Thapelo Mookeng

CTU 2024

Software Development

SUBJECT NAME: Business Programming Semester 2

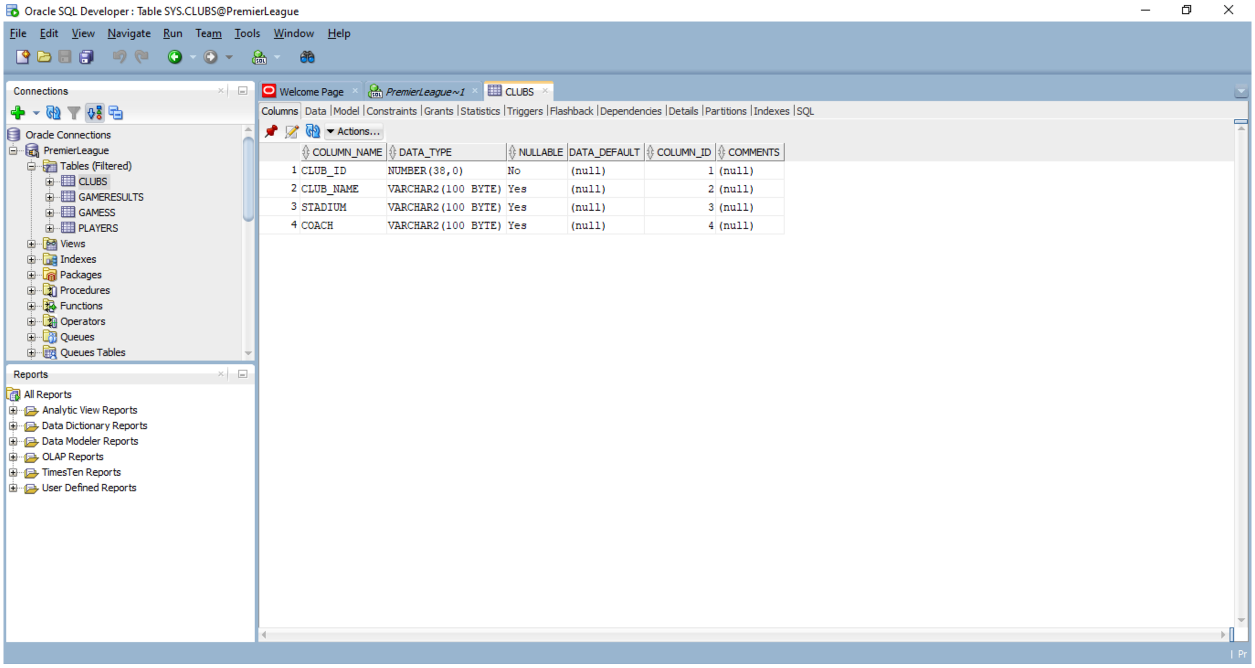
SUBJECT CODE: PRG522

Student Number – **20220**

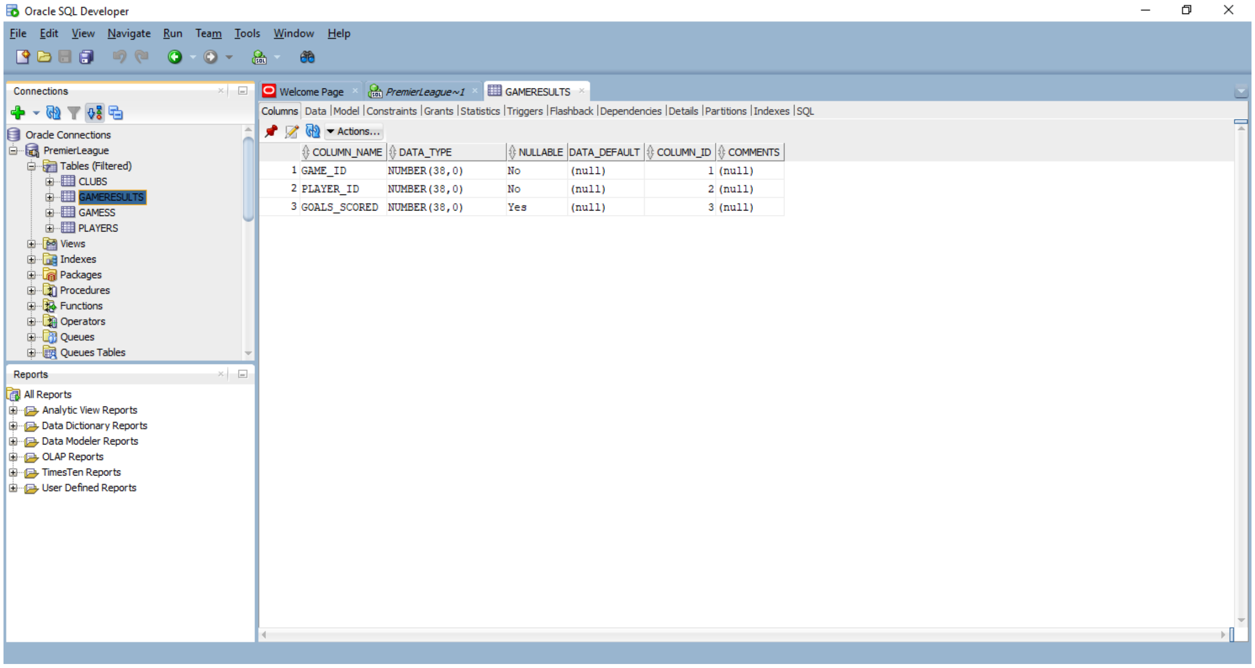
4th April 2024:

Task 1: Database Design and Normalization (20 Marks)

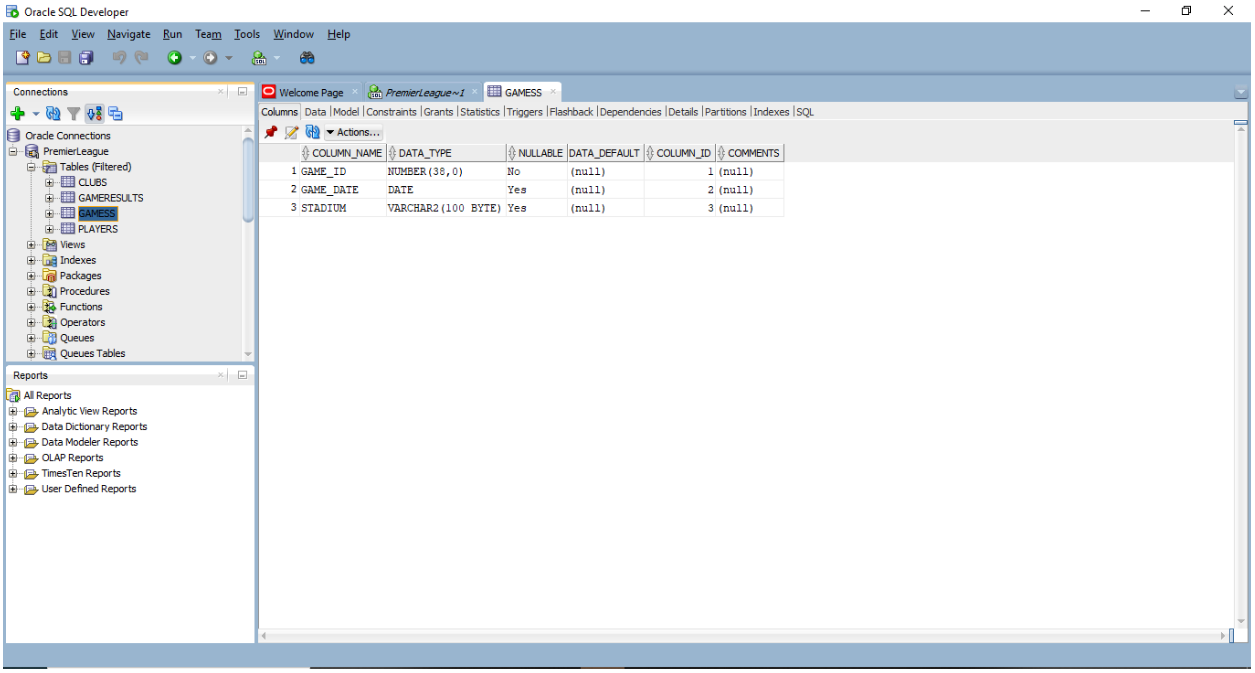
•Transform the conceptual design (ER diagram) into the relational model by converting the entities andrelationships into appropriate tables. Check if your tables are normalized using the 1st, 2nd, and 3rd normalforms.



