2018 FIFA World Cup:
Database Design

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Table of Contents

Executive Summary

The myriad of statistics and planning of an event like the World Cup is colossal; therefore, FIFA needs a database that centralizes their data and satisfies all of their statistical and planning needs so that they can function for the hectic month that they run every four years. The constant games and immediate action that takes place during this is enormous and they need a database that can get FIFA results and facts fast while modifying referee assignments, access fact about red and yellow cards to inhibit suspensions if necessary, and how to track the progress of the tournament from an economical standpoint.

The next pages of this document will outline the basic database system that FIFA needs to operate under for the month of June 12 to July 13 in 2018. We will go through the E-R diagram of the database followed by the create statements and purposes of each of the tables in the database. We will look at sample data and view some queries that can be useful to FIFA as they conduct their business. Then, we will take a look the stored procedures and views for the different parts of the FIFA organization. We will briefly talk about security and which groups of people have access to different views and tables. Lastly, we will mention the known implementation problems with this database with possible solutions and further enhancements that we can possibly implement in the future.

Entity Relationship Diagram

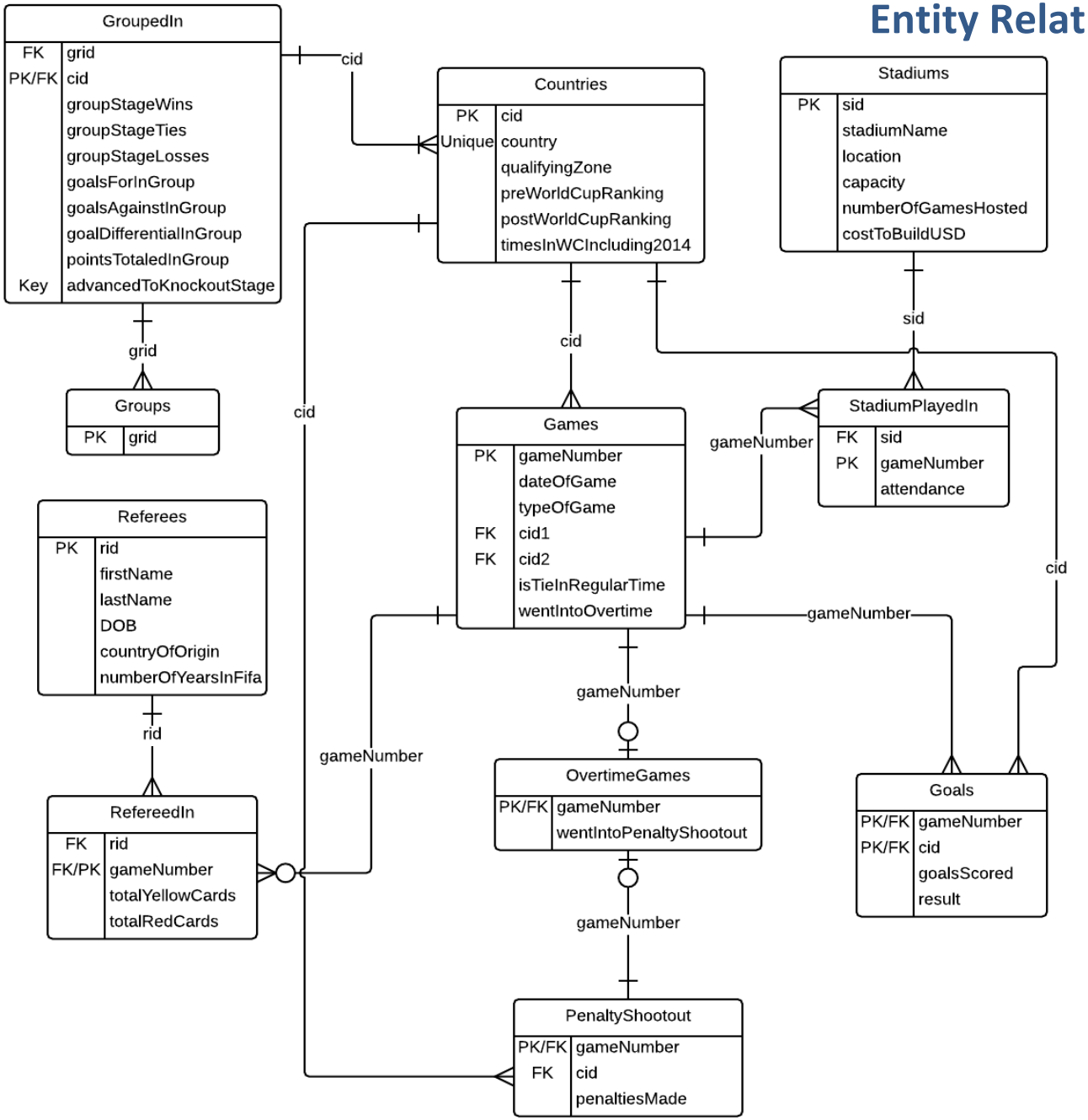

Table Statements

countries table

The *countries* table serves the purpose of containing all the relevant information about the various countries that are participating in the 2018 FIFA World Cup. We will be able to see how many teams from each of the 7 qualifying zones were able to qualify for this years World Cup and also to track the changes of ranking before and after the world cup. This will also allow us to see which countries have been in the World Cup in the past as well as to see if there are newcomers to this year's competition.

```
create table countries(
     cid text NOT NULL,
     country text UNIQUE,
     qualifyingZone text NOT NULL,
     preWorldCupRanking int NOT NULL,
     postWorldCupRanking int NOT NULL,
     timesInWCIncluding2014 int NOT NULL,
     primary key(cid)
     );
```

