio de Balaídos	1	3	2
3	3	9003	9008	2019-08-18	Wanda Metropolitano Stadium	1	0	1
4	4	9001	9013	2019-08-24	Santiago Bernabéu Stadium	1	1	0
5	5	9018	9003	2019-08-25	Estadio Municipal de Butarque	0	1	2
6	6	9010	9002	2019-08-31	El Sadar Stadium	2	2	0
7	7	9001	9012	2019-09-14	Santiago Bernabéu Stadium	3	2	1
8	8	9016	9004	2019-09-15	Mendizorrotza Stadium	0	1	2
9	9	9004	9001	2019-09-22	Ramon Sanchez-Pizjuán Stadiu...	0	1	2
10	10	9002	9017	2019-09-21	Wanda Metropolitano Stadium	0	0	0
11	11	9002	9005	2019-09-21	Camp Nou	2	1	1
12	12	9008	9002	2019-09-28	Coliseum Alfonso Pérez	0	2	2
13	13	9003	9001	2019-09-28	Wanda Metropolitano Stadium	0	0	0
14	14	9003	9009	2019-09-28	Wanda Metropolitano Stadium	1	1	0
15	15	9019	9001	2019-10-19	Son Moix	1	0	1
16	16	9004	9012	2019-10-20	Ramon Sanchez-Pizjuán Stadiu...	1	0	1
17	18	9005	9011	2019-11-03	Estadio de la Cerámica	0	0	0
18	19	9014	9001	2019-11-09	Ipurua Municipal Stadium	0	4	2
19	20	9009	9007	2019-11-09	Mestalla Stadium	2	0	1
20	21	9002	9017	2019-11-09	Camp Nou	4	1	1
21	22	9018	9002	2019-11-23	Estadio Municipal de Butarque	1	2	2
22	23	9013	9004	2019-11-24	José Zorrilla Stadium	0	1	2
23	24	9001	9006	2019-11-23	Santiago Bernabéu Stadium	3	1	1
24	25	9007	9003	2019-11-23	Nuevo Estadio de Los Cármenes	1	1	0
25	26	9011	9003	2020-06-14	San Mamés	1	1	0
26	27	9001	9003	2020-02-01	Santiago Bernabéu Stadium	1	0	1
27	28	9002	9003	2020-06-30	Camp Nou	2	2	0
28	29	9002	9011	2020-06-23	Camp Nou	2	1	1
29	30	9001	9002	2020-03-01	Santiago Bernabéu Stadium	2	0	1
30	31	9002	9001	2019-12-18	Camp Nou	1	1	0
31	32	9009	9001	2019-12-15	Mestalla Stadium	1	1	0

\* (only a portion of the instances are shown)

## 5. player table instances

	<a href="#">Data</a>	<a href="#">Output</a>	<a href="#">Scratch Pad</a>		
	<a href="#">id [PK]</a>	<a href="#">integer</a>	<a href="#">name character varying (50)</a>	<a href="#">country character varying (50)</a>	<a href="#">date_of_birth date</a>
1		90011	Thibaut Courtois	Belgium	1992-05-11
2		90012	Raphael Varane	France	1992-05-11
3		90013	Sergio Ramos	Spain	1992-05-11
4		90014	Casemiro	Brazil	1992-05-11
5		90015	Toni Kroos	Germany	1992-05-11
6		90016	Luka Modric	Croatia	1992-05-11
7		90017	Eden Hazard	Belgium	1992-05-11
8		90018	Isco	Spain	1992-05-11
9		90019	Karim Benzema	France	1992-05-11
10		90021	Marc Andre ter Stegen	Germany	1992-05-11
11		90022	Sergino Dest	Netherlands	1999-05-11
12		90023	Gerard Pique	Spain	1989-05-11
13		90024	Frenkie De Jong	Netherlands	1997-05-11
14		90025	Philip Coutinho	Brazil	1992-05-11
15		90026	Sergio Busquets	Spain	1990-05-11
16		90027	Lionel Messi	Argentina	1990-05-11
17		90028	Luis Suarez	Uruguay	1989-05-11
18		90029	Ansu Fati	Spain	2000-05-11
19		90031	Jan Oblak	Slovenia	1993-01-07
20		90032	Jose Maria Jimenez	Uruguay	1995-01-20
21		90033	Kieren Trippier	England	1990-09-19
22		90034	Koke	Spain	1991-05-11
23		90035	Saul Niguez	Spain	1993-05-11
24		90036	Thomas Lemar	France	1995-11-12
25		90037	Joao Felix	Portugal	1999-11-03
26		90041	Bono	Canada	1991-04-05
27		90042	Jules Kounde	France	1992-11-12
28		90043	Jesus Navas	Spain	1985-11-21

\* (only a portion of the instances are shown)

## 6. plays table instances

	<a href="#">Data</a>	<a href="#">Output</a>	<a href="#">Scratch Pad</a>	
	<a href="#">id [PK]</a>	<a href="#">integer</a>	<a href="#">team_id</a>	<a href="#">integer</a>
			<a href="#">starting_date</a>	<a href="#">date</a>
1	90011	9001	2014-09-16	192660.00
2	90012	9001	2014-09-16	162660.00
3	90013	9001	2014-09-16	292660.00
4	90014	9001	2014-09-16	112660.00
5	90015	9001	2014-09-16	211660.00
6	90016	9001	2014-09-16	292660.00
7	90017	9001	2014-09-16	392660.00
8	90018	9001	2014-09-16	112660.00
9	90019	9001	2009-09-16	212660.00
10	90021	9002	2014-09-16	272660.00
11	90022	9002	2020-09-16	92660.00
12	90023	9002	2004-09-16	392660.00
13	90024	9002	2019-03-11	422660.00
14	90025	9002	2014-09-16	392660.00
15	90026	9002	2014-09-16	262660.00
16	90027	9002	2003-09-16	912660.00
17	90028	9002	2015-09-16	352660.00
18	90029	9002	2020-09-16	12660.00
19	90031	9003	2017-09-16	301921.00
20	90032	9003	2015-09-16	112660.00
21	90033	9003	2019-01-19	202660.00
22	90034	9003	2009-09-16	212660.00
23	90036	9003	2018-07-01	392660.00
24	90037	9003	2019-06-01	322660.00
25	90035	9003	2016-09-16	126602.00
26	90041	9004	2020-09-04	32660.00

\* (only a portion of the instances are shown)