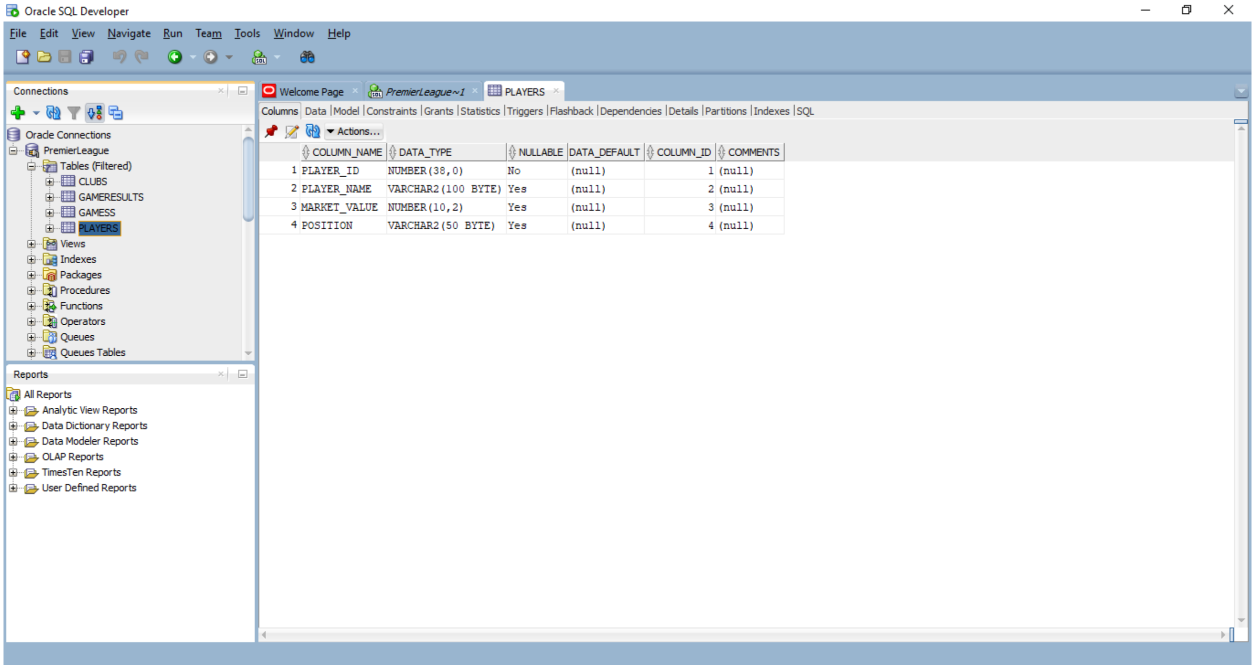
	COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
1	CLUB_ID	NUMBER(38,0)	No	(null)	1	(null)
2	CLUB_NAME	VARCHAR2(100 BYTE)	Yes	(null)	2	(null)
3	STADIUM	VARCHAR2(100 BYTE)	Yes	(null)	3	(null)
4	COACH	VARCHAR2(100 BYTE)	Yes	(null)	4	(null)



	COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
1	GAME_ID	NUMBER(38,0)	No	(null)	1	(null)
2	PLAYER_ID	NUMBER(38,0)	No	(null)	2	(null)
3	GOALS_SCORED	NUMBER(38,0)	Yes	(null)	3	(null)



	COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
1	GAME_ID	NUMBER(38,0)	No	(null)	1	(null)
2	GAME_DATE	DATE	Yes	(null)	2	(null)
3	STADIUM	VARCHAR2(100 BYTE)	Yes	(null)	3	(null)



	COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
1	PLAYER_ID	NUMBER(38,0)	No	(null)	1	(null)
2	PLAYER_NAME	VARCHAR2(100 BYTE)	Yes	(null)	2	(null)
3	MARKET_VALUE	NUMBER(10,2)	Yes	(null)	3	(null)
4	POSITION	VARCHAR2(50 BYTE)	Yes	(null)	4	(null)

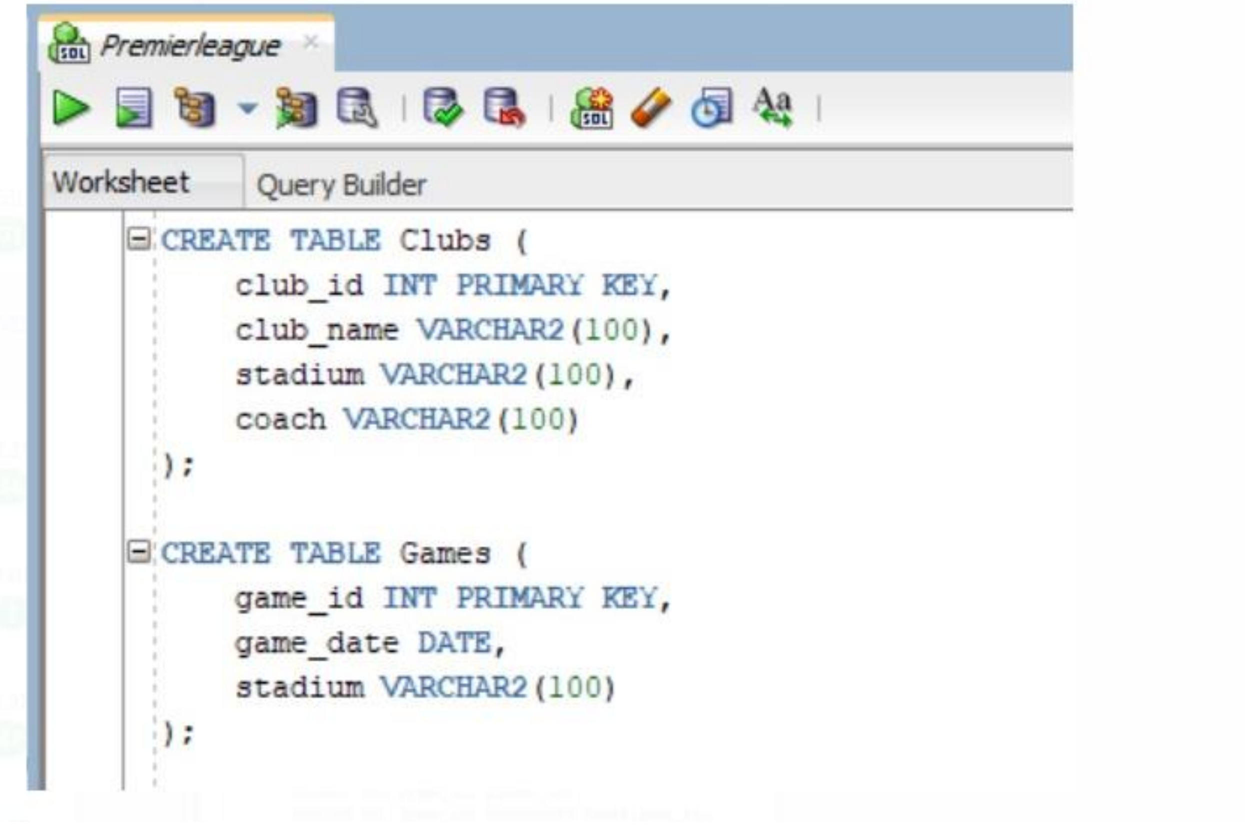
Task 2: Database Creation and Data Population (16 Marks)

i.In Oracle SQL Developer, create a database called "PremiumLeague."