Functional Dependencies

```
cid → country, qualifyingZone, preWorldCupRanking, postWorldCupRanking,
      timesInWCIncluding2014
```

---

games table

The *games* table serves the purpose of keeping track of all 64 games that occur at the 2018 World Cup. It is a necessity to make sure the dates of each game are available as well as what type of game it is, whether in the Group Stage or one of the Knockout Stages. We would also hope to keep track of which games have participated in a tie as well as seeing if that tie went into overtime or was considered a tie and marked as such.

```
create table games(
     gameNumber int NOT NULL PRIMARY KEY,
     dateOfGameMD text NOT NULL,
     typeOfGame text NOT NULL,
     CHECK (typeOfGame in ('Group Stage', 'Round of 16', 'Quarterfinal', 'Semifinal',
     'Third Place', 'Final')),
     cid1 text references countries(cid) NOT NULL,
     cid2 text references countries(cid) NOT NULL,
     CHECK (cid1 != cid2),
     isTieInRegularTime boolean DEFAULT false,
     wentIntoOvertime boolean DEFAULT false
     );
```

Functional Dependencies

gameNumber → dateOfGameMD, typeOfGame, cid1, cid2, isTieInRegularTime, wentIntoOvertime

---

group table

The purpose of the group table, even though it seems inconsequential for its length, allows the user to document the groups that are required in the World Cup. There are 32 teams divided up into 8 groups and one table would not have been sufficient and violated normal form rules. Therefore, this table is here to differentiate the different groups and to run analysis on the different groups in the future.

```
create table groups(
     grid text NOT NULL,
     primary key(grid)
     );
```

Functional Dependencies

grid →

---

groupedIn table

The purpose of the *groupedIn* table is to keep track of the standings for each of the groups. The many check constraints for this group are mainly to make sure the number of goals is a positive number or 0. For the *pointsTotaledInGroup*, the points were calculated as follows: a win gains the country 3 points, a tie gains the country 1 point, and a loss gains the country no points. Since each team participates in 3 total games in the Group Stage, the maximum number of points is 9 and the minimum is 0, hence the check constraints. Since there are 4 countries per group, *placeInGroup* must be between 1 and 4. The tiebreaker for teams with the same amount of points in the group is a higher-goal differential. The top two teams from each group go onto the Knockout Round of the World Cup.

```
drop table groupedIn; create table groupedIn(
     cid text references countries(cid) NOT NULL,
     grid text references groups(grid) NOT NULL,
     groupStageWins int DEFAULT 0,
     groupStageTies int DEFAULT 0,
     groupStageLosses int DEFAULT 0,
     goalsForInGroup int DEFAULT 0,
     goalsAgainstInGroup int DEFAULT 0,
     goalDifferentialInGroup int DEFAULT 0,
     pointsTotaledInGroup int DEFAULT 0,
     placeInGroup int NOT NULL,
     CHECK (groupStageWins >= 0
        AND groupStageTies >= 0
        AND groupStageWins >= 0
        AND goalsForInGroup >= 0
        AND goalsAgainstInGroup >=0
        AND pointsTotaledInGroup >= 0
        AND pointsTotaledInGroup <= 9
        AND placeInGroup >= 1
        AND placeInGroup <= 4
        ),
     primary key(cid)
     );
```

Functional Dependencies

```
cid → grid, groupStageWins, groupStageTies, groupStageLosses, goalsForInGroup,
      goalsAgainstInGroup, goalDifferentialInGroup, pointsTotaledInGroup, placeInGroup
```

---

referees table

The *referees* table holds all information that is important regarding each individual referee. Each referee must be certified with FIFA for at least a year to be eligible to be selected, hence the check constraint that occurs in the table. While it is possible to do so, we try to not select 2 head referees from the same country to diminish possible discrimination.

```
create table referees(
     rid text NOT NULL PRIMARY KEY,
     firstName text NOT NULL,
     lastName text NOT NULL,
     dateOfBirthMDY text NOT NULL,
     zoneOfRefereeing text,
     countryOfOrigin text,
     numberOfYearsInFifa int DEFAULT 1,
     check (numberOfYearsInFifa > 0)
     );
```

Functional Dependencies

```
rid → firstName, lastName, dateOfBirthMDY, zoneOfRefereeing, countryOfOrigin,
      numberOfYearsInFIfa
```

