

# Team Data Scraping

Different sources require different scraping techniques.

The easiest (yet unfortunately less-desireable) source is basketball-reference.com. This site is html, and we can easily scrape anything from it using pd.read\_html(url).

The most difficult (and most desirable) source is stats.nba.com. This website uses no HTML and is completely dynamic, so I have to use selenium to scrape those statistics.

```
In [ ]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import matplotlib.ticker as mtick
import sqlite3
import seaborn as sns
from matplotlib.offsetbox import OffsetImage, AnnotationBbox
from selenium import webdriver
from selenium.webdriver.common.keys import Keys
from bs4 import BeautifulSoup
from selenium.webdriver.common.by import By
from selenium.webdriver.support.ui import WebDriverWait
from selenium.webdriver.support import expected_conditions as EC
import time
import requests
import shutil
import datetime
from scipy.stats import norm
from sklearn.preprocessing import OneHotEncoder, OrdinalEncoder
import os
import winsound
os.chdir('C:\\\\Users\\\\Travis\\\\OneDrive\\\\Data Science\\\\Personal_Projects\\\\Sports\\\\NBA_P')
import warnings
warnings.filterwarnings('ignore')

from selenium.common.exceptions import WebDriverException
```

## Functions

```
In [ ]: # if no driver is open, open one
def check_driver():
    try:
        driver.title

    # open if not open

    except WebDriverException:
        driver = webdriver.Chrome()
```

```
In [ ]: def replace_name_values(filename):
    # replace values with dashes for compatibility
    filename = filename.replace('%', '_')
```

```

filename = filename.replace('=', '_')
filename = filename.replace('?', '_')
filename = filename.replace('&', '_')
filename = filename.replace('20Season_', '')
filename = filename.replace('_20Season', '')
filename = filename.replace('SeasonType_', '')
filename = filename.replace('sort_gdate_dir_-1_', '')
filename = filename.replace('SeasonYear_', '')
return filename

```

```

In [ ]: def grab_team_data(url_list, file_folder):
    i = 0
    for u in url_list:

        try:
            driver.get(u)
            src = driver.page_source
            parser = BeautifulSoup(src, "lxml")
            table = parser.find("table", attrs = {"class": "Crom_table_p1"})
        except:
            print(f'{u} Failed to load')
            continue
        try:
            headers = table.findAll('th')
            headerlist = [h.text.strip() for h in headers[0:]]
            row_names = table.findAll('a')
            row_list = [b.text.strip() for b in row_names[0:]]
            rows = table.findAll('tr')[0:]
        except:
            print(f'{u} Failed to load')
            continue

        # get the data
        player_stats = [[td.getText().strip() for td in rows[i].findAll('td')][1:] for i in range(len(rows))] #set the length of the list
        tot_cols = len(player_stats[1])
        headerlist = headerlist[:tot_cols]
        stats = pd.DataFrame(player_stats, columns = headerlist)

        # name file
        filename = file_folder + str(u[31:]).replace('/', '_') + '.csv'
        filename = replace_name_values(filename)

        # save to csv
        pd.DataFrame.to_csv(stats, filename)
        i += 1
        lu = len(url_list)
        print(f'{filename} Completed Successfully! {i} / {lu} Complete!')
        winsound.Beep(523, 500)

```

```

In [ ]: def team_data_filename_transformer(url):
    filename = str(url[31:]).replace('/', '_') + '.csv'
    filename = replace_name_values(filename)
    return filename

```

```
In [ ]: driver = webdriver.Chrome()
```

```
In [ ]: def grab_box_scores(url_list, file_folder):
```

```
# Function to scrape box scores of individual games

i = 0
for u in url_list:
    driver.get(u)

    # click "all pages"
    xpath_all = '//*[@id="__next"]/div[2]/div[2]/div[3]/section[2]/div/div'
    elem = WebDriverWait(driver, 30).until(EC.presence_of_element_located(
        driver.find_element(by=By.XPATH, value=xpath_all)).click()
    src = driver.page_source
    parser = BeautifulSoup(src, "lxml")

    # Find Table and scrape data
    table = parser.find("table", attrs = {"class":"Crom_table_p1izz"})
    headers = table.findAll('th')
    headerlist = [h.text.strip() for h in headers[0:]]
    row_names = table.findAll('a')
    row_list = [b.text.strip() for b in row_names[0:]]
    rows = table.findAll('tr')[0:]
    player_stats = [[td.getText().strip() for td in rows[i].findAll('td')][2]
    tot_cols = len(player_stats[2])
    headerlist = headerlist[:tot_cols]
    stats = pd.DataFrame(player_stats, columns = headerlist)

    # File Name
    filename = file_folder + str(u[31:]).replace('/', '_') + '.csv'
    filename = replace_name_values(filename)
    filename = filename.replace('SeasonType_Regular_20Season', 'Reg_Season')

    # Save to CSV
    pd.DataFrame.to_csv(stats, filename)
    i += 1
    lu = len(url_list)
    print(f'{filename} Completed Successfully! {i} / {lu} Complete!')
```

```
In [ ]: def append_the_data(folder, data_prefix, filename_selector):

    # Appending data together via folder and/or file name

    path = folder
    p = os.listdir(path)
    pf = pd.DataFrame(p)

    # first filter
    pf_reg = pf.loc[pf[0].astype(str).str.contains(filename_selector)]]

    appended_data = pd.DataFrame()

    for file in pf_reg[0]:
        data = pd.read_csv(folder + '/' + file)
        # if Season is in the data, drop it
        if 'Season' in data.columns:
            data = data.drop(columns = ['Season'])

        # for some reason, this was the only way I could get the data to append correctly
        if '1996' in file:
            data['Season'] = 1996
        elif '1997' in file:
```

```
        data['Season'] = 1997
    elif '1998' in file:
        data['Season'] = 1998
    elif '1999' in file:
        data['Season'] = 1999
    elif '2000' in file:
        data['Season'] = 2000
    elif '2001' in file:
        data['Season'] = 2001
    elif '2002' in file:
        data['Season'] = 2002
    elif '2003' in file:
        data['Season'] = 2003
    elif '2004' in file:
        data['Season'] = 2004
    elif '2005' in file:
        data['Season'] = 2005
    elif '2006' in file:
        data['Season'] = 2006
    elif '2007' in file:
        data['Season'] = 2007
    elif '2008' in file:
        data['Season'] = 2008
    elif '2009' in file:
        data['Season'] = 2009
    elif '2010' in file:
        data['Season'] = 2010
    elif '2011' in file:
        data['Season'] = 2011
    elif '2012' in file:
        data['Season'] = 2012
    elif '2013' in file:
        data['Season'] = 2013
    elif '2014' in file:
        data['Season'] = 2014
    elif '2015' in file:
        data['Season'] = 2015
    elif '2016' in file:
        data['Season'] = 2016
    elif '2017' in file:
        data['Season'] = 2017
    elif '2018' in file:
        data['Season'] = 2018
    elif '2019' in file:
        data['Season'] = 2019
    elif '2020' in file:
        data['Season'] = 2020
    elif '2021' in file:
        data['Season'] = 2021
    elif '2022' in file:
        data['Season'] = 2022

data['season_type'] = np.where('Reg' in file, 'Regular', 'Playoffs')
# add prefix to columns
data = data.add_prefix(data_prefix)
data.columns = data.columns.str.lower()

# save data to appended data
appended_data = pd.DataFrame.append(appended_data, data)
```

```
appended_data = pd.concat(appended_data)

return appended_data
```

```
In [ ]: def quintuple_merge(df1, df2, df3, df4, df5, prefix1, prefix2, prefix3, prefix4, prefix5):

    # Merge 5 dataframes together

    merge_cols1 = [(prefix1 + 'team'), (prefix1 + 'matchup'), (prefix1 + 'gamedate')]
    merge_cols2 = [(prefix2 + 'team'), (prefix2 + 'matchup'), (prefix2 + 'gamedate')]
    merge_cols3 = [(prefix3 + 'team'), (prefix3 + 'matchup'), (prefix3 + 'gamedate')]
    merge_cols4 = [(prefix4 + 'team'), (prefix4 + 'matchup'), (prefix4 + 'gamedate')]
    merge_cols5 = [(prefix5 + 'team'), (prefix5 + 'matchup'), (prefix5 + 'gamedate')]

    df = pd.merge(df1, df2, left_on= merge_cols1, right_on = merge_cols2, how='left')
    df = pd.merge(df,df3, left_on= merge_cols1, right_on = merge_cols3, how='left')
    df = pd.merge(df,df4, left_on= merge_cols1, right_on = merge_cols4, how='left')
    df = pd.merge(df,df5, left_on= merge_cols1, right_on = merge_cols5, how='left')

    return df
```

```
In [ ]: # Add folders if necessary
if os.path.isdir('data/team') is False:
    os.mkdir('data/team')

if os.path.isdir('data/team/team_general') is False:
    os.mkdir('data/team/team_general')
```

```
In [ ]: check_df = pd.read_csv('data/team/both_team_boxscores_ALL_with_GameDifferences.csv')
check_df.sort_values(by=['gamedate'], ascending = False, inplace=True)
check_df
```

