worldcup

April 19, 2023

1 2022 Qatar World Cup Analysis

The World Cup is one of the, if not the largest, sporting event in the world. The World Cup is a tournament consisting of some of the best qualifying nations in international football. Countries are divided into groups, where the top two teams from each group move on to the 'knockout rounds', effectively dwindling down the competition until one team is left standing.The World Cup is a global event that transcends borders, cultures, and languages, captivating audiences with the sheer talent, passion, and dedication of the world's top footballers. The World Cup also serves as a platform for countries to showcase their national identity and pride, and to unite their citizens around a common goal. Whether you are a casual fan or a die-hard supporter, the World Cup is an unforgettable experience that captures the imagination and inspires a sense of unity that extends far beyond the pitch. And for the players, it is considered the highest honor in the sport; one that demands a lot of passion and excellence in order to persevere and bring home glory to their country.

The 2022 World Cup in Qatar has recently concluded with an Argentinian extra-time victory in the final over France; a dramatic victory that perfectly captures the essence of the tournament. The dataset that we will be utilizing in our project focuses on each individual match from the tournament, and contains a large amount of data about the match itself, specifically for each team; possession, shots attempted, shots on goal, total passes, etc. We are hoping to showcase some trends, and insights that can summarize and visualize the tournament effectively through data.

1.1 Importing packages

[ ]:
```
%matplotlib inline
import warnings
warnings.simplefilter(action='ignore')

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
from plotnine import *
```

1.2 Loading, cleaning, and exploring datasets

We have three main datasets which we will be working with in our project; our main dataset is the `matches` dataset which contains information about the matches played in the 2022 Qatar World

Cup. The second dataset, `countries`, relates to the individual country statistics, which we will be aggregating from our information about each match in order to get a better understanding of the teams and their performance. Lastly, we are going to take a look at a `players` dataset, which contains much information about the actual participants in the tournament, and their performance in the matches.

1.2.1 Matches Dataset - loading and cleaning

[ ]:
```
matches = pd.read_csv('cup.csv')
matches.head()
```

[ ]:

	team1	team2	possession team1	possession team2	\
0	QATAR	ECUADOR	42%	50%	
1	ENGLAND	IRAN	72%	19%	
2	SENEGAL	NETHERLANDS	44%	45%	
3	UNITED STATES	WALES	51%	39%	
4	ARGENTINA	SAUDI ARABIA	64%	24%	

	possession in contest	number of goals team1	number of goals team2	\
0	8%	0	2	
1	9%	6	2	
2	11%	0	2	
3	10%	1	1	
4	12%	1	2	

	date	hour	category	…	penalties scored team1	\
0	20 NOV 2022	17 : 00	Group A	…	0	
1	21 NOV 2022	14 : 00	Group B	…	0	
2	21 NOV 2022	17 : 00	Group A	…	0	
3	21 NOV 2022	20 : 00	Group B	…	0	
4	22 NOV 2022	11 : 00	Group C	…	1	

	penalties scored team2	goal preventions team1	goal preventions team2	\
0	1	6	5	
1	1	8	13	
2	0	9	15	
3	1	7	7	
4	0	4	14	

	own goals team1	own goals team2	forced turnovers team1	\
0	0	0	52	
1	0	0	63	
2	0	0	63	
3	0	0	81	
4	0	0	65	

	forced turnovers team2	defensive pressures applied team1	\

```
0                        72                                  256
1                        72                                  139
2                        73                                  263
3                        72                                  242
4                        80                                  163

   defensive pressures applied team2
0                                279
1                                416
2                                251
3                                292
4                                361

[5 rows x 88 columns]
```

[ ]:
```
# only take the team1 and team2 columns and drop the rest
matches = matches[[
    'team1',
    'team2',
    'possession team1',
    'possession team2',
    'possession in contest',
    'number of goals team1',
    'number of goals team2',
    'category',
    'total attempts team1',
    'total attempts team2',
    'conceded team1',
    'conceded team2',
    'goal inside the penalty area team1',
    'goal inside the penalty area team2',
    'goal outside the penalty area team1',
    'goal outside the penalty area team2',
    'assists team1',
    'assists team2',
    'yellow cards team1',
    'yellow cards team2',
    'red cards team1',
    'red cards team2',
    'fouls against team1',
    'fouls against team2',
    'offsides team1',
    'offsides team2',
    'passes team1',
    'passes team2',
    'passes completed team1',
    'passes completed team2',
```

```
    'crosses team1',
    'crosses team2',
    'crosses completed team1',
    'crosses completed team2',
    'corners team1',
    'corners team2',
    'free kicks team1',
    'free kicks team2',
    'penalties scored team1',
    'penalties scored team2',
    'goal preventions team1',
    'goal preventions team2',
    'own goals team1',
    'own goals team2',
    'forced turnovers team1',
    'forced turnovers team2'
]]

matches['team1'] = matches['team1'].str.title()
matches['team2'] = matches['team2'].str.title()

matches['GroupID'] = matches['category'].apply(lambda x: x[-1] if 'Group' in x␣
 ↪else np.nan)
matches['category'] = matches['category'].apply(lambda x: x[:-2] if 'Group' in␣
 ↪x else x)

matches['possession team1'] = matches['possession team1'].str[:-1].astype(int)
matches['possession team2'] = matches['possession team2'].str[:-1].astype(int)
matches['possession in contest'] = matches['possession in contest'].str[:-1].
 ↪astype(int)

matches.head()
```

[ ]:

	team1	team2	possession team1	possession team2	\
0	Qatar	Ecuador	42	50	
1	England	Iran	72	19	
2	Senegal	Netherlands	44	45	
3	United States	Wales	51	39	
4	Argentina	Saudi Arabia	64	24	

	possession in contest	number of goals team1	number of goals team2	\
0	8	0	2	
1	9	6	2	
2	11	0	2	
3	10	1	1	
4	12	1	2	

```
  category  total attempts team1  total attempts team2  …  free kicks team2  \
0    Group                    5                     6  …                17
1    Group                   13                     8  …                10
2    Group                   14                     9  …                14
3    Group                    6                     7  …                15
4    Group                   14                     3  …                16

   penalties scored team1  penalties scored team2  goal preventions team1  \
0                       0                       1                       6
1                       0                       1                       8
2                       0                       0                       9
3                       0                       1                       7
4                       1                       0                       4

   goal preventions team2  own goals team1  own goals team2  \
0                       5                0                0
1                      13                0                0
2                      15                0                0
3                       7                0                0
4                      14                0                0

   forced turnovers team1  forced turnovers team2  GroupID
0                      52                      72        A
1                      63                      72        B
2                      63                      73        A
3                      81                      72        B
4                      65                      80        C

[5 rows x 47 columns]
```

[ ]:
```
matches['category'].unique()
```

[ ]:
```
array(['Group', 'Round of 16', 'Quarter-final', 'Semi-final',
       'Play-off for third place', 'Final'], dtype=object)
```

[ ]:
```
# dividing the data based on what stage of the tournament the match was in
groupMatches = matches.loc[matches['category'] == 'Group']
ro16 = matches.loc[matches['category'] == 'Round of 16']
quarterfinals = matches.loc[matches['category'] == 'Quarter-final']
semifinals = matches.loc[matches['category'] == 'Semi-final']
thirdPlaceMatch = matches.loc[matches['category'] == 'Play-off for third place']
final = matches.loc[matches['category'] == 'Final']
```