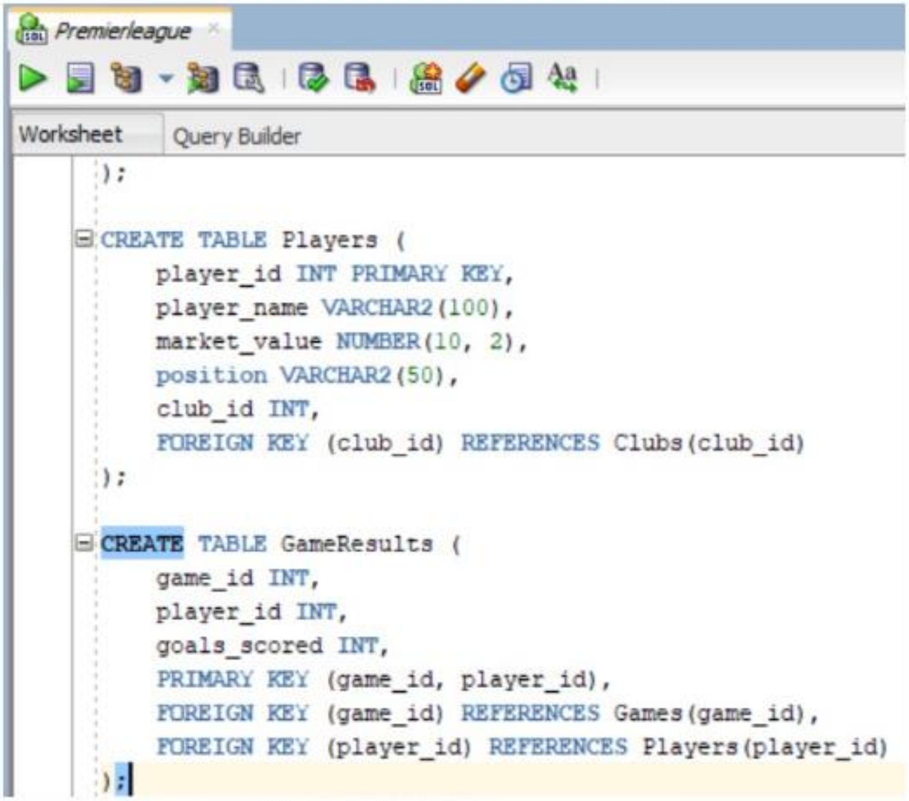
PRG522 – Formative Assessment 1,2,3 Semester 2 Paper 2024 | V1.0 Page 4 of 4

ii.Implement the tables specified in Task 1 using DDL (Data Definition Language) commands. Choose theappropriate data types, primary and foreign keys for the attributes. Provide detailed assumptions for any of your design decisions.

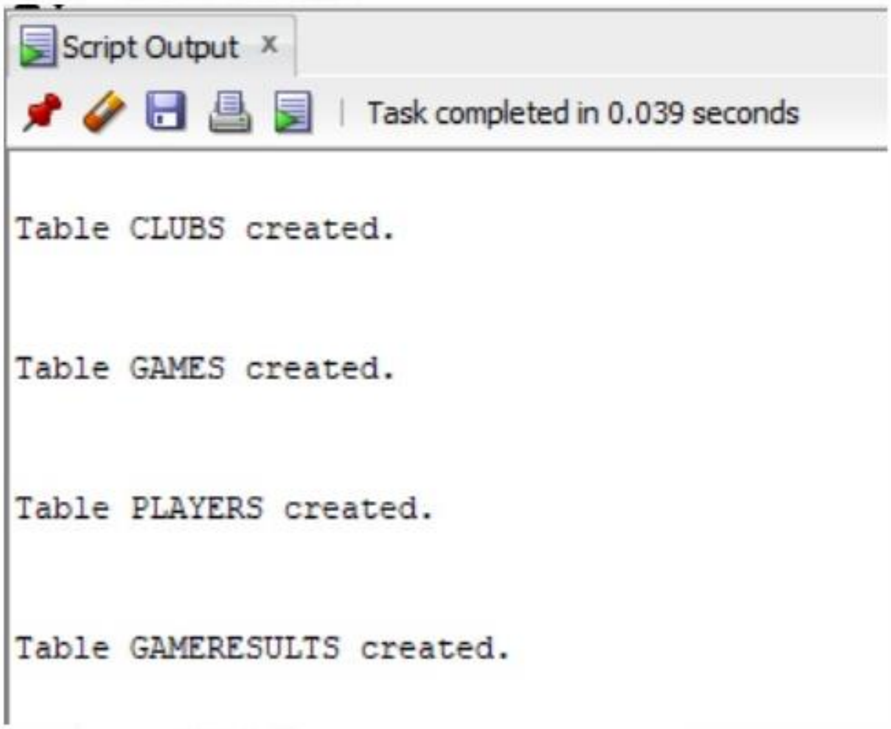
iii.Generate some data to populate your tables to simulate real-world scenarios.



```
CREATE TABLE Clubs (
    club_id INT PRIMARY KEY,
    club_name VARCHAR2(100),
    stadium VARCHAR2(100),
    coach VARCHAR2(100)
);

CREATE TABLE Games (
    game_id INT PRIMARY KEY,
    game_date DATE,
    stadium VARCHAR2(100)
);
```

