In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
import plotly.graph_objects as go
import pandas as pd
from ipywidgets import interact, FloatSlider
from sklearn.preprocessing import MinMaxScaler
from ipywidgets import interact, Dropdown
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

In [2]:
```
df = pd.read_csv('nba.csv',sep =";", encoding='latin-1')
```

In [3]:
```
df.shape
```

Out[3]:
```
(483, 30)
```

In [4]:
```
df.columns
```

Out[4]:
```
Index(['Rk', 'Player', 'Pos', 'Age', 'Tm', 'G', 'GS', 'MP', 'FG', 'FGA', 'FG%',
       '3P', '3PA', '3P%', '2P', '2PA', '2P%', 'eFG%', 'FT', 'FTA', 'FT%',
       'ORB', 'DRB', 'TRB', 'AST', 'STL', 'BLK', 'TOV', 'PF', 'PTS'],
      dtype='object')
```

In [5]:
```
df.dtypes
```

Out[5]:
```
Rk          int64
Player     object
Pos        object
Age         int64
Tm         object
G           int64
GS          int64
MP        float64
FG        float64
FGA       float64
FG%       float64
3P        float64
3PA       float64
3P%       float64
2P        float64
2PA       float64
2P%       float64
eFG%      float64
FT        float64
FTA       float64
FT%       float64
ORB       float64
DRB       float64
TRB       float64
AST       float64
STL       float64
BLK       float64
TOV       float64
PF        float64
PTS       float64
dtype: object
```

In [6]:
```
cat_vars = ['Pos', 'Tm']
for i in cat_vars:
```

```
    print(df[i].unique())
```

```
['C' 'SG' 'PF' 'PG' 'SF' 'SF-PF']
['TOR' 'MIA' 'UTA' 'MEM' 'MIN' 'PHO' 'CLE' 'MIL' 'ORL' 'NYK' 'WAS' 'POR'
 'DET' 'CHO' 'PHI' 'BOS' 'SAS' 'SAC' 'TOT' 'LAC' 'OKC' 'ATL' 'CHI' 'DEN'
 'BRK' 'HOU' 'IND' 'LAL' 'DAL' 'GSW' 'NOP']
```

In [7]:
```
for column in cat_vars:
    if column in df.columns:
        value_counts = df[column].value_counts()
        print(f"Column: {column}")
        print(value_counts)
```

```
Column: Pos
Pos
SG       109
SF       105
PF        94
C         92
PG        82
SF-PF      1
Name: count, dtype: int64
Column: Tm
Tm
OKC    18
POR    18
LAC    18
PHI    18
MIL    18
SAC    17
MIA    17
HOU    17
WAS    17
ORL    16
CLE    16
PHO    16
MEM    16
DEN    16
GSW    16
NOP    16
LAL    15
ATL    15
IND    15
DAL    15
BRK    15
TOR    15
SAS    15
CHO    15
DET    15
NYK    15
MIN    15
UTA    15
CHI    14
BOS    13
TOT     6
Name: count, dtype: int64
```

In [8]:
```
df.head()
```

Out[8]:

	Rk	Player	Pos	Age	Tm	G	GS	MP	FG	FGA	...	FT%	ORB	DRB	TRB	AST	STL	BLK	TO
0	1	Precious Achiuwa	C	24	TOR	7	0	20.7	3.0	6.9	...	0.857	1.7	4.9	6.6	1.6	0.4	0.4	1
1	2	Bam Adebayo	C	26	MIA	12	12	34.8	8.3	15.6	...	0.830	2.2	8.0	10.2	3.9	1.3	1.2	2

2	3	Ochai Agbaji	SG	23	UTA	12	4	17.8	1.8	4.3	...	0.500	0.9	2.0	2.9	0.9	0.3	0.8	0
3	4	Santi Aldama	PF	23	MEM	6	0	23.5	5.0	10.5	...	0.500	0.8	4.7	5.5	2.0	0.5	0.8	1
4	5	Nickeil Alexander-Walker	SG	25	MIN	12	2	19.7	2.1	5.0	...	0.333	0.1	1.7	1.8	2.4	0.8	0.8	1