---

refereedIn table

The purpose of the *refereedIn* table is to keep track of each head referee's games so that we may check if anything out of the ordinary happened in their games. Yellow card and red cards are kept track to analyze the referees are handing out more

cards than others. Also, every red card must be discussed at the daily committee meeting to see if a longer suspension is necessary than the default 1 game, so the committee must know if there are any red cards in any games.

```
create table refereedIn(
     gameNumber int PRIMARY KEY references games(gameNumber) NOT NULL,
     rid text references referees(rid) NOT NULL,
     totalYellowCards int,
     totalRedCards int,
     CHECK (
          totalYellowCards >= 0
      AND totalRedCards >= 0
            )
     );
```

Functional Dependencies

gameNumber → rid, totalYellowCards, totalRedCards

---

stadiums table

The purpose of the *stadiums* table is to keep track of the various stadiums built for the FIFA World Cup. We would like to fill as many of our stadiums with spectators every single game, so knowing the capacity and how many games each are hosting will allow us to see which stadiums need the most cleanup help and pitch resurfacing after each game.

```
create table stadiums(
     sid text NOT NULL PRIMARY KEY,
     stadiumName text NOT NULL,
     locationCity text NOT NULL,
     capacity int NOT NULL,
     CHECK (capacity > 0)
     numberOfGamesHosted int DEFAULT 0,
     costToBuildUSDinMillions int DEFAULT 0
```

```
);
```

Functional Dependencies

```
sid → stadiumName, locationCity, capacity, numberOfGamesHosted, costToBuildUSD
```

---

stadiumPlayedIn table

The *stadiumPlayedIn* table allows us to see which stadiums are hosting which games, and the attendance at each game. We can then calculate various statistics to see how many of our games have sold out and which stadiums need help selling tickets for subsequent games.

```
create table stadiumPlayedIn(
     gameNumber int references games(gameNumber) NOT NULL,
     sid text references stadiums(sid) NOT NULL,
     attendance int DEFAULT 0,
     primary key(gameNumber) );
```

Functional Dependencies

```
gameNumber → sid, attendance
```

---

goals table

The *goals* table allows us to be able to input the goals scored for each team and the result for each team in their game. *W* means win, *T* means tie, and *L* means loss. The countries can play in multiple games and there are always 2 teams per game.

```
create table goals(
     gameNumber int references games(gameNumber) NOT NULL,
     cid text references countries(cid) NOT NULL,
```

```
    goalsScored int DEFAULT 0,
    result char(1) DEFAULT 'T',
    CHECK (goalsScored >= 0),
    CHECK (result = 'W' OR result = 'T' OR result = 'L'),
    primary key(gameNumber, cid)
    );
```

Functional Dependencies

gameNumber, cid → goalsScored, result

---

overtimeGames table

The purpose of the *overtimeGames* table is to keep track of which games have gone into overtime and which games had to be decided by penalty kicks. The only games that can go into overtime are those who are tied at the end of regulation and are in Knockout Stage game. There is 30 minutes of extra time and if the game is still tied after those 30 minutes, the game goes into a penalty shootout; therefore, we would like to know which games were decided in overtime or by penaltyShooutout

Create table

```
create table overtimeGames(
    gameNumber int references games(gameNumber) NOT NULL,
    wentIntoPenaltyShootout boolean DEFAULT false,
    primary key(gameNumber)
    );
```

Functional Dependencies

gameNumber → wentIntoPenaltyShootout

---

penaltyShootout table

The purpose of the *penaltyShootout* table is to state how many penalties each team made if their game was decided in a penalty shootout. Each team gets 5 penalty shots and the team with more goals at the end of the five wins. If the amount of kicks made is still tied after 5 shots each, it becomes sudden-death penalties until one team is in the lead at the end of a round of shooting.

```
create table penaltyShootout(
     gameNumber int references overtimeGames(gameNumber) NOT NULL,
     cid text references countries(cid) NOT NULL,
     penaltiesMade int NOT NULL,
     CHECK (penaltiesMade >= 0),
     primary key(gameNumber, cid)
     );
```

Functional Dependencies

gameNumber,, cid → penaltiesMade

Sample Data

countries

sample data

	cid text	country text	qualifyingzone text	preworldcupr integer	postworldcuprank integer	timesinwcincluding2 integer
1	c01	Brazil	CONMEBOL	3	7	20
2	c02	Mexico	CONCACAF	20	18	15
3	c03	Croatia	UEFA	18	17	4
4	c04	Cameroon	CAF	56	53	7
5	c05	Netherlands	UEFA	15	3	10
6	c06	Chile	CONMEBOL	14	12	9
7	c07	Spain	UEFA	1	8	14
8	c08	Australia	AFC	62	76	4
9	c09	Colombia	CONMEBOL	8	4	5
10	c10	Greece	UEFA	12	13	3
11	c11	Ivory Coast	CAF	23	25	3
12	c12	Japan	AFC	46	45	5
13	c13	Costa Rica	CONCACAF	28	16	4
14	c14	Uruguay	CONMEBOL	7	6	12
15	c15	Italy	UEFA	9	14	18
16	c16	England	UEFA	10	20	14
17	c17	France	UEFA	17	10	14
18	c18	Switzerland	UEFA	6	9	10
19	c19	Ecuador	CONMEBOL	26	21	3
20	c20	Honduras	CONCACAF	33	40	3
21	c21	Argentina	CONMEBOL	5	2	16
22	c22	Nigeria	CAF	44	34	5
23	c23	Bosnia-Herzegovina	UEFA	21	19	1
24	c24	Iran	CAF	43	49	4
25	c25	Germany	UEFA	2	1	18
26	c26	United States	CONCACAF	13	15	10
27	c27	Portugal	UEFA	4	11	6
28	c28	Ghana	CAF	37	38	3
29	c29	Belgium	UEFA	11	5	12
30	c30	Algeria	CAF	22	24	4
31	c31	Russia	UEFA	19	23	10
32	c32	South Korea	AFC	57	56	9