Out[ ]:	Unnamed: 0.1	Unnamed: 0	team	matchup	gamedate	w/l	min	pts	fgm	fga	...	t1_t2_ft_
	<b>60210</b>	60210	60210	LAC	LAC @ TOR	12/31/2021	L	48.0	108.0	38.0	78.0	...
	<b>60203</b>	60203	60203	UTA	UTA vs. MIN	12/31/2021	W	48.0	120.0	37.0	78.0	...
	<b>60205</b>	60205	60205	IND	IND vs. CHI	12/31/2021	L	48.0	106.0	38.0	91.0	...
	<b>60206</b>	60206	60206	PHX	PHX @ BOS	12/31/2021	L	48.0	108.0	41.0	100.0	...
	<b>60207</b>	60207	60207	MIN	MIN @ UTA	12/31/2021	L	48.0	108.0	40.0	93.0	...
	...	...	...	...	...	...	...	...	...	...	...	...
	<b>10080</b>	10080	10080	MIN	MIN vs. HOU	01/01/2001	W	48.0	106.0	41.0	82.0	...
	<b>10081</b>	10081	10081	CHH	CHH @ POR	01/01/2001	L	48.0	67.0	26.0	80.0	...
	<b>10082</b>	10082	10082	HOU	HOU @ MIN	01/01/2001	L	48.0	96.0	31.0	77.0	...
	<b>3909</b>	3909	3909	PHI	PHI @ VAN	01/01/1998	W	48.0	115.0	44.0	79.0	...
	<b>3908</b>	3908	3908	VAN	VAN vs. PHI	01/01/1998	L	48.0	104.0	39.0	78.0	...

65462 rows × 222 columns

## Team Season Data (General)

```
In [ ]: # make the url list of PREVIOUS SEASONS DATA
years = ['2021-22', '2020-21', '2019-20', '2018-19', '2017-18', '2016-17', '2015-16',
         '2012-13', '2011-12', '2010-11', '2009-10', '2008-09', '2007-08', '2006-07',
         '2003-04', '2002-03', '2001-02', '2000-01', '1999-00', '1998-99', '1997-98',
         types = ['traditional', 'advanced', 'four-factors', 'scoring', 'opponent', 'defense']
         season_types = ['Playoffs', 'Regular%20Season']

team_urlz = []

for year in years:
    for type in types:
        for s_types in season_types:
            url = 'https://www.nba.com/stats/teams/' + type + '?SeasonType=' + s_types +
            team_urlz.append(str(url))
```

```
In [ ]: len(team_urlz)
```

```
Out[ ]: 312
```

## Add 2022-23 Data

```
In [ ]: # get current date
today = datetime.date.today()

this_year_team_urls = []

for type in types:
    url = 'https://www.nba.com/stats/teams/' + type + '?SeasonType=Regular%20Season&Seas
    this_year_team_urls.append(str(url))

this_year_team_urls
```

```
Out[ ]: ['https://www.nba.com/stats/teams/traditional?SeasonType=Regular%20Season&Season=2022
-23',
'https://www.nba.com/stats/teams/advanced?SeasonType=Regular%20Season&Season=2022-2
3',
'https://www.nba.com/stats/teams/four-factors?SeasonType=Regular%20Season&Season=202
2-23',
'https://www.nba.com/stats/teams/scoring?SeasonType=Regular%20Season&Season=2022-2
3',
'https://www.nba.com/stats/teams/opponent?SeasonType=Regular%20Season&Season=2022-2
3',
'https://www.nba.com/stats/teams/defense?SeasonType=Regular%20Season&Season=2022-2
3']
```

```
In [ ]: # check latest date in boxescores file
check_df = pd.read_csv('data/team/both_team_boxescores_ALL_with_GameDifferences.csv')
check_df['gamedate'] = pd.to_datetime(check_df['gamedate'])
check_df['gamedate'] = check_df['gamedate'].dt.date
check_df = check_df.sort_values(by=['gamedate'], ascending = False)
latest_date = check_df['gamedate'].iloc[0]
latest_date
```

```
Out[ ]: datetime.date(2022, 6, 16)
```

```
In [ ]: check_df
```

Out[ ]:

	Unnamed: 0.1	Unnamed: 0	team	matchup	gamedate	w/l	min	pts	fgm	fga	...	t1_t2_ft_pc
<b>65288</b>	65288	65288	BOS	BOS vs. GSW	2022-06-16	L	48.0	90.0	34.0	80.0	...	
<b>65289</b>	65289	65289	GSW	GSW @ BOS	2022-06-16	W	48.0	103.0	38.0	92.0	...	
<b>65290</b>	65290	65290	BOS	BOS @ GSW	2022-06-13	L	48.0	94.0	31.0	75.0	...	
<b>65291</b>	65291	65291	GSW	GSW vs. BOS	2022-06-13	W	48.0	104.0	41.0	88.0	...	
<b>65292</b>	65292	65292	BOS	BOS vs. GSW	2022-06-10	L	48.0	97.0	34.0	85.0	...	
...	...	...	...	...	...	...	...	...	...	...	...	...
<b>2355</b>	2355	2355	LAC	LAC @ GSW	1996-11-01	W	48.0	97.0	41.0	86.0	...	
<b>2353</b>	2353	2353	CHI	CHI @ BOS	1996-11-01	W	48.0	107.0	42.0	74.0	...	
<b>2352</b>	2352	2352	DAL	DAL @ DEN	1996-11-01	W	48.0	92.0	35.0	88.0	...	
<b>2350</b>	2350	2350	MIA	MIA vs. ATL	1996-11-01	W	48.0	94.0	35.0	78.0	...	
<b>2351</b>	2351	2351	CLE	CLE @ NJN	1996-11-01	W	48.0	90.0	34.0	72.0	...	