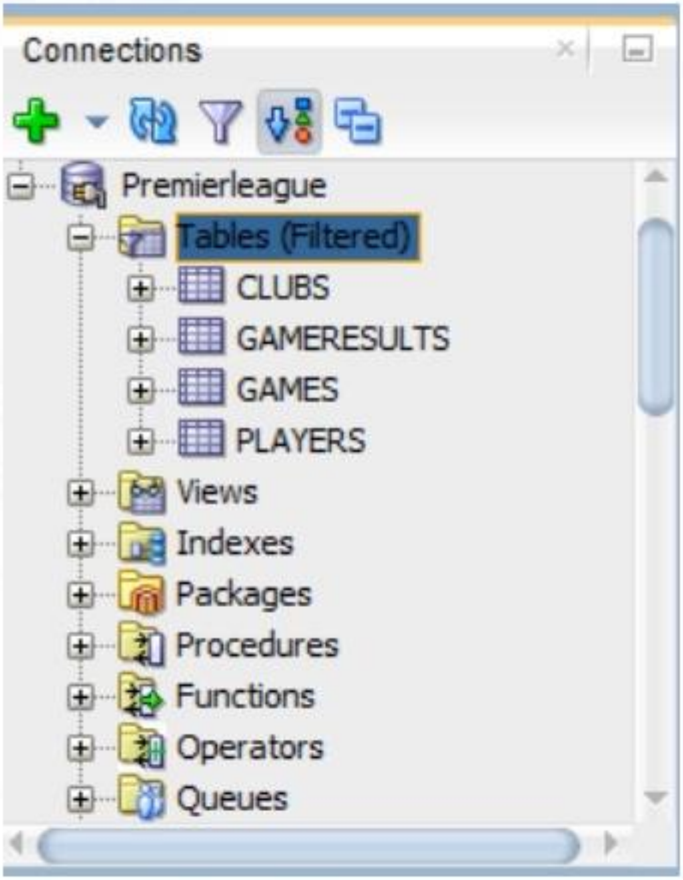


```
);

CREATE TABLE Players (
    player_id INT PRIMARY KEY,
    player_name VARCHAR2(100),
    market_value NUMBER(10, 2),
    position VARCHAR2(50),
    club_id INT,
    FOREIGN KEY (club_id) REFERENCES Clubs(club_id)
);

CREATE TABLE GameResults (
    game_id INT,
    player_id INT,
    goals_scored INT,
    PRIMARY KEY (game_id, player_id),
    FOREIGN KEY (game_id) REFERENCES Games(game_id),
    FOREIGN KEY (player_id) REFERENCES Players(player_id)
);
```

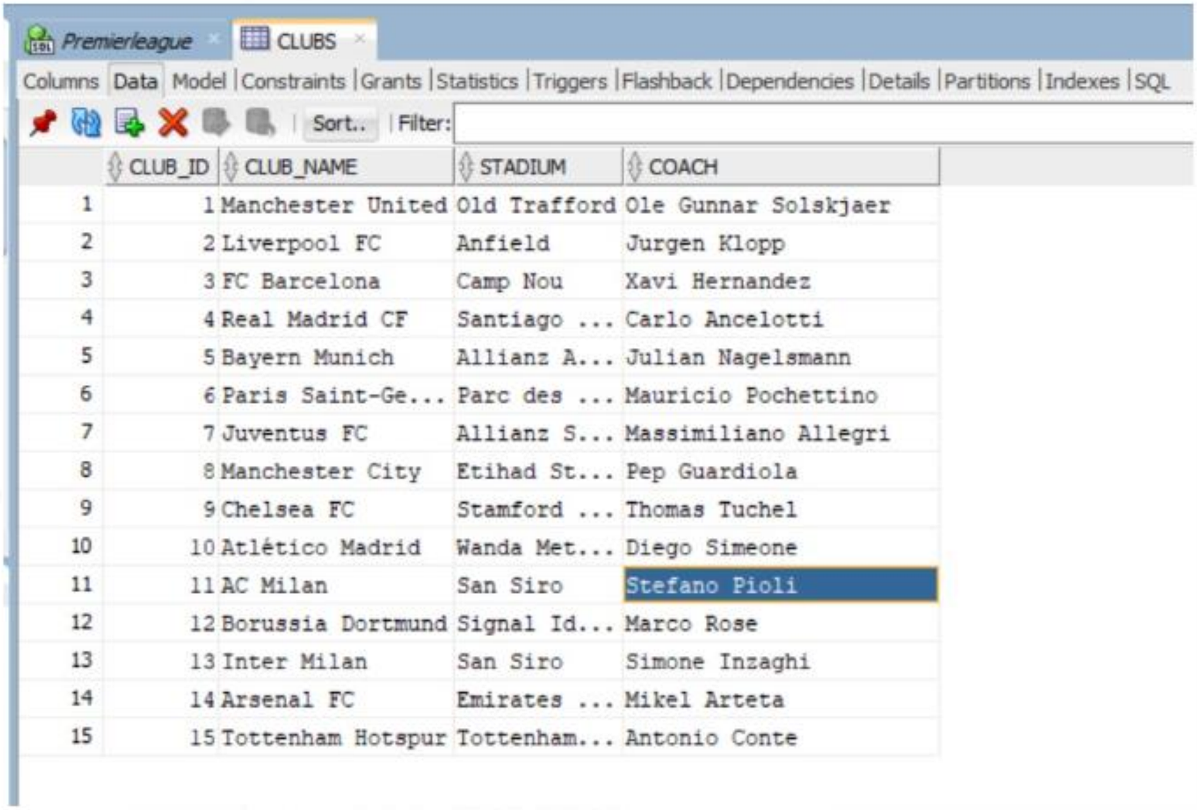


Task completed in 0.039 seconds

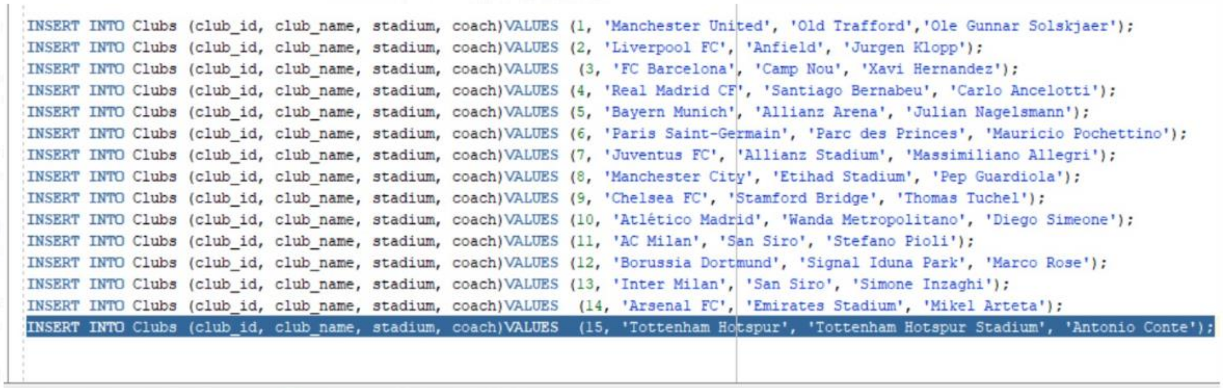
```
Table CLUBS created.


Table GAMES created.


Table PLAYERS created.


Table GAMERESULTS created.
```



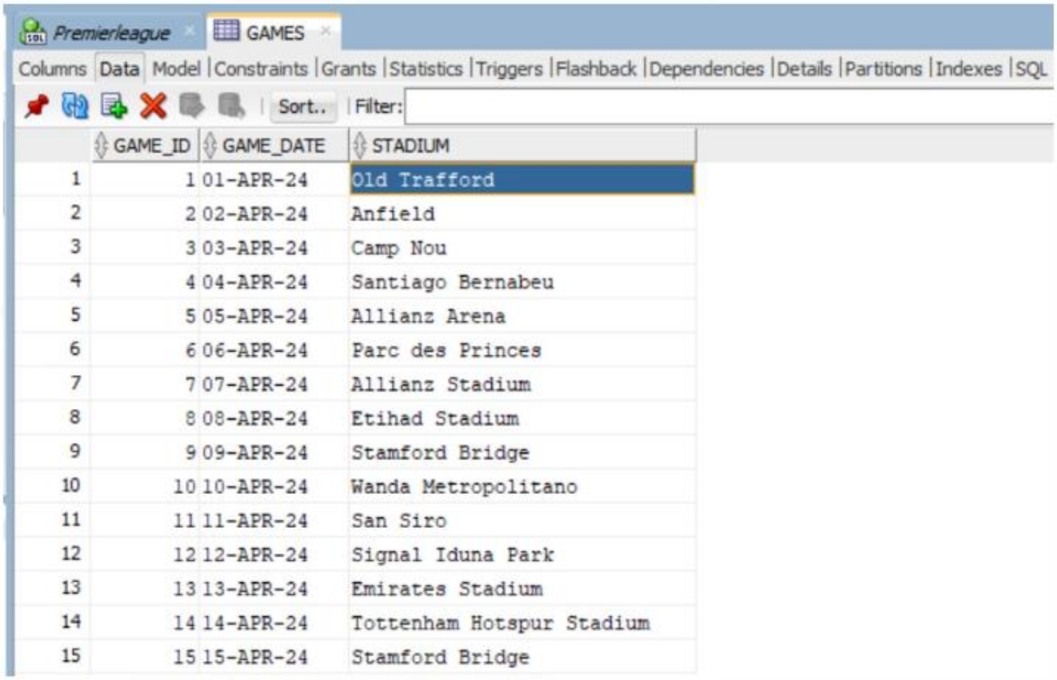
Connections
Premierleague
Tables (Filtered)
CLUBS
GAMERESULTS
GAMES
PLAYERS
Views
Indexes
Packages
Procedures
Functions
Operators
Queues