games sample data

	game integ	dateofgam text	typeofgame text	cid1 text	cid2 text	istieinreg boolean	wentintoo boolean
1	1	06/12	Group Stage	c01	c03	f	f
2	2	06/13	Group Stage	c02	c04	f	f
3	3	06/13	Group Stage	c07	c05	f	f
4	4	06/13	Group Stage	c06	c08	f	f
5	5	06/14	Group Stage	c09	c10	f	f
6	6	06/14	Group Stage	c11	c12	f	f
7	7	06/14	Group Stage	c14	c13	f	f
8	8	06/14	Group Stage	c16	c15	f	f
9	9	06/15	Group Stage	c18	c19	f	f
10	10	06/15	Group Stage	c17	c20	f	f
11	11	06/15	Group Stage	c21	c23	f	f
12	12	06/16	Group Stage	c24	c22	t	f
13	13	06/16	Group Stage	c25	c27	f	f
14	14	06/16	Group Stage	c28	c26	f	f
15	15	06/17	Group Stage	c29	c30	f	f
16	16	06/17	Group Stage	c31	c32	t	f
17	17	06/17	Group Stage	c01	c02	t	f
18	18	06/18	Group Stage	c04	c03	f	f
19	19	06/18	Group Stage	c07	c06	f	f
20	20	06/18	Group Stage	c08	c05	f	f
21	21	06/19	Group Stage	c09	c11	f	f
22	22	06/19	Group Stage	c12	c10	t	f
23	23	06/19	Group Stage	c14	c16	f	f
24	24	06/20	Group Stage	c15	c13	f	f
25	25	06/20	Group Stage	c18	c17	f	f
26	26	06/20	Group Stage	c20	c19	f	f
27	27	06/21	Group Stage	c21	c24	f	f
28	28	06/21	Group Stage	c22	c23	t	f
29	29	06/21	Group Stage	c25	c28	t	f
30	30	06/22	Group Stage	c26	c27	f	f
31	31	06/22	Group Stage	c29	c31	f	f
32	32	06/22	Group Stage	c32	c30	f	f
33	33	06/23	Group Stage	c04	c01	f	f
34	34	06/23	Group Stage	c03	c02	f	f
35	35	06/23	Group Stage	c08	c07	f	f
36	36	06/23	Group Stage	c05	c06	f	f
37	37	06/24	Group Stage	c12	c09	f	f
38	38	06/24	Group Stage	c10	c11	f	f
39	39	06/24	Group Stage	c15	c14	f	f
40	40	06/24	Group Stage	c13	c16	t	f
41	41	06/25	Group Stage	c20	c18	f	f
42	42	06/25	Group Stage	c19	c17	t	f
43	43	06/25	Group Stage	c22	c21	f	f
44	44	06/25	Group Stage	c23	c24	f	f
45	45	06/26	Group Stage	c26	c25	f	f
46	46	06/26	Group Stage	c27	c28	f	f
47	47	06/26	Group Stage	c32	c29	f	f
48	48	06/26	Group Stage	c30	c31	t	f
49	49	06/28	Round of 16	c01	c06	t	t
50	50	06/28	Round of 16	c09	c14	f	f
51	51	06/29	Round of 16	c05	c02	f	f
52	52	06/29	Round of 16	c13	c10	t	t
53	53	06/30	Round of 16	c17	c22	f	f
54	54	06/30	Round of 16	c25	c30	t	t
55	55	07/01	Round of 16	c21	c18	t	t
56	56	07/01	Round of 16	c29	c26	t	t
57	57	07/04	Quarterfinal	c01	c09	f	f
58	58	07/04	Quarterfinal	c17	c25	f	f
59	59	07/05	Quarterfinal	c05	c13	t	t
60	60	07/05	Quarterfinal	c21	c29	f	f
61	61	07/08	Semifinal	c01	c25	f	f
62	62	07/09	Semifinal	c05	c21	t	t
63	63	07/12	Third Place	c01	c05	f	f
64	64	07/13	Final	c25	c21	t	t

groups sample data

	grid text
1	groupA
2	groupB
3	groupC
4	groupD
5	groupE
6	groupF
7	groupG
8	groupH