65462 rows × 222 columns

In [ ]: driver = webdriver.Chrome()

```
# if yesterday is later than latest date, then run the code
yesterday = today - datetime.timedelta(days=1)

if latest_date < yesterday:
    # get the data
    grab_team_data(this_year_team_urls, 'data/team/team_general/')
else:
    print('yesterday is not later than latest date, so do not run the code')
```

```
data/team/team_general/_traditional_Regular_Season_2022-23.csv Completed Successfully!
y! 1 / 6 Complete!
data/team/team_general/_advanced_Regular_Season_2022-23.csv Completed Successfully! 2
/ 6 Complete!
data/team/team_general/_four-factors_Regular_Season_2022-23.csv Completed Successfully!
y! 3 / 6 Complete!
data/team/team_general/_scoring_Regular_Season_2022-23.csv Completed Successfully! 4
/ 6 Complete!
data/team/team_general/_opponent_Regular_Season_2022-23.csv Completed Successfully! 5
/ 6 Complete!
data/team/team_general/_defense_Regular_Season_2022-23.csv Completed Successfully! 6
/ 6 Complete!
```

```
In [ ]: def fix_box_url(url):
    name = team_data_filename_transformer(url)
    new_name = name.replace('Reg_Season_Season', 'Reg')
    new_name = new_name.replace('Playoffs_Season_Season', 'Playoffs')
    new_name = new_name.replace('SeasonYear', 'Yr')
    new_name = new_name.replace('SeasonType', '')
    return new_name
```

```
In [ ]: def post_dl_fix(filename):
    new_name = filename.replace('Reg_Season_Season', 'Reg')
    new_name = new_name.replace('Playoffs_Season_Season', 'Playoffs')
    new_name = new_name.replace('SeasonYear', 'Yr')
    new_name = new_name.replace('SeasonType', '')
    return new_name
```

## Box Score Scraping

```
In [ ]: types = ['boxscores-traditional', 'boxscores-advanced', 'boxscores-four-factors',
            'boxscores-misc', 'boxscores-scoring']
season_types = ['Playoffs', 'Regular%20Season']

box_urls = []

for year in years:
    for type in types:
        for s_types in season_types:
            url = 'https://www.nba.com/stats/teams/' + type + '?SeasonType=' + s_types +
            box_urls.append(str(url))

print(len(box_urls))
```

260

```
In [ ]: needed_boxes = pd.DataFrame(box_urls, columns=['url'])

needed_boxes['filenames'] = needed_boxes.apply(lambda row: fix_box_url(row['url']), axis=1)

needed_boxes = needed_boxes[~needed_boxes['filenames'].isin(team_box_files)]

needed_urls = needed_boxes['url'].tolist()

print(len(needed_urls))
needed_boxes
```

130

Out[ ]:

	url	filenames
1	https://www.nba.com/stats/teams/boxscores-trad...	_boxscores-traditional_Regular_20Season_Seaso...
3	https://www.nba.com/stats/teams/boxscores-adva...	_boxscores-advanced_Regular_20Season_Season_2...
5	https://www.nba.com/stats/teams/boxscores-four...	_boxscores-four-factors_Regular_20Season_Seas...
7	https://www.nba.com/stats/teams/boxscores-misc...	_boxscores-misc_Regular_20Season_Season_2021...
9	https://www.nba.com/stats/teams/boxscores-scor...	_boxscores-scoring_Regular_20Season_Season_20...
...	...	...
251	https://www.nba.com/stats/teams/boxscores-trad...	_boxscores-traditional_Regular_20Season_Seaso...
253	https://www.nba.com/stats/teams/boxscores-adva...	_boxscores-advanced_Regular_20Season_Season_1...
255	https://www.nba.com/stats/teams/boxscores-four...	_boxscores-four-factors_Regular_20Season_Seas...
257	https://www.nba.com/stats/teams/boxscores-misc...	_boxscores-misc_Regular_20Season_Season_1996...
259	https://www.nba.com/stats/teams/boxscores-scor...	_boxscores-scoring_Regular_20Season_Season_19...

130 rows × 2 columns

In [ ]: `grab_box_scores(needed_urls, 'data/team/team_boxscores/')`

data/team/team\_boxscores/\_boxscores-traditional\_SeasonType\_Playoffs\_Season\_2021-22\_SeasonYear\_2021-22.csv Completed Successfully! 1 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_Reg\_Season\_Season\_2021-22\_SeasonYear\_2021-22.csv Completed Successfully! 2 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-advanced\_Reg\_Season\_Season\_2021-22\_SeasonYear\_2021-22.csv Completed Successfully! 3 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-four-factors\_Reg\_Season\_Season\_2021-22\_SeasonYear\_2021-22.csv Completed Successfully! 4 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-misc\_Reg\_Season\_Season\_2021-22\_SeasonYear\_2021-22.csv Completed Successfully! 5 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-scoring\_Reg\_Season\_Season\_2021-22\_SeasonYear\_2021-22.csv Completed Successfully! 6 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_SeasonType\_Playoffs\_Season\_2020-21\_SeasonYear\_2020-21.csv Completed Successfully! 7 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_Reg\_Season\_Season\_2020-21\_SeasonYear\_2020-21.csv Completed Successfully! 8 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-advanced\_Reg\_Season\_Season\_2020-21\_SeasonYear\_2020-21.csv Completed Successfully! 9 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-four-factors\_Reg\_Season\_Season\_2020-21\_SeasonYear\_2020-21.csv Completed Successfully! 10 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-misc\_Reg\_Season\_Season\_2020-21\_SeasonYear\_2020-21.csv Completed Successfully! 11 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-scoring\_Reg\_Season\_Season\_2020-21\_SeasonYear\_2020-21.csv Completed Successfully! 12 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_SeasonType\_Playoffs\_Season\_2019-20\_SeasonYear\_2019-20.csv Completed Successfully! 13 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_Reg\_Season\_Season\_2019-20\_SeasonYear\_2019-20.csv Completed Successfully! 14 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-advanced\_Reg\_Season\_Season\_2019-20\_SeasonYear\_2019-20.csv Completed Successfully! 15 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-four-factors\_Reg\_Season\_Season\_2019-20\_SeasonYear\_2019-20.csv Completed Successfully! 16 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-misc\_Reg\_Season\_Season\_2019-20\_SeasonYear\_2019-20.csv Completed Successfully! 17 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-scoring\_Reg\_Season\_Season\_2019-20\_SeasonYear\_2019-20.csv Completed Successfully! 18 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_SeasonType\_Playoffs\_Season\_2018-19\_SeasonYear\_2018-19.csv Completed Successfully! 19 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_Reg\_Season\_Season\_2018-19\_SeasonYear\_2018-19.csv Completed Successfully! 20 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-advanced\_Reg\_Season\_Season\_2018-19\_SeasonYear\_2018-19.csv Completed Successfully! 21 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-four-factors\_Reg\_Season\_Season\_2018-19\_SeasonYear\_2018-19.csv Completed Successfully! 22 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-misc\_Reg\_Season\_Season\_2018-19\_SeasonYear\_2018-19.csv Completed Successfully! 23 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-scoring\_Reg\_Season\_Season\_2018-19\_SeasonYear\_2018-19.csv Completed Successfully! 24 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_SeasonType\_Playoffs\_Season\_2017-18\_SeasonYear\_2017-18.csv Completed Successfully! 25 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-traditional\_Reg\_Season\_Season\_2017-18\_SeasonYear\_2017-18.csv Completed Successfully! 26 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-advanced\_Reg\_Season\_Season\_2017-18\_SeasonYear\_2017-18.csv Completed Successfully! 27 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-four-factors\_Reg\_Season\_Season\_2017-18\_SeasonYear\_2017-18.csv Completed Successfully! 28 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-misc\_Reg\_Season\_Season\_2017-18\_SeasonYear\_2017-18.csv Completed Successfully! 29 / 194 Complete!  
data/team/team\_boxscores/\_boxscores-scoring\_Reg\_Season\_Season\_2017-18\_SeasonYear\_2017-18.csv Completed Successfully! 30 / 194 Complete!