Premierleague
CLUBS
Columns | Data | Model | Constraints | Grants | Statistics | Triggers | Flashback | Dependencies | Details | Partitions | Indexes | SQL
Sort..
Filter:

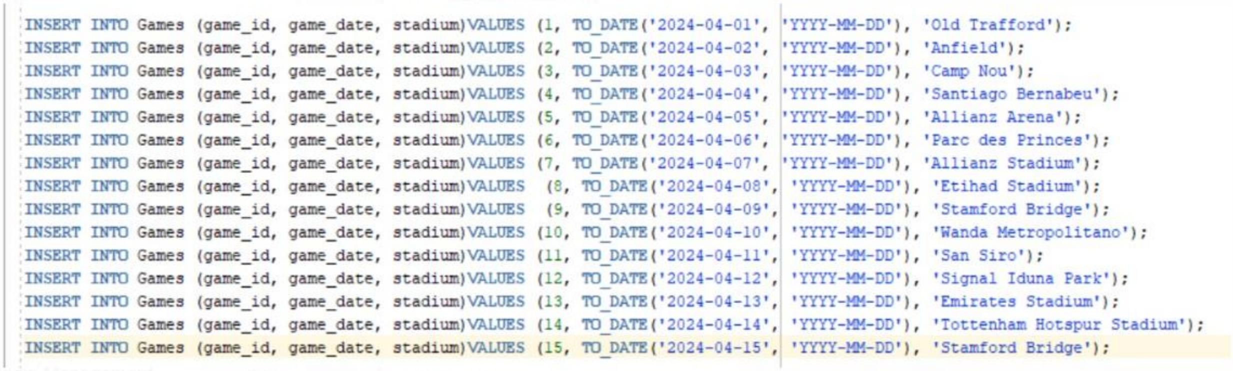
	CLUB_ID	CLUB_NAME	STADIUM	COACH
1	1	Manchester United	Old Trafford	Ole Gunnar Solskjaer
2	2	Liverpool FC	Anfield	Jurgen Klopp
3	3	FC Barcelona	Camp Nou	Xavi Hernandez
4	4	Real Madrid CF	Santiago ...	Carlo Ancelotti
5	5	Bayern Munich	Allianz A...	Julian Nagelsmann
6	6	Paris Saint-Ge...	Parc des ...	Mauricio Pochettino
7	7	Juventus FC	Allianz S...	Massimiliano Allegri
8	8	Manchester City	Etihad St...	Pep Guardiola
9	9	Chelsea FC	Stamford ...	Thomas Tuchel
10	10	Atlético Madrid	Wanda Met...	Diego Simeone
11	11	AC Milan	San Siro	Stefano Pioli
12	12	Borussia Dortmund	Signal Id...	Marco Rose
13	13	Inter Milan	San Siro	Simone Inzaghi
14	14	Arsenal FC	Emirates ...	Mikel Arteta
15	15	Tottenham Hotspur	Tottenham...	Antonio Conte



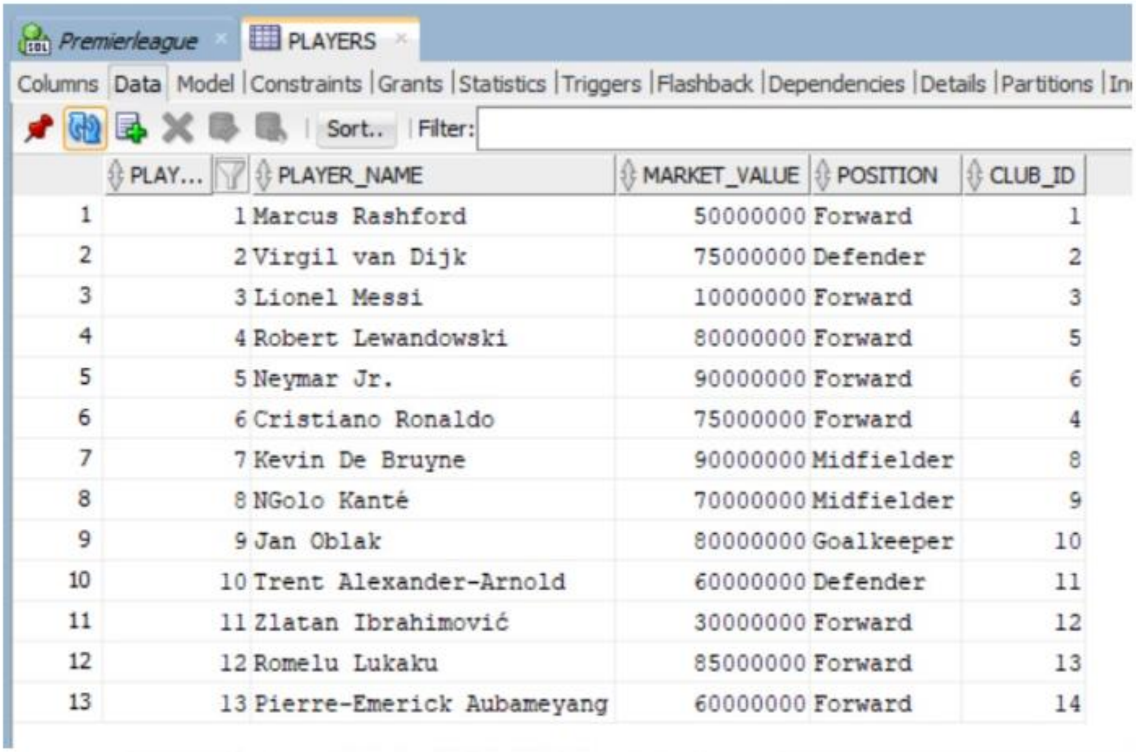
```
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (1, 'Manchester United', 'Old Trafford','Ole Gunnar Solskjaer');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (2, 'Liverpool FC', 'Anfield', 'Jurgen Klopp');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES  (3, 'FC Barcelona', 'Camp Nou', 'Xavi Hernandez');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (4, 'Real Madrid CF', 'Santiago Bernabeu', 'Carlo Ancelotti');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (5, 'Bayern Munich', 'Allianz Arena', 'Julian Nagelsmann');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (6, 'Paris Saint-Germain', 'Parc des Princes', 'Mauricio Pochettino');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (7, 'Juventus FC', 'Allianz Stadium', 'Massimiliano Allegri');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (8, 'Manchester City', 'Etihad Stadium', 'Pep Guardiola');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (9, 'Chelsea FC', 'Stamford Bridge', 'Thomas Tuchel');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (10, 'Atlético Madrid', 'Wanda Metropolitano', 'Diego Simeone');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (11, 'AC Milan', 'San Siro', 'Stefano Pioli');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (12, 'Borussia Dortmund', 'Signal Iduna Park', 'Marco Rose');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES (13, 'Inter Milan', 'San Siro', 'Simone Inzaghi');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES  (14, 'Arsenal FC', 'Emirates Stadium', 'Mikel Arteta');
INSERT INTO Clubs (club_id, club_name, stadium, coach)VALUES  (15, 'Tottenham Hotspur', 'Tottenham Hotspur Stadium', 'Antonio Conte');
```



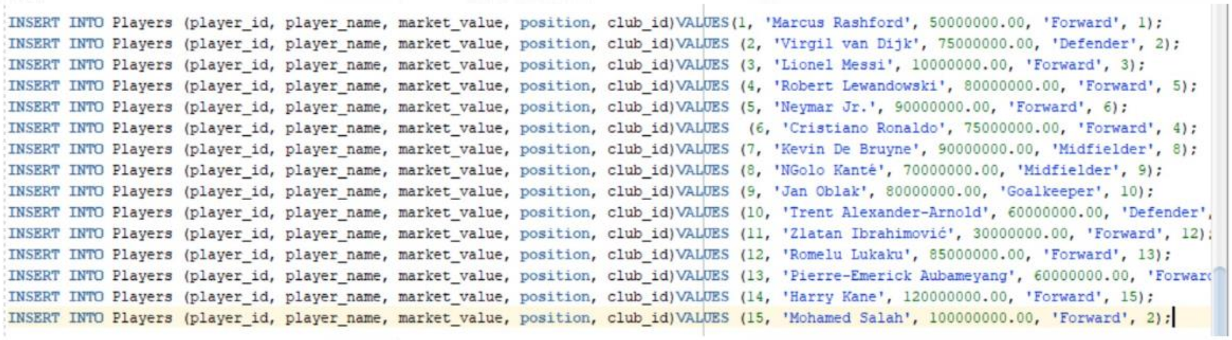
	GAME_ID	GAME_DATE	STADIUM
1	1	01-APR-24	Old Trafford
2	2	02-APR-24	Anfield
3	3	03-APR-24	Camp Nou
4	4	04-APR-24	Santiago Bernabeu
5	5	05-APR-24	Allianz Arena
6	6	06-APR-24	Parc des Princes
7	7	07-APR-24	Allianz Stadium
8	8	08-APR-24	Etihad Stadium
9	9	09-APR-24	Stamford Bridge
10	10	10-APR-24	Wanda Metropolitano
11	11	11-APR-24	San Siro
12	12	12-APR-24	Signal Iduna Park
13	13	13-APR-24	Emirates Stadium
14	14	14-APR-24	Tottenham Hotspur Stadium
15	15	15-APR-24	Stamford Bridge



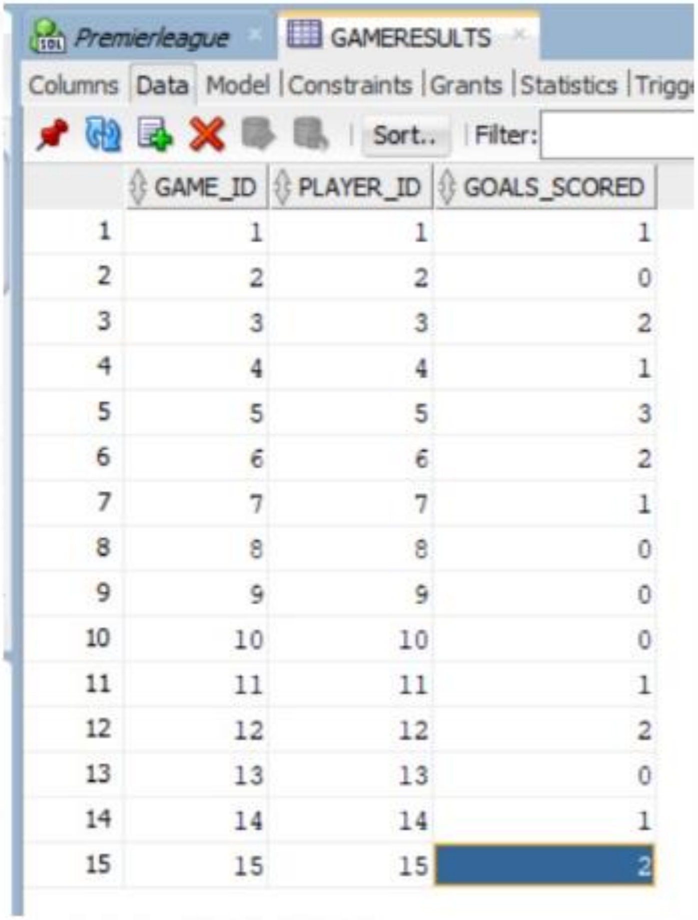
```
INSERT INTO Games (game_id, game_date, stadium)VALUES (1, TO_DATE('2024-04-01', 'YYYY-MM-DD'), 'Old Trafford');
INSERT INTO Games (game_id, game_date, stadium)VALUES (2, TO_DATE('2024-04-02', 'YYYY-MM-DD'), 'Anfield');
INSERT INTO Games (game_id, game_date, stadium)VALUES (3, TO_DATE('2024-04-03', 'YYYY-MM-DD'), 'Camp Nou');
INSERT INTO Games (game_id, game_date, stadium)VALUES (4, TO_DATE('2024-04-04', 'YYYY-MM-DD'), 'Santiago Bernabeu');
INSERT INTO Games (game_id, game_date, stadium)VALUES (5, TO_DATE('2024-04-05', 'YYYY-MM-DD'), 'Allianz Arena');
INSERT INTO Games (game_id, game_date, stadium)VALUES (6, TO_DATE('2024-04-06', 'YYYY-MM-DD'), 'Parc des Princes');
INSERT INTO Games (game_id, game_date, stadium)VALUES (7, TO_DATE('2024-04-07', 'YYYY-MM-DD'), 'Allianz Stadium');
INSERT INTO Games (game_id, game_date, stadium)VALUES  (8, TO_DATE('2024-04-08', 'YYYY-MM-DD'), 'Etihad Stadium');
INSERT INTO Games (game_id, game_date, stadium)VALUES  (9, TO_DATE('2024-04-09', 'YYYY-MM-DD'), 'Stamford Bridge');
INSERT INTO Games (game_id, game_date, stadium)VALUES (10, TO_DATE('2024-04-10', 'YYYY-MM-DD'), 'Wanda Metropolitano');
INSERT INTO Games (game_id, game_date, stadium)VALUES (11, TO_DATE('2024-04-11', 'YYYY-MM-DD'), 'San Siro');
INSERT INTO Games (game_id, game_date, stadium)VALUES (12, TO_DATE('2024-04-12', 'YYYY-MM-DD'), 'Signal Iduna Park');
INSERT INTO Games (game_id, game_date, stadium)VALUES (13, TO_DATE('2024-04-13', 'YYYY-MM-DD'), 'Emirates Stadium');
INSERT INTO Games (game_id, game_date, stadium)VALUES (14, TO_DATE('2024-04-14', 'YYYY-MM-DD'), 'Tottenham Hotspur Stadium');
INSERT INTO Games (game_id, game_date, stadium)VALUES (15, TO_DATE('2024-04-15', 'YYYY-MM-DD'), 'Stamford Bridge');
```