groupedIn sample data

	cid text	grid text	groupsta integer	groupsti integer	groupsta integer	goalsfori integer	goalsagi integer	goaldiff integer	pointsI integer	placel integ
1	c01	groupA	2	1	0	7	2	5	7	1
2	c02	groupA	2	1	0	4	1	3	7	2
3	c03	groupA	1	0	2	6	6	0	3	3
4	c04	groupA	0	0	3	1	9	-8	0	4
5	c05	groupB	3	0	0	10	3	7	9	1
6	c06	groupB	2	0	1	5	3	2	6	2
7	c07	groupB	1	0	2	4	7	-3	3	3
8	c08	groupB	0	0	3	3	9	-6	0	4
9	c09	groupC	3	0	0	9	2	7	9	1
10	c10	groupC	1	1	1	2	4	-2	4	2
11	c11	groupC	1	0	2	4	5	-1	3	3
12	c12	groupC	0	1	2	2	6	-4	1	4
13	c13	groupD	2	1	0	4	1	3	7	1
14	c14	groupD	2	0	1	4	4	0	6	2
15	c15	groupD	1	0	2	2	3	-1	3	3
16	c16	groupD	0	1	2	2	4	-2	1	4
16	c16	groupD	0	1	2	2	4	-2	1	4
17	c17	groupE	2	1	0	8	2	6	7	1
18	c18	groupE	2	0	1	7	6	1	6	2
19	c19	groupE	1	1	1	3	3	0	4	3
20	c20	groupE	0	0	3	1	8	-7	0	4
21	c21	groupF	3	0	0	6	3	3	9	1
22	c22	groupF	1	1	1	3	3	0	4	2
23	c23	groupF	1	0	2	4	4	0	3	3
24	c24	groupF	0	1	2	1	4	-3	1	4
25	c25	groupG	2	1	0	7	2	5	7	1
26	c26	groupG	1	1	1	4	4	0	4	2
27	c27	groupG	1	1	1	4	7	-3	4	3
28	c28	groupG	0	1	2	4	6	-2	1	4
29	c29	groupH	3	0	0	4	1	3	9	1
30	c30	groupH	1	1	1	6	5	1	4	2
31	c31	groupH	0	2	1	2	3	-1	2	3
32	c32	groupH	0	1	2	3	6	-3	1	4

referees sample data

	rid text	firstname text	lastname text	dateofbirthmdy text	zoneofrefereeing text	countryoforigin text	numberofyearsinfi integer
1	r01	Ravshan	Irmatov	08/09/1977	AFC	Uzbekistan	11
2	r02	Yuichi	Nishimura	04/17/1972	AFC	Japan	10
3	r03	Nawaf	Shukralla	10/13/1976	AFC	Bahrain	7
4	r04	Ben	Williams	04/14/1977	AFC	Australia	9
5	r05	Noumandi	Doue	09/29/1970	CAF	Ivory Coast	10
6	r06	Bakary	Gassama	02/10/1979	CAF	Gambia	7
7	r07	Djamel	Hairmoudi	12/10/1970	CAF	Algeria	10
8	r08	Joel	Aguilar	07/02/1975	CONCACAF	El Salvador	13
9	r09	Mark	Geiger	08/25/1974	CONCACAF	United State	6
10	r10	Marco	Rodriguez	11/10/1973	CONCACAF	Mexico	15
11	r11	Nestor	Pitana	06/17/1975	CONMEBOL	Argentina	4
12	r12	Sandro	Ricci	11/19/1974	CONMEBOL	Brazil	3
13	r13	Enrique	Osses	06/25/1976	CONMEBOL	Chile	9
14	r14	Wilmar	Roldan	01/24/1980	CONMEBOL	Colombia	6
15	r15	Carlos	Vera	06/25/1976	CONMEBOL	Ecuador	8
16	r16	Peter	OLeary	03/03/1972	OFC	New Zealand	11
17	r17	Felix	Brych	08/03/1975	UEFA	Germany	7
18	r18	Cuneyt	Cakir	11/23/1976	UEFA	Turkey	8
19	r19	Jonas	Eriksson	03/28/1974	UEFA	Sweden	12
20	r20	Bjorn	Kuipers	03/28/1973	UEFA	Netherlands	8
21	r21	Milorad	Mazic	03/23/1973	UEFA	Serbia	5
22	r22	Nicola	Rizzoli	10/05/1971	UEFA	Italy	7
23	r23	Carlos	Velasco Car	03/16/1971	UEFA	Spain	6
24	r24	Pedro	Proenca	11/03/1970	UEFA	Portugal	11
25	r25	Howard	Webb	07/14/1971	UEFA	England	9