data/team/team\_boxscores/\_boxscores-traditional\_SeasonType\_Playoffs\_Season\_2016-17\_SeasonYear\_2016-17.csv Completed Successfully! 31 / 194 Complete!

data/team/team\_boxscores/\_boxscores-traditional\_Reg\_Season\_Season\_2016-17\_SeasonYear\_2016-17.csv Completed Successfully! 32 / 194 Complete!

data/team/team\_boxscores/\_boxscores-advanced\_Reg\_Season\_Season\_2016-17\_SeasonYear\_2016-17.csv Completed Successfully! 33 / 194 Complete!

data/team/team\_boxscores/\_boxscores-four-factors\_Reg\_Season\_Season\_2016-17\_SeasonYear\_2016-17.csv Completed Successfully! 34 / 194 Complete!

data/team/team\_boxscores/\_boxscores-misc\_Reg\_Season\_Season\_2016-17\_SeasonYear\_2016-17.csv Completed Successfully! 35 / 194 Complete!

data/team/team\_boxscores/\_boxscores-scoring\_Reg\_Season\_Season\_2016-17\_SeasonYear\_2016-17.csv Completed Successfully! 36 / 194 Complete!

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 '_boxscores-traditional_Playoffs_Season_1999-00_Yr_1999-00.csv',
 '_boxscores-traditional_Playoffs_Season_2000-01_Yr_2000-01.csv',
 '_boxscores-traditional_Playoffs_Season_2001-02_Yr_2001-02.csv',
 '_boxscores-traditional_Playoffs_Season_2002-03_Yr_2002-03.csv',
 '_boxscores-traditional_Playoffs_Season_2003-04_Yr_2003-04.csv',
 '_boxscores-traditional_Playoffs_Season_2004-05_Yr_2004-05.csv',
 '_boxscores-traditional_Playoffs_Season_2005-06_Yr_2005-06.csv',
 '_boxscores-traditional_Playoffs_Season_2006-07_Yr_2006-07.csv',
 '_boxscores-traditional_Playoffs_Season_2007-08_Yr_2007-08.csv',
 '_boxscores-traditional_Playoffs_Season_2008-09_Yr_2008-09.csv',
 '_boxscores-traditional_Playoffs_Season_2009-10_Yr_2009-10.csv',
 '_boxscores-traditional_Playoffs_Season_2010-11_Yr_2010-11.csv',
 '_boxscores-traditional_Playoffs_Season_2011-12_Yr_2011-12.csv',
 '_boxscores-traditional_Playoffs_Season_2012-13_Yr_2012-13.csv',
 '_boxscores-traditional_Playoffs_Season_2013-14_Yr_2013-14.csv',
 '_boxscores-traditional_Playoffs_Season_2014-15_Yr_2014-15.csv',
 '_boxscores-traditional_Playoffs_Season_2015-16_Yr_2015-16.csv',
 '_boxscores-traditional_Playoffs_Season_2016-17_Yr_2016-17.csv',
 '_boxscores-traditional_Playoffs_Season_2017-18_Yr_2017-18.csv',
 '_boxscores-traditional_Playoffs_Season_2018-19_Yr_2018-19.csv',
 '_boxscores-traditional_Playoffs_Season_2019-20_Yr_2019-20.csv',
 '_boxscores-traditional_Playoffs_Season_2020-21_Yr_2020-21.csv',
 '_boxscores-traditional_Playoffs_Season_2021-22_Yr_2021-22.csv']
```

```
In [ ]: def get_seasontype(filename):
    if 'Playoffs' in filename:
        return 'Playoffs'
    else:
        return 'Regular'
```

```
In [ ]: # append all trad_boxes to one file
trad_df = pd.DataFrame()

for file in trad_files:
    df = pd.read_csv('data/team/team_boxscores/traditional/' + file)
    # drop index
    df = df.drop(df.columns[0], axis=1)
    df.columns = df.columns.str.lower()
    df['season'] = file[-11:-7]
    df['season_type'] = get_seasontype(file)
    trad_df = trad_df.append(df)

trad_df = trad_df.dropna()
trad_df = trad_df.reset_index(drop=True)
trad_df
```

Out[ ]:

	team	match up	game date	w/l	min	pts	fgm	fga	fg%	3pm	...	dreb	reb	ast	tov
0	UTA	UTA @ SAC	04/20/1997	W	48.0	113.0	43.0	76.0	56.6	2.0	...	23.0	32.0	29.0	9.0
1	TOR	TOR @ BOS	04/20/1997	W	48.0	125.0	49.0	92.0	53.3	8.0	...	26.0	34.0	25.0	5.0
2	LAL	LAL @ POR	04/20/1997	L	48.0	96.0	38.0	82.0	46.3	3.0	...	24.0	35.0	18.0	12.0
3	CHH	CHH @ MIL	04/20/1997	L	48.0	100.0	37.0	80.0	46.3	5.0	...	23.0	31.0	19.0	16.0
4	DET	DET @ IND	04/20/1997	W	53.0	124.0	42.0	80.0	52.5	10.0	...	29.0	37.0	19.0	12.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
65457	PHI	PHI vs. TOR	04/16/2022	W	48.0	131.0	43.0	84.0	51.2	16.0	...	29.0	39.0	29.0	4.0
65458	GSW	GSW vs. DEN	04/16/2022	W	48.0	123.0	43.0	82.0	52.4	16.0	...	31.0	41.0	33.0	13.0
65459	MIN	MIN @ MEM	04/16/2022	W	48.0	130.0	45.0	90.0	50.0	16.0	...	35.0	46.0	32.0	19.0
65460	UTA	UTA @ DAL	04/16/2022	W	48.0	99.0	36.0	83.0	43.4	7.0	...	40.0	53.0	15.0	14.0
65461	DAL	DAL vs. UTA	04/16/2022	L	48.0	93.0	29.0	76.0	38.2	9.0	...	27.0	34.0	17.0	7.0

65462 rows × 26 columns

In [ ]: trad\_df.to\_csv('data/team/team\_boxscores/All\_Traditional.csv')

In [ ]: trad\_df.season.unique()

Out[ ]: array(['1996', '1997', '1998', '1999', '2000', '2001', '2002', '2003', '2004', '2005', '2006', '2007', '2008', '2009', '2010', '2011', '2012', '2013', '2014', '2015', '2016', '2017', '2018', '2019', '2020', '2021'], dtype=object)

In [ ]: adv\_files = os.listdir('data/team/team\_boxscores/advanced')

adv\_df = pd.DataFrame()

for file in adv\_files:  
 df = pd.read\_csv('data/team/team\_boxscores/advanced/' + file)

```
# drop index
df = df.drop(df.columns[0], axis=1)
df.columns = df.columns.str.lower()
df['season'] = file[-11:-7]
df['season_type'] = get_seasontype(file)
adv_df = adv_df.append(df)

adv_df = adv_df.dropna()
adv_df = adv_df.reset_index(drop=True)
adv_df
```

Out[ ]:

	team	match up	game date	w/l	min	offrtg	defrtg	netrtg	ast%	ast/to	...	oreb%	dreb
<b>0</b>	UTA	UTA @ SAC	04/20/1997	W	48.0	127.0	122.5	4.5	67.4	3.22	...	34.3	63
<b>1</b>	TOR	TOR @ BOS	04/20/1997	W	48.0	126.3	94.0	32.3	51.0	5.00	...	19.1	63
<b>2</b>	IND	IND vs. DET	04/20/1997	L	53.0	117.6	122.8	-5.1	61.4	1.93	...	49.2	80
<b>3</b>	SAC	SAC vs. UTA	04/20/1997	L	48.0	120.2	127.0	-6.7	65.6	1.58	...	35.8	65
<b>4</b>	CHH	CHH @ MIL	04/20/1997	L	48.0	102.0	125.0	-23.0	51.4	1.19	...	26.7	62
...	...	...	...	...	...	...	...	...	...	...	...	...	...
<b>65457</b>	GSW	GSW vs. DEN	04/16/2022	W	48.0	130.9	113.8	17.0	76.7	2.54	...	34.1	66
<b>65458</b>	UTA	UTA @ DAL	04/16/2022	W	48.0	108.8	103.3	5.5	41.7	1.07	...	39.6	82
<b>65459</b>	MEM	MEM vs. MIN	04/16/2022	L	48.0	111.4	121.5	-10.1	64.1	2.08	...	25.0	67
<b>65460</b>	DAL	DAL vs. UTA	04/16/2022	L	48.0	103.3	108.8	-5.5	58.6	2.43	...	17.6	60
<b>65461</b>	MIN	MIN @ MEM	04/16/2022	W	48.0	121.5	111.4	10.1	71.1	1.68	...	32.6	75

65462 rows × 21 columns

In [ ]: `adv_df.to_csv('data/team/team_boxscores/All_Advanced.csv')`

In [ ]: `four_factors_files = os.listdir('data/team/team_boxscores/four-factors')`

```
four_factors_df = pd.DataFrame()
for file in four_factors_files:
    df = pd.read_csv('data/team/team_boxscores/four-factors/' + file)
    # drop index
    df = df.drop(df.columns[0], axis=1)
    df.columns = df.columns.str.lower()
    df['season'] = file[-11:-7]
    df['season_type'] = get_seasontype(file)
    four_factors_df = four_factors_df.append(df)
```

```
four_factors_df = four_factors_df.dropna()
four_factors_df = four_factors_df.reset_index(drop=True)
four_factors_df
```

Out[ ]:

	team	match up	game date	w/l	min	efg%	ftarate	tov%	oreb%	oppefg%	oppfta rate	opp
<b>0</b>	SAS	SAS vs. HOU	04/20/1997	L	48.0	45.9	0.337	8.8	34.0	46.5	0.318	
<b>1</b>	TOR	TOR @ BOS	04/20/1997	W	48.0	57.6	0.272	5.1	19.1	48.7	0.382	
<b>2</b>	SAC	SAC vs. UTA	04/20/1997	L	48.0	57.6	0.953	14.6	35.8	57.9	0.382	
<b>3</b>	LAL	LAL @ POR	04/20/1997	L	48.0	48.2	0.293	12.9	27.7	55.1	0.500	
<b>4</b>	DET	DET @ IND	04/20/1997	W	53.0	58.8	0.488	11.9	19.5	48.0	0.290	
...	...	...	...	...	...	...	...	...	...	...	...	
<b>65457</b>	GSW	GSW vs. DEN	04/16/2022	W	48.0	62.2	0.354	13.8	34.1	52.2	0.140	
<b>65458</b>	DEN	DEN @ GSW	04/16/2022	L	48.0	52.2	0.140	11.7	33.3	62.2	0.354	
<b>65459</b>	MIN	MIN @ MEM	04/16/2022	W	48.0	58.9	0.300	17.8	32.6	49.4	0.500	
<b>65460</b>	TOR	TOR @ PHI	04/16/2022	L	48.0	56.1	0.280	8.8	27.9	60.7	0.405	
<b>65461</b>	UTA	UTA @ DAL	04/16/2022	W	48.0	47.6	0.277	15.4	39.6	44.1	0.447	

65462 rows × 15 columns

In [ ]:

```
four_factors_df.to_csv('data/team/team_boxscores/All_Four_Factors.csv')
```

In [ ]:

```
misc_box_files = os.listdir('data/team/team_boxscores/misc')

misc_box_df = pd.DataFrame()
for file in misc_box_files:
    df = pd.read_csv('data/team/team_boxscores/misc/' + file)
    # drop index
    df = df.drop(df.columns[0], axis=1)
    df.columns = df.columns.str.lower()
```

```

df['season'] = file[-11:-7]
df['season_type'] = get_seasontype(file)
misc_box_df = misc_box_df.append(df)

misc_box_df = misc_box_df.dropna()
misc_box_df = misc_box_df.reset_index(drop=True)
misc_box_df

```

Out[ ]:

	team	match up	game date	w/l	min	ptsoff to	2ndpts	fbps	pitp	opp ptsoff to	opp2nd pts
0	LAL	LAL @ POR	04/20/1997	L	48.0	15.0	16.0	13.0	64.0	15.0	12.0
1	TOR	TOR @ BOS	04/20/1997	W	48.0	27.0	15.0	30.0	68.0	4.0	14.0
2	CLE	CLE vs. WAS	04/20/1997	L	48.0	13.0	10.0	8.0	40.0	10.0	26.0
3	HOU	HOU @ SAS	04/20/1997	W	48.0	14.0	15.0	4.0	38.0	21.0	18.0
4	MIL	MIL vs. CHH	04/20/1997	W	48.0	20.0	18.0	28.0	74.0	18.0	10.0
...	...	...	...	...	...	...	...	...	...	...	...
65457	MEM	MEM vs. MIN	04/16/2022	L	48.0	25.0	14.0	18.0	60.0	11.0	19.0
65458	DAL	DAL vs. UTA	04/16/2022	L	48.0	14.0	7.0	10.0	36.0	10.0	20.0
65459	UTA	UTA @ DAL	04/16/2022	W	48.0	10.0	20.0	8.0	50.0	14.0	7.0
65460	DEN	DEN @ GSW	04/16/2022	L	48.0	17.0	8.0	16.0	54.0	21.0	20.0
65461	TOR	TOR @ PHI	04/16/2022	L	48.0	4.0	7.0	10.0	48.0	11.0	17.0

65462 rows × 15 columns

In [ ]: misc\_box\_df.to\_csv('data/team/team\_boxscores/All\_Misc.csv')

```

In [ ]: scoring_box_files = os.listdir('data/team/team_boxscores/scoring')

scoring_box_df = pd.DataFrame()
for file in scoring_box_files:
    df = pd.read_csv('data/team/team_boxscores/scoring/' + file)

```

```
# drop index
df = df.drop(df.columns[0], axis=1)
df.columns = df.columns.str.lower()
df['season'] = file[-11:-7]
df['season_type'] = get_seasontype(file)
scoring_box_df = scoring_box_df.append(df)

scoring_box_df = scoring_box_df.dropna()
scoring_box_df = scoring_box_df.reset_index(drop=True)
scoring_box_df
```

Out[ ]:

	team	match up	game date	w/l	min	%fga2pt	%fga3pt	%pts2pt	%pts2pt mr	%pts3pt	..
0	TOR	TOR @ BOS	04/20/1997	W	48.0	76.1	23.9	65.6	11.2	19.2	..
1	HOU	HOU @ SAS	04/20/1997	W	48.0	70.6	29.4	56.3	19.4	20.4	..
2	UTA	UTA @ SAC	04/20/1997	W	48.0	90.8	9.2	72.6	14.2	5.3	..
3	CHH	CHH @ MIL	04/20/1997	L	48.0	82.5	17.5	64.0	22.0	15.0	..
4	POR	POR vs. LAL	04/20/1997	W	48.0	82.4	17.6	60.0	16.0	15.0	..
...	...	...	...	...	...	...	...	...	...	...	..
65457	GSW	GSW vs. DEN	04/16/2022	W	48.0	57.3	42.7	43.9	9.8	39.0	..
65458	PHI	PHI vs. TOR	04/16/2022	W	48.0	61.9	38.1	41.2	3.1	36.6	..
65459	MEM	MEM vs. MIN	04/16/2022	L	48.0	68.6	31.4	54.7	3.4	17.9	..
65460	DEN	DEN @ GSW	04/16/2022	L	48.0	62.4	37.6	59.8	9.3	30.8	..
65461	DAL	DAL vs. UTA	04/16/2022	L	48.0	57.9	42.1	43.0	4.3	29.0	..

65462 rows × 22 columns

In [ ]: `scoring_box_df.to_csv('data/team/team_boxscores/All_Scoring.csv')`

## Fix dtypes

In [ ]: `four_factors_df.columns`

Out[ ]: `Index(['team', 'match up', 'game date', 'w/l', 'min', 'efg%', 'fttarate', 'tov%', 'oreb%', 'oppefg%', 'oppfta rate', 'opptov%', 'opporeb%', 'season', 'season_type'], dtype='object')`

```
In [ ]: four_factors_df['efg%'] = four_factors_df['efg%'].astype(str)
four_factors_df['efg%'] = four_factors_df['efg%'].str.replace('%', '')
four_factors_df['efg%'] = four_factors_df['efg%'].astype(float)

four_factors_df['tov%'] = four_factors_df['tov%'].astype(str)
four_factors_df['tov%'] = four_factors_df['tov%'].str.replace('%', '')
four_factors_df['tov%'] = four_factors_df['tov%'].astype(float)

four_factors_df['opptov%'] = four_factors_df['opptov%'].astype(str)
four_factors_df['opptov%'] = four_factors_df['opptov%'].str.replace('%', '')
four_factors_df['opptov%'] = four_factors_df['opptov%'].astype(float)

four_factors_df['opporeb%'] = four_factors_df['opporeb%'].astype(str)
four_factors_df['opporeb%'] = four_factors_df['opporeb%'].str.replace('%', '')
four_factors_df['opporeb%'] = four_factors_df['opporeb%'].astype(float)
```

```
In [ ]: trad_df.rename(columns = {'game\x0date': 'gamedate'}, inplace = True)
trad_df.rename(columns = {'match\x0up': 'matchup'}, inplace = True)
trad_df.rename(columns = {'game date': 'gamedate'}, inplace = True)
trad_df.rename(columns = {'match up': 'matchup'}, inplace = True)

adv_df.rename(columns = {'adv_game\x0date': 'adv_gamedate'}, inplace = True)
adv_df.rename(columns = {'adv_match\x0up': 'adv_matchup'}, inplace = True)
adv_df.rename(columns = {'adv_game date': 'adv_gamedate'}, inplace = True)
adv_df.rename(columns = {'adv_match up': 'adv_matchup'}, inplace = True)

four_factors_df.rename(columns = {'four_game\x0date': 'four_gamedate'}, inplace = True)
four_factors_df.rename(columns = {'four_match\x0up': 'four_matchup'}, inplace = True)
four_factors_df.rename(columns = {'four_game date': 'four_gamedate'}, inplace = True)
four_factors_df.rename(columns = {'four_match up': 'four_matchup'}, inplace = True)

misc_box_df.rename(columns = {'misc_game\x0date': 'misc_gamedate'}, inplace = True)
misc_box_df.rename(columns = {'misc_match\x0up': 'misc_matchup'}, inplace = True)
misc_box_df.rename(columns = {'misc_game date': 'misc_gamedate'}, inplace = True)
misc_box_df.rename(columns = {'misc_match up': 'misc_matchup'}, inplace = True)

scoring_box_df.rename(columns = {'scoring_game\x0date': 'scoring_gamedate'}, inplace = True)
scoring_box_df.rename(columns = {'scoring_match\x0up': 'scoring_matchup'}, inplace = True)
scoring_box_df.rename(columns = {'scoring_game date': 'scoring_gamedate'}, inplace = True)
scoring_box_df.rename(columns = {'scoring_match up': 'scoring_matchup'}, inplace = True)
```

## Save Advanced Boxes

```
In [ ]: adv_df.to_csv('data/team/team_boxscores/ALL_advanced_boxes.csv')
trad_df.to_csv('data/team/team_boxscores/ALL_traditional_boxes.csv')
four_factors_df.to_csv('data/team/team_boxscores/ALL_four_factors_boxes.csv')
misc_box_df.to_csv('data/team/team_boxscores/ALL_misc_boxes.csv')
scoring_box_df.to_csv('data/team/team_boxscores/ALL_scoring_boxes.csv')
```

```
In [ ]: trad_boxes = pd.read_csv('data/team/team_boxscores/ALL_traditional_boxes.csv')
adv_boxes = pd.read_csv('data/team/team_boxscores/ALL_advanced_boxes.csv')
four_factors_df = pd.read_csv('data/team/team_boxscores/ALL_four_factors_boxes.csv')
misc_boxes = pd.read_csv('data/team/team_boxscores/ALL_misc_boxes.csv')
scoring_boxes = pd.read_csv('data/team/team_boxscores/ALL_scoring_boxes.csv')
```

```
In [ ]: # add prefixes to columns for each boxscore type (other than trad)
adv_boxes.columns = ['adv_' + str(col) for col in adv_boxes.columns]
```

```
four_factors_df.columns = ['four_' + str(col) for col in four_factors_df.columns]
misc_boxes.columns = ['misc_' + str(col) for col in misc_boxes.columns]
scoring_boxes.columns = ['scoring_' + str(col) for col in scoring_boxes.columns]
```

In [ ]: # pre-merge check  
print(f' traditional: {trad\_boxes.shape}, advanced = {adv\_boxes.shape}, four factors =  
traditional: (65462, 27), advanced = (65462, 22), four factors = (65462, 16), misc =  
(65462, 16), scoring = (65462, 23)

In [ ]: adv\_boxes.head(2)

Out[ ]: adv\_Unnamed:  
0 adv\_team adv\_match up adv\_game date adv\_w/l adv\_min adv\_offrtg adv\_defrtg  
1 0 UTA UTA @ SAC 04/20/1997 W 48.0 127.0 122.5  
1 1 TOR TOR @ BOS 04/20/1997 W 48.0 126.3 94.0

2 rows × 22 columns

In [ ]: adv\_boxes.rename(columns = {'adv\_game\xa0date': 'adv\_gamedate'}, inplace = True)  
adv\_boxes.rename(columns = {'adv\_match\xa0up': 'adv\_matchup'}, inplace = True)  
adv\_boxes.rename(columns = {'adv\_game date': 'adv\_gamedate'}, inplace = True)  
adv\_boxes.rename(columns = {'adv\_match up': 'adv\_matchup'}, inplace = True)

In [ ]: four\_factors\_df.rename(columns = {'four\_game\xa0date': 'four\_gamedate'}, inplace = True)  
four\_factors\_df.rename(columns = {'four\_match\xa0up': 'four\_matchup'}, inplace = True)  
four\_factors\_df.rename(columns = {'four\_game date': 'four\_gamedate'}, inplace = True)  
four\_factors\_df.rename(columns = {'four\_match up': 'four\_matchup'}, inplace = True)

In [ ]: misc\_boxes.rename(columns = {'misc\_game\xa0date': 'misc\_gamedate'}, inplace = True)  
misc\_boxes.rename(columns = {'misc\_match\xa0up': 'misc\_matchup'}, inplace = True)  
misc\_boxes.rename(columns = {'misc\_game date': 'misc\_gamedate'}, inplace = True)  
misc\_boxes.rename(columns = {'misc\_match up': 'misc\_matchup'}, inplace = True)  
  
scoring\_boxes.rename(columns = {'scoring\_game\xa0date': 'scoring\_gamedate'}, inplace = True)  
scoring\_boxes.rename(columns = {'scoring\_match\xa0up': 'scoring\_matchup'}, inplace = True)  
scoring\_boxes.rename(columns = {'scoring\_game date': 'scoring\_gamedate'}, inplace = True)  
scoring\_boxes.rename(columns = {'scoring\_match up': 'scoring\_matchup'}, inplace = True)

In [ ]: all\_boxes = quintuple\_merge(trad\_boxes, adv\_boxes, four\_factors\_df, misc\_boxes, scoring\_boxes)

Out[ ]:

		team	matchup	gamedate	w/l	min	pts	fgm	fga	fg%	...	scoring_%ptsoff
<b>0</b>	0	UTA	UTA @ SAC	04/20/1997	W	48.0	113.0	43.0	76.0	56.6	...	1
<b>1</b>	1	TOR	TOR @ BOS	04/20/1997	W	48.0	125.0	49.0	92.0	53.3	...	2
<b>2</b>	2	LAL	LAL @ POR	04/20/1997	L	48.0	96.0	38.0	82.0	46.3	...	1
<b>3</b>	3	CHE	CHE @ MIL	04/20/1997	L	48.0	100.0	37.0	80.0	46.3	...	1
<b>4</b>	4	DET	DET @ IND	04/20/1997	W	53.0	124.0	42.0	80.0	52.5	...	1
...	...	...	...	...	...	...	...	...	...	...	...	...
<b>65457</b>	65457	PHI	PHI vs. TOR	04/16/2022	W	48.0	131.0	43.0	84.0	51.2	...	
<b>65458</b>	65458	GSW	GSW vs. DEN	04/16/2022	W	48.0	123.0	43.0	82.0	52.4	...	1
<b>65459</b>	65459	MIN	MIN @ MEM	04/16/2022	W	48.0	130.0	45.0	90.0	50.0	...	
<b>65460</b>	65460	UTA	UTA @ DAL	04/16/2022	W	48.0	99.0	36.0	83.0	43.4	...	1
<b>65461</b>	65461	DAL	DAL vs. UTA	04/16/2022	L	48.0	93.0	29.0	76.0	38.2	...	1

65462 rows × 104 columns

In [ ]: `#find all unnamed columns`  
`unnamed_cols = [col for col in all_boxes.columns if 'Unnamed' in col]`  
`unnamed_cols`

Out[ ]: `['Unnamed: 0', 'adv_Unnamed: 0', 'four_Unnamed: 0', 'misc_Unnamed: 0', 'scoring_Unnamed: 0']`

In [ ]: `all_boxes = all_boxes.drop(unnamed_cols, axis = 1)`

In [ ]: `all_boxes.to_csv('data/team/team_boxscores/ALL_BOXES.csv')`

## Load all\_boxes

In [ ]: `all_boxes = pd.read_csv('data/team/team_boxscores/ALL_BOXES.csv')`

## Fixing up all\_boxes

We have 68000 rows, with 2 rows per game, meaning approximately 34,000 games.

I need to match games up now

```
In [ ]: all_boxes_copy = all_boxes.copy()
all_boxes_copy = all_boxes_copy.add_prefix('tm2__')

In [ ]: print(f' all_boxes shape: {all_boxes.shape}, all_boxes_copy shape: {all_boxes_copy.shape}')
        all_boxes shape: (65462, 100), all_boxes_copy shape: (65462, 100)

In [ ]: # add game id and second team to all_boxes
        all_boxes['matchup'] = all_boxes['matchup'].astype(str)
        all_boxes['team_2'] = all_boxes['matchup'].str[-3:]
        all_boxes.head(3)
```

		Unnamed: 0	team	matchup	gamedate	w/l	min	pts	fgm	fga	fg%	...	scoring_%ptspitp	sc
<b>0</b>		0	UTA	UTA @ SAC	04/20/1997	W	48.0	113.0	43.0	76.0	56.6	...		58.4
<b>1</b>		1	TOR	TOR @ BOS	04/20/1997	W	48.0	125.0	49.0	92.0	53.3	...		54.4
<b>2</b>		2	LAL	LAL @ POR	04/20/1997	L	48.0	96.0	38.0	82.0	46.3	...		66.7

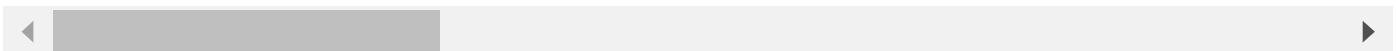
3 rows × 101 columns

```
In [ ]: all_boxes['game_id'] = np.where(all_boxes['matchup'].str.contains('vs'),
                                         all_boxes['matchup'].str[-3:] + ' @ ' +
                                         all_boxes['matchup'].str[0:3] + '_',
                                         all_boxes['gamedate'].astype(str),
                                         all_boxes['matchup'].astype(str) + '_' + all_boxes['gamedate'].astype(str))

In [ ]: # create Game_id
        all_boxes_copy['game_id'] = np.where(all_boxes_copy['tm2__matchup'].str.contains('vs'),
                                              all_boxes_copy['tm2__matchup'].str[-3:] + ' @ ' +
                                              all_boxes_copy['tm2__matchup'].str[0:3] + '_',
                                              all_boxes_copy['tm2__gamedate'].astype(str),
                                              all_boxes_copy['tm2__matchup'].astype(str) + '_' + all_boxes_copy['tm2__gamedate'].astype(str).head(3))
```

	tm2__Unnamed: 0	tm2_team	tm2_matchup	tm2_gamedate	tm2_w/l	tm2_min	tm2_pts	tm2_
<b>0</b>	0	UTA	UTA @ SAC	04/20/1997	W	48.0	113.0	
<b>1</b>	1	TOR	TOR @ BOS	04/20/1997	W	48.0	125.0	
<b>2</b>	2	LAL	LAL @ POR	04/20/1997	L	48.0	96.0	

3 rows × 101 columns



```
In [ ]: check1 = all_boxes[['game_id', 'team_2']]
check2 = all_boxes_copy[['game_id', 'tm2_team']]
```

```
Out[ ]: game_id      object
team_2       object
dtype: object
```

```
In [ ]: all_boxes.game_id = all_boxes.game_id.astype(str)
all_boxes_copy.game_id = all_boxes_copy.game_id.astype(str)
all_boxes_copy.tm2_team = all_boxes_copy.tm2_team.astype(str)
all_boxes.team_2 = all_boxes.team_2.astype(str)
```

```
In [ ]: # merge the dfs
boxes_both_teams = pd.merge(all_boxes, all_boxes_copy,
                            left_on = ['game_id', 'team_2'],
                            right_on = ['game_id', 'tm2_team'],
                            how = 'left')
boxes_both_teams
```

Out[ ]:

	Unnamed: 0	team	matchup	gamedate	w/l	min	pts	fgm	fga	fg%	...	tm2_scoring_%
<b>0</b>	0	UTA	UTA @ SAC	04/20/1997	W	48.0	113.0	43.0	76.0	56.6	...	
<b>1</b>	1	TOR	TOR @ BOS	04/20/1997	W	48.0	125.0	49.0	92.0	53.3	...	
<b>2</b>	2	LAL	LAL @ POR	04/20/1997	L	48.0	96.0	38.0	82.0	46.3	...	
<b>3</b>	3	CHH	CHH @ MIL	04/20/1997	L	48.0	100.0	37.0	80.0	46.3	...	
<b>4</b>	4	DET	DET @ IND	04/20/1997	W	53.0	124.0	42.0	80.0	52.5	...	
...	...	...	...	...	...	...	...	...	...	...	...	...
<b>65457</b>	65457	PHI	PHI vs. TOR	04/16/2022	W	48.0	131.0	43.0	84.0	51.2	...	
<b>65458</b>	65458	GSW	GSW vs. DEN	04/16/2022	W	48.0	123.0	43.0	82.0	52.4	...	
<b>65459</b>	65459	MIN	MIN @ MEM	04/16/2022	W	48.0	130.0	45.0	90.0	50.0	...	
<b>65460</b>	65460	UTA	UTA @ DAL	04/16/2022	W	48.0	99.0	36.0	83.0	43.4	...	
<b>65461</b>	65461	DAL	DAL vs. UTA	04/16/2022	L	48.0	93.0	29.0	76.0	38.2	...	

65462 rows × 202 columns

In [ ]: boxes\_both\_teams = boxes\_both\_teams.drop\_duplicates()  
 boxes\_both\_teams2 = boxes\_both\_teams.dropna(subset = ['tm2\_scoring\_season'])

In [ ]: boxes\_both\_teams2

Out[ ]:

		team	matchup	gamedate	w/l	min	pts	fgm	fga	fg%	...	tm2_scoring_%
<b>0</b>	0	UTA	UTA @ SAC	04/20/1997	W	48.0	113.0	43.0	76.0	56.6	...	
<b>1</b>	1	TOR	TOR @ BOS	04/20/1997	W	48.0	125.0	49.0	92.0	53.3	...	
<b>2</b>	2	LAL	LAL @ POR	04/20/1997	L	48.0	96.0	38.0	82.0	46.3	...	
<b>3</b>	3	CHH	CHH @ MIL	04/20/1997	L	48.0	100.0	37.0	80.0	46.3	...	
<b>4</b>	4	DET	DET @ IND	04/20/1997	W	53.0	124.0	42.0	80.0	52.5	...	
...	...	...	...	...	...	...	...	...	...	...	...	...
<b>65457</b>	65457	PHI	PHI vs. TOR	04/16/2022	W	48.0	131.0	43.0	84.0	51.2	...	
<b>65458</b>	65458	GSW	GSW vs. DEN	04/16/2022	W	48.0	123.0	43.0	82.0	52.4	...	
<b>65459</b>	65459	MIN	MIN @ MEM	04/16/2022	W	48.0	130.0	45.0	90.0	50.0	...	
<b>65460</b>	65460	UTA	UTA @ DAL	04/16/2022	W	48.0	99.0	36.0	83.0	43.4	...	
<b>65461</b>	65461	DAL	DAL vs. UTA	04/16/2022	L	48.0	93.0	29.0	76.0	38.2	...	

65462 rows × 202 columns

In [ ]: rbbt = boxes\_both\_teams2

In [ ]: rbbt.to\_csv('data/team/both\_team\_boxscores\_ALL.csv')

## Add Features

```
In [ ]: rbbt = rbbt.assign(t1_t2_pts = rbbt['pts'] - rbbt['tm2_pts'])
rbbt = rbbt.assign(t1_t2_fgm = rbbt['fgm'] - rbbt['tm2_fgm'])
rbbt = rbbt.assign(t1_t2_fta = rbbt['fta'] - rbbt['tm2_fta'])
rbbt = rbbt.assign(t1_t2_ft_percent = rbbt['ft%'] - rbbt['tm2_ft%'])
rbbt = rbbt.assign(t1_t2_3pm = rbbt['3pm'] - rbbt['tm2_3pm'])
rbbt = rbbt.assign(t1_t2_3pa = rbbt['3pa'] - rbbt['tm2_3pa'])
rbbt = rbbt.assign(t1_t2_3p_percent = rbbt['3p%'] - rbbt['tm2_3p%'])
rbbt = rbbt.assign(t1_t2_ftm = rbbt['ftm'] - rbbt['tm2_ftm'])
rbbt = rbbt.assign(t1_t2_dreb = rbbt['dreb'] - rbbt['tm2_dreb'])
rbbt = rbbt.assign(t1_t2_reb = rbbt['reb'] - rbbt['tm2_reb'])
rbbt = rbbt.assign(t1_t2_ast = rbbt['ast'] - rbbt['tm2_ast'])
rbbt = rbbt.assign(t1_t2_stl = rbbt['stl'] - rbbt['tm2_stl'])
```

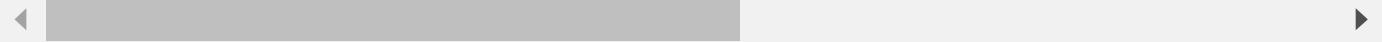
```
rbbt = rbbt.assign(t1_t2_blk = rbbt['blk'] - rbbt['tm2_blk'])
rbbt = rbbt.assign(t1_t2_tov = rbbt['tov'] - rbbt['tm2_tov'])
rbbt = rbbt.assign(t1_t2_pf = rbbt['pf'] - rbbt['tm2_pf'])
```

In [ ]: rbbt

Out[ ]:

		team	matchup	gamedate	w/l	min	pts	fgm	fga	fg%	...	t1_t2_fta	t1_t2
	Unnamed: 0												
0	0	UTA	UTA @ SAC	04/20/1997	W	48.0	113.0	43.0	76.0	56.6	...	-28.0	
1	1	TOR	TOR @ BOS	04/20/1997	W	48.0	125.0	49.0	92.0	53.3	...	-4.0	
2	2	LAL	LAL @ POR	04/20/1997	L	48.0	96.0	38.0	82.0	46.3	...	-10.0	
3	3	CHH	CHH @ MIL	04/20/1997	L	48.0	100.0	37.0	80.0	46.3	...	6.0	
4	4	DET	DET @ IND	04/20/1997	W	53.0	124.0	42.0	80.0	52.5	...	10.0	
...	...	...	...	...	...	...	...	...	...	...	...	...	
65457	65457	PHI	PHI vs. TOR	04/16/2022	W	48.0	131.0	43.0	84.0	51.2	...	11.0	
65458	65458	GSW	GSW vs. DEN	04/16/2022	W	48.0	123.0	43.0	82.0	52.4	...	16.0	
65459	65459	MIN	MIN @ MEM	04/16/2022	W	48.0	130.0	45.0	90.0	50.0	...	-16.0	
65460	65460	UTA	UTA @ DAL	04/16/2022	W	48.0	99.0	36.0	83.0	43.4	...	-11.0	
65461	65461	DAL	DAL vs. UTA	04/16/2022	L	48.0	93.0	29.0	76.0	38.2	...	11.0	

65462 rows × 220 columns



```
In [ ]: new_cols = ['t1_t2_pts', 't1_t2_fgm', 't1_t2_fga', 't1_t2_fg_percent', 't1_t2_3pm', 't1_t2_fta']
In [ ]: rbbt['who_wins'] = np.where(rbbt['w/l'] == 'W', 't1', 't2')
In [ ]: rbbt.to_csv('data/team/both_team_boxscores_ALL_with_GameDifferences.csv')
```