5 rows × 30 columns

In [9]:
```
df.tail()
```

Out[9]:

	Rk	Player	Pos	Age	Tm	G	GS	MP	FG	FGA	...	FT%	ORB	DRB	TRB	AST	STL	BLK
478	467	Thaddeus Young	PF	35	TOR	3	0	3.3	0.7	1.3	...	0.000	0.3	0.7	1.0	1.0	0.0	0.0
479	468	Trae Young	PG	25	ATL	11	11	35.7	6.3	17.6	...	0.898	0.6	2.0	2.6	11.1	1.5	0.0
480	469	Omer Yurtseven	C	25	UTA	7	0	4.6	1.0	1.4	...	0.500	0.4	1.1	1.6	0.4	0.0	0.1
481	470	Cody Zeller	C	31	NOP	10	0	6.8	0.3	1.4	...	0.400	1.0	1.8	2.8	0.8	0.2	0.1
482	471	Ivica Zubac	C	26	LAC	11	11	25.9	4.3	7.3	...	0.600	3.0	5.3	8.3	0.8	0.2	1.6

5 rows × 30 columns

In [10]:
```
df.describe()
```

Out[10]:

	Rk	Age	G	GS	MP	FG	FGA	FG%	
count	483.000000	483.000000	483.000000	483.000000	483.000000	483.000000	483.000000	483.000000	483.00
mean	236.472050	26.099379	8.320911	3.830228	18.699793	3.133747	6.764389	0.431329	0.95
std	136.449498	4.430943	3.996694	5.013691	10.836910	2.639502	5.400013	0.177420	0.95
min	1.000000	19.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
25%	117.500000	23.000000	5.000000	0.000000	8.850000	1.000000	2.600000	0.378000	0.10
50%	238.000000	25.000000	10.000000	0.000000	19.000000	2.500000	5.300000	0.447000	0.70
75%	354.500000	29.000000	12.000000	9.000000	28.700000	4.500000	10.000000	0.512500	1.50
max	471.000000	39.000000	14.000000	14.000000	38.400000	11.500000	22.700000	1.000000	5.60

8 rows × 27 columns

In [11]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 483 entries, 0 to 482
Data columns (total 30 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Rk      483 non-null    int64
 1   Player  483 non-null    object
 2   Pos     483 non-null    object
 3   Age     483 non-null    int64
 4   Tm      483 non-null    object
 5   G       483 non-null    int64
```

```
 6   GS      483 non-null    int64
 7   MP      483 non-null    float64
 8   FG      483 non-null    float64
 9   FGA     483 non-null    float64
 10  FG%     483 non-null    float64
 11  3P      483 non-null    float64
 12  3PA     483 non-null    float64
 13  3P%     483 non-null    float64
 14  2P      483 non-null    float64
 15  2PA     483 non-null    float64
 16  2P%     483 non-null    float64
 17  eFG%    483 non-null    float64
 18  FT      483 non-null    float64
 19  FTA     483 non-null    float64
 20  FT%     483 non-null    float64
 21  ORB     483 non-null    float64
 22  DRB     483 non-null    float64
 23  TRB     483 non-null    float64
 24  AST     483 non-null    float64
 25  STL     483 non-null    float64
 26  BLK     483 non-null    float64
 27  TOV     483 non-null    float64
 28  PF      483 non-null    float64
 29  PTS     483 non-null    float64
dtypes: float64(23), int64(4), object(3)
memory usage: 113.3+ KB
```

In [12]:

```
missing_data = df.isnull()

print(missing_data)
duplicates = df.duplicated()

# Displaying the duplicate rows
print("Duplicate Rows:")
print(df[duplicates])

# Dropping duplicates
df_no_duplicates = df.drop_duplicates()
```

```
        Rk  Player    Pos    Age     Tm      G     GS     MP     FG    FGA  \
0    False   False  False  False  False  False  False  False  False  False
1    False   False  False  False  False  False  False  False  False  False
2    False   False  False  False  False  False  False  False  False  False
3    False   False  False  False  False  False  False  False  False  False
4    False   False  False  False  False  False  False  False  False  False
..     ...     ...    ...    ...    ...    ...    ...    ...    ...    ...
478  False   False  False  False  False  False  False  False  False  False
479  False   False  False  False  False  False  False  False  False  False
480  False   False  False  False  False  False  False  False  False  False
481  False   False  False  False  False  False  False  False  False  False
482  False   False  False  False  False  False  False  False  False  False