refereedIn sample data

	gamen integer	rid text	totalyel integer	totalred integer
1	1	r02	4	0
2	2	r14	2	0
3	3	r22	4	0
4	4	r05	4	0
5	5	r09	3	0
6	6	r17	4	0
7	7	r20	3	1
8	8	r13	1	0
9	9	r01	2	0
10	10	r12	7	1
11	11	r08	2	0
12	12	r21	1	0
13	13	r15	1	1
14	14	r19	2	0
15	15	r10	4	0
16	16	r18	2	0
17	17	r11	4	0
18	18	r07	1	1
19	19	r09	2	0
20	20	r24	3	0
21	21	r25	2	0
22	22	r23	5	1
23	23	r08	2	0
24	24	r12	2	0
25	25	r20	1	0
26	26	r04	5	0
27	27	r21	2	0
28	28	r16	2	0
29	29	r12	1	0
30	30	r11	1	0
31	31	r17	3	0
32	32	r14	3	0
33	33	r19	3	0
34	34	r01	3	1
35	35	r03	3	0
36	36	r06	2	0
37	37	r24	2	0
38	38	r15	3	0
39	39	r10	4	1
40	40	r07	3	0
41	41	r11	1	0
42	42	r05	1	2
43	43	r22	2	0
44	44	r23	2	0
45	45	r01	3	0
46	46	r03	4	0
47	47	r04	2	1
48	48	r18	5	0
49	49	r25	7	0
50	50	r20	3	0
51	51	r24	3	0
52	52	r04	8	0
53	53	r09	1	0
54	54	r12	2	0
55	55	r19	5	0
56	56	r07	2	0
57	57	r11	2	0
58	58	r23	4	0
59	59	r22	3	0
60	60	r01	6	0
61	61	r10	1	0
62	62	r18	3	0
63	63	r07	5	0
64	64	r22	4	0

stadiums sample data

	sid text	stadiumname text	locationcity text	capacity integer	numberofgameshosted integer	costtobuildusdinmillions integer
1	s01	Maracana Stadium	Rio de Jar	74738	7	1200
2	s02	Estadio Mineirao	Belo Hori:	58259	6	695
3	s03	Arena Fonte Nova	Salvador	51708	6	267
4	s04	Arena Pantanal	Cuiaba	41112	4	293
5	s05	Arena de Amazonia	Manaus	40549	4	270
6	s06	Arena das Dunas	Natal	39971	4	400
7	s07	Arena da Daixada	Curitiba	39631	4	295
8	s08	Arena Pernambuco	Recife	42583	5	426
9	s09	Estadio Beira-Rio	Porto Ale	43394	5	326
10	s10	Estadio Castelao	Fortaleza	60348	6	207
11	s11	Arena Corinthians	Sao Paulo	63321	6	435
12	s12	Estadio Nacional Mane Garrincha	Brasilia	69432	7	900

stadiumPlayedIn sample data

	sid text	gamenumber integer	attendance integer
1	s11	1	62103
2	s06	2	39216
3	s03	3	48173
4	s04	4	40275
5	s02	5	57174
6	s08	6	40267
7	s10	7	58679
8	s05	8	39800
9	s12	9	68351
10	s09	10	43012
11	s01	11	74738
12	s07	12	39081
13	s03	13	51081
14	s06	14	39760
15	s02	15	56800
16	s04	16	37603
17	s10	17	60342
18	s05	18	39982
19	s01	19	42877
20	s09	20	74101
21	s12	21	68748
22	s06	22	39485
23	s11	23	62575
24	s08	24	40285
25	s03	25	51003
26	s07	26	39224
27	s02	27	57698
28	s04	28	40499
29	s10	29	59621
30	s05	30	40123
31	s01	31	73819
32	s09	32	42732
33	s12	33	69112
34	s08	34	41212
35	s07	35	39375
36	s11	36	62996
37	s04	37	40340
38	s10	38	59095
39	s06	39	39706
40	s02	40	57823
41	s05	41	40322
42	s01	42	73749
43	s09	43	43285
44	s03	44	48011
45	s08	45	41876
46	s12	46	67540
47	s11	47	61397
48	s07	48	39311
49	s02	49	57714
50	s01	50	73804
51	s10	51	58817
52	s08	52	41242
53	s12	53	67882
54	s09	54	43063
55	s11	55	63255
56	s03	56	51227
57	s10	57	74240
58	s01	58	60342
59	s03	59	68551
60	s12	60	51179
61	s02	61	58141
62	s11	62	63267
63	s12	63	68034
64	s01	64	74738