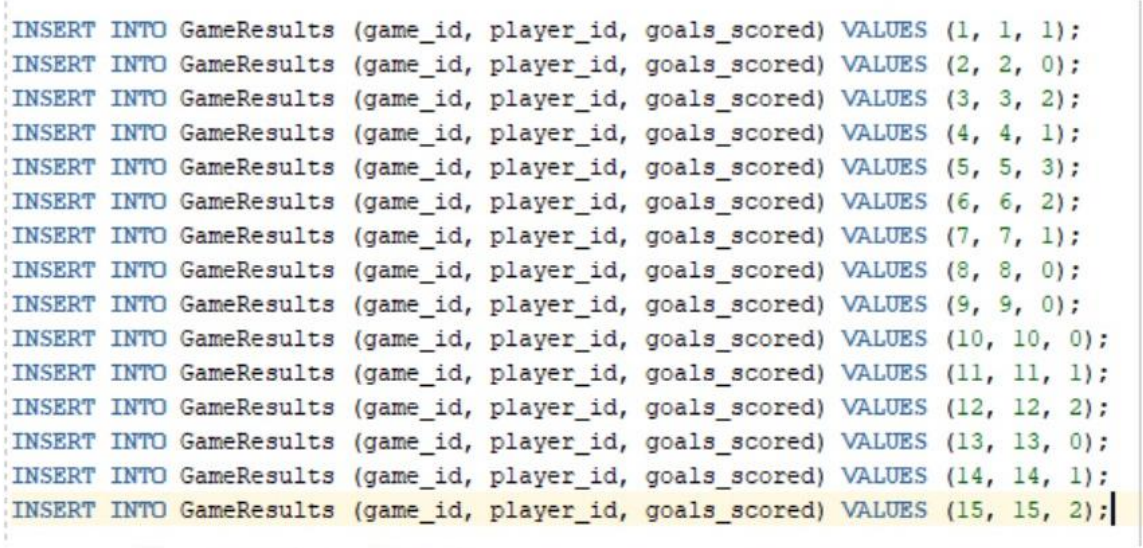
	PLAY...	PLAYER_NAME	MARKET_VALUE	POSITION	CLUB_ID
1	1	Marcus Rashford	50000000	Forward	1
2	2	Virgil van Dijk	75000000	Defender	2
3	3	Lionel Messi	10000000	Forward	3
4	4	Robert Lewandowski	80000000	Forward	5
5	5	Neymar Jr.	90000000	Forward	6
6	6	Cristiano Ronaldo	75000000	Forward	4
7	7	Kevin De Bruyne	90000000	Midfielder	8
8	8	NGolo Kanté	70000000	Midfielder	9
9	9	Jan Oblak	80000000	Goalkeeper	10
10	10	Trent Alexander-Arnold	60000000	Defender	11
11	11	Zlatan Ibrahimović	30000000	Forward	12
12	12	Romelu Lukaku	85000000	Forward	13
13	13	Pierre-Emerick Aubameyang	60000000	Forward	14



```
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES(1, 'Marcus Rashford', 50000000.00, 'Forward', 1);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (2, 'Virgil van Dijk', 75000000.00, 'Defender', 2);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (3, 'Lionel Messi', 10000000.00, 'Forward', 3);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (4, 'Robert Lewandowski', 80000000.00, 'Forward', 5);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (5, 'Neymar Jr.', 90000000.00, 'Forward', 6);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES  (6, 'Cristiano Ronaldo', 75000000.00, 'Forward', 4);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (7, 'Kevin De Bruyne', 90000000.00, 'Midfielder', 8);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (8, 'NGolo Kanté', 70000000.00, 'Midfielder', 9);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (9, 'Jan Oblak', 80000000.00, 'Goalkeeper', 10);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (10, 'Trent Alexander-Arnold', 60000000.00, 'Defender',
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (11, 'Zlatan Ibrahimović', 30000000.00, 'Forward', 12);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (12, 'Romelu Lukaku', 85000000.00, 'Forward', 13);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (13, 'Pierre-Emerick Aubameyang', 60000000.00, 'Forwar
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (14, 'Harry Kane', 120000000.00, 'Forward', 15);
INSERT INTO Players (player_id, player_name, market_value, position, club_id)VALUES (15, 'Mohamed Salah', 100000000.00, 'Forward', 2);
```



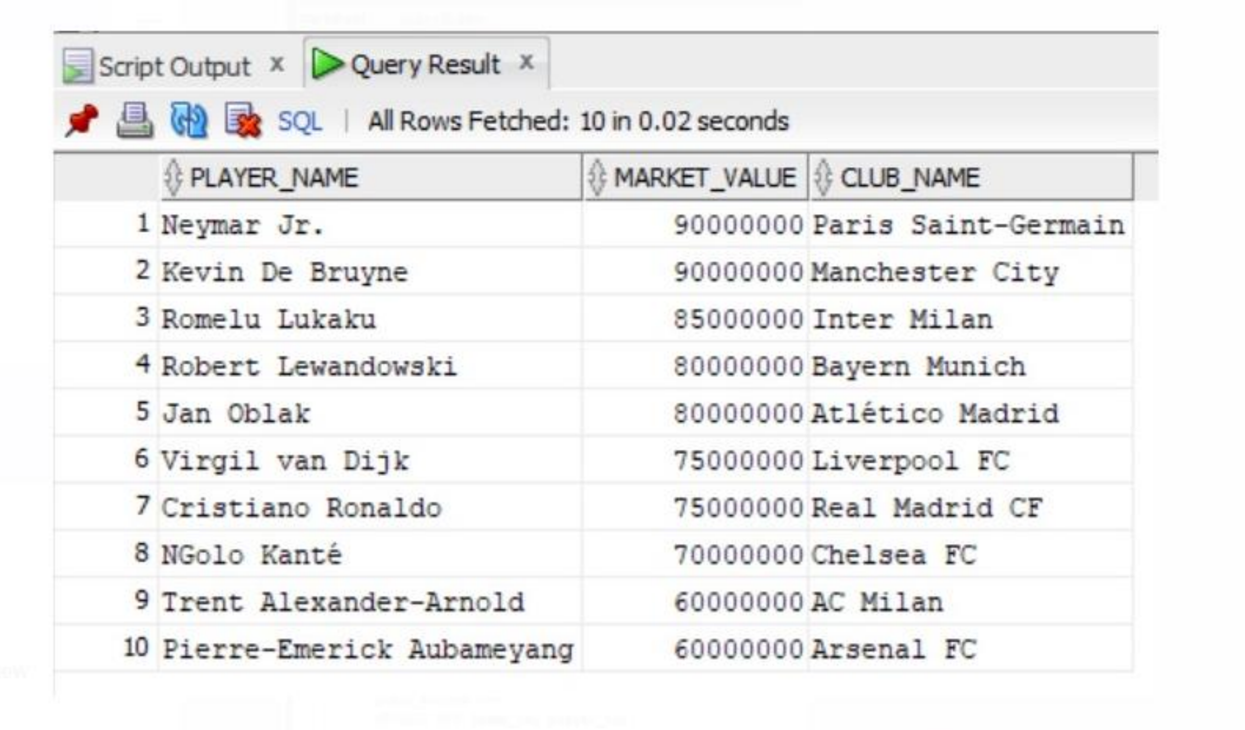
	GAME_ID	PLAYER_ID	GOALS_SCORED
1	1	1	1
2	2	2	0
3	3	3	2
4	4	4	1
5	5	5	3
6	6	6	2
7	7	7	1
8	8	8	0
9	9	9	0
10	10	10	0
11	11	11	1
12	12	12	2
13	13	13	0
14	14	14	1
15	15	15	2



```sql
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (1, 1, 1);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (2, 2, 0);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (3, 3, 2);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (4, 4, 1);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (5, 5, 3);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (6, 6, 2);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (7, 7, 1);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (8, 8, 0);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (9, 9, 0);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (10, 10, 0);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (11, 11, 1);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (12, 12, 2);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (13, 13, 0);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (14, 14, 1);
INSERT INTO GameResults (game_id, player_id, goals_scored) VALUES (15, 15, 2);
```