     ...    FT%    ORB    DRB    TRB    AST    STL    BLK    TOV     PF    PTS
0    ...  False  False  False  False  False  False  False  False  False  False
1    ...  False  False  False  False  False  False  False  False  False  False
2    ...  False  False  False  False  False  False  False  False  False  False
3    ...  False  False  False  False  False  False  False  False  False  False
4    ...  False  False  False  False  False  False  False  False  False  False
..   ...    ...    ...    ...    ...    ...    ...    ...    ...    ...    ...
478  ...  False  False  False  False  False  False  False  False  False  False
479  ...  False  False  False  False  False  False  False  False  False  False
480  ...  False  False  False  False  False  False  False  False  False  False
481  ...  False  False  False  False  False  False  False  False  False  False
482  ...  False  False  False  False  False  False  False  False  False  False

[483 rows x 30 columns]
```

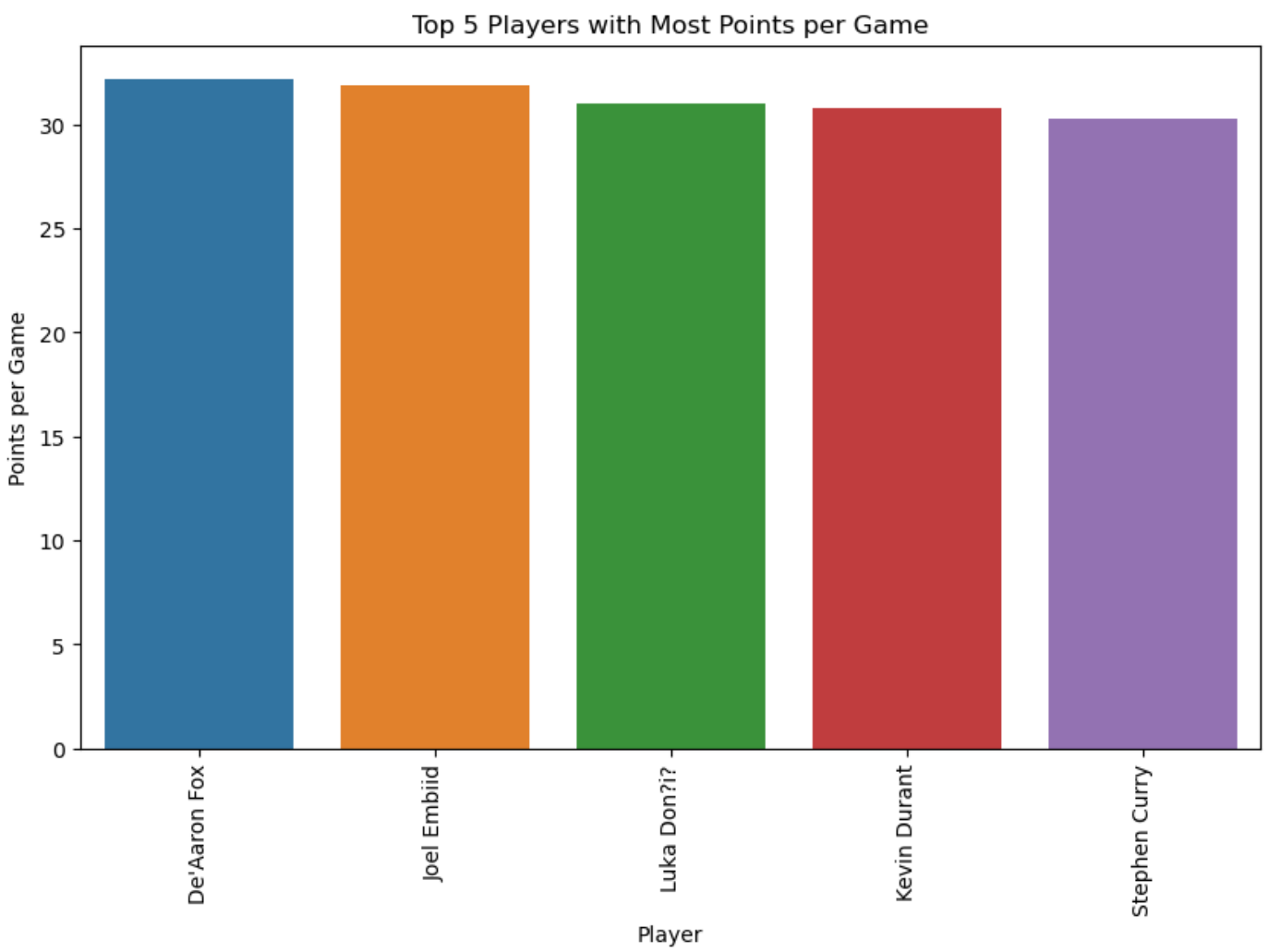
```
Duplicate Rows:
Empty DataFrame
Columns: [Rk, Player, Pos, Age, Tm, G, GS, MP, FG, FGA, FG%, 3P, 3PA, 3P%, 2P, 2PA, 2P%,
eFG%, FT, FTA, FT%, ORB, DRB, TRB, AST, STL, BLK, TOV, PF, PTS]
Index: []