goals sample data

	gam integ	cid text	goal inte	resu char
1	1	c01	3	W
2	1	c03	1	L
3	2	c02	1	W
4	2	c04	0	L
5	3	c07	1	L
6	3	c05	5	W
7	4	c06	3	W
8	4	c08	1	L
9	5	c09	3	W
10	5	c10	0	L
11	6	c11	2	W
12	6	c12	1	L
13	7	c14	1	L
14	7	c13	3	W
15	8	c16	1	L
16	8	c15	2	W
17	9	c18	2	W
18	9	c19	1	L
19	10	c17	3	W
20	10	c20	0	L
21	11	c21	2	W
22	11	c23	1	L
23	12	c24	0	T
24	12	c22	0	T
25	13	c25	4	W
26	13	c27	0	L
27	14	c28	1	L
28	14	c26	2	W
29	15	c29	2	W
30	15	c30	1	L
31	16	c31	1	T
32	16	c32	1	T
33	17	c01	0	T
34	17	c02	0	T
35	18	c04	0	L
36	18	c03	4	W
37	19	c07	0	L
38	19	c06	2	W
39	20	c08	2	L
40	20	c05	3	W
41	21	c09	2	W
42	21	c11	1	L
43	22	c12	0	T
44	22	c10	0	T
45	23	c14	2	W
46	23	c16	1	L
47	24	c15	0	L
48	24	c13	1	W
49	25	c18	2	L
50	25	c17	5	W
51	26	c20	1	L
52	26	c19	2	W
53	27	c21	1	W
54	27	c24	0	L
55	28	c22	1	W
56	28	c23	0	L
57	29	c25	2	T
58	29	c28	2	T
59	30	c26	1	T
60	30	c27	0	T
61	31	c29	2	L
62	31	c31	4	W
63	32	c32	1	L
64	32	c30	4	W
65	33	c04	1	L
66	33	c01	3	W
67	34	c03	0	L
68	34	c02	3	W
69	35	c08	2	W
70	35	c07	0	L
71	36	c05	1	L
72	36	c06	4	W
73	37	c12	2	W
74	37	c09	1	L
75	38	c10	0	L
76	38	c11	1	W
77	39	c15	0	L
78	39	c14	1	W
79	40	c13	0	T
80	40	c16	0	T
81	41	c20	0	L
82	41	c18	3	W
83	42	c19	0	T
84	42	c17	0	T
85	43	c22	2	L
86	43	c21	3	W
87	44	c23	3	W
88	44	c24	1	L
89	45	c26	0	L
90	45	c25	1	W
91	46	c27	2	W
92	46	c28	1	L
93	47	c32	0	L
94	47	c29	1	W
95	48	c30	1	T
96	48	c31	1	T
97	49	c01	1	W
98	49	c06	1	L
99	50	c09	2	W
100	50	c14	0	L
101	51	c05	2	W
102	51	c02	1	L
103	52	c13	1	W
104	52	c10	1	L
105	53	c17	2	W
106	53	c22	0	L
107	54	c25	2	W
108	54	c30	1	L
109	55	c21	1	W
110	55	c18	0	L
111	56	c29	2	W
112	56	c26	1	L
113	57	c01	2	W
114	57	c09	1	L
115	58	c17	0	L
116	58	c25	1	W
117	59	c05	0	W
118	59	c13	0	L
119	60	c21	1	W
120	60	c29	0	L
121	61	c01	1	L
122	61	c25	7	W
123	62	c05	0	L
124	62	c21	0	L
125	63	c01	0	L
126	63	c05	3	W
127	64	c25	1	W
128	64	c21	0	L

overtimeGames sample data

	gam integ	wentintopenaltyshootout boolean
1	49	t
2	52	t
3	54	f
4	55	f
5	56	f
6	59	t
7	62	t
8	64	f

penaltyShootout sample data

	gam integ	cid text	penaltiesmade integer
1	49	c01	3
2	49	c06	2
3	52	c13	5
4	52	c10	3
5	59	c05	4
6	59	c13	3
7	62	c05	2
8	62	c21	4

Views

The Disciplined Referee

Referees are always the most scrutinized people in any football tournament across the world. With millions of people watching every whistle, the referee's moves are questioned from the opening kickoff. We want to make sure that the referees are doing a fine job controlling the games and not letting them get out of hand. One of the ways we monitor this idea is through seeing how many yellow and red cards they hand out. If a referee is handing out more than 5 cards in a game, most of the time they are not doing the best they can do to officiate the games. Therefore, we want to view the referees who have given out more than 5 yellow and red cards combined in a single game to make sure the committee takes a look at the match.

```
create view tooManyCards as (
     select i.gameNumber, r.firstName, r.lastName
     from referees r, refereedIn i
     where r.rid = i.rid
     and ((i.totalYellowCards + i.totalRedCards) > 5)
     order by i.gameNumber ASC);


select *
from tooManyCards;
```

	gamenumber integer	firstname text	lastname text
1	10	Sandro	Ricci
2	22	Carlos	Velasco
3	49	Howard	Webb
4	52	Ben	Williams
5	60	Ravshan	Irmatov

Stored Procedures

Goals In A Game

The following stored procedure *TotalGoalsScored* lets the user input a game number and outputs how many goals were scored in that game. This will be relevant information to the users because it will tell which games had a high output of goals and which were very close and had very little amounts of goals scored.

```
create or replace function TotalGoalsScored(int, REFCURSOR) returns refcursor as
$$
declare
     numberOfGame  int          := $1;
     resultSet     REFCURSOR    := $2;
begin
     open resultset for
          select sum(goalsScored)
          from goals
          where gameNumber = numberOfGame;
     return resultSet;
end;
$$
language plpgsql;

select TotalGoalsScored(63, 'results');
Fetch all from results;
```

	sum bigint
1	3

Queries

To win the World Cup, you must go through 7 hard fought games and must persevere through hard times throughout the group stages and the knockout stages. The following queries will produce statistics about the champion.