## 7. scorer table instances

	<b>match_id</b> [PK] integer	<b>player_id</b> [PK] integer	<b>scored_for</b> boolean	<b>time_of_goal</b> [PK] numeric (4,2)
1	1	90111	true	89.00
2	2	90171	true	91.00
3	2	900110	false	80.00
4	2	90015	false	61.00
5	2	90019	false	12.00
6	3	900310	true	56.00
7	4	90019	true	82.12
8	4	90019	false	88.12
9	5	900311	false	71.86
10	6	90101	true	7.00
11	6	90101	true	81.00
12	6	90029	false	51.00
13	6	900210	false	64.00
14	7	90019	true	25.00
15	7	90019	true	31.00
16	7	90014	true	40.00
17	7	90121	false	75.00
18	7	90122	false	49.00
19	8	90046	false	79.00
20	9	90019	false	64.57
21	11	90027	true	9.00
22	11	90027	true	79.77
23	11	90053	false	57.00
24	12	90028	false	79.77
25	12	90027	false	9.15
26	14	900312	true	36.00
27	14	90091	false	82.00
28	15	90191	true	7.00
29	16	90045	true	86.00

\* (only a portion of the instances are shown)

## 8. stadium table instances

	<b>name</b> [PK] character varying (50)	<b>city</b> character varying (50)	<b>country</b> character varying (50)	<b>capacity</b> integer
1	San Mamés	Bilbao	Spain	53289
2	Santiago Bernabéu Stadium	Madrid	Spain	81044
3	Camp Nou	Barcelona	Spain	99354
4	Wanda Metropolitano Stadium	Madrid	Spain	68456
5	Ramon Sanchez-Pizjuán Stadium	Seville	Spain	43883
6	Estadio de la Cerámica	Villarreal	Spain	23500
7	Anoeta Stadium	San Sebastián	Spain	39500
8	Nuevo Estadio de Los Cármenes	Granada	Spain	19336
9	Coliseum Alfonso Pérez	Getafe	Spain	17000
10	Mestalla Stadium	Valencia	Spain	48600
11	El Sadar Stadium	Navarre	Spain	23576
12	Estadi Ciutat de València	Valencia	Spain	26354
13	José Zorrilla Stadium	Valladolid	Spain	27846
14	Ipurua Municipal Stadium	Eibar	Spain	8164
15	Estadio Benito Villamarín	Seville	Spain	60720
16	Mendizorrotza Stadium	Vitoria-Gasteiz	Spain	19840
17	Estadio de Balaídos	Vigo	Spain	35000
18	Estadio Municipal de Butarque	Leganés	Spain	12450
19	Son Moix	Palma de Mallorca	Spain	23142
20	RCDE Stadium	Barcelona	Spain	40000
21	Old Trafford	Manchester	England	76000
22	San Siro	Milan	Italy	75923
23	Anfield	Liverpool	England	53394
24	Allianz Arena	Munich	Germany	75024
25	Le Parc des Princes	Paris	France	47929
26	Signal Iduna Park	Dortmund	Germany	81365

## 9. team table instances

		Data Output		Scratch Pad				
		id [PK] integer	stadium_name character varying (50)	league_name character varying	country character var	full_name character varying (70)	founded_on date	budget numeric (15,2)
1	9001	Santiago Bernabéu Stadium	La Liga	Spain	Real Madrid C.F.	1902-03-02	169610000.00	
2	9002	Camp Nou	La Liga	Spain	Barcelona	1899-11-29	169074000.00	
3	9003	Wanda Metropolitano Stadiu...	La Liga	Spain	Atletico Madrid	1903-04-26	61716000.00	
4	9004	Ramon Sanchez-Pizjuan Sta...	La Liga	Spain	Sevilla	1890-01-25	31069000.00	
5	9005	Estadio de la Cerámica	La Liga	Spain	Villarreal CF	1923-03-10	29636000.00	
6	9006	Anoeta Stadium	La Liga	Spain	Real Sociedad	1909-09-07	14175000.00	
7	9007	Nuevo Estadio de Los Cárm...	La Liga	Spain	Granada	1931-04-14	4929000.00	
8	9008	Coliseum Alfonso Pérez	La Liga	Spain	Getafe	1983-07-08	4868000.00	
9	9009	Mestalla Stadium	La Liga	Spain	Valencia	1919-03-18	59704000.00	
10	9010	El Sadar Stadium	La Liga	Spain	Osasuna	1920-10-24	3915000.00	
11	9011	San Mamés	La Liga	Spain	Athletic Club	1998-01-01	16649000.00	
12	9012	Estadi Ciutat de València	La Liga	Spain	Levante	1909-09-09	7388000.00	
13	9013	José Zorrilla Stadium	La Liga	Spain	Valladolid	1928-06-20	2772000.00	
14	9014	Ipurua Municipal Stadium	La Liga	Spain	Eibar	1940-11-30	4837000.00	
15	9015	Estadio Benito Villamarín	La Liga	Spain	Betis	1907-09-12	14450000.00	
16	9016	Mendizorrotza Stadium	La Liga	Spain	Alaves	1921-01-23	3978000.00	
17	9017	Estadio de Balaídos	La Liga	Spain	Celta Vigo	1923-08-23	10593000.00	
18	9018	Estadio Municipal de Butarq...	La Liga	Spain	Leganes	1928-06-23	4178000.00	
19	9019	Son Moix	La Liga	Spain	Mallorca	1916-03-05	2046000.00	
20	9020	RCDE Stadium	La Liga	Spain	Espanyol	1900-10-13	9386000.00	
21	1001	Old Trafford	EPL	England	Manchester United F.C.	1902-09-11	139716000.00	
22	1002	Anfield	EPL	England	Liverpool F.C.	1892-06-03	119716000.00	
23	2001	Le Parc des Princes	Ligue 1	France	Paris Saint-Germain F.C.	1970-08-12	219716000.00	
24	3001	Allianz Arena	Bundesliga	Germany	Bayern Munich	1900-02-27	151716000.00	
25	3002	Signal Iduna Park	Bundesliga	Germany	Borussia Dortmund	1909-12-19	91716000.00	
26	4001	San Siro	Seria A	Italy	AC Milan	1899-01-29	79716000.00	
27	4002	San Siro	Seria A	Italy	Inter Milan	1908-03-09	99716000.00	

## **Queries:**

The queries along with their relational algebraic expression, SQL statement and snapshot of output is shown below -

### **Query statement 1 -**

Find the names and capacities of all the stadiums in Spain that has a capacity greater than 50,000.

Relational algebraic expression -

$$\Pi_{name, capacity} (\sigma_{country = "Spain"} \wedge capacity > 50,000 (stadium))$$

SQL statement -

```
SELECT name, capacity
FROM stadium
WHERE country = 'Spain'
      AND capacity > 50000
```

Snapshot of output -

	name [PK] character varying (50)	capacity integer
1	San Mamés	53289
2	Santiago Bernabéu Stadium	81044
3	Camp Nou	99354
4	Wanda Metropolitano Stadium	68456
5	Estadio Benito Villamarín	60720

\*(total 5 outputs)

### **Query statement 2 –**

Join the two tables ‘player’ and ‘plays’ and show their name, country, wage and date\_of\_birth.