1.2.2 Countries Dataset - loading and cleaning

[ ]:
```
countries = pd.read_csv('precup_rank.csv', index_col='Nation')
countries.head()
```

[ ]:

Nation	Rank	Points
Brazil	1	1841.30
Belgium	2	1816.71
Argentina	3	1773.88
France	4	1759.78
England	5	1728.47

[ ]:
```
# we are creating a lot of columns, and it doesn't look pretty, but this is␣
 ↪what we want to do; is there a better way to do this?
# also, a problem that might arise is that it will become hard to distinguish␣
 ↪actual zeroes from missing values, which we might need to research a better␣
 ↪way for that as well
countries['Possession in Group'] = 0
countries['Possession in Round of 16'] = 0
countries['Possession in Quarter-final'] = 0
countries['Possession in Semi-final'] = 0
countries['Possession in Play-off for third place'] = 0
countries['Possession in Final'] = 0

countries['Total Passes in Group'] = 0
countries['Total Passes in Round of 16'] = 0
countries['Total Passes in Quarter-final'] = 0
countries['Total Passes in Semi-final'] = 0
countries['Total Passes in Play-off for third place'] = 0
countries['Total Passes in Final'] = 0

countries['Completed Passes in Group'] = 0
countries['Completed Passes in Round of 16'] = 0
countries['Completed Passes in Quarter-final'] = 0
countries['Completed Passes in Semi-final'] = 0
countries['Completed Passes in Play-off for third place'] = 0
countries['Completed Passes in Final'] = 0

countries['Shot Attempts in Group'] = 0
countries['Shot Attempts in Round of 16'] = 0
countries['Shot Attempts in Quarter-final'] = 0
countries['Shot Attempts in Semi-final'] = 0
countries['Shot Attempts in Play-off for third place'] = 0
countries['Shot Attempts in Final'] = 0

countries['Total Goals in Group'] = 0
```

```
countries['Total Goals in Round of 16'] = 0
countries['Total Goals in Quarter-final'] = 0
countries['Total Goals in Semi-final'] = 0
countries['Total Goals in Play-off for third place'] = 0
countries['Total Goals in Final'] = 0

countries['Close Range Goals in Group'] = 0
countries['Close Range Goals in Round of 16'] = 0
countries['Close Range Goals in Quarter-final'] = 0
countries['Close Range Goals in Semi-final'] = 0
countries['Close Range Goals in Play-off for third place'] = 0
countries['Close Range Goals in Final'] = 0

countries['Long Range Goals in Group'] = 0
countries['Long Range Goals in Round of 16'] = 0
countries['Long Range Goals in Quarter-final'] = 0
countries['Long Range Goals in Semi-final'] = 0
countries['Long Range Goals in Play-off for third place'] = 0
countries['Long Range Goals in Final'] = 0

countries['Conceded in Group'] = 0
countries['Conceded in Round of 16'] = 0
countries['Conceded in Quarter-final'] = 0
countries['Conceded in Semi-final'] = 0
countries['Conceded in Play-off for third place'] = 0
countries['Conceded in Final'] = 0

countries['Assists in Group'] = 0
countries['Assists in Round of 16'] = 0
countries['Assists in Quarter-final'] = 0
countries['Assists in Semi-final'] = 0
countries['Assists in Play-off for third place'] = 0
countries['Assists in Final'] = 0

countries['Fouls in Group'] = 0
countries['Fouls in Round of 16'] = 0
countries['Fouls in Quarter-final'] = 0
countries['Fouls in Semi-final'] = 0
countries['Fouls in Play-off for third place'] = 0
countries['Fouls in Final'] = 0

countries['Yellow Cards in Group'] = 0
countries['Yellow Cards in Round of 16'] = 0
countries['Yellow Cards in Quarter-final'] = 0
countries['Yellow Cards in Semi-final'] = 0
countries['Yellow Cards in Play-off for third place'] = 0
countries['Yellow Cards in Final'] = 0
```

```
countries['Red Cards in Group'] = 0
countries['Red Cards in Round of 16'] = 0
countries['Red Cards in Quarter-final'] = 0
countries['Red Cards in Semi-final'] = 0
countries['Red Cards in Play-off for third place'] = 0
countries['Red Cards in Final'] = 0

countries['Offsides in Group'] = 0
countries['Offsides in Round of 16'] = 0
countries['Offsides in Quarter-final'] = 0
countries['Offsides in Semi-final'] = 0
countries['Offsides in Play-off for third place'] = 0
countries['Offsides in Final'] = 0

countries['Saves in Group'] = 0
countries['Saves in Round of 16'] = 0
countries['Saves in Quarter-final'] = 0
countries['Saves in Semi-final'] = 0
countries['Saves in Play-off for third place'] = 0
countries['Saves in Final'] = 0

countries['Penalties in Group'] = 0
countries['Penalties in Round of 16'] = 0
countries['Penalties in Quarter-final'] = 0
countries['Penalties in Semi-final'] = 0
countries['Penalties in Play-off for third place'] = 0
countries['Penalties in Final'] = 0

countries['Free Kicks in Group'] = 0
countries['Free Kicks in Round of 16'] = 0
countries['Free Kicks in Quarter-final'] = 0
countries['Free Kicks in Semi-final'] = 0
countries['Free Kicks in Play-off for third place'] = 0
countries['Free Kicks in Final'] = 0

countries['Corners in Group'] = 0
countries['Corners in Round of 16'] = 0
countries['Corners in Quarter-final'] = 0
countries['Corners in Semi-final'] = 0
countries['Corners in Play-off for third place'] = 0
countries['Corners in Final'] = 0

countries['Own Goals in Group'] = 0
countries['Own Goals in Round of 16'] = 0
countries['Own Goals in Quarter-final'] = 0
countries['Own Goals in Semi-final'] = 0
```

```
countries['Own Goals in Play-off for third place'] = 0
countries['Own Goals in Final'] = 0

countries['Forced Turnovers in Group'] = 0
countries['Forced Turnovers in Round of 16'] = 0
countries['Forced Turnovers in Quarter-final'] = 0
countries['Forced Turnovers in Semi-final'] = 0
countries['Forced Turnovers in Play-off for third place'] = 0
countries['Forced Turnovers in Final'] = 0

countries['GroupID'] = ''
```

Now that we have our `countries` dataset prepared for data to enter it, we need to start to modify our `matches` dataset, so that any redundant information is discarded, and all the information we need is correctly represented.

We are now going to write some code which will allow us to clean up the way some of this data looks. Ideally, we want to observe these statistics based on country, while we have it here as `team1` or `team2`, which isn't really helpful if we want to get a context of a particular country. So, using the `countries` dataset that we have introduced earlier that just contains their FIFA rank at the time of the World Cup, we will be adding each countries individual statistics to the dataset.