This first query outputs the country that won the world cup and the query is to the bottom of the query.

```
select country
from countries
where cid in (select cid
              from goals
              where gameNumber in (select gameNumber
                                   from games
                                   where typeOfGame = 'Final'
                                   )
               AND result = 'W'
);
```

	country text
1	Germany

This query will produce all of the teams that the champion played throughout all rounds of the tournament.

```
select country
from countries
where cid in (select cid1
              from games
              where gameNumber in (select gameNumber
                                   from games
                                   where cid1 in (select cid
                                                  from goals
                                                  where gameNumber in (select gameNumber
                                                                       from games
                                                                       where typeOfGame = 'Final'
                                                                       )
                                                   AND result = 'W'
                                                   )
                                   or cid2 in (select cid
                                               from goals
                                               where gameNumber in (select gameNumber
                                                                    from games
                                                                    where typeOfGame = 'Final'
                                                                    )
                                               AND result = 'W'
                                               )
                                   )
              AND cid not in (select cid
                              from goals
                              where gameNumber in (select gameNumber
                                                   from games
                                                   where typeOfGame = 'Final'
                                                   )
                              AND result = 'W'
                              )
              )
       OR cid in (select cid2
                  from games
                  where gameNumber in (select gameNumber
                                       from games
                                       where cid1 in (select cid
                                                      from goals
                                                      where gameNumber in (select gameNumber
                                                                           from games
                                                                           where typeOfGame = 'Final'
                                                                           )
                                                      AND result = 'W'
```

```
                                )
                    or cid2 in (select cid
                                from goals
                                where gameNumber in (select gameNumber
                                                     from games
                                                     where typeOfGame = 'Final'
                                                     )
                                AND result = 'W'
                                )
                    )
 AND cid not in (select cid
                 from goals
                 where gameNumber in (select gameNumber
                                      from games
                                      where typeOfGame = 'Final'
                                      )
                 AND result = 'W'
                    )
);
```

	country text
1	Brazil
2	France
3	Argentina
4	United States
5	Portugal
6	Ghana
7	Algeria

The following query will output the total goals scored by the champion throughout their passage through the World Cup.

```
select sum(goalsScored) as "Total Goals Scored"
from goals
where cid in (select cid
              from goals
              where gameNumber in (select gameNumber
                                   from games
                                    where typeOfGame = 'Final'
                                    )
              AND result = 'W'
              );
```

	Total Goals Scored bigint
1	18

Security

There are 3 main users to the database: the head referee coordinator, the stadium managers, and admin to keep track of games. For each role, they will have been revoked all privileges which will be omitted for the time being.

refereeCoordinator

The referee coordinator will have the ability to select any table as to look at anything he chooses to, update or insert any objects in *refereedIn* to update any changes to the games that are being refereed, and update any objects in *referees* as to add any referees to the list or update any information as the years progress.

```
GRANT SELECT on ALL TABLES IN SCHEMA PUBLIC to refereeCoordinator
GRANT SELECT, UPDATE, INSERT on referees to refereeCoordinator
GRANT SELECT, UPDATE, INSERT on refereedIn to refereeCoordinator
```

stadiumManager

The stadium manager will have the ability to select any table that he would like to look at, update or insert any objects in *stadiums* to change capacity size if the workers add more seats or if they add a new stadium, and update or insert any objects in *playedIn* so that he or she can keep track of the daily statistics for the games.

```
GRANT SELECT on ALL TABLES IN SCHEMA PUBLIC to stadiumManager
GRANT SELECT, UPDATE, INSERT on stadiums to stadiumManager
GRANT SELECT, UPDATE, INSERT on stadiumPlayedIn to stadiumManager
```

Administrator

The administrator will have god-like powers and can do whatever they wish.

```
GRANT ALL PRIVILEGES ON ALL TABLES IN SCHEMA public TO fifaAdministrator
```

Implementation Notes, Known Problems and Further Implementation

- All of the sample data for this database was input via the 2014 standings and statistics to be shown that this system can implement an entire World Cup, possibly in 2018.
- Overall, the implementation went very well with only a couple of known problems as of now.
- The system would fail to satisfy the Normal Rules if they used this database for the next World Cup. The database would need to implement a row or table to accommodate multiple years since the tables could have duplicate data if not. If one could implement a new row in games and countries called "year" or something to that effect, we could create an opportunity for there to be multiple tournaments in the system and to have a bigger database for the history of the World Cup.
- Another problem that was encountered is the best way to go about calling each game individually with countries in the queries. The queries were getting extremely bulky and confusing for there to be legitimate usage for a World Cup, and therefore, there must be a more compact and easier way to implement this idea. Also, this database may not be in Normal Form since the "countries" to "games" may be a many-to-many relationship. Unfortunately, this was found out too far down the line of development. One possibility is there to be a "*PlayedIn*" table connecting *countries* and *games*, where there are two columns *cid* and *gameNumber* so that there is an easier query to see what countries are playing in which games and will satisfy Normal Form if it has not already done so.
- A further enhancement would for there to include a database for the qualification of the World Cup. It is important to FIFA that they may control and keep track of every single part of qualification for the World Cup, so this system must keep track of possibly over 200 teams that try to qualify for the World Cup, and well over 1,400 games for every qualification period.
- One further implementation that would be helpful would to have a track for assistant referees as well and not just for head referees of each game. This will allow the committee to better see the referee teams and choose which teams of referees should work together for future games.