[0 rows x 30 columns]
```

In [13]:
```python
df.dropna(thresh=5, inplace=True)
```

In [14]:
```python
def plot_team_composition(position):
    df_filtered = df[df['Pos'] == position] if position != 'All' else df

    team_counts = df_filtered['Tm'].value_counts().reset_index()
    team_counts.columns = ['Team', 'Number of Players']

    fig = px.bar(
        team_counts,
        x='Team',
        y='Number of Players',
        title=f'Number of Players per Team - Position: {position}'
    )

    fig.show()

positions = ['All'] + sorted(df['Pos'].unique().tolist())
position_dropdown = Dropdown(options=positions, value='All', description='Position:')
interact(plot_team_composition, position=position_dropdown)
```

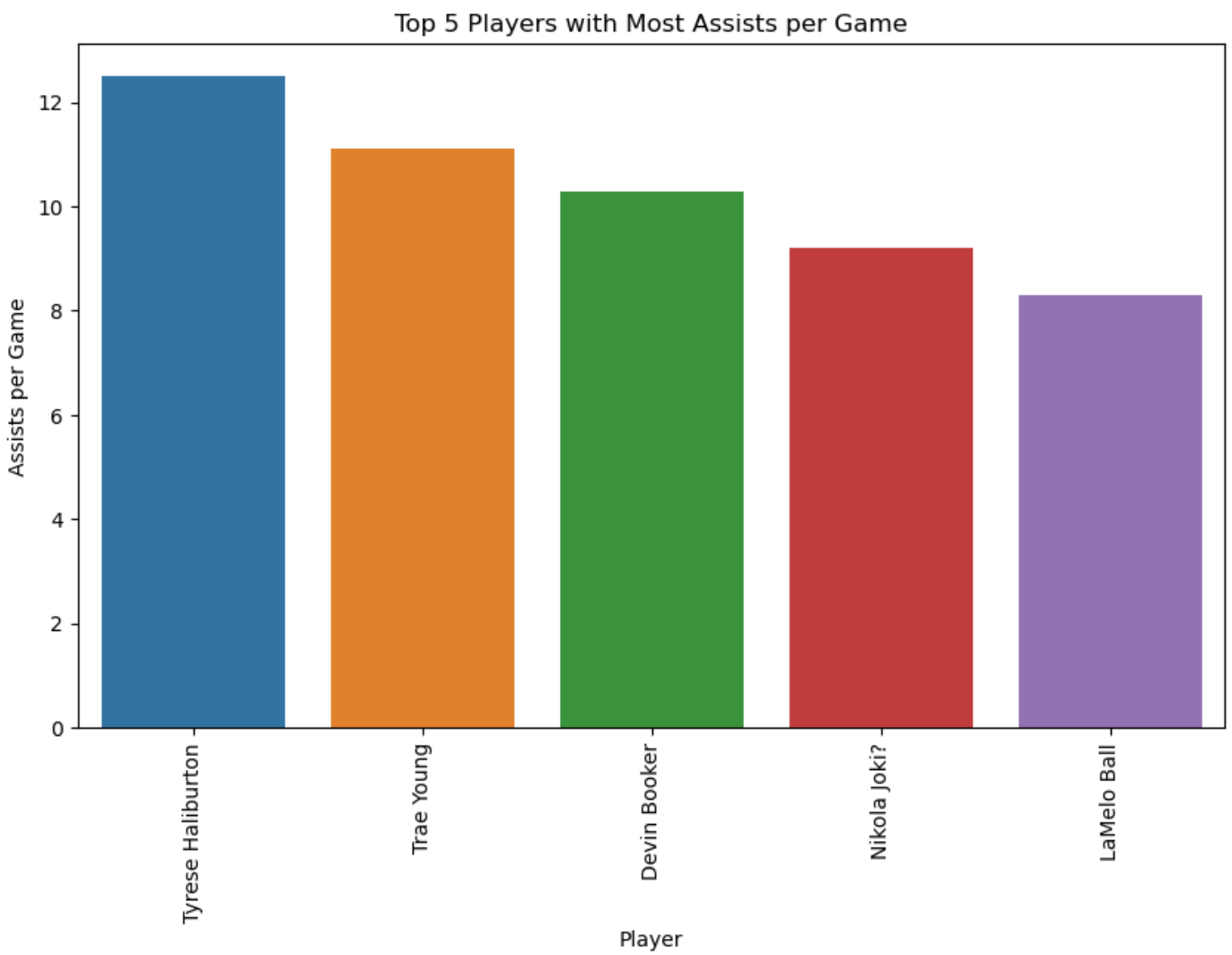
Out[14]:
```
interactive(children=(Dropdown(description='Position:', options=('All', 'C', 'PF', 'PG',
'SF', 'SF-PF', 'SG'),…
<function __main__.plot_team_composition(position)>
```

In [15]:
```python
top_5_scorers = df.nlargest(5, 'PTS')['Player']

plt.figure(figsize=(10,6))
sns.barplot(x=top_5_scorers, y=df.loc[top_5_scorers.index, 'PTS'])
plt.title('Top 5 Players with Most Points per Game')
plt.xticks(rotation=90)
plt.xlabel('Player')
plt.ylabel('Points per Game')
plt.show()
```



In [16]:

```
top_5_passers = df.nlargest(5, 'AST')['Player']