Relational algebraic expression -

$$\Pi_{name, country, wage, date\_of\_birth} (plays \bowtie player)$$

SQL statement –

```
SELECT name, country, wage, date_of_birth FROM player NATURAL JOIN plays
```

Snapshot of output -

	<b>name</b> character varying (50)	<b>country</b> character varying (50)	<b>wage</b> numeric (10,2)	<b>date_of_birth</b> date
1	Thibaut Courtois	Belgium	192660.00	1992-05-11
2	Raphael Varane	France	162660.00	1992-05-11
3	Sergio Ramos	Spain	292660.00	1992-05-11
4	Casemiro	Brazil	112660.00	1992-05-11
5	Toni Kroos	Germany	211660.00	1992-05-11
6	Luka Modric	Croatia	292660.00	1992-05-11
7	Eden Hazard	Belgium	392660.00	1992-05-11
8	Isco	Spain	112660.00	1992-05-11
9	Karim Benzema	France	212660.00	1992-05-11
10	Marc Andre ter Stegen	Germany	272660.00	1992-05-11
11	Sergino Dest	Netherlands	92660.00	1999-05-11
12	Gerard Pique	Spain	392660.00	1989-05-11
13	Frenkie De Jong	Netherlands	422660.00	1997-05-11
14	Philip Coutinho	Brazil	392660.00	1992-05-11
15	Sergio Busquets	Spain	262660.00	1990-05-11
16	Lionel Messi	Argentina	912660.00	1990-05-11
17	Luis Suarez	Uruguay	352660.00	1989-05-11
18	Ansu Fati	Spain	12660.00	2000-05-11
19	Jan Oblak	Slovenia	301921.00	1993-01-07
20	Jose Maria Jimenez	Uruguay	112660.00	1995-01-20
21	Kieren Trippier	England	202660.00	1990-09-19
22	Koke	Spain	212660.00	1991-05-11
23	Saul Niguez	Spain	126602.00	1993-05-11
24	Thomas Lemar	France	392660.00	1995-11-12
25	Joao Felix	Portugal	322660.00	1999-11-03
26	Bono	Canada	32660.00	1991-04-05
27	Jules Kounde	France	18960.00	1992-11-12
28	Jesus Navas	Spain	102660.00	1985-11-21
29	Lucas Ocompos	Argentina	122660.00	1988-03-10
30	Luuk De Jong	Netherlands	122920.00	1999-07-01

\*(only a portion of the total output is shown here)

Query statement 3 -

Show the cross product of the two table league and stadium.

Relational algebraic expression -

$\Pi_{league.name, league.country, league.division, stadium.name, city, stadium.country, capacity} (league \times stadium)$

SQL statement -

```
SELECT * FROM league, stadium
```

Snapshot of output -

	name character varying (20)	country character varying (50)	division integer	name character varying (50)	city character varying (50)	country character varying (50)	capacity integer
1	La Liga	Spain	1	San Mamés	Bilbao	Spain	53289
2	La Liga	Spain	1	Santiago Bernabéu Stadium	Madrid	Spain	81044
3	La Liga	Spain	1	Camp Nou	Barcelona	Spain	99354
4	La Liga	Spain	1	Wanda Metropolitano Stadi...	Madrid	Spain	68456
5	La Liga	Spain	1	Ramon Sanchez-Pizjuán Sta...	Seville	Spain	43883
6	La Liga	Spain	1	Estadio de la Cerámica	Villarreal	Spain	23500
7	La Liga	Spain	1	Anoeta Stadium	San Sebastián	Spain	39500
8	La Liga	Spain	1	Nuevo Estadio de Los Cárm...	Granada	Spain	19336
9	La Liga	Spain	1	Coliseum Alfonso Pérez	Getafe	Spain	17000
10	La Liga	Spain	1	Mestalla Stadium	Valencia	Spain	48600
11	La Liga	Spain	1	El Sadar Stadium	Navarre	Spain	23576
12	La Liga	Spain	1	Estadi Ciutat de València	Valencia	Spain	26354
13	La Liga	Spain	1	José Zorrilla Stadium	Valladolid	Spain	27846
14	La Liga	Spain	1	Ipurua Municipal Stadium	Eibar	Spain	8164
15	La Liga	Spain	1	Estadio Benito Villamarín	Seville	Spain	60720
16	La Liga	Spain	1	Mendizorrotza Stadium	Vitoria-Gasteiz	Spain	19840
17	La Liga	Spain	1	Estadio de Balaídos	Vigo	Spain	35000
18	La Liga	Spain	1	Estadio Municipal de Butarq...	Leganés	Spain	12450
19	La Liga	Spain	1	Son Moix	Palma de Mallorca	Spain	23142
20	La Liga	Spain	1	RCDE Stadium	Barcelona	Spain	40000
21	La Liga	Spain	1	Old Trafford	Manchester	England	76000
22	La Liga	Spain	1	San Siro	Milan	Italy	75923
23	La Liga	Spain	1	Anfield	Liverpool	England	53394
24	La Liga	Spain	1	Allianz Arena	Munich	Germany	75024
25	La Liga	Spain	1	Le Parc des Princes	Paris	France	47929
26	La Liga	Spain	1	Signal Iduna Park	Dortmund	Germany	81365
27	EPL	England	1	San Mamés	Bilbao	Spain	53289
28	EPL	England	1	Santiago Bernabéu Stadium	Madrid	Spain	81044
29	EPL	England	1	Camp Nou	Barcelona	Spain	99354
30	EPL	England	1	Wanda Metropolitano Stadi...	Madrid	Spain	68456

\*(only a portion of the total output is shown here)

#### Query statement 4 -

Display name, country, team\_id and wage of all players, put null in places where a player doesn't play for any team.

Relational algebraic expression -

$$\Pi_{name, country, team\_id, wage} (\text{player} \bowtie \text{plays})$$

SQL statement -

```
SELECT name, country, team_id, wage FROM player NATURAL LEFT OUTER JOIN plays
```

Snapshot of output -

	<b>name</b> character varying (50)	<b>country</b> character varying (50)	<b>team_id</b> integer	<b>wage</b> numeric (10,2)
1	Thibaut Courtois	Belgium	9001	192660.00
2	Raphael Varane	France	9001	162660.00
3	Sergio Ramos	Spain	9001	292660.00
4	Casemiro	Brazil	9001	112660.00
5	Toni Kroos	Germany	9001	211660.00
6	Luka Modric	Croatia	9001	292660.00
7	Eden Hazard	Belgium	9001	392660.00
8	Isco	Spain	9001	112660.00
9	Karim Benzema	France	9001	212660.00
10	Marc Andre ter Stegen	Germany	9002	272660.00
11	Sergino Dest	Netherlands	9002	92660.00
12	Gerard Pique	Spain	9002	392660.00
13	Frenkie De Jong	Netherlands	9002	422660.00
14	Philip Coutinho	Brazil	9002	392660.00
15	Sergio Busquets	Spain	9002	262660.00
16	Lionel Messi	Argentina	9002	912660.00
17	Luis Suarez	Uruguay	9002	352660.00
18	Ansu Fati	Spain	9002	12660.00
19	Jan Oblak	Slovenia	9003	301921.00
20	Jose Maria Jimenez	Uruguay	9003	112660.00
21	Kieren Trippier	England	9003	202660.00
22	Koke	Spain	9003	212660.00
23	Saul Niguez	Spain	9003	126602.00
24	Thomas Lemar	France	9003	392660.00
25	Joao Felix	Portugal	9003	322660.00
26	Bono	Canada	9004	32660.00
27	Jules Kounde	France	9004	18960.00

