The Challenge

- How many matches were played each world cup year from 1930.
- Total goals scored for each tournament year.
- All teams who have reached finals and how many times.
- All teams who have reached semis and how many times.
- How many goals and average goals scored in all semi-finals.
- How many goals and average goals scored in all quarter-finals.
- How many goals and average number scored in all finals
- How many matches were played outside quarter-finals and above.
- **The #kicker**:
- Two new columns for each of the outcome of every match stating:
- a. outcome = D for Draw, A for AwayTeam Wins, H for HomeTeam wins.
- b. Winner of each game: 'Draw' if no winner.

PS: Our predominant choice of plotting library on this one is plotly

In [1]:
```
import pandas as pd
import plotly.express as px
import plotly.graph_objects as go
import numpy as np
```

In [2]:
```
#Read our dataset
df = pd.read_csv("world_cup_results.csv")
```

In [3]:
```
#Initial view of our dataframe shape
df.shape
```

Out[3]:
```
(852, 11)
```

In [4]:
```
#Some information about our df shows we have no missing values
#However our date field is not of the right type. We'll deal with it as we go
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 852 entries, 0 to 851
Data columns (total 11 columns):
Year           852 non-null int64
Date           852 non-null object
Time           852 non-null object
Round          852 non-null object
Stadium        852 non-null object
City           852 non-null object
HomeTeam       852 non-null object
HomeGoals      852 non-null int64
AwayGoals      852 non-null int64
AwayTeam       852 non-null object
Observation    852 non-null object
dtypes: int64(3), object(8)
memory usage: 73.3+ KB
```

In [5]:
```
#Depending on your data source, you might have column names with spaces
#One quick thing I do most times is to convert everything to lowercase and add an undrscore in place of spaces in na
#It's not the case here but I will drop in the flow all the same

# headers = [line.lower().replace(' ', '_') for line in df.columns]
# df.columns = headers
# df.head()
```

In [6]:
```
#let's deal with the duplicates
#Notice that from a shape of (852cols, 11rows) we now arrive at (836, 11). There was duplicates
df = df.drop_duplicates()
df.shape
```

Out[6]:
```
(836, 11)
```

Let's prep our data in antipaction of questions lined up

- We need a column for total goals scored: combining home and away goals for each row/match
- We wanna isolate the day of the week and month from the date column making them columns of their own.

In [7]:
```
#Total goals column
df['TotalGoals'] = df['HomeGoals'] + df['AwayGoals']
```

In [8]:
```
#get a day of the week and month columns
df['month'] = df['Date'].apply(lambda x: x.split('-')[1]) #split the literal string, pick the 2nd item which is the
df['day'] = pd.to_datetime(df['Date']).dt.day_name() #convert to datetime and get day of the week
```

In [9]:
```
#Let's see what our df looks like now by peeping the head
df.head(2)
```

Out[9]:

	Year	Date	Time	Round	Stadium	City	HomeTeam	HomeGoals	AwayGoals	AwayTeam	Observation	TotalGoals	month	day
0	1930	13-Jul-30	15:00	Group 1	Pocitos	Montevideo	France	4	1	Mexico		5	Jul	Saturday
1	1930	13-Jul-30	15:00	Group 4	Parque Central	Montevideo	USA	3	0	Belgium		3	Jul	Saturday