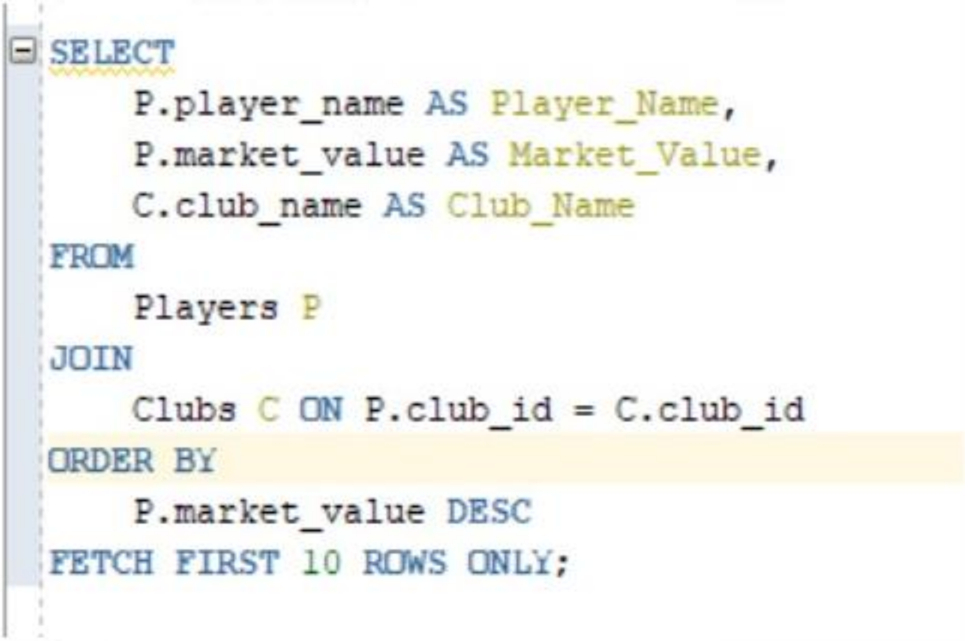
Task 3: SQL Queries (14 Marks)

i.Write an SQL query that returns the top 10 players in terms of market value and the clubs they play for.



All Rows Fetched: 10 in 0.02 seconds

	PLAYER_NAME	MARKET_VALUE	CLUB_NAME
1	Neymar Jr.	90000000	Paris Saint-Germain
2	Kevin De Bruyne	90000000	Manchester City
3	Romelu Lukaku	85000000	Inter Milan
4	Robert Lewandowski	80000000	Bayern Munich
5	Jan Oblak	80000000	Atlético Madrid
6	Virgil van Dijk	75000000	Liverpool FC
7	Cristiano Ronaldo	75000000	Real Madrid CF
8	NGolo Kanté	70000000	Chelsea FC
9	Trent Alexander-Arnold	60000000	AC Milan
10	Pierre-Emerick Aubameyang	60000000	Arsenal FC



```
SELECT
    P.player_name AS Player_Name,
    P.market_value AS Market_Value,
    C.club_name AS Club_Name
FROM
    Players P
JOIN
    Clubs C ON P.club_id = C.club_id
ORDER BY
    P.market_value DESC
FETCH FIRST 10 ROWS ONLY;
```

Task 4: Database Security and Access Control (20 Marks)

i.Discuss the use of database roles and privileges to secure a database system.

ii.Discuss the available grant options and how they enable the database administrator to control access. Provideexamples of granting permissions on the database created in Tasks 1 and 2.

iii.Discuss the role of views in controlling database access.

i. **Use of Database Roles and Privileges**:

Database roles and privileges play a crucial role in securing a database system by controlling access to database objects and data. Here's how they contribute to security:

- **Roles**: Roles are named groups of related privileges that can be granted to users or other roles. By assigning roles to users, you can manage permissions efficiently, especially in large databases with many users. Roles help simplify access management by allowing you to grant or revoke a set of privileges to multiple users at once.

- **Privileges**: Privileges are specific rights granted to users or roles to perform certain actions on database objects, such as tables, views, procedures, and so on. Common privileges include SELECT, INSERT, UPDATE, DELETE, EXECUTE, and others. By granting appropriate privileges, you can control what actions users can perform on specific database objects.

- **Access Control**: Database roles and privileges help enforce the principle of least privilege, which means granting users only the minimum privileges necessary to perform their tasks. This reduces the risk of unauthorized access and minimizes the potential impact of security breaches.

- **Granular Control**: Roles and privileges allow for granular control over access permissions. You can tailor access rights to individual users or groups based on their roles and responsibilities within the organization.

- **Dynamic Administration**: Roles and privileges can be dynamically managed, allowing administrators to adapt access control policies as organizational requirements change. This flexibility ensures that security measures remain effective over time.

ii. **Grant Options for Access Control**:

Oracle provides various grant options to control access to database objects. Some common grant options include:

- **GRANT**: This command allows the database administrator to grant specific privileges to users or roles. For example, granting SELECT privilege on a table to a user allows them to retrieve data from that table.

- **REVOKE**:This command allows the database administrator to revoke previously granted privileges from users or roles. For example, revoking UPDATE privilege on a table from a user removes their ability to modify data in that table.

- **WITH GRANT OPTION**: This option allows a user or role to further grant the privileges they have been granted to other users or roles. It effectively delegates the authority to manage access permissions.

- **CASCADE**: When revoking privileges, CASCADE option ensures that privileges granted by the revoked privilege are also revoked. This helps maintain consistency in access control.

Examples of granting permissions on the database created in Tasks 1 and 2:

sql

```
-- Grant SELECT privilege on the Clubs table to a user
GRANT SELECT ON Clubs TO username;

-- Grant INSERT privilege on the Games table to a role
GRANT INSERT ON Games TO rolename;

-- Grant EXECUTE privilege on a stored procedure to a role with the ability to further grant it
GRANT EXECUTE ON procedure_name TO rolename WITH GRANT OPTION;
```

iii. **Role of Views in Controlling Database Access**:

Views are virtual tables that present data from one or more tables. They provide an additional layer of security by controlling access to sensitive data. Here's how views contribute to access control:

- **Data Abstraction**: Views can be used to hide sensitive data by exposing only the necessary information to users. This ensures that users only see the data they are authorized to access.

- **Restricting Columns**: Views can restrict access to certain columns of a table, allowing users to view only specific columns while hiding others. This prevents unauthorized access to sensitive information.

- **Joining Tables**:Views can join multiple tables and present the result as a single virtual table. This helps simplify access to complex data structures while ensuring that users are only exposed to relevant data.

- **Implementing Business** Logic: Views can encapsulate complex business logic, providing users with a simplified interface to interact with the database. This helps enforce data integrity and security policies.

- **Access Control:**Views can be used to grant selective access to data, allowing different users to view different subsets of data based on their roles and privileges. This enhances security by restricting access to sensitive information.