\*(a portion of the outputs is skipped here)

71	Kylian Mbappe	France	2001	499910.55
72	Neymar	Brazil	2001	899919.55
73	Zinedine Zidane	France	[null]	[null]
74	Prothito Shovon Majumder T...	Bangladesh	[null]	[null]
75	Jawad Habib	Bangladesh	[null]	[null]
76	Jahir Sadik Monon	Bangladesh	9001	100.00
77	Ronaldinho	Brazil	[null]	[null]
78	Johan Cruyff	Netherlands	[null]	[null]
79	Pele	Brazil	[null]	[null]
80	Maradona	Argentina	[null]	[null]
81	Alfredo Di Stefano	Argentina	[null]	[null]
82	Paolo Maldini	Italy	[null]	[null]

### Query statement 5 -

Join the stadium table and league table using their country to show which country each stadium is in along with their name, capacity, and league.name.

### Relational algebraic expression -

$$\Pi_{\text{stadium.name, country, capacity, league.name}} (\text{league} \bowtie_{\text{league.country} = \text{stadium.country}} \text{stadium})$$

### SQL statement -

```
SELECT stadium.name, country, capacity, league.name FROM stadium JOIN league USING (country)
```

### Snapshot of output -

	name character varying (50)	country character varying (50)	capacity integer	name character varying (20)
1	RCDE Stadium	Spain	40000	La Liga
2	Son Moix	Spain	23142	La Liga
3	Estadio Municipal de Butarq...	Spain	12450	La Liga
4	Estadio de Balaídos	Spain	35000	La Liga
5	Mendizorrotza Stadium	Spain	19840	La Liga
6	Estadio Benito Villamarín	Spain	60720	La Liga
7	Ipurua Municipal Stadium	Spain	8164	La Liga
8	José Zorrilla Stadium	Spain	27846	La Liga
9	Estadi Ciutat de València	Spain	26354	La Liga
10	El Sadar Stadium	Spain	23576	La Liga
11	Mestalla Stadium	Spain	48600	La Liga
12	Coliseum Alfonso Pérez	Spain	17000	La Liga
13	Nuevo Estadio de Los Cárm...	Spain	19336	La Liga
14	Anoeta Stadium	Spain	39500	La Liga
15	Estadio de la Cerámica	Spain	23500	La Liga
16	Ramon Sanchez-Pizjuan Sta...	Spain	43883	La Liga

\*(only a portion of the total output is shown here)

### Query statement 6 -

Show all player names along with their country, the name of the team they play for and the league they play in.

Relational algebraic expression -

$$\Pi_{name, playerList.country, full\_name, league\_name} (\rho_{playerList} (player \bowtie plays) \bowtie_{team.id = playerList.team_id} team)$$

### SQL statement -

```
SELECT name, playerList.country, full_name, league_name
FROM (player NATURAL JOIN plays) as playerList JOIN team ON team.id = playerList.team_id
```

### Snapshot of output -

	name character varying (50)	country character varying (50)	full_name character varying (70)	league_name character varying (20)
1	Thibaut Courtois	Belgium	Real Madrid C.F.	La Liga
2	Raphael Varane	France	Real Madrid C.F.	La Liga
3	Sergio Ramos	Spain	Real Madrid C.F.	La Liga
4	Casemiro	Brazil	Real Madrid C.F.	La Liga
5	Toni Kroos	Germany	Real Madrid C.F.	La Liga
6	Luka Modric	Croatia	Real Madrid C.F.	La Liga
7	Eden Hazard	Belgium	Real Madrid C.F.	La Liga
8	Isco	Spain	Real Madrid C.F.	La Liga
9	Karim Benzema	France	Real Madrid C.F.	La Liga
10	Marc Andre ter Stegen	Germany	Barcelona	La Liga
11	Sergino Dest	Netherlands	Barcelona	La Liga
12	Gerard Pique	Spain	Barcelona	La Liga
13	Frenkie De Jong	Netherlands	Barcelona	La Liga
14	Philip Coutinho	Brazil	Barcelona	La Liga
15	Sergio Busquets	Spain	Barcelona	La Liga
16	Lionel Messi	Argentina	Barcelona	La Liga
17	Luis Suarez	Uruguay	Barcelona	La Liga
18	Ansu Fati	Spain	Barcelona	La Liga
19	Jan Oblak	Slovenia	Atletico Madrid	La Liga
20	Jose Maria Jimenez	Uruguay	Atletico Madrid	La Liga
21	Kieren Trippier	England	Atletico Madrid	La Liga
22	Koke	Spain	Atletico Madrid	La Liga
23	Saul Niguez	Spain	Atletico Madrid	La Liga
24	Thomas Lemar	France	Atletico Madrid	La Liga
25	Joao Felix	Portugal	Atletico Madrid	La Liga
26	Bono	Canada	Sevilla	La Liga
27	Jules Kounde	France	Sevilla	La Liga
28	Jesus Navas	Spain	Sevilla	La Liga
29	Lucas Ocompos	Argentina	Sevilla	La Liga
30	Luuk De Jong	Netherlands	Sevilla	La Liga
31	Sergio Asenjo	Spain	Villarreal CF	La Liga

\*(only a portion of the total output is shown here)

### Query statement 7 -

Find the id, team\_id, wage of all players whose wage is greater than at least one player in the team with team\_id = 9003.

Relational algebraic expression -

$$\prod_{P} P.id, P.team\_id, P.wage \left( \sigma_{P.wage > Q.wage \wedge Q.team\_id = 9003} (\rho_P(\text{plays}) \times \rho_Q(\text{plays})) \right)$$

SQL statement -

```
SELECT id, team_id, wage
FROM plays
WHERE wage > some(SELECT wage FROM plays WHERE team_id = 9003)
```

Snapshot of output -

	<u><b>id</b></u> [PK] integer	<u><b>team_id</b></u> integer	<u><b>wage</b></u> numeric (10,2)
1	90011	9001	192660.00
2	90012	9001	162660.00
3	90013	9001	292660.00
4	90015	9001	211660.00
5	90016	9001	292660.00
6	90017	9001	392660.00
7	90019	9001	212660.00
8	90021	9002	272660.00
9	90023	9002	392660.00
10	90024	9002	422660.00
11	90025	9002	392660.00
12	90026	9002	262660.00
13	90027	9002	912660.00
14	90028	9002	352660.00
15	90031	9003	301921.00
16	90033	9003	202660.00
17	90034	9003	212660.00
18	90036	9003	392660.00
19	90037	9003	322660.00
20	90035	9003	126602.00
21	90044	9004	122660.00
22	90045	9004	122920.00
23	90111	9011	123920.00
24	900310	9003	290020.00
25	900311	9003	160020.00
26	900210	9002	190020.00
27	900312	9003	329020.00
28	90091	9009	329020.00
29	900115	9001	139020.00
30	90092	9009	129020.00
31	90181	9018	215020.00

\*(only a portion of the total output is shown here)

### Query statement 8 -

Find the id, team\_id, wage of all players whose wage is greater than all players in the team with team\_id = 9003.

Relational algebraic expression -

$$\Pi_{id, team\_id, wage} (\sigma_{wage > (\Pi_{wage} (plays) - \Pi_{plays.wage} (\sigma_{plays.x < d.x (A \times \rho_d (\sigma_{plays.team\_id = 9003))))} (plays))}$$

### SQL statement -

```
SELECT id, team_id, wage
FROM plays
WHERE wage > all(SELECT wage FROM plays WHERE team_id = 9003)
```

Snapshot of output -

	<b>id</b> [PK] integer	<b>team_id</b> integer	<b>wage</b> numeric (10,2)
1	90024	9002	422660.00
2	90027	9002	912660.00
3	40011	4001	411119.18
4	40021	4002	396119.18
5	30011	3001	401010.55
6	30012	3001	479910.55
7	10021	1002	400910.55
8	10022	1002	499910.55
9	10012	1001	499910.55
10	20011	2001	499910.55
11	20012	2001	899919.55

\*(total ten outputs)

### Query Statement 9 -

Find the player id, team id, country, league name of all the players who play in a team which is in the same league as they were born in.

Relational algebraic expression -

$$\Pi_{player\_id, team\_id, country, league\_name} \\ (\sigma_{(S.plays\_id = T.id \wedge S.country = T.country) (\rho_T (player \bowtie plays))} (\rho_S (plays \bowtie_{team.id = plays.team_id} team)))$$

SQL statement -

```
SELECT plays_id, team_id, country, league_name
FROM (plays AS P(plays_id, team_id) JOIN team ON team_id = team.id) AS S
WHERE EXISTS (SELECT * FROM (plays NATURAL JOIN player) AS T
               WHERE S.plays_id = T.id AND T.country = S.country);
```

Snapshot of output -

	plays_id integer	team_id integer	country character varying (50)	league_name character varying (20)
1	90013	9001	Spain	La Liga
2	90018	9001	Spain	La Liga
3	90023	9002	Spain	La Liga
4	90026	9002	Spain	La Liga
5	90029	9002	Spain	La Liga
6	90034	9003	Spain	La Liga
7	90035	9003	Spain	La Liga
8	90043	9004	Spain	La Liga
9	90051	9005	Spain	La Liga
10	90052	9005	Spain	La Liga
11	90053	9005	Spain	La Liga
12	90054	9005	Spain	La Liga
13	90111	9011	Spain	La Liga
14	90171	9017	Spain	La Liga
15	900110	9001	Spain	La Liga
16	900310	9003	Spain	La Liga
17	90131	9013	Spain	La Liga
18	900311	9003	Spain	La Liga
19	90101	9010	Spain	La Liga
20	90122	9012	Spain	La Liga
21	90046	9004	Spain	La Liga
22	900312	9003	Spain	La Liga
23	90072	9007	Spain	La Liga
24	90112	9011	Spain	La Liga
25	30021	3002	Germany	Bundesliga
26	30011	3001	Germany	Bundesliga
27	30013	3001	Germany	Bundesliga
28	10011	1001	England	EPL
29	20011	2001	France	Ligue 1

\*(total 29 outputs)

Query statement 10 -

Find the player ids, country, and wages in descending order of their wages. DARA

Relational algebraic expression -

$$\Pi_{id, country, wage} (\tau_{wage \text{ DESC}} (\text{plays} \bowtie \text{player}))$$

SQL statement -

```
SELECT id, country, wage FROM (plays NATURAL JOIN player) ORDER BY wage DESC
```

Snapshot of output -

	<b>id</b> integer	<b>country</b> character varying (50)	<b>wage</b> numeric (10,2)
1	90027	Argentina	912660.00
2	20012	Brazil	899919.55
3	10012	Portugal	499910.55
4	10022	Egypt	499910.55
5	20011	France	499910.55
6	30012	Poland	479910.55
7	90024	Netherlands	422660.00
8	40011	Sweden	411119.18
9	30011	Germany	401010.55
10	10021	Senegal	400910.55
11	40021	Belgium	396119.18
12	90017	Belgium	392660.00
13	90023	Spain	392660.00
14	90025	Brazil	392660.00
15	90036	France	392660.00
16	30021	Germany	391810.88
17	90028	Uruguay	352660.00
18	40022	Argentina	346119.18
19	900312	Spain	329020.00
20	90091	France	329020.00
21	90037	Portugal	322660.00
22	90031	Slovenia	301921.00
23	90013	Spain	292660.00
24	90016	Croatia	292660.00
25	10011	England	290910.55
26	900310	Spain	290020.00
27	90021	Germany	272660.00
28	90026	Spain	262660.00
29	90181	Morocco	215020.00
30	90019	France	212660.00

\*(only a portion of the output is shown)

Query statement 11 -

Find the number of players in each country.

Relational algebraic expression -

$$\Pi_{country, num\_of\_player} (country \vee \text{count}(id) \text{ as } num\_of\_player (\text{player} \bowtie \text{plays}))$$

SQL statement -

```
SELECT country, count(id) num_of_player
FROM (plays NATURAL JOIN player) as T
GROUP BY country
```

Snapshot of output -

	country character varying (50)	num_of_player bigint
1	Argentina	5
2	Spain	24
3	Croatia	1
4	Bangladesh	1
5	England	2
6	Slovenia	1
7	Uruguay	3
8	Egypt	1
9	Morocco	1
10	Belgium	3
11	Norway	1
12	Sweden	1
13	France	7
14	Netherlands	3
15	Brazil	6
16	Senegal	1
17	Ivort Coast	1
18	Poland	1
19	Germany	5
20	Denmark	1
21	Canada	1
22	Portugal	2

\*(total 22 outputs were shown)

### Query statement 12 -

Find name, country and goals of all the players who has scored more than 5 goals.