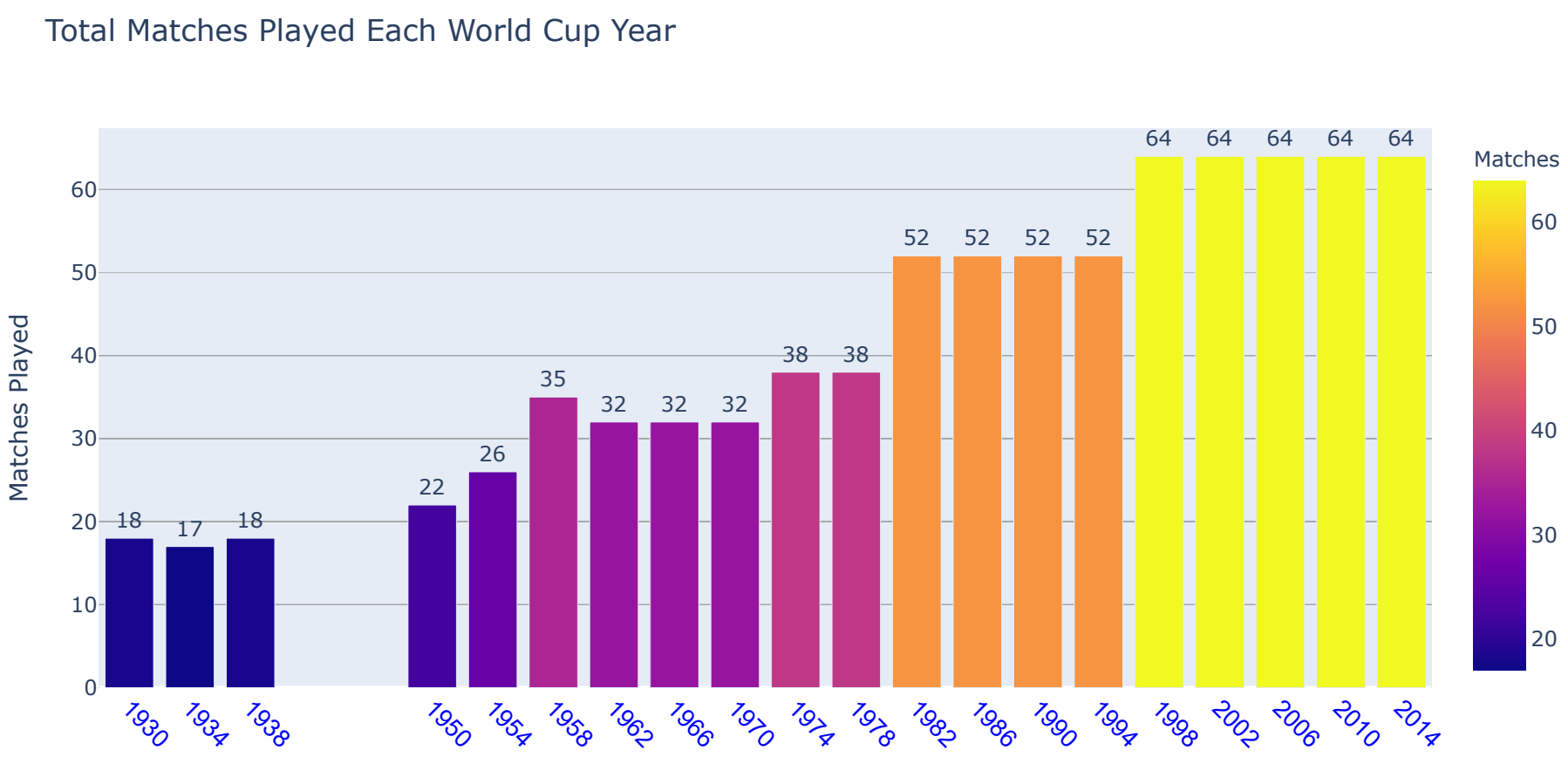
In [10]:
```
#For the kicker down the line we are going to add two more columns
#I like to see all my cols if possible so in anticipation of the 2 coming up, I'll drop some I KNOW I won't make use
#Notice that in this process  I have taken the liberty to order the columns
df = df[['Year', 'month', 'day', 'Time', 'Round', 'HomeTeam', 'HomeGoals', 'AwayTeam', 'AwayGoals', 'TotalGoals']]
df.head(2)
```

Out[10]:

	Year	month	day	Time	Round	HomeTeam	HomeGoals	AwayTeam	AwayGoals	TotalGoals
0	1930	Jul	Saturday	15:00	Group 1	France	4	Mexico	1	5
1	1930	Jul	Saturday	15:00	Group 4	USA	3	Belgium	0	3

Que 1: How many matches were played each world cup year from 1930.

In [11]:
```
#A value_count on the Year column nicely delivers this
#To plot this effortlessly with plotly, we will convert the result to a fresh dataframe
#Notice how nicely plotly highlights the expected years world cups were not played
matches_per_year = df.Year.value_counts() #a series to hold our values
all_games = pd.DataFrame(matches_per_year) #make series into a dataframe
all_games.reset_index(inplace=True) #reset it's index inplace
all_games.columns = ['Year', 'Matches'] #rename the columns as needed
fig = px.bar(all_games, x='Year', y='Matches', text='Matches', color='Matches', height=500,
             labels={'Matches':'Matches Played', 'Year':'World Cup Year'},
            title="Total Matches Played Each World Cup Year")
fig.update_traces(texttemplate='%{text}', textposition='outside')
fig.update_layout(uniformtext_minsize=8, uniformtext_mode='hide')
fig.update_xaxes(
    tickangle=45, tickfont=dict(family='Arial', color='blue', size=14),
    tickvals=[line for line in all_games.Year])
fig.show()
```



Salient Point 0

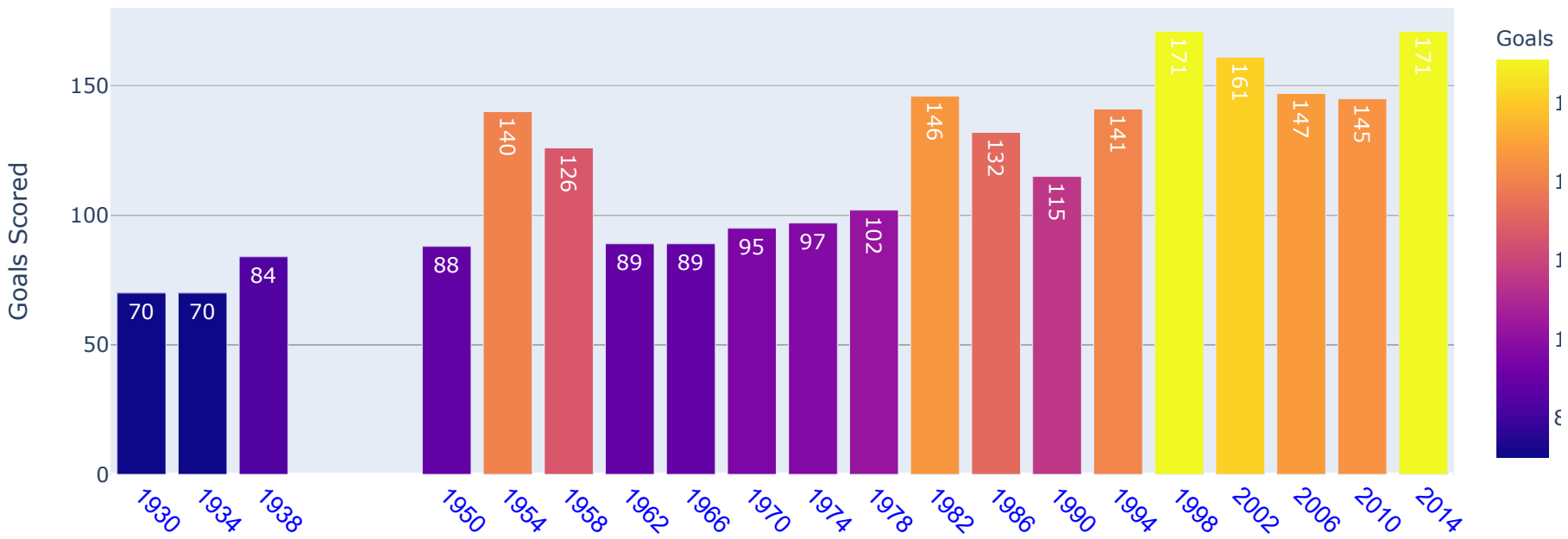
- My first salient observation is that there was no FIFA world cup in 1942 abd 1946 as a result of World War II

Que 2: Total goals scored for each tournament year.

- Group initial dataframe by year summing total goals
- Convert result to a dataframe and drop a plot on the result

In [12]:
```
all_goals = df.groupby(['Year']).TotalGoals.sum()
all_goals_df = pd.DataFrame(all_goals)
all_goals_df.reset_index(inplace=True) #reset it's index inplace
all_goals_df.columns = ['Year', 'Goals'] #rename the columns as needed

fig = px.bar(all_goals_df, x='Year', y='Goals', text='Goals', color='Goals', height=450,
             labels={'Goals':'Goals Scored', 'Year':'World Cup Year'},
            title="Total Goals Scored Each World Cup Year")
fig.update_traces(texttemplate='%{text}', textposition='inside')
fig.update_layout(uniformtext_minsize=8, uniformtext_mode='hide')
fig.update_xaxes(
    tickangle=45, tickfont=dict(family='Arial', color='blue', size=14),
    tickvals=[line for line in all_goals_df.Year])
fig.show()
```



Salient Point 1

- My second salient observation is that though it had less macthes played (at 26) than subsequent 5 world cups after it, the net shook more times in 1954 than them these 5 individually. That's remarkable. They either had terrible goalkeepers and/or defenders or strikers of that year were prolific amongs other considerations.

Que 3: All teams who have reached finals and how many times.

In [13]:
```
#Take a piece of the df corresponding to all 'Final' in the 'Round' column
all_finals = df[df['Round'] == 'Final']
all_finals.head()
```

Out[13]:

	Year	month	day	Time	Round	HomeTeam	HomeGoals	AwayTeam	AwayGoals	TotalGoals
17	1930	Jul	Tuesday	14:15	Final	Uruguay	4	Argentina	2	6
34	1934	Jun	Saturday	17:30	Final	Italy	2	Czechoslovakia	1	3
52	1938	Jun	Saturday	17:00	Final	Italy	4	Hungary	2	6
100	1954	Jul	Saturday	17:00	Final	Germany FR	3	Hungary	2	5
135	1958	Jun	Saturday	15:00	Final	Brazil	5	Sweden	2	7

In [14]:
```
#Let's make a list of all teams who reach this stage.
#This will be a list of all featuring HomeTeams and AwayTeams
#A simple concatenation of a python list of both will do
teams = [line for line in all_finals.HomeTeam] + [line for line in all_finals.AwayTeam]
#Peep a sample
teams[:5]
```

Out[14]: ['Uruguay', 'Italy', 'Italy', 'Germany FR', 'Brazil']

In [15]:
```
#To count the frequency that I am going to eventually plot I prefer to use a dataframe. It's seamless
#So I will make a dataframe from the list 'teams' and take a drop a value_counts(). Neat, yea?
all_finals_df = pd.DataFrame(columns=['Teams'], data = teams)
#peep the head()
all_finals_df.head(2)
```

Out[15]:

	Teams
0	Uruguay
1	Italy

In [16]:
```
#To demonstrate this value_counts() counting, see the result before we plot
#PS: I am choosing to leave Germany and Germany FR as different entities
all_finals_df.Teams.value_counts()
```

Out[16]:
```
Italy            6
Brazil           6
Germany FR       6
Argentina        5
Netherlands      3
France           2
Germany          2
Hungary          2
Czechoslovakia   2
Uruguay          1
England          1
Spain            1
Sweden           1
Name: Teams, dtype: int64
```

In [17]:
```
#Ler me get this same result outside pandas
finals_teams = {} #Dict to team as key and apperance number as value
for team in teams:
    if team in finals_teams.keys(): #if this team is already in the dict
        finals_teams[team] += 1 #increment it by one
    else: #else
        finals_teams[team] = 1 #It's its first instance in the loop, assign it a value of 1

finals_teams
```

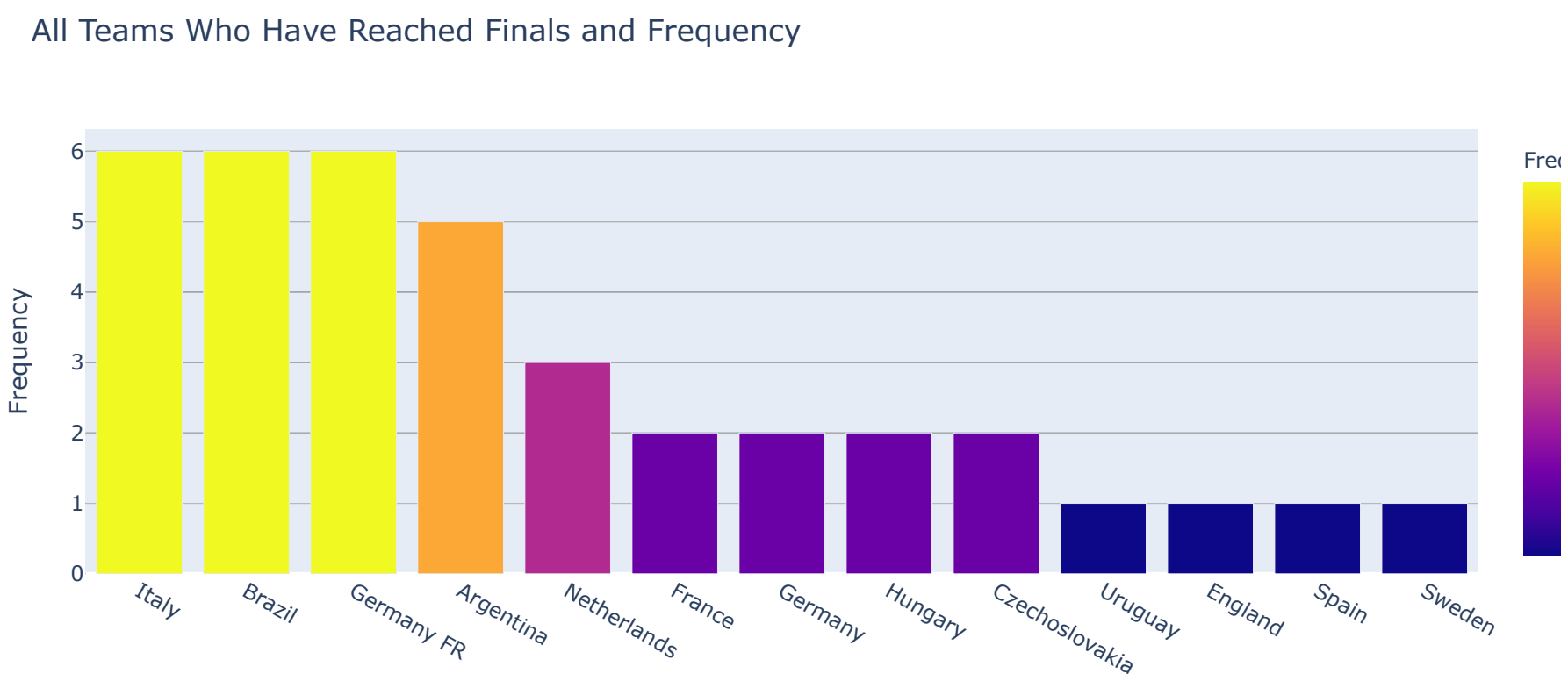
Out[17]:
```
{'Uruguay': 1,
 'Italy': 6,
 'Germany FR': 6,
 'Brazil': 6,
 'England': 1,
 'Netherlands': 3,
 'Argentina': 5,
 'Germany': 2,
 'Czechoslovakia': 2,
 'Hungary': 2,
 'Sweden': 1,
 'France': 2,
 'Spain': 1}
```

In [18]:
```
#We know that a python dictionary as a property is unordered so we can't successfully sort a regular dict
#The above is not sorted so let's sort and reverse to get it in descending order.
#Notice that the result is a list of tuples. To plot take not of this.
#Compare the result below with what value_counts() gave us some cells up.
#I will prefer to plot with a dataframe made from value_counts()
sorted(finals_teams.items(), key=lambda x: x[1], reverse=True)
```

Out[18]:
```
[('Italy', 6),
 ('Germany FR', 6),
 ('Brazil', 6),
 ('Argentina', 5),
 ('Netherlands', 3),
 ('Germany', 2),
 ('Czechoslovakia', 2),
 ('Hungary', 2),
 ('France', 2),
 ('Uruguay', 1),
 ('England', 1),
 ('Sweden', 1),
 ('Spain', 1)]
```

In [19]:
```
#Make a dataframe from counting values in all_finals_df
finals_teams_ranked = all_finals_df.Teams.value_counts()
finals_teams_ranked_df = pd.DataFrame(finals_teams_ranked)
finals_teams_ranked_df.reset_index(inplace=True)
finals_teams_ranked_df.columns = ['Teams', 'Frequency'] #rename the columns as needed

fig = px.bar(finals_teams_ranked_df, x='Teams', y='Frequency', color='Frequency', height=450,
             labels={'Teams':'Teams in the Finals'},
            title="All Teams Who Have Reached Finals and Frequency")
fig.update_layout(uniformtext_minsize=8)
fig.show()
```



Que 4: All teams who have reached semis and how many times.

- Much like the previous item but this time done on Semi-finals

In [20]:
```
#Take a piece of the df corresponding to all 'Semi-finals' in the 'Round' column
all_semi_finals = df[df['Round'] == 'Semi-finals']
all_semi_finals.head()
```

Out[20]:

	Year	month	day	Time	Round	HomeTeam	HomeGoals	AwayTeam	AwayGoals	TotalGoals
15	1930	Jul	Friday	14:45	Semi-finals	Argentina	6	USA	1	7
16	1930	Jul	Saturday	14:45	Semi-finals	Uruguay	6	Yugoslavia	1	7
31	1934	Jun	Saturday	16:30	Semi-finals	Italy	1	Austria	0	1
32	1934	Jun	Saturday	16:30	Semi-finals	Czechoslovakia	3	Germany	1	4
49	1938	Jun	Wednesday	18:00	Semi-finals	Hungary	5	Sweden	1	6

In [21]:
```
#Make a list of all teams invovled Home and Away
teams = [line for line in all_semi_finals.HomeTeam] + [line for line in all_semi_finals.AwayTeam]
```

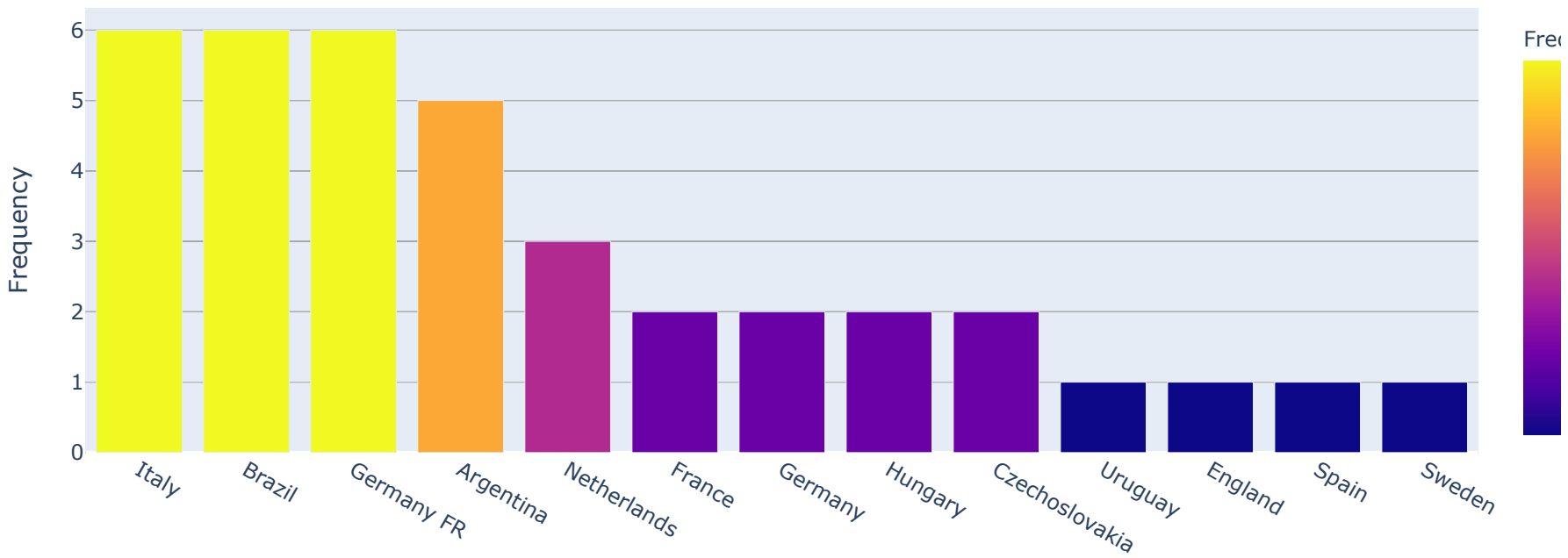
In [22]:
```
#Make a df of teams
all_semi_finals_df = pd.DataFrame(columns=['Teams'], data = teams)
#peep the head()
all_semi_finals_df.head(2)
```

Out[22]:

	Teams
0	Argentina
1	Uruguay

In [23]:
```
#Make a dataframe from counting values in all_semi_finals
#See 'Finals' cell above for explanation as the steps are identical. We are avoiding functions for practise
semifinals_teams_ranked = all_semi_finals_df.Teams.value_counts()
semifinals_teams_ranked_df = pd.DataFrame(semifinals_teams_ranked)
semifinals_teams_ranked_df.reset_index(inplace=True)
semifinals_teams_ranked_df.columns = ['Teams', 'Frequency']

fig = px.bar(finals_teams_ranked_df, x='Teams', y='Frequency', color='Frequency', height=450,
             labels={'Teams':'Teams in the Finals'},
            title="All Teams Who Have Reached Semi-Final and Frequency")
fig.update_layout(uniformtext_minsize=8)
fig.show()
```



Que 5: How many goals and average goals scored in all semi-finals.

In [24]:
```
#Continue with our dataframe holding only semi-final matches
#Let's take a sum and mean of 'TotalGoals'
semi_goals_sum = all_semi_finals.TotalGoals.sum()
semi_goals_ave = all_semi_finals.TotalGoals.mean()
print(f"{semi_goals_sum} goals were scored in all Semi-Finals\nAn average of {semi_goals_ave:.2f} in every match.")
```

```
123 goals were scored in all Semi-Finals
An average of 3.62 in every match.
```

Que 6: How many goals and average goals scored in all quarter-finals.

In [25]:
```
#Get a slice of the original df for all quarter-finals
all_qtrs = df[df['Round'] == 'Quarter-finals']
all_qtrs.head()
```

Out[25]:

	Year	month	day	Time	Round	HomeTeam	HomeGoals	AwayTeam	AwayGoals	TotalGoals
26	1934	May	Wednesday	16:30	Quarter-finals	Czechoslovakia	3	Switzerland	2	5
27	1934	May	Wednesday	16:30	Quarter-finals	Germany	2	Sweden	1	3
28	1934	May	Wednesday	16:30	Quarter-finals	Italy	1	Spain	1	2
29	1934	May	Wednesday	16:30	Quarter-finals	Austria	2	Hungary	1	3
30	1934	Jun	Thursday	16:30	Quarter-finals	Italy	1	Spain	0	1

In [26]:
```
qtrs_goals_sum = all_qtrs.TotalGoals.sum()
qtrs_goals_ave = all_qtrs.TotalGoals.mean()
print(f"{qtrs_goals_sum} goals were scored in all Semi-Finals\nAn average of {qtrs_goals_ave:.2f} in every match.")
```

```
175 goals were scored in all Semi-Finals
An average of 2.82 in every match.
```

In [27]:
```
#All goals in finals
finals = df[df['Round'] == 'Final']['HomeGoals'].sum() + df[df['Round'] == 'Final']['AwayGoals'].sum()#[['HomeTeam',
print(f"{finals} goals in finals")
```

```
68 goals in finals
```

Que 7: How many goals and average number scored in all finals

In [28]:
```
#Working with the piece of the original df holding finals
finals_goals_sum = all_finals.TotalGoals.sum()
finals_goals_ave = all_finals.TotalGoals.mean()
print(f"{finals_goals_sum} goals were scored in all Semi-Finals\nAn average of {finals_goals_ave:.2f} in every match
```

```
68 goals were scored in all Semi-Finals
An average of 3.58 in every match.
```

Que 8: How many matches were played outside quarter-finals and above.

In [29]:
```
#Let's be creative here!
#First get a slice with no finals
df_less_finals = df[df['Round'] != 'Final']

#From there get a slies with no semi-finals and viola we are left with all matches neither finals or semis
df_less_finals_semis = df_less_finals[df_less_finals['Round'] != 'Semi-Finals']

#One more dropping qtrs. This is fun.
df_less_finals_semis_qtrs = df_less_finals_semis[df_less_finals_semis['Round'] != 'Quarter-finals']
```

In [30]:
```
#Did it work? Well, let's check!
'Final' in df_less_finals_semis_qtrs.Round.tolist() or 'Semi-Finals' in df_less_finals_semis_qtrs.Round.tolist()
```

Out[30]: False

In [31]:
```
#Just in case that was lady-luck, let's make sure other Rounds are there
'Round of 16' in df_less_finals_semis_qtrs.Round.tolist()
```

Out[31]: True

In [32]:
```
#Total matches in this slice of the dataframe is same number of rows. A number of move will show the number
d_rest0 = df_less_finals_semis_qtrs.shape[0]
d_rest1 = len(df_less_finals_semis_qtrs)

d_rest0 == d_rest1
```

Out[32]: True

In [33]:
```
print(f"There are {d_rest0} matches played outside Quater-finals and above")
```

```
There are 755 matches played outside Quater-finals and above
```

The Kicker.

Ques 9, 10:

- Two new columns for each of the outcome of every match stating:
- a. outcome = D for Draw, A for AwayTeam Wins, H for HomeTeam wins.
- b. Winner of each game: 'Draw' if no winner.

In [34]:
```
#I love python lists a lot as I know them in and out
#I will use a zip of four different columns from the datafarame  to solve the kicker
# a python list of all four columns we are considering
AwayT_list = df['AwayTeam'].tolist()
HomeT_list = df['HomeTeam'].tolist()
AwayG_list = df['AwayGoals'].tolist()
HomeG_list = df['HomeGoals'].tolist()

#Two empty lists to hold our values for the two new columns
verdict, winner = [], []

#We zip the four lists created and step through them looking for the kicker condition, assigning values as we go
for at, ht, ag, hg in zip (AwayT_list, HomeT_list, AwayG_list, HomeG_list):
    if ag > hg:
        verdict.append('A')
        winner.append (at)
    elif hg > ag:
        verdict.append('H')
        winner.append(ht)
    elif hg == ag:
        if ag == 0:
            verdict.append('D')
            winner.append('Draw')
        else:
            verdict.append('A')
            winner.append(at)

#Finally write the two new columns to our dataframe
df['Verdict'] = verdict
df['Winner'] = winner
```

In [35]:
```
df.sample(10)
```

Out[35]:

	Year	month	day	Time	Round	HomeTeam	HomeGoals	AwayTeam	AwayGoals	TotalGoals	Verdict	Winner
467	1994	Jun	Saturday	16:00	Group E	Italy	0	Republic of Ireland	1	1	A	Republic of Ireland
338	1982	Jun	Thursday	17:15	Group 2	Algeria	3	Chile	2	5	H	Algeria
465	1994	Jun	Friday	15:00	Group C	Germany	1	Bolivia	0	1	H	Germany
393	1986	Jun	Thursday	12:00	Group D	Algeria	0	Spain	3	3	A	Spain
7	1930	Jul	Wednesday	14:45	Group 4	USA	3	Paraguay	0	3	H	USA
685	2006	Jun	Thursday	16:00	Group E	Ghana	2	USA	1	3	H	Ghana
565	1998	Jun	Saturday	21:00	Round of 16	Brazil	4	Chile	1	5	H	Brazil
512	1994	Jul	Wednesday	16:00	Semi-finals	Bulgaria	1	Italy	2	3	A	Italy
435	1990	Jun	Sunday	21:00	Group E	Belgium	3	Uruguay	1	4	H	Belgium
347	1982	Jun	Tuesday	21:00	Group 2	Germany FR	0	England	0	0	D	Draw

Bonus Content ¶

- A sunburst chart showing all Finals and Semi-final games
- How many goals scored in Jun/Jul
- Of Jun or July how many goals were scored on the day of the week they were played

In [36]:
```
#Assemble all games played in Finals and Semi-finals
finals = df[df['Round'] == 'Final']
semis = df[df['Round']== 'Semi-finals']

#Conct both dataframes resetting the index
finals_semis = pd.concat([finals, semis]).reset_index(drop=True)
finals_semis.shape
```

Out[36]: (53, 12)

In [37]:
```
#Let's cherry-pick the columns we need
plot_df = finals_semis[['TotalGoals', 'Round', 'Year', 'month', 'day']]
plot_df.head(1)
```

Out[37]:

	TotalGoals	Round	Year	month	day
0	6	Final	1930	Jul	Tuesday

In [38]:

```
#The Plot

values2 = [68, 123, 36, 32, 65, 58, 20, 16, 6, 15, 5, 6, 25, 24, 5, 11, 11, 19, 8, 3, 7, 3, 7]

fig = go.Figure(go.Sunburst(
    labels=[
        "Final", "Semi-finals", "Jun", "Jul", 'Jun ', 'Jul ',
        'Saturday', 'Sunday',
        'Sunday ', 'Friday ', 'Saturday ', 'Tuesday ',
        'Monday  ', 'Saturday  ', 'Tuesday  ', 'Wednesday  ',
        'Friday   ', 'Monday   ', 'Sunday   ', 'Saturday   ', 'Thursday   ', 'Tuesday   ', 'Wednesday   '
    ],
    parents=[
        "", "", "Final", "Final", 'Semi-finals', 'Semi-finals',
        'Jun', 'Jun',
        'Jul', 'Jul', 'Jul', 'Jul',
        'Jun ', 'Jun ', 'Jun ', 'Jun ',
        'Jul ', 'Jul ', 'Jul ', 'Jul ', 'Jul ', 'Jul ', 'Jul '
    ],
    values=values2),
                layout=go.Layout(paper_bgcolor='rgba(0,0,0,0)', plot_bgcolor='rgba(0,0,0,0)')
                          )

fig.update_layout(margin=dict(t=0, l=0, r=0, b=0), title_text='Matches')
fig.data[0].marker=dict(colors=px.colors.sequential.Aggrnyl)
fig.show()
```