# Bar plot of top 5 scorers
plt.figure(figsize=(10,6))
sns.barplot(x=top_5_passers, y=df.loc[top_5_passers.index, 'AST'])
plt.title('Top 5 Players with Most Assists per Game')
plt.xticks(rotation=90)
plt.xlabel('Player')
plt.ylabel('Assists per Game')
plt.show()
```



In [17]:

```
scaler = MinMaxScaler()
df[['PTS_norm', 'FG%_norm', 'AST_norm', 'TOV_norm']] = scaler.fit_transform(df[['PTS', '

def plot_top_players(pts_weight, fg_weight, ast_weight, tov_weight):
    df['CompositeScore'] = (df['PTS_norm'] * pts_weight +
                            df['FG%_norm'] * fg_weight +
                            df['AST_norm'] * ast_weight -
                            df['TOV_norm'] * tov_weight)
    top_players = df.sort_values(by='CompositeScore', ascending=False)
    print(top_players[['Player', 'CompositeScore']])


    fig = px.scatter_3d(
        top_players,
        x='AST', y='PTS', z='TOV',
        color='CompositeScore',
        hover_data=['Player'],
        title='Top 30 Players: 3D Plot (Assists, Points, FG%, Turnovers)',
        color_continuous_scale=px.colors.diverging.Tealrose,
        opacity=0.8
    )

    fig.update_layout(
        width=800,
        height=600,
        scene=dict(
            xaxis_title='Assists',
            yaxis_title='Points',
            zaxis_title='Turnovers'
        )
    )
```