Relational algebraic expression -

$$\prod_{name, country, goals} (\text{player} \bowtie_{player\_id = id} (\prod_{player\_id, goals} (\sigma_{count(player\_id) > 5} (\text{country} \vee_{count(player\_id) as goals} (\text{player} \bowtie \text{plays}))))))$$

SQL statement -

```
SELECT name, country, goals
FROM player JOIN (SELECT player_id, COUNT(player_id) AS goals
                    FROM scorer
                    GROUP BY player_id HAVING(COUNT(player_id)>5) AS temp
                ON player_id = id
ORDER BY goals DESC
```

Snapshot of output -

Data Output    Scratch Pad

---

	name character varying (50)	country character varying (50)	goals bigint
1	Lionel Messi	Argentina	11
2	Karim Benzema	France	10
3	Diego Costa	Spain	6

\*(total three outputs were shown)

### Query statement 13 -

Find name, country, and goals of all players who scored less than 5 goals. (Using with clause)

Relational algebraic expression -

$$\prod_{name, country, goals} (\text{player} \bowtie_{player\_id = id} (\prod_{player\_id, goals} (\sigma_{count(player\_id) < 5} (\text{country} \vee_{count(player\_id) as goals} (\text{player} \bowtie \text{plays}))))))$$

SQL statement -

```
WITH temp AS (SELECT player_id, COUNT(player_id) AS goals
              FROM scorer
              GROUP BY player_id
              HAVING(COUNT(player_id)<5))
SELECT name, country, goals
      FROM player JOIN temp
      ON player_id = id ORDER BY goals DESC
```

Snapshot of output -

	<b>name</b> character varying (50)	<b>country</b> character varying (50)	<b>goals</b> bigint
1	Luis Suarez	Uruguay	3
2	Robert Lewandowski	Poland	3
3	Kevin Gameiro	France	3
4	Zlatan Ibrahimovic	Sweden	2
5	Lukaku	Belgium	2
6	Saul Niguez	Spain	2
7	Thomas Muller	Germany	2
8	Erling Haaland	Norway	2
9	Toni Kroos	Germany	2
10	Aritz Aduriz	Spain	2
11	Mohammad Salah	Egypt	2
12	Marcus Rashford	England	2
13	Bruno Fernandes	Portugal	2
14	Kylian Mbappe	France	2
15	Sergio Ramos	Spain	2
16	Roberto Torres	Spain	2
17	Vinicius Junior	Brazil	2
18	Daniel Wass	Denmark	1
19	Lucas Olaza	Uruguay	1
20	Youssef En-Nesyri	Morocco	1
21	Ever Banega	Argentina	1
22	Willian Jose	Brazil	1
23	German Sanchez	Spain	1
24	Iker Muniain	Spain	1
25	Lautaro Martinez	Argentina	1
26	Marco Reus	Germany	1
27	Josua Kimmich	Germany	1
28	Sadio Mane	Senegal	1
29	Neymar	Brazil	1
30	Casemiro	Brazil	1

\*(only a portion of the total output is shown here)

#### Query statement 14 -

Find the name, team id, country of all the players that has the substring ‘junior’ in their name.

Relational algebraic expression -

Not applicable. (Regex not part of relational algebra)

SQL statement -

```
SELECT name
  FROM plays NATURAL JOIN player
 WHERE name ilike '%junior%'
```

Snapshot of output -

	name	
	character varying (50)	🔒
1	Lago Junior	
2	Vinicio Junior	

\*(total two outputs)

#### Query statement 15 -

Find the match id, results all the matches where the team with id = 1001 was involved.

Relational algebraic expression -

$$\prod_{match\_id, home\_team\_id, away\_team\_id, home\_team\_goals, away\_team\_goals, winner} (\sigma_{home\_team\_id = '9001'}(\text{matches}) \cup \sigma_{away\_team\_id = '9001'}(\text{matches}))$$

SQL statement –

```
SELECT match_id, home_team_id, away_team_id, home_team_goals, away_team_goals, winner
FROM
(SELECT * FROM matches WHERE home_team_id = '9001'
UNION
SELECT * FROM matches WHERE away_team_id = '9001') as S
```

Snapshot of output -

	match_id integer	home_team_id integer	away_team_id integer	home_team_goals integer	away_team_goals integer	winner integer
1	19	9014	9001	0	4	2
2	2	9017	9001	1	3	2
3	27	9001	9003	1	0	1
4	24	9001	9006	3	1	1
5	31	9002	9001	1	1	0
6	7	9001	9012	3	2	1
7	9	9004	9001	0	1	2
8	15	9019	9001	1	0	1
9	17	9001	9015	0	0	0
10	4	9001	9013	1	1	0
11	32	9009	9001	1	1	0
12	13	9003	9001	0	0	0
13	30	9001	9002	2	0	1

\*(total 13 outputs)

### Query statement 16 -

Find all the Spanish players that play for the team with id = 9003.

Relational algebraic expression -

$$\prod_{id} (\sigma_{home\_team\_id = '9001'} (plays)) \cap \prod_{id} (\sigma_{country = 'Spain'} (player))$$

SQL statement -

```
SELECT *
FROM (SELECT id FROM plays WHERE team_id = '9003'
      INTERSECT
      SELECT id FROM player WHERE country = 'Spain') as A
```

Snapshot of output -

	id integer
1	900311
2	90035
3	90034
4	900310
5	900312

\*(total 5 outputs)

### Query statement 17 -

Decrease the wage of the players in team\_id = 9002 by 10% who earn more than 400,000 euros a week.

Relational algebraic expression -

$\text{plays} \leftarrow (\text{plays} - \sigma_{\text{team\_id} = '9002' \wedge \text{wage} > 400000}(\text{plays})) \cup \prod_{\text{player\_id}, 9002, \text{starting\_date}, \text{wage} * 1.1} (\sigma_{\text{team\_id} = '9002' \wedge \text{wage} > 400000}(\text{plays}))$
---

SQL statement -

```
UPDATE plays
SET wage = (wage - (0.1 * wage))
WHERE team_id = '9002' and wage > 400000
```

Snapshot of output -

Before update:

	Data Output		Scratch Pad	
	<b>id</b> [PK] integer	team_id integer	starting_date date	wage numeric (10,2)
1	90024	9002	2019-03-11	422660.00
2	90027	9002	2003-09-16	1003926.00

After updating:

	Data Output		Scratch Pad	
	<b>id</b> [PK] integer	team_id integer	starting_date date	wage numeric (10,2)
1	90023	9002	2004-09-16	392660.00
2	90027	9002	2003-09-16	903533.40

### Query statement 18 -

Delete the manager named ‘Diego Maradona’ from the manager table.

Relational algebraic expression -

$\text{manager} \leftarrow (\text{manager} - \sigma_{\text{name} = 'Diego Maradona'}(\text{manager}))$
--

SQL statement -

```
DELETE
FROM manager
WHERE name = 'Diego Maradona'
```

Snapshot of output -

Before deleting:

Data Output    Scratch Pad				
	<b>id</b> [PK] integer	<b>name</b> character varying (50)	<b>country</b> character varying (50)	<b>date_of_birth</b> date
1	99999	Diego Maradona	Argentina	1960-10-30

After deletion:

Data Output    Scratch Pad				
	<b>id</b> [PK] integer	<b>name</b> character varying (50)	<b>country</b> character varying (50)	<b>date_of_birth</b> date

Query statement 19 -

Find the total number of goals scored by players from the country France.

$$\prod \text{total\_goals\_by\_french\_players} (\forall \text{count}(\text{player\_id}) (\prod_{\text{player\_d}} (\text{scorer}) \cap \sigma_{\text{country} = \text{'France'}}(\text{player})))$$

SQL statement -

```
SELECT count(player_id) as total_goals_by_french_players
FROM scorer
where scorer.player_id in (SELECT id
                           FROM player
                           WHERE country = 'France');
```

Snapshot of output -

Data Output		Scratch Pad
	total_goals_by_french_players	
1		15

Query statement 20 -

Find the names of cities, total capacity of all the stadiums in those cities when sum of capacity of all the stadiums in that city more than 30000.

Relational expression -

$$\prod_{city, tot\_capacity} (\sigma_{tot\_capacity > 30000} (city \vee sum(capacity) as tot_capacity (stadium)))$$

SQL statement -

```
SELECT city, sum(capacity) as tot_capacity
FROM stadium
GROUP BY city
HAVING sum(capacity) > 30000
```

Snapshot of output -

	city character varying (50)		tot_capacity bigint	
1	Seville		104603	
2	San Sebastián		39500	
3	Dortmund		81365	
4	Milan		75923	
5	Paris		47929	
6	Bilbao		53289	
7	Manchester		76000	
8	Barcelona		139354	
9	Munich		75024	
10	Madrid		149500	
11	Valencia		74954	
12	Liverpool		53394	
13	Vigo		35000	

\*(total 13 outputs)

## Creating Views and using them to answer queries -

Creating a view named ‘scorerInfo’ to keep track of the info of each player in the scorer table.

Relational algebraic expression -

$$\text{scorerInfo} \leftarrow (\prod_{\text{match\_id}, \text{player\_id}, \text{name}, \text{team\_id}, \text{scored\_for}} ((\text{player} \bowtie \text{plays}) \bowtie_{\text{player\_id} = \text{id}} \text{scorer}))$$

SQL statement -

```
CREATE VIEW scorerInfo( match_id, player_id, name, team_id, scored_for)
AS (SELECT match_id, player_id, name, team_id, scored_for
    FROM (scorer JOIN player ON(player_id = id)) AS S NATURAL JOIN plays)
```

Created view -

scorerinfo
Columns (5)
match_id
player_id
name
team_id
scored_for

Using the view to answer the following query -

Show the number of goals each player has scored in each game in descending order.

Relational algebraic expression -

$$\prod_{\text{match\_id}, \text{name}, \text{player\_id}, \text{goals}} (\text{match\_id}, \text{name}, \text{player\_id}) \nabla \text{count}(\text{player\_id}) \text{ as goals} (\text{scorerInfo}))$$

SQL statement -

```
SELECT match_id, name, player_id, count(player_id) as goals
FROM scorerInfo
GROUP BY match_id, name, player_id ORDER BY goals DESC
```

Snapshot of output -

	<b>Data Output</b>	<b>Scratch Pad</b>		
	<b>match_id</b> integer	<b>name</b> character varying (50)	<b>player_id</b> integer	<b>goals</b> bigint
1	21	Lionel Messi	90027	3
2	4	Karim Benzema	90019	2
3	40	Kylian Mbappe	20011	2
4	35	Zlatan Ibrahimovic	40011	2
5	11	Lionel Messi	90027	2
6	28	Saul Niguez	90035	2
7	6	Roberto Torres	90101	2
8	35	Lukaku	40021	2
9	37	Erling Haaland	30022	2
10	7	Karim Benzema	90019	2
11	19	Karim Benzema	90019	2
12	29	Lionel Messi	90027	2
13	37	Robert Lewandowski	30012	2
14	2	Toni Kroos	90015	1
15	28	Diego Costa	900312	1
16	31	Lionel Messi	90027	1
17	11	Gerard Moreno	90053	1
18	21	Luis Suarez	90028	1
19	14	Diego Costa	900312	1
20	37	Josua Kimmich	30013	1
21	1	Aritz Aduriz	90111	1

\*(only a portion of the output is displayed)

For our final query we'll be -

Creating a view named 'matchInfo' to keep track of the info of each match along with the home and away teams, the venue, the scores and the winner of the match.

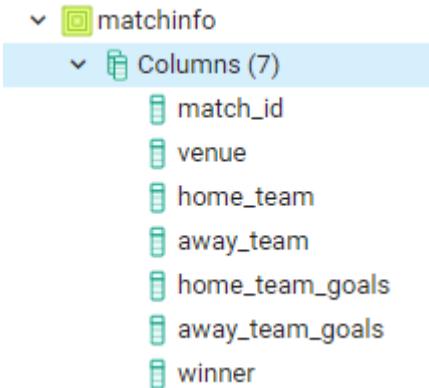
Relational algebraic expression –

$$\begin{aligned} M &\leftarrow \rho_M(\text{matches}) \\ A &\leftarrow \prod_{\text{full\_name}}(\text{team} \bowtie_{\text{home\_team\_id} = id} M) \\ B &\leftarrow \prod_{\text{full\_name}}(\text{team} \bowtie_{\text{away\_team\_id} = id} M) \end{aligned}$$
$$\text{matchInfo} \leftarrow (\prod_{M} M.\text{match\_id}, M.\text{venue}, \rho_{\text{home\_team}}(A), \rho_{\text{away\_team}}(B), M.\text{home\_team\_goals}, M.\text{away\_team\_goals}, M.\text{winner}(M))$$

SQL statement -

```
CREATE VIEW matchInfo
AS (SELECT M.match_id, M.venue,
           (SELECT full_name from team where M.home_team_id = id) as home_team,
           (SELECT full_name from team where M.away_team_id = id) as away_team,
           M.home_team_goals, M.away_team_goals, M.winner
    FROM matches as M)
```

Created view -



Using the view matchInfo,

List all the scorers from the scorer table with their corresponding match informations.

Relational algebraic expression -

$$\begin{aligned} \prod_{\text{match\_id}, \text{scorer\_name}(\text{name}), \text{venue}, \text{home\_team}, \text{away\_team}, \text{winner}} \\ (\text{matchInfo} \bowtie (\text{scorer} \bowtie_{\text{player\_id} = id} \text{player})) \end{aligned}$$

SQL statement -

```
SELECT match_id, name AS scorer_name, venue, home_team, away_team, winner
FROM matchInfo NATURAL JOIN (scorer JOIN player ON player_id = id)
```

Snapshot of output -

Data Output		Scratch Pad				
	match_id integer	scorer_name character varying (50)	venue character varying (50)	home_team character varying (70)	away_team character varying (70)	winner integer
1	1	Aritz Aduriz	San Mamés	Athletic Club	Barcelona	1
2	2	Losada	Estadio de Balaídos	Celta Vigo	Real Madrid C.F.	2
3	2	Lucas Vasquez	Estadio de Balaídos	Celta Vigo	Real Madrid C.F.	2
4	2	Toni Kroos	Estadio de Balaídos	Celta Vigo	Real Madrid C.F.	2
5	2	Karim Benzema	Estadio de Balaídos	Celta Vigo	Real Madrid C.F.	2
6	3	Alvaro Morata	Wanda Metropolitano Stadiu...	Atletico Madrid	Getafe	1
7	4	Karim Benzema	Santiago Bernabéu Stadium	Real Madrid C.F.	Valladolid	0
8	4	Karim Benzema	Santiago Bernabéu Stadium	Real Madrid C.F.	Valladolid	0
9	5	Vitolo	Estadio Municipal de Butarq...	Leganes	Atletico Madrid	2
10	6	Roberto Torres	El Sadar Stadium	Osasuna	Barcelona	0
11	6	Roberto Torres	El Sadar Stadium	Osasuna	Barcelona	0
12	6	Ansu Fati	El Sadar Stadium	Osasuna	Barcelona	0
13	6	Arthur Melo	El Sadar Stadium	Osasuna	Barcelona	0
14	7	Karim Benzema	Santiago Bernabéu Stadium	Real Madrid C.F.	Levante	1
15	7	Karim Benzema	Santiago Bernabéu Stadium	Real Madrid C.F.	Levante	1
16	7	Casemiro	Santiago Bernabéu Stadium	Real Madrid C.F.	Levante	1
17	7	Gonzalo Melero	Santiago Bernabéu Stadium	Real Madrid C.F.	Levante	1
18	7	Borja Mayoral	Santiago Bernabéu Stadium	Real Madrid C.F.	Levante	1
19	8	Joan Jordan	Mendizorrotza Stadium	Alaves	Sevilla	2
20	9	Karim Benzema	Ramon Sanchez-Pizjuan Sta...	Sevilla	Real Madrid C.F.	2
21	11	Lionel Messi	Camp Nou	Barcelona	Villarreal CF	1
22	11	Lionel Messi	Camp Nou	Barcelona	Villarreal CF	1
23	11	Gerard Moreno	Camp Nou	Barcelona	Villarreal CF	1
24	12	Luis Suarez	Coliseum Alfonso Pérez	Getafe	Barcelona	2
25	12	Lionel Messi	Coliseum Alfonso Pérez	Getafe	Barcelona	2
26	14	Diego Costa	Wanda Metropolitano Stadiu...	Atletico Madrid	Valencia	0
27	14	Kevin Gameiro	Wanda Metropolitano Stadiu...	Atletico Madrid	Valencia	0
28	15	Lago Junior	Son Moix	Mallorca	Real Madrid C.F.	1
--	--	--	--	--	--	--

\*(only a portion of the output is shown here)

### **List of all the non-trivial Functional Dependencies –**

The schemas listed below are all the canonical cover type functional dependencies. They have been reduced to canonical cover type dependencies by removing extraneous attributes.

- For schema **League**(name, country, division)  
 $\text{name, country} \rightarrow \text{division}$
- For schema **Manager**(id, name, country, date\_of\_birth)  
 $\text{id} \rightarrow \text{name, country, date\_of\_birth}$
- For schema **Player**(id, name, country, date\_of\_birth)  
 $\text{id} \rightarrow \text{name, country, date\_of\_birth}$
- For schema **Stadium**(name, city, country, capacity)  
 $\text{name} \rightarrow \text{city, country, capacity}$
- For schema **Team**(team\_id, stadium, country, league\_name, full\_name, founded\_on, budget)  
 $\text{team\_id} \rightarrow \text{stadium, country, league\_name, full\_name, founded\_on}$   
 $\text{full\_name} \rightarrow \text{team\_id, stadium, country, league\_name, founded\_on}$
- For schema **Plays**(player\_id, team\_id, starting\_date, wage)  
 $\text{player\_id} \rightarrow \text{team\_id, starting\_date, wage}$
- For schema **Manages**(manager\_id, team\_id, starting\_date, wage)  
 $\text{manager\_id} \rightarrow \text{team\_id, starting\_date, wage}$
- For schema **Matches**(match\_id, home\_team\_id, away\_team\_id, date\_of\_match, venue, home\_team\_goals, away\_team\_goals, winner)  
 $\text{match\_id} \rightarrow \text{home\_team\_id, away\_team\_id, date\_of\_match, venue, home\_team\_goals, away\_team\_goals, winner}$   
 $\text{home\_team\_id, away\_team\_id, date\_of\_match} \rightarrow \text{match\_id, venue, home\_team\_goals, away\_team\_goals, winner}$

- For schema **Scorer**(match\_id, player\_id, time\_of\_goal, scored\_for)

match\_id, player\_id, time\_of\_goal → scored\_for

#### **Proof that the schemas are in desired normal forms -**

From the aforementioned schemas and functional dependencies, we can see that all the schemas in our database has their primary keys on the left side of the functional dependencies except,

full\_name → team\_id, stadium, country, league\_name, founded\_on (in the **Team** schema)

And,

home\_team\_id, away\_team\_id, date\_of\_match → match\_id, venue, home\_team\_goals, away\_team\_goals, winner (in the **Matches** schema)

Now, for the schemas in our database to be in their desired normal forms (BCNF or 3NF), the attributes full\_name has to be the super-key in the **Team** schema. The full\_name of a team has an unique constraint in our database that makes sure all the teams in the league has unique names, which is the case in real-world scenarios. So the full\_name attribute (declared unique) is a super-key for our database.

Moreover, list of attributes home\_team\_id, away\_team\_id, date\_of\_match can uniquely identify any match in the database because two matches cannot take place between the same teams on the same day (as is the case in real football leagues). So these are also the super-key in the **Matches** schema.

Therefore, all the schemas in our database has non-trivial functional dependencies where the left side is either a primary key or a super-key. So it can be said that all the schemas in our database is in Boyce Codd Normal Form's. And if they are in BCNF then surely they are in 3NF as well.

So all the schemas in our database are in their desired normal forms.

#### **Conclusion -**

The database has almost all the attributes to keep track of the matches, players, managers, teams and scorers of any league for one year. The relations between the set of tables can also be easily found through proper queries. The current relations in the database has almost 900 tuples combined, although the actual leagues can each contain up to a few thousand tuples.