[ ]:
```
def parseRound(round):
    teamID = ''
    for team in countries.index:
        roundMatches = round.loc[((round['team1'] == team) | (round['team2'] ==␣
 ↪team))]
        for _, match in roundMatches.iterrows():

            if match['team1'] == team:
                teamID = '1'
            else:
                teamID = '2'

            if match['category'] == 'Group':
                countries.loc[team, f'GroupID'] = match[f'GroupID']

            #print(team, match[f'number of goals team{teamID}'])
            countries.loc[team, f'Possession in {match["category"]}'] +=␣
 ↪match[f'possession team{teamID}']
            countries.loc[team, f'Total Passes in {match["category"]}'] +=␣
 ↪match[f'passes team{teamID}']
            countries.loc[team, f'Completed Passes in {match["category"]}'] +=␣
 ↪match[f'passes completed team{teamID}']
            countries.loc[team, f'Total Goals in {match["category"]}'] +=␣
 ↪match[f'number of goals team{teamID}']
```

```
            countries.loc[team, f'Close Range Goals in {match["category"]}'] +=␣
 ↪match[f'goal inside the penalty area team{teamID}']
            countries.loc[team, f'Long Range Goals in {match["category"]}'] +=␣
 ↪match[f'goal outside the penalty area team{teamID}']
            countries.loc[team, f'Conceded in {match["category"]}'] +=␣
 ↪match[f'conceded team{teamID}']
            countries.loc[team, f'Assists in {match["category"]}'] +=␣
 ↪match[f'assists team{teamID}']
            countries.loc[team, f'Own Goals in {match["category"]}'] +=␣
 ↪match[f'own goals team{teamID}']
            countries.loc[team, f'Forced Turnovers in {match["category"]}'] +=␣
 ↪match[f'forced turnovers team{teamID}']
            countries.loc[team, f'Saves in {match["category"]}'] +=␣
 ↪match[f'goal preventions team{teamID}']
            countries.loc[team, f'Penalties in {match["category"]}'] +=␣
 ↪match[f'penalties scored team{teamID}']
            countries.loc[team, f'Free Kicks in {match["category"]}'] +=␣
 ↪match[f'free kicks team{teamID}']
            countries.loc[team, f'Corners in {match["category"]}'] +=␣
 ↪match[f'corners team{teamID}']
            countries.loc[team, f'Fouls in {match["category"]}'] +=␣
 ↪match[f'fouls against team{teamID}']
            countries.loc[team, f'Offsides in {match["category"]}'] +=␣
 ↪match[f'offsides team{teamID}']
            countries.loc[team, f'Yellow Cards in {match["category"]}'] +=␣
 ↪match[f'yellow cards team{teamID}']
            countries.loc[team, f'Red Cards in {match["category"]}'] +=␣
 ↪match[f'red cards team{teamID}']
            countries.loc[team, f'Shot Attempts in {match["category"]}'] +=␣
 ↪match[f'total attempts team{teamID}']


parseRound(groupMatches)
parseRound(ro16)
parseRound(quarterfinals)
parseRound(semifinals)
parseRound(thirdPlaceMatch)
parseRound(final)
```

[ ]:
```
countries['Average Possession in Group'] = round(countries['Possession in␣
 ↪Group'] / 3, 2)
countries['Goals Per Game in Group'] = round(countries['Total Goals in Group'] /
 ↪ 3, 2)

countries['Total Goals'] = countries['Total Goals in Group'] + countries['Total␣
 ↪Goals in Round of 16'] + \
```

```
    countries['Total Goals in Quarter-final'] + countries['Total Goals in␣
↪Semi-final'] + countries['Total Goals in Play-off for third place'] \
          + countries['Total Goals in Final']

countries.head()
```

[ ]:

Nation	Rank	Points	Possession in Group	Possession in Round of 16	\
Brazil	1	1841.30	160	47	
Belgium	2	1816.71	149	0	
Argentina	3	1773.88	181	53	
France	4	1759.78	156	48	
England	5	1728.47	181	54	

Nation	Possession in Quarter-final	Possession in Semi-final	\
Brazil	45	0	
Belgium	0	0	
Argentina	44	34	
France	36	34	
England	54	0	

Nation	Possession in Play-off for third place	Possession in Final	\
Brazil	0	0	
Belgium	0	0	
Argentina	0	46	
France	0	40	
England	0	0	

Nation	Total Passes in Group	Total Passes in Round of 16	…	\
Brazil	1698	616	…	
Belgium	1779	0	…	
Argentina	2005	711	…	
France	1873	540	…	
England	1947	597	…	

Nation	Forced Turnovers in Group	Forced Turnovers in Round of 16	\
Brazil	211	73	
Belgium	180	0	
Argentina	176	67	
France	223	71	
England	171	60	

Forced Turnovers in Quarter-final	Forced Turnovers in Semi-final	\

```
Nation
Brazil                                    77                                  0
Belgium                                    0                                  0
Argentina                                 79                                 85
France                                    54                                 72
England                                   49                                  0

          Forced Turnovers in Play-off for third place  \
Nation
Brazil                                                 0
Belgium                                                0
Argentina                                              0
France                                                 0
England                                                0

          Forced Turnovers in Final  GroupID  Average Possession in Group  \
Nation
Brazil                            0        G                        53.33
Belgium                           0        F                        49.67
Argentina                        87        C                        60.33
France                          104        D                        52.00
England                           0        B                        60.33

          Goals Per Game in Group  Total Goals
Nation
Brazil                       1.00            8
Belgium                      0.33            1
Argentina                    1.67           15
France                       2.00           16
England                      3.00           13

[5 rows x 120 columns]
```

[ ]:
```
groupA = countries.loc[countries['GroupID'] == 'A']
groupB = countries.loc[countries['GroupID'] == 'B']
groupC = countries.loc[countries['GroupID'] == 'C']
groupD = countries.loc[countries['GroupID'] == 'D']
groupE = countries.loc[countries['GroupID'] == 'E']
groupF = countries.loc[countries['GroupID'] == 'F']
groupG = countries.loc[countries['GroupID'] == 'G']
groupH = countries.loc[countries['GroupID'] == 'H']

print(f'Group A mean: {groupA["Rank"].mean()}')
print(f'Group B mean: {groupB["Rank"].mean()}')
print(f'Group C mean: {groupC["Rank"].mean()}')
print(f'Group D mean: {groupD["Rank"].mean()}')
print(f'Group E mean: {groupE["Rank"].mean()}')
```

```
print(f'Group F mean: {groupF["Rank"].mean()}')
print(f'Group G mean: {groupG["Rank"].mean()}')
print(f'Group H mean: {groupH["Rank"].mean()}')
```

```
Group A mean: 30.0
Group B mean: 15.0
Group C mean: 23.25
Group D mean: 20.5
Group E mean: 18.25
Group F mean: 19.25
Group G mean: 20.0
Group H mean: 28.0
```

It seems that based on the mean ranks of our groups, Group B has the highest average rank, while Group A seems to have the lowest. Let's take a look at the two groups, and see what that's about.

[ ]:
```
groupB
```

[ ]:
```
               Rank   Points  Possession in Group  Possession in Round of 16  \
Nation
England           5  1728.47                  181                         54
United States    16  1627.48                  136                         54
Wales            19  1569.82                  123                          0
Iran             20  1564.61                   94                          0

               Possession in Quarter-final  Possession in Semi-final  \
Nation
England                                 54                         0
United States                            0                         0
Wales                                    0                         0
Iran                                     0                         0

               Possession in Play-off for third place  Possession in Final  \
Nation
England                                             0                   0
United States                                       0                   0
Wales                                               0                   0
Iran                                                0                   0

               Total Passes in Group  Total Passes in Round of 16  …  \
Nation                                                             …
England                         1947                         597  …
United States                   1466                         567  …
Wales                           1242                           0  …
Iran                             982                           0  …

               Forced Turnovers in Group  Forced Turnovers in Round of 16  \
Nation
```

```
England                          171                                60
United States                    216                                77
Wales                            210                                 0
Iran                             219                                 0

              Forced Turnovers in Quarter-final  \
Nation
England                                      49
United States                                 0
Wales                                         0
Iran                                          0

              Forced Turnovers in Semi-final  \
Nation
England                                    0
United States                              0
Wales                                      0
Iran                                       0

              Forced Turnovers in Play-off for third place  \
Nation
England                                                  0
United States                                            0
Wales                                                    0
Iran                                                     0

              Forced Turnovers in Final  GroupID  \
Nation
England                             0        B
United States                       0        B
Wales                               0        B
Iran                                0        B

              Average Possession in Group  Goals Per Game in Group  \
Nation
England                             60.33                      3.00
United States                       45.33                      0.67
Wales                               41.00                      0.33
Iran                                31.33                      1.33

              Total Goals
Nation
England                13
United States           3
Wales                   1
Iran                    4
```

[4 rows x 120 columns]

[ ]:
```
groupA
```

[ ]:
```
             Rank   Points  Possession in Group  Possession in Round of 16  \
Nation
Netherlands     8  1694.51                  147                         33
Senegal        18  1584.38                  124                         35
Ecuador        44  1464.39                  140                          0
Qatar          50  1439.89                  122                          0

             Possession in Quarter-final  Possession in Semi-final  \
Nation
Netherlands                           45                         0
Senegal                                0                         0
Ecuador                                0                         0
Qatar                                  0                         0

             Possession in Play-off for third place  Possession in Final  \
Nation
Netherlands                                       0                    0
Senegal                                           0                    0
Ecuador                                           0                    0
Qatar                                             0                    0

             Total Passes in Group  Total Passes in Round of 16  …  \
Nation                                                          …
Netherlands                   1757                          396  …
Senegal                       1163                          393  …
Ecuador                       1337                            0  …
Qatar                         1333                            0  …

             Forced Turnovers in Group  Forced Turnovers in Round of 16  \
Nation
Netherlands                        220                               101
Senegal                            192                                74
Ecuador                            183                                 0
Qatar                              171                                 0

             Forced Turnovers in Quarter-final  \
Nation
Netherlands                                 91
Senegal                                      0
Ecuador                                      0
Qatar                                        0

             Forced Turnovers in Semi-final  \
```

```
Nation
Netherlands                                0
Senegal                                    0
Ecuador                                    0
Qatar                                      0

            Forced Turnovers in Play-off for third place  \
Nation
Netherlands                                             0
Senegal                                                 0
Ecuador                                                 0
Qatar                                                   0

            Forced Turnovers in Final  GroupID  Average Possession in Group  \
Nation
Netherlands                         0        A                        49.00
Senegal                             0        A                        41.33
Ecuador                             0        A                        46.67
Qatar                               0        A                        40.67

            Goals Per Game in Group  Total Goals
Nation
Netherlands                    1.67           10
Senegal                        1.67            5
Ecuador                        1.33            4
Qatar                          0.33            1

[4 rows x 120 columns]
```

1.2.3 Players Dataset - loading and cleaning

[ ]:
```
players = pd.read_csv('player_stats.csv')

duplicate_columns = ['player', 'club', 'position', 'age', 'team', 'birth_year',␣
 ↪'minutes_90s']
players = players[duplicate_columns]

keeper_columns =␣
 ↪['position','team','age','club','birth_year','games','games_starts','minutes','minutes_90s'

player_defense = pd.read_csv('player_defense.csv').drop(duplicate_columns[2:],␣
 ↪axis=1)
player_shooting = pd.read_csv('player_shooting.csv').drop(duplicate_columns[2:
 ↪], axis=1)
player_possession = pd.read_csv('player_possession.csv').
 ↪drop(duplicate_columns[2:], axis=1)
```

```
player_keepers = pd.read_csv('player_keepers.csv').drop(keeper_columns, axis=1)


# merging all of the above dataframes into one
players = players.merge(player_defense, on='player')
players = players.merge(player_shooting, on='player')
players = players.merge(player_possession, on='player')

#players = players.merge(player_keepers, on='player') -> for some reason␣
 ↪everything fucks up with keepers added


players['age'] = players['age'].astype(str).str[:2].astype(int)


players
```

[ ]:

```
                  player             club position  age        team  \
0             Aaron Mooy           Celtic       MF   32   Australia
1           Aaron Ramsey             Nice       MF   31       Wales
2      Abdelhamid Sabiri        Sampdoria       MF   26     Morocco
3      Abdelkarim Hassan       Al Sadd SC       DF   29       Qatar
4    Abderrazak Hamdallah       Al-Ittihad       FW   32     Morocco
..                    …              …      …  …         …
675       Ángel Di María         Juventus       MF   34   Argentina
676      Ángelo Preciado             Genk       DF   24     Ecuador
677         Éder Militão      Real Madrid       DF   24      Brazil
678         Óscar Duarte         Al-Wehda       DF   33  Costa Rica
679       İlkay Gündoğan  Manchester City       MF   32     Germany

     birth_year  minutes_90s  tackles  tackles_won  tackles_def_3rd  …  \
0          1990          4.0      9.0            6              4.0  …
1          1990          3.0      2.0            0              0.0  …
2          1996          2.0      3.0            1              1.0  …
3          1993          3.0      7.0            3              5.0  …
4          1990          0.8      0.0            0              0.0  …
..          …           …       …          …              …  …
675        1988          3.2      3.0            1              2.0  …
676        1998          2.9      7.0            5              3.0  …
677        1998          3.9      7.0            6              4.0  …
678        1989          3.0      4.0            2              4.0  …
679        1990          2.1      3.0            1              1.0  …

     touches_att_3rd  touches_att_pen_area  touches_live_ball  \
0               26.0                   0.0              255.0
1               42.0                   5.0              147.0
2               13.0                   1.0               86.0
```

```
3               17.0                  2.0              193.0
4               12.0                  5.0               28.0
..               …                    …                 …
675            132.0                 17.0              201.0
676             46.0                  3.0              162.0
677             55.0                  6.0              306.0
678              4.0                  1.0              132.0
679             55.0                  6.0              186.0

     dribbles_completed  dribbles  dribbles_completed_pct  miscontrols  \
0                   2.0       3.0                    66.7          5.0
1                   2.0       8.0                    25.0          9.0
2                   0.0       3.0                     0.0          0.0
3                   1.0       5.0                    20.0          2.0
4                   2.0       3.0                    66.7          4.0
..                  …         …                      …             …
675                13.0      25.0                    52.0         10.0
676                 0.0       4.0                     0.0          6.0
677                 0.0       0.0                     NaN          6.0
678                 0.0       0.0                     NaN          1.0
679                 2.0       2.0                   100.0          4.0

     dispossessed  passes_received  progressive_passes_received
0             4.0            152.0                          1.0
1             4.0             98.0                          7.0
2             3.0             54.0                          0.0
3             0.0            138.0                          1.0
4             3.0             18.0                          3.0
..            …               …                             …
675           6.0            163.0                         24.0
676           2.0             81.0                          1.0
677           1.0            217.0                          5.0
678           0.0             70.0                          0.0
679           1.0            142.0                          6.0

[680 rows x 54 columns]
```

Some things we could look at: - What club had the most players represented - Ratio of positions - Average age of players

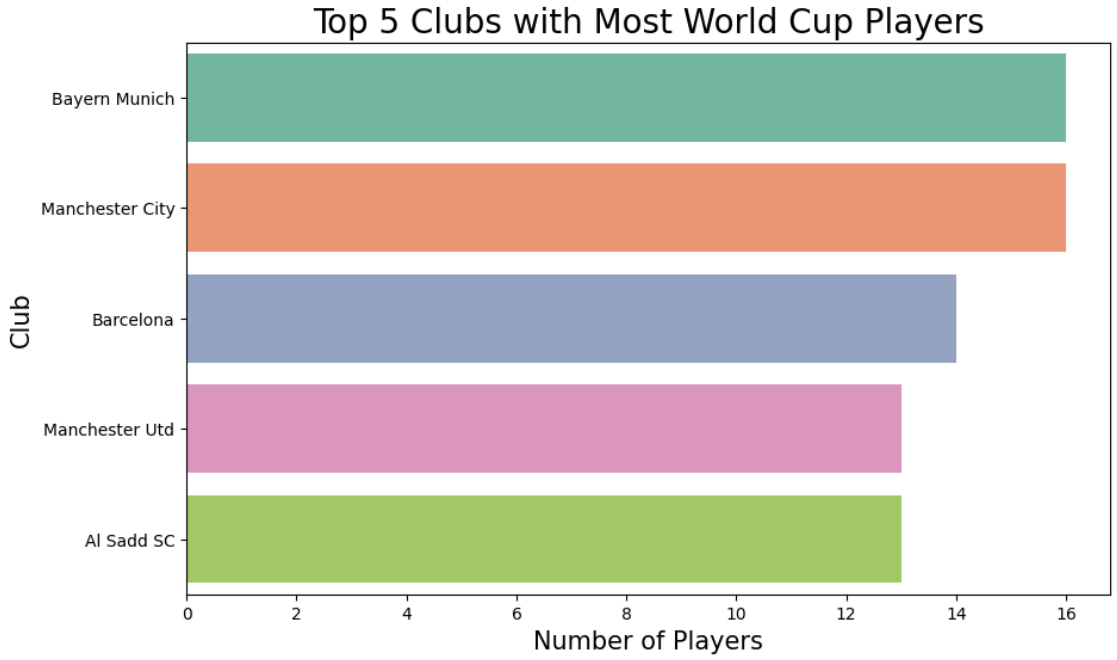
1.3 Visualizing the players, and their performances

Some things we want to see with our players:

- Most represented clubs
- Distribution of positions
- Average age of players
- Top goal scorers

- Top assisters
- Top players under 21 goals + assists (g/a)

[ ]:
```
plt.figure(figsize=(10, 6))
sns.countplot(y='club', data=players, order=players['club'].value_counts().
 ↪iloc[:5].index, palette='Set2')
plt.title('Top 5 Clubs with Most World Cup Players', fontsize=20)
plt.xlabel('Number of Players', fontsize=15)
plt.ylabel('Club', fontsize=15)
plt.show()
```

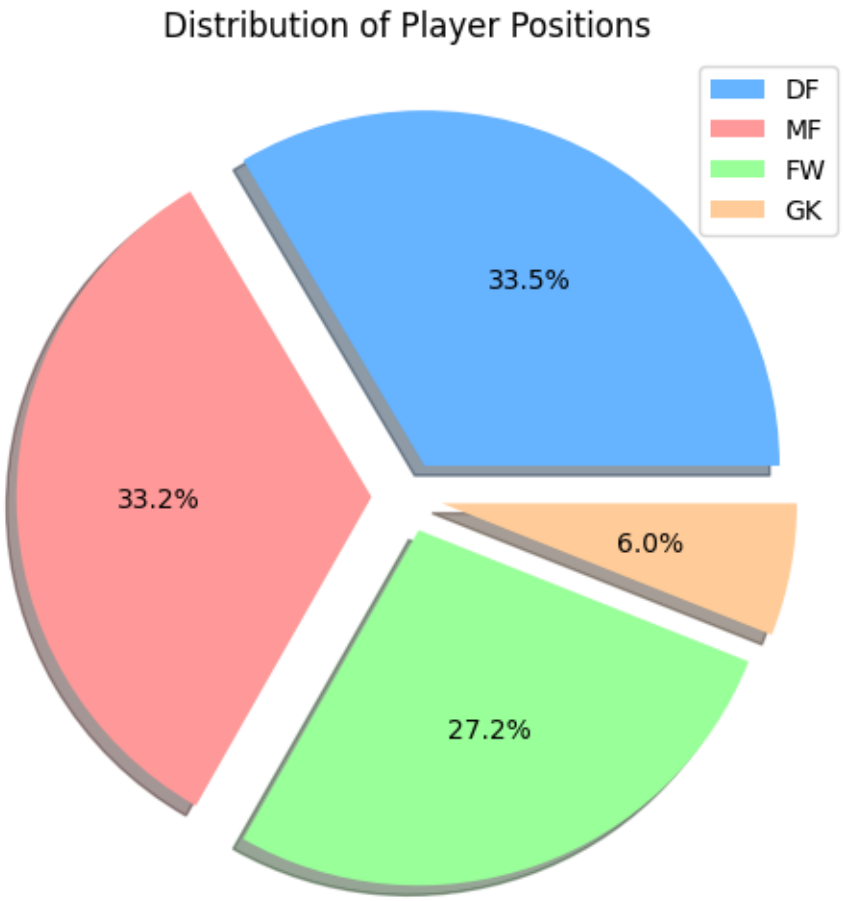


Al Sadd SC is an interesting outlier because all of these other clubs are very well known and highly regarded around the worl, but Al Sadd SC does not fit the mold of the rest of these historic clubs. The reason behind the strong showing from Al Saad SC is because it is a club in Qatar (who is the host nation of this World Cup), and the majority of the players from the Qatar national team actually play for that club.

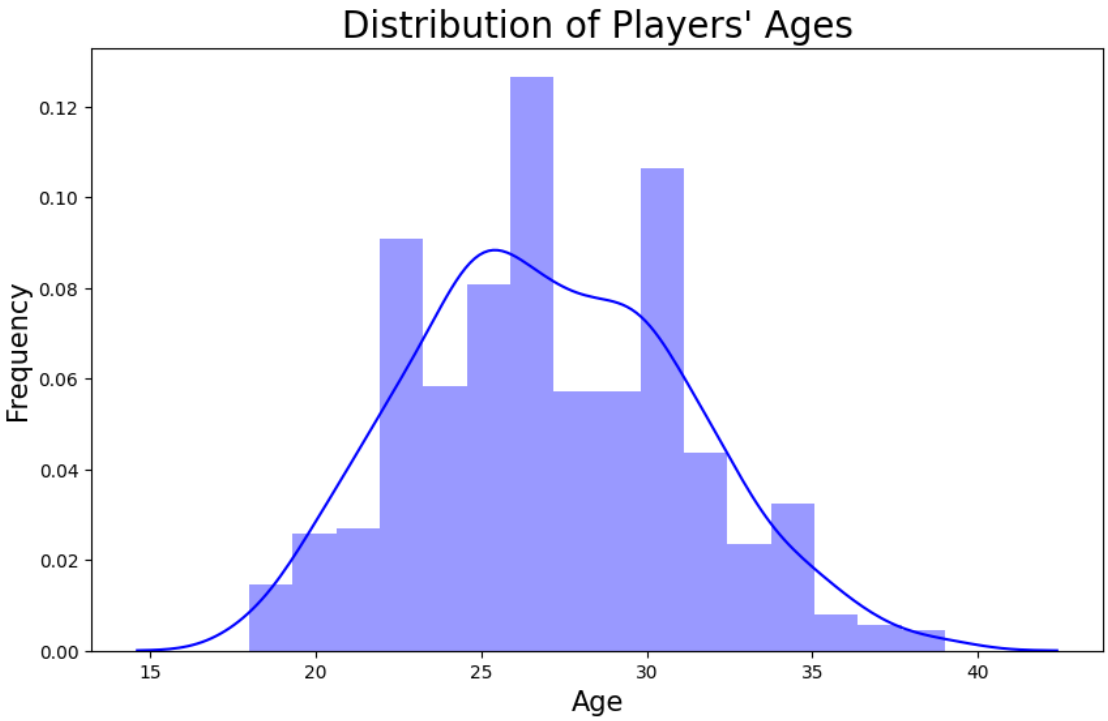
[ ]:
```
colors = ['#66b3ff','#ff9999','#99ff99','#ffcc99']

ax = plt.figure(figsize=(10, 6))

ax = players['position'].value_counts().plot(kind='pie',
                                             autopct='%1.1f%%', shadow=True,␣
 ↪explode=[0.1, 0.1, 0.1, 0.1], colors=colors,
                                             legend=True, title='Distribution of␣
 ↪Player Positions', ylabel='', labeldistance=None)
```

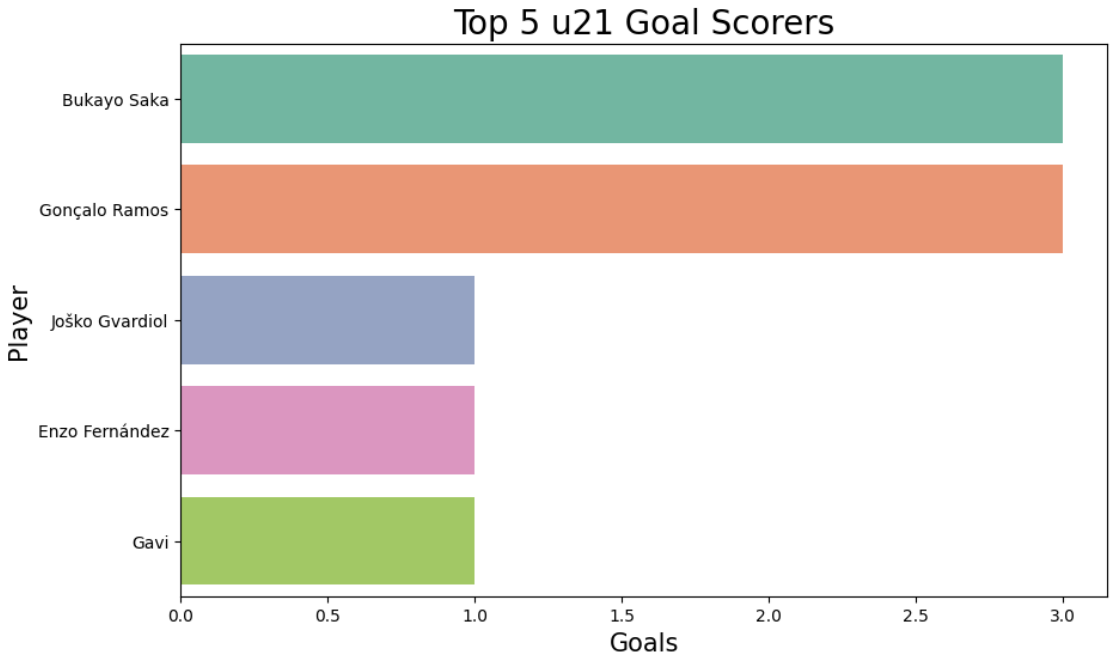


[ ]:
```
plt.figure(figsize=(10, 6))
sns.distplot(players['age'], color='blue')
plt.title('Distribution of Players\' Ages', fontsize=20)
plt.xlabel('Age', fontsize=15)
plt.ylabel('Frequency', fontsize=15)
plt.show()
```



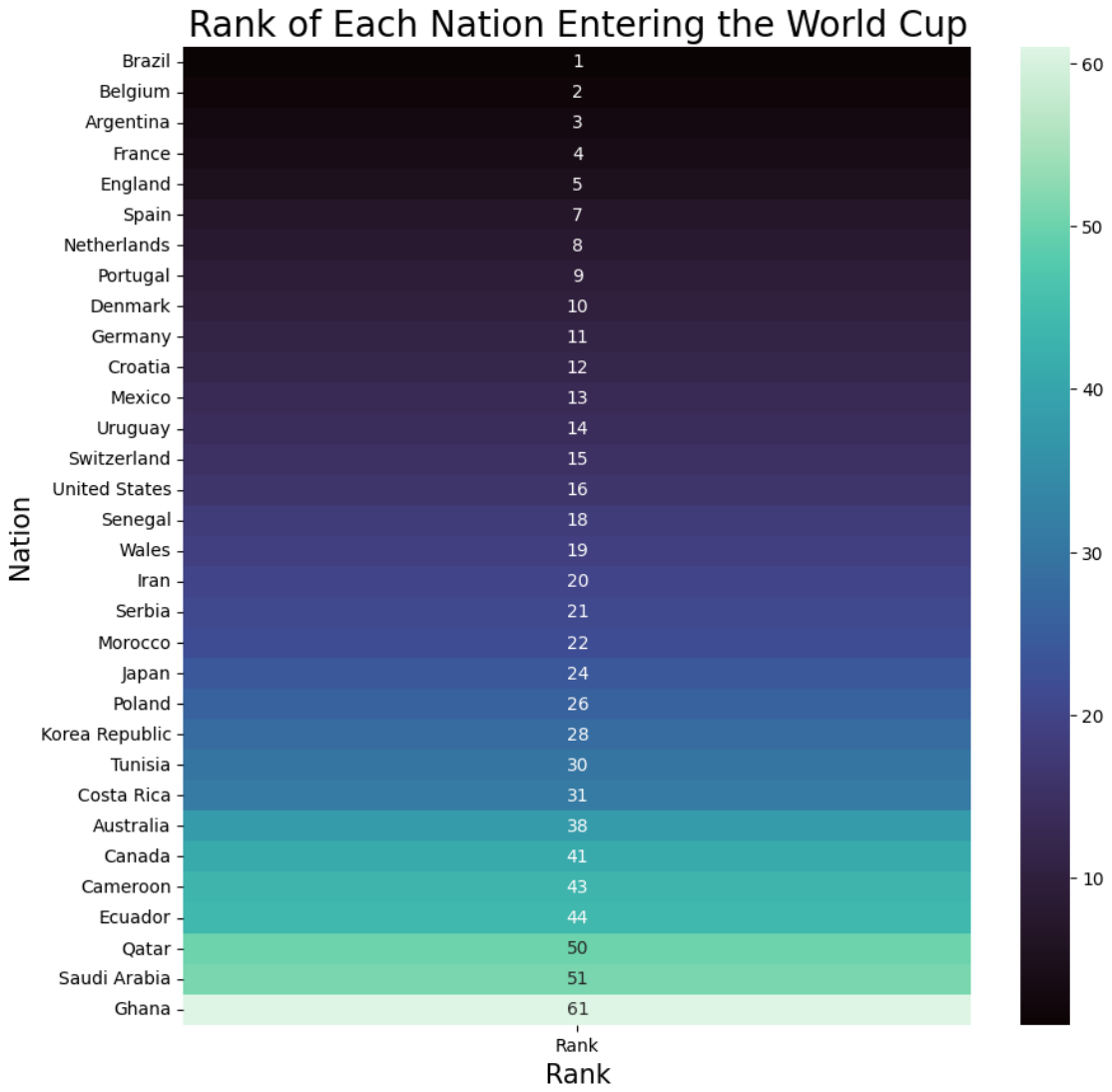
[ ]:
```
plt.figure(figsize=(10, 6))
sns.barplot(x='goals', y='player', data=players[players['age'] <= 21].
 ↪sort_values('goals', ascending=False).head(5), palette='Set2')
plt.title('Top 5 u21 Goal Scorers', fontsize=20)
plt.xlabel('Goals', fontsize=15)
plt.ylabel('Player', fontsize=15)
```

[ ]:
```
Text(0, 0.5, 'Player')
```

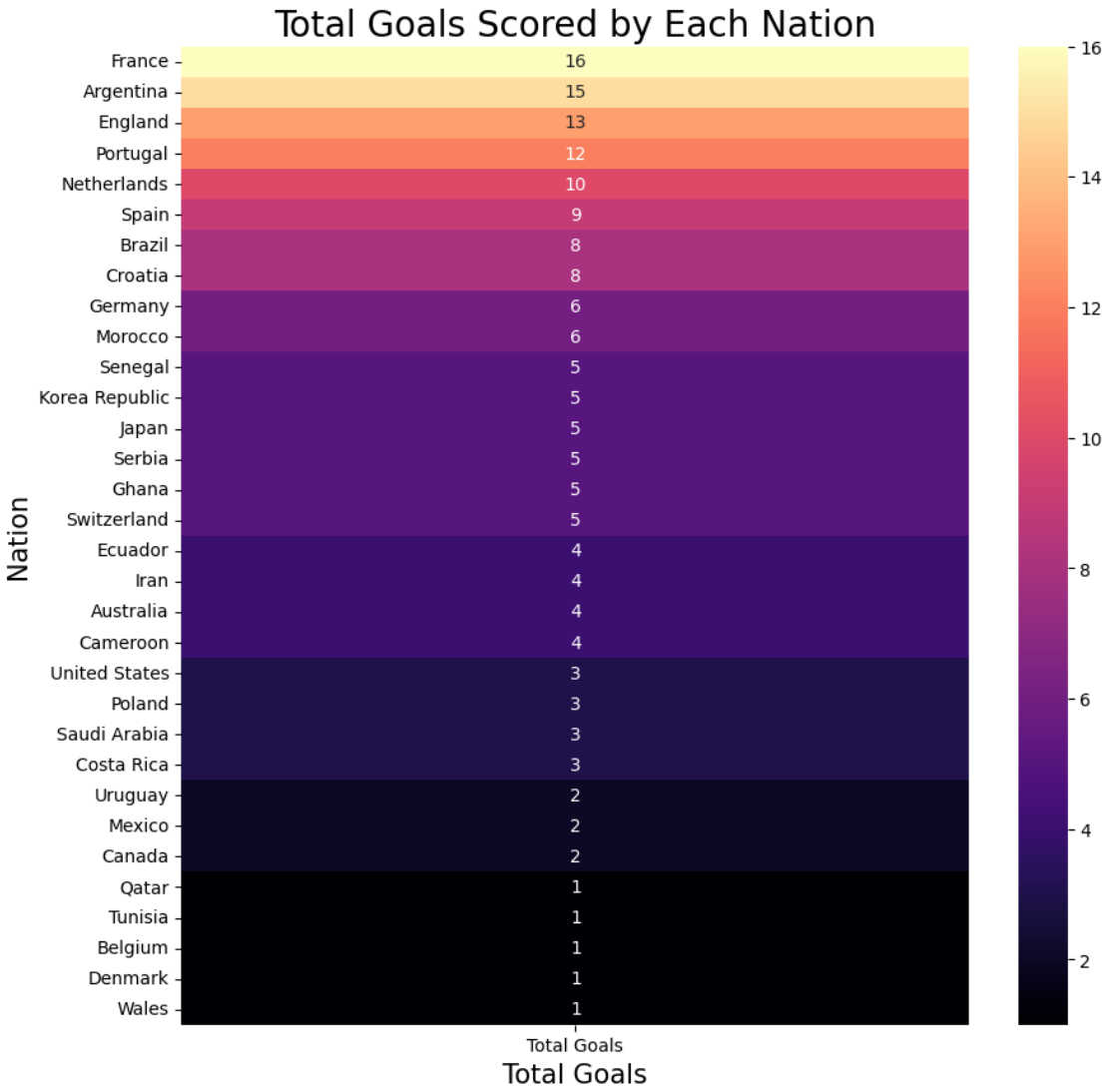


1.4 Visualizing the Group Stage

[ ]:
```
plt.figure(figsize=(10, 10))
sns.heatmap(countries['Rank'].to_frame(), annot=True, fmt='g', cmap='mako')
plt.title('Rank of Each Nation Entering the World Cup', fontsize=20)
plt.xlabel('Rank', fontsize=15)
plt.ylabel('Nation', fontsize=15)
plt.show()
```



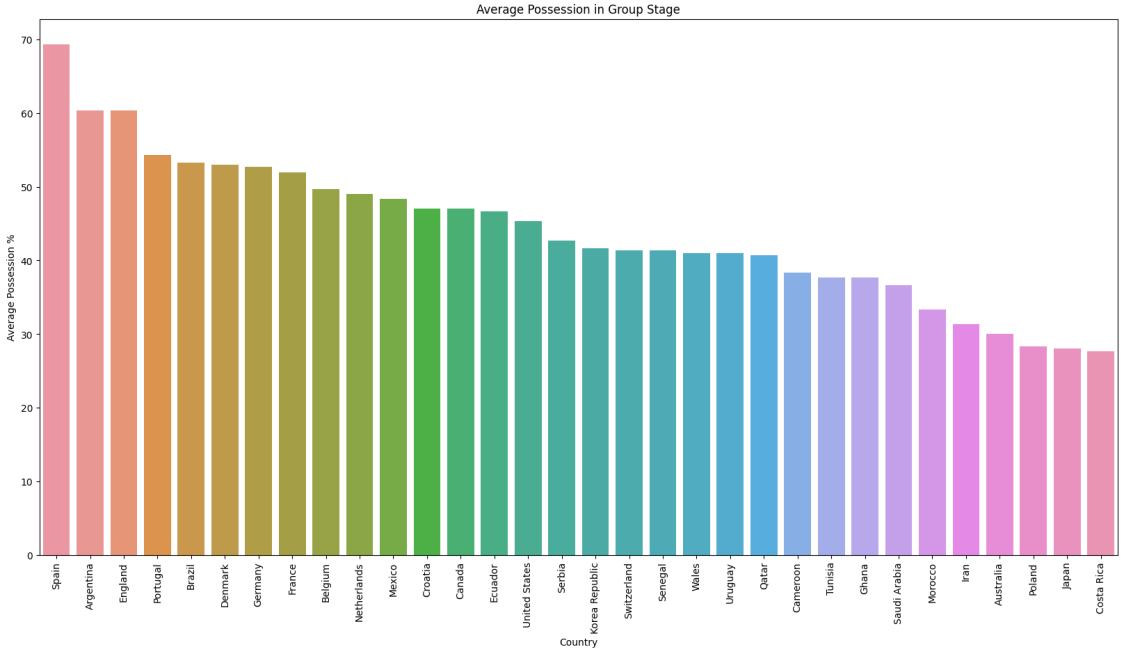
[ ]:
```
# create a heatmap using the Total Goals column
plt.figure(figsize=(10, 10))
sns.heatmap(countries[['Total Goals']].sort_values(by='Total Goals',␣
 ↪ascending=False), annot=True, cmap='magma')
plt.title('Total Goals Scored by Each Nation', fontsize=20)
plt.xlabel('Total Goals', fontsize=15)
plt.ylabel('Nation', fontsize=15)
plt.show()
```



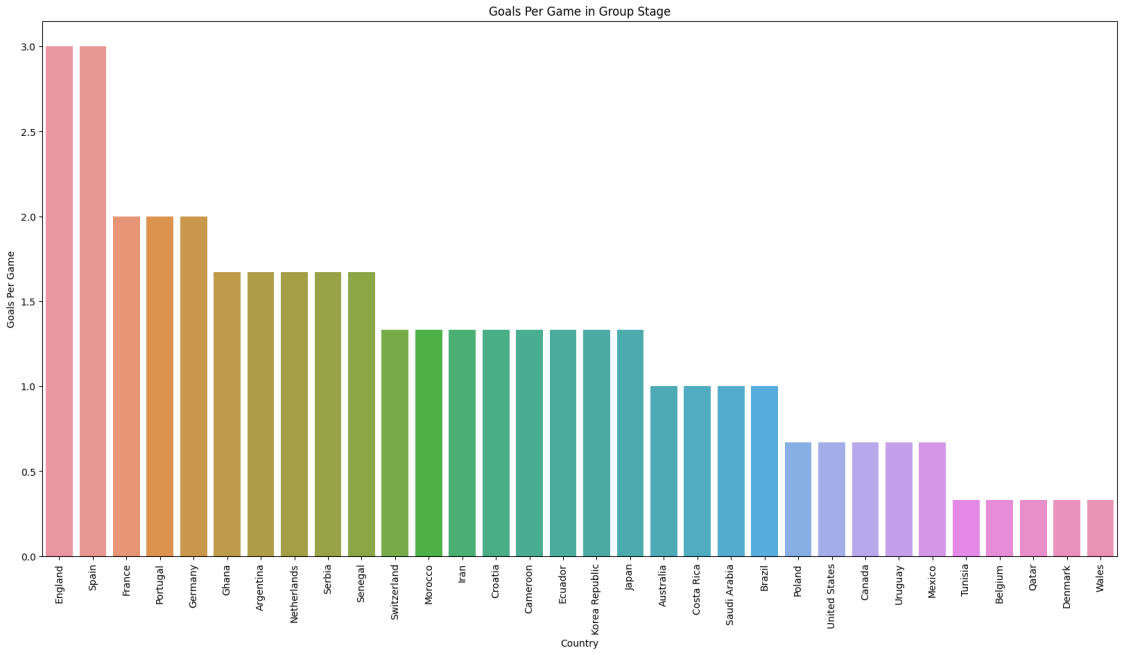
It makes sense that France and Argentina were the two top scorers tournament wide, because they were the two finalists, and went all the way.

[ ]:
```
# i want this to be colored by groupid but for some reason it doesnt want to␣
  ↪work...any ideas?
plt.figure(figsize=(20, 10))
sns.barplot(x=countries['Average Possession in Group'].
  ↪sort_values(ascending=False).index, y=countries['Average Possession in␣
  ↪Group'].sort_values(ascending=False))
plt.xticks(rotation=90)
plt.xlabel('Country')
plt.ylabel('Average Possession %')
plt.title('Average Possession in Group Stage')
```

```
plt.show()
```

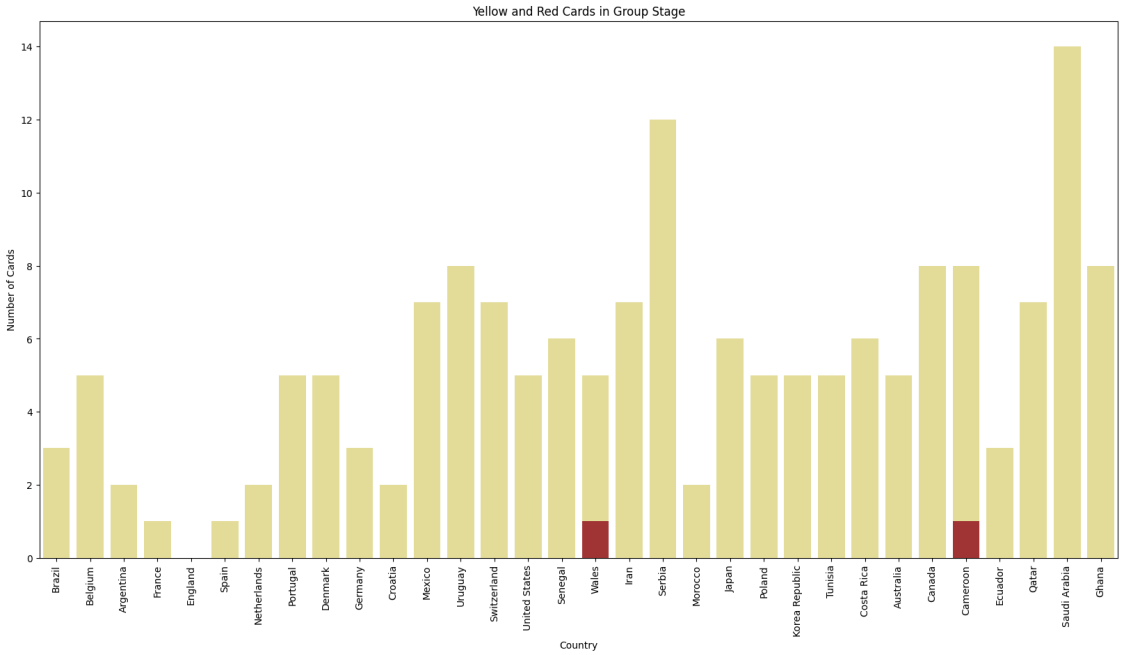


[ ]:
```
plt.figure(figsize=(20, 10))
sns.barplot(x=countries['Goals Per Game in Group'].sort_values(ascending=False).
  ↪index, y=countries['Goals Per Game in Group'].sort_values(ascending=False))
plt.xticks(rotation=90)
plt.xlabel('Country')
plt.ylabel('Goals Per Game')
plt.title('Goals Per Game in Group Stage')
plt.show()
```



It appears that this particular visualization gives us many different groups in tiers in which they found goals in the group stages. England and Spain were king among them with 3 goals averaged per match (who were also both in the top 3 of possession as well), while the likes of Tunisia, Belgium, Qatar, Denmark, and Wales were among the lowest with under 0.5 goals per match. Let's look further at these two kings of the Group Stage to see what else they have in common.

[ ]:
```
# create a multibar bar graph comparing yellow and red cards
plt.figure(figsize=(20, 10))
sns.barplot(x=countries.index, y=countries['Yellow Cards in Group'],␣
 ↪color='khaki')
sns.barplot(x=countries.index, y=countries['Red Cards in Group'],␣
 ↪color='firebrick')
plt.xticks(rotation=90)
plt.xlabel('Country')
plt.ylabel('Number of Cards')
plt.title('Yellow and Red Cards in Group Stage')
plt.show()
```



We can see that there were a lot of yellow cards distributed during the group stage, but not as many red cards. Wales and Cameroon were the only nations to have a player get sent off during the group stages, and England was the only nation not to pick up a single card during the round. Saudia Arabia, followed by Serbia were by far the most carded nations.

1.5 Visualizing the Round of 16

1.6 Visualizing the Quarter-Finals

1.7 Visualizing the Semi-Finals

1.8 Visualizing the Third-Place Match

1.9 Visualizing the Final