```
    fig.update_traces(marker=dict(size=5, line=dict(width=2, color='DarkSlateGrey')), se

    fig.show()

interact(plot_top_players,
         pts_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='PTS Weight
         fg_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='FG% Weight'
         ast_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='AST Weight
         tov_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='TOV Weight
```

```
interactive(children=(FloatSlider(value=1.0, description='PTS Weight', max=2.0), FloatSl
ider(value=1.0, descri…
<function __main__.plot_top_players(pts_weight, fg_weight, ast_weight, tov_weight)>
```

Out[17]:

In [18]:

```
scaler = MinMaxScaler()
df[['TRB_norm', 'STL_norm', 'BLK_norm']] = scaler.fit_transform(df[['TRB', 'STL', 'BLK']

def plot_top_players(trb_weight, stl_weight, blk_weight):
    df['CompositeScore'] = (df['TRB_norm'] * trb_weight +
                            df['STL_norm'] * stl_weight +
                            df['BLK_norm'] * blk_weight)

    print(df[['Player', 'CompositeScore']].sort_values(by='CompositeScore', ascending=Fa

    top_players = df.sort_values(by='CompositeScore', ascending=False)

    fig = px.scatter_3d(
        top_players,
        x='TRB',
        y='STL',
        z='BLK',
        color='CompositeScore',
        hover_data=['Player']
    )

    fig.update_layout(
        title='Top Players Based on Weighted TRB, STL, BLK (3D Plot)',
        scene=dict(
            xaxis_title='Total Rebounds',
            yaxis_title='Steals',
            zaxis_title='Blocks'
        ),
        width=800,
        height=600
    )

    fig.show()

interact(plot_top_players,
         trb_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='TRB Weight
         stl_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='STL Weight
         blk_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='BLK Weight
```

```
interactive(children=(FloatSlider(value=1.0, description='TRB Weight', max=2.0), FloatSl
ider(value=1.0, descri…
<function __main__.plot_top_players(trb_weight, stl_weight, blk_weight)>
```

Out[18]:

In [19]:

```
import plotly.graph_objects as go

df['2P_points'] = df['2P'] * 2
df['3P_points'] = df['3P'] * 3
df['Total_points'] = df['2P_points'] + df['3P_points']

top_scorers = df.sort_values('Total_points', ascending=False).head(30)
```

```
fig = go.Figure()

fig.add_trace(go.Bar(
    x=top_scorers['Player'],
    y=top_scorers['2P_points'],
    name='2-Pointers',
    hoverinfo='text',
    text=top_scorers['2P_points'],
))

fig.add_trace(go.Bar(
    x=top_scorers['Player'],
    y=top_scorers['3P_points'],
    name='3-Pointers',
    hoverinfo='text',
    text=top_scorers['3P_points'],
))

fig.update_layout(
    barmode='stack',
    title='Top 30 Scorers: Breakdown by 2-Pointers and 3-Pointers',
    xaxis_title='Player/Team',
    yaxis_title='Total Points',
    hovermode='x'
)

fig.show()
```

In [20]:

```
scaler = MinMaxScaler()
normalized_columns = ['PTS', 'AST', 'FG%', 'TOV', 'BLK', 'STL', 'TRB']
df[normalized_columns] = scaler.fit_transform(df[normalized_columns])
```

```python
team_to_city = {
    'TOR': {'lat': 43.7, 'lon': -79.4},   # Toronto Raptors
    'MIA': {'lat': 25.8, 'lon': -80.2},   # Miami Heat
    'UTA': {'lat': 40.8, 'lon': -111.9},  # Utah Jazz
    'MEM': {'lat': 35.1, 'lon': -90.0},   # Memphis Grizzlies
    'MIN': {'lat': 44.9, 'lon': -93.2},   # Minnesota Timberwolves
    'PHO': {'lat': 33.4, 'lon': -112.0},  # Phoenix Suns
    'CLE': {'lat': 41.5, 'lon': -81.7},   # Cleveland Cavaliers
    'MIL': {'lat': 43.0, 'lon': -87.9},   # Milwaukee Bucks
    'ORL': {'lat': 28.5, 'lon': -81.4},   # Orlando Magic
    'NYK': {'lat': 40.7, 'lon': -74.0},   # New York Knicks
    'WAS': {'lat': 38.9, 'lon': -77.0},   # Washington Wizards
    'POR': {'lat': 45.5, 'lon': -122.7},  # Portland Trail Blazers
    'DET': {'lat': 42.3, 'lon': -83.0},   # Detroit Pistons
    'CHO': {'lat': 35.2, 'lon': -80.8},   # Charlotte Hornets
    'PHI': {'lat': 39.9, 'lon': -75.2},   # Philadelphia 76ers
    'BOS': {'lat': 42.3, 'lon': -71.1},   # Boston Celtics
    'SAS': {'lat': 29.4, 'lon': -98.5},   # San Antonio Spurs
    'SAC': {'lat': 38.5, 'lon': -121.5},  # Sacramento Kings
    'TOT': {'lat': 43.7, 'lon': -79.4},   # Placeholder for traded players
    'LAC': {'lat': 34.0, 'lon': -118.3},  # LA Clippers
    'OKC': {'lat': 35.5, 'lon': -97.5},   # Oklahoma City Thunder
    'ATL': {'lat': 33.7, 'lon': -84.4},   # Atlanta Hawks
    'CHI': {'lat': 41.8, 'lon': -87.6},   # Chicago Bulls
    'DEN': {'lat': 39.7, 'lon': -105.0},  # Denver Nuggets
    'BRK': {'lat': 40.7, 'lon': -74.0},   # Brooklyn Nets
    'HOU': {'lat': 29.7, 'lon': -95.4},   # Houston Rockets
    'IND': {'lat': 39.8, 'lon': -86.2},   # Indiana Pacers
    'LAL': {'lat': 34.0, 'lon': -118.3},  # Los Angeles Lakers
    'DAL': {'lat': 32.8, 'lon': -96.8},   # Dallas Mavericks
    'GSW': {'lat': 37.8, 'lon': -122.4},  # Golden State Warriors
    'NOP': {'lat': 29.9, 'lon': -90.1}    # New Orleans Pelicans
}
# Function to update plot based on slider values
def plot_players(pts_weight, ast_weight, fg_weight, tov_weight, blk_weight, stl_weight,
    # Recalculate composite score inside the function
    df['CompositeScore'] = (df['PTS'] * pts_weight +
                            df['AST'] * ast_weight +
                            df['FG%'] * fg_weight -
                            df['TOV'] * tov_weight +
                            df['BLK'] * blk_weight +
                            df['STL'] * stl_weight +
                            df['TRB'] * trb_weight)

    # Filter the top players
    top_players = df.sort_values(by='CompositeScore', ascending=True)
    print(top_players[['Player', 'CompositeScore']])

    # Add team city coordinates to the DataFrame
    top_players['lat'] = top_players['Tm'].map(lambda x: team_to_city.get(x, {}).get('la
    top_players['lon'] = top_players['Tm'].map(lambda x: team_to_city.get(x, {}).get('lo

    # Create the plot
    fig = px.scatter_geo(
        top_players,
        lat='lat',
        lon='lon',
        color='CompositeScore',
        hover_name='Player',
        hover_data=['CompositeScore'],
        title='NBA Players Composite Score by Team City',
        scope='usa'
    )
    fig.show()
```

```
interact(plot_players,
         pts_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='PTS Weight
         ast_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='AST Weight
         fg_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='FG% Weight'
         tov_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='TOV Weight
         blk_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='BLK Weight
         stl_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='STL Weight
         trb_weight=FloatSlider(value=1, min=0, max=2, step=0.1, description='TRB Weight
```

Out[20]:
```
interactive(children=(FloatSlider(value=1.0, description='PTS Weight', max=2.0), FloatSl
ider(value=1.0, descri…
<function __main__.plot_players(pts_weight, ast_weight, fg_weight, tov_weight, blk_weigh
t, stl_weight, trb_weight)>
```

In [ ]:

In [ ]: