# CSE_151A_Project(Cheese)

November 16, 2024

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import sklearn as skl
import seaborn as sns
from sklearn import datasets
from sklearn.model_selection import cross_val_score
from sklearn.metrics import mean_squared_error, r2_score
from sklearn.model_selection import train_test_split
```

## 1 CSV File Upload

```python
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```python
# all_data_csv = glob.glob("data/*.csv")
from google.colab import files
# Choosing Kaggle key file from local computer
# To get a kaggle key, you have to log into your kaggle account and go to your
 ↪account settings
# Scroll down to the API section and create a new token
# You should be able to download a file named 'kaggle' and this is the one you
 ↪upload
files.upload()
```

```
<IPython.core.display.HTML object>
```

```
Saving kaggle.json to kaggle.json
```

```
[2]: {'kaggle.json':
     b'{"username":"emilguzman","key":"c18df66dc739ffe362255a0762353e69"}'}
```

```python
!mkdir -p ~/.kaggle
!mv kaggle.json ~/.kaggle/
!chmod 600 ~/.kaggle/kaggle.json
```

```
[4]: !kaggle datasets download -d mexwell/nba-shots
```

Dataset URL: https://www.kaggle.com/datasets/mexwell/nba-shots
License(s): other
Downloading nba-shots.zip to /content
100% 80.4M/80.4M [00:05<00:00, 31.4MB/s]
100% 80.4M/80.4M [00:05<00:00, 16.6MB/s]

```
[5]: !unzip \*.zip && rm *.zip
```

Archive:  nba-shots.zip
  inflating: NBA_2004_Shots.csv
  inflating: NBA_2005_Shots.csv
  inflating: NBA_2006_Shots.csv
  inflating: NBA_2007_Shots.csv
  inflating: NBA_2008_Shots.csv
  inflating: NBA_2009_Shots.csv
  inflating: NBA_2010_Shots.csv
  inflating: NBA_2011_Shots.csv
  inflating: NBA_2012_Shots.csv
  inflating: NBA_2013_Shots.csv
  inflating: NBA_2014_Shots.csv
  inflating: NBA_2015_Shots.csv
  inflating: NBA_2016_Shots.csv
  inflating: NBA_2017_Shots.csv
  inflating: NBA_2018_Shots.csv
  inflating: NBA_2019_Shots.csv
  inflating: NBA_2020_Shots.csv
  inflating: NBA_2021_Shots.csv
  inflating: NBA_2022_Shots.csv
  inflating: NBA_2023_Shots.csv
  inflating: NBA_2024_Shots.csv

```
[9]: # Consolidating all csv files
     import os
     file_names = os.listdir()
     all_data_csv = [file for file in file_names if file.endswith('.csv')]
```

```
[12]: dfs_combine = []

      # for each file, add to dfs_combine
      for file in all_data_csv:
          df = pd.read_csv(file)
          dfs_combine.append(df)

      # join dfs together
      df_all_data = pd.concat(dfs_combine, ignore_index=True)
```

```
# save combined dfs into new file
df_all_data.to_csv('all_years.csv', index=False)
```

[13]:
```
# removes the individual year csv files from directory
for file in all_data_csv:
    os.remove(file)
```

## 2  Exploration

[14]:
```
data = pd.read_csv('all_years.csv')
```

[15]:
```
print('Data Columns: ')
print(data.columns)
print('Data Shape: ')
print(data.shape)
```

```
Data Columns:
Index(['SEASON_1', 'SEASON_2', 'TEAM_ID', 'TEAM_NAME', 'PLAYER_ID',
       'PLAYER_NAME', 'POSITION_GROUP', 'POSITION', 'GAME_DATE', 'GAME_ID',
       'HOME_TEAM', 'AWAY_TEAM', 'EVENT_TYPE', 'SHOT_MADE', 'ACTION_TYPE',
       'SHOT_TYPE', 'BASIC_ZONE', 'ZONE_NAME', 'ZONE_ABB', 'ZONE_RANGE',
       'LOC_X', 'LOC_Y', 'SHOT_DISTANCE', 'QUARTER', 'MINS_LEFT', 'SECS_LEFT'],
      dtype='object')
Data Shape:
(4231262, 26)
```

[16]:
```
data.head()
```

[16]:
```
   SEASON_1 SEASON_2      TEAM_ID            TEAM_NAME  PLAYER_ID  \
0      2011  2010-11   1610612759      San Antonio Spurs       2588
1      2011  2010-11   1610612759      San Antonio Spurs     202390
2      2011  2010-11   1610612746  Los Angeles Clippers     201933
3      2011  2010-11   1610612746  Los Angeles Clippers     201933
4      2011  2010-11   1610612763      Memphis Grizzlies     201564

     PLAYER_NAME POSITION_GROUP POSITION   GAME_DATE   GAME_ID  … \
0    Matt Bonner              F       PF  04-13-2011  21001229  …
1      Gary Neal              G       SG  04-13-2011  21001229  …
2  Blake Griffin              F       PF  04-13-2011  21001228  …
3  Blake Griffin              F       PF  04-13-2011  21001228  …
4      O.J. Mayo              G       SG  04-13-2011  21001228  …

       BASIC_ZONE   ZONE_NAME ZONE_ABB  ZONE_RANGE  LOC_X  LOC_Y  \
0       Mid-Range  Right Side        R    8-16 ft.  -12.5   7.45
1   Right Corner 3  Right Side        R     24+ ft.  -23.0   5.95
```

```
2     Restricted Area      Center      C  Less Than 8 ft.   0.8   6.45
3     Restricted Area      Center      C  Less Than 8 ft.   1.1   7.25
4  Above the Break 3       Center      C          24+ ft.  -1.7  32.15

   SHOT_DISTANCE  QUARTER  MINS_LEFT  SECS_LEFT
0             12        4          0          0
1             23        4          0          0
2              1        4          0          0
3              2        4          0          0
4             26        4          0          7

[5 rows x 26 columns]
```

```
[17]:  for attribute in data.columns:
           print('-----' + attribute + '-----')
           print(data[attribute].unique())
           print('\n')
```

```
-----SEASON_1-----
[2011 2004 2009 2019 2018 2017 2008 2021 2024 2014 2006 2022 2020 2016
 2015 2007 2013 2012 2010 2005 2023]


-----SEASON_2-----
['2010-11' '2003-04' '2008-09' '2018-19' '2017-18' '2016-17' '2007-08'
 '2020-21' '2023-24' '2013-14' '2005-06' '2021-22' '2019-20' '2015-16'
 '2014-15' '2006-07' '2012-13' '2011-12' '2009-10' '2004-05' '2022-23']


-----TEAM_ID-----
[1610612759 1610612746 1610612763 1610612758 1610612756 1610612747
 1610612751 1610612754 1610612753 1610612764 1610612739 1610612745
 1610612760 1610612750 1610612749 1610612740 1610612742 1610612757
 1610612741 1610612744 1610612748 1610612761 1610612755 1610612752
 1610612743 1610612738 1610612762 1610612765 1610612766 1610612737]


-----TEAM_NAME-----
['San Antonio Spurs' 'Los Angeles Clippers' 'Memphis Grizzlies'
 'Sacramento Kings' 'Phoenix Suns' 'Los Angeles Lakers' 'New Jersey Nets'
 'Indiana Pacers' 'Orlando Magic' 'Washington Wizards'
 'Cleveland Cavaliers' 'Houston Rockets' 'Oklahoma City Thunder'
 'Minnesota Timberwolves' 'Milwaukee Bucks' 'New Orleans Hornets'
 'Dallas Mavericks' 'Portland Trail Blazers' 'Chicago Bulls'
 'Golden State Warriors' 'Miami Heat' 'Toronto Raptors'
 'Philadelphia 76ers' 'New York Knicks' 'Denver Nuggets' 'Boston Celtics'
 'Utah Jazz' 'Detroit Pistons' 'Charlotte Bobcats' 'Atlanta Hawks'
```

```
 'Seattle SuperSonics' 'LA Clippers' 'Brooklyn Nets' 'Charlotte Hornets'
 'New Orleans Pelicans' 'New Orleans/Oklahoma City Hornets']


-----PLAYER_ID-----
[   2588  202390  201933 … 1630620 1631213 1631495]


-----PLAYER_NAME-----
['Matt Bonner' 'Gary Neal' 'Blake Griffin' … 'Darius Days'
 'Tyrese Martin' 'Donovan Williams']


-----POSITION_GROUP-----
['F' 'G' 'C' nan]


-----POSITION-----
['PF' 'SG' 'PG' 'SF' 'C' 'C-PF' 'SG-PG' 'SF-SG' 'PG-SG' 'PF-SF' 'SF-PF'
 'SG-SF' 'PG-SF' 'PF-C' nan 'SG-PF' 'SG-PG-SF' 'SF-C']


-----GAME_DATE-----
['04-13-2011' '04-12-2011' '04-11-2011' … '04-01-2023' '12-06-2022'
 '12-01-2022']


-----GAME_ID-----
[21001229 21001228 21001230 … 22200214 22201008 22201216]


-----HOME_TEAM-----
['PHX' 'LAC' 'SAC' 'CHI' 'ORL' 'CLE' 'MIN' 'OKC' 'DAL' 'GSW' 'TOR' 'PHI'
 'BOS' 'UTA' 'CHA' 'LAL' 'NYK' 'POR' 'WAS' 'DEN' 'HOU' 'MIL' 'DET' 'ATL'
 'NOH' 'NJN' 'IND' 'MIA' 'MEM' 'SAS' 'SEA' 'BKN' 'NOP' 'NOK']


-----AWAY_TEAM-----
['SAS' 'MEM' 'LAL' 'NJN' 'IND' 'WAS' 'HOU' 'MIL' 'NOH' 'POR' 'MIA' 'DET'
 'NYK' 'DEN' 'ATL' 'CHI' 'BOS' 'OKC' 'GSW' 'MIN' 'DAL' 'TOR' 'CLE' 'ORL'
 'UTA' 'CHA' 'SAC' 'PHX' 'LAC' 'PHI' 'SEA' 'NOP' 'BKN' 'NOK']


-----EVENT_TYPE-----
['Missed Shot' 'Made Shot']


-----SHOT_MADE-----
```

```
[False  True]



-----ACTION_TYPE-----
['Jump Bank Shot' 'Jump Shot' 'Tip Shot' 'Layup Shot' 'Driving Layup Shot'
 'Dunk Shot' 'Reverse Layup Shot' 'Alley Oop Dunk Shot'
 'Turnaround Bank shot' 'Running Layup Shot' 'Driving Reverse Layup Shot'
 'Fadeaway Jump Shot' 'Running Jump Shot' 'Floating Jump shot'
 'Putback Dunk Shot' 'Pullup Bank shot' 'Turnaround Jump Shot'
 'Step Back Jump shot' 'Hook Shot' 'Pullup Jump shot' 'Slam Dunk Shot'
 'Driving Jump shot' 'Turnaround Fadeaway shot' 'Finger Roll Layup Shot'
 'Driving Dunk Shot' 'Jump Hook Shot' 'Putback Layup Shot'
 'Running Bank shot' 'Turnaround Hook Shot'
 'Driving Finger Roll Layup Shot' 'Driving Hook Shot' 'Driving Bank shot'
 'Alley Oop Layup shot' 'Driving Slam Dunk Shot' 'Hook Bank Shot'
 'Running Dunk Shot' 'Running Reverse Layup Shot' 'Running Hook Shot'
 'Fadeaway Bank shot' 'Putback Slam Dunk Shot' 'Reverse Slam Dunk Shot'
 'Running Slam Dunk Shot' 'Jump Bank Hook Shot' 'Reverse Dunk Shot'
 'Driving Bank Hook Shot' 'Running Tip Shot'
 'Running Finger Roll Layup Shot' 'Turnaround Bank Hook Shot'
 'Running Bank Hook Shot' 'Putback Reverse Dunk Shot'
 'Driving Finger Roll Shot' 'Running Finger Roll Shot'
 'Follow Up Dunk Shot' 'Finger Roll Shot' 'Turnaround Finger Roll Shot'
 'Running Pull-Up Jump Shot' 'Cutting Dunk Shot'
 'Driving Floating Bank Jump Shot' 'Driving Floating Jump Shot'
 'Tip Layup Shot' 'Cutting Layup Shot' 'Tip Dunk Shot'
 'Running Reverse Dunk Shot' 'Turnaround Fadeaway Bank Jump Shot'
 'Cutting Finger Roll Layup Shot' 'Driving Reverse Dunk Shot'
 'Step Back Bank Jump Shot' 'Running Alley Oop Dunk Shot'
 'Running Alley Oop Layup Shot' 'No Shot']



-----SHOT_TYPE-----
['2PT Field Goal' '3PT Field Goal']



-----BASIC_ZONE-----
['Mid-Range' 'Right Corner 3' 'Restricted Area' 'Above the Break 3'
 'In The Paint (Non-RA)' 'Backcourt' 'Left Corner 3']



-----ZONE_NAME-----
['Right Side' 'Center' 'Left Side Center' 'Right Side Center' 'Left Side'
 'Back Court']



-----ZONE_ABB-----
['R' 'C' 'LC' 'RC' 'L' 'BC']
```

```
-----ZONE_RANGE-----
['8-16 ft.' '24+ ft.' 'Less Than 8 ft.' '16-24 ft.' 'Back Court Shot']



-----LOC_X-----
[-1.25e+01 -2.30e+01  8.00e-01  1.10e+00 -1.70e+00  1.72e+01  1.57e+01
 -8.90e+00  2.30e+00 -1.00e-01  5.00e-01 -2.39e+01  7.00e-01  1.52e+01
 -1.00e+00 -1.43e+01 -1.93e+01  4.30e+00 -2.90e+00 -2.31e+01 -1.60e+01
 -2.15e+01  5.40e+00 -1.71e+01 -1.11e+01 -1.50e+00 -7.00e-01 -8.80e+00
  1.60e+00  1.96e+01 -0.00e+00 -2.09e+01 -6.70e+00  4.00e-01  2.90e+00
  1.94e+01 -4.00e-01 -9.00e-01 -6.00e-01 -1.95e+01 -1.20e+00 -8.00e+00
 -2.40e+00  1.98e+01  6.20e+00 -2.06e+01 -2.00e+00 -7.30e+00 -1.51e+01
  1.14e+01  1.66e+01 -1.38e+01 -6.10e+00 -1.80e+00  1.30e+00  8.10e+00
  7.80e+00  1.08e+01 -2.33e+01 -7.00e+00  3.50e+00 -3.00e-01 -2.41e+01
  2.00e-01  1.49e+01 -7.50e+00  1.60e+01 -6.40e+00  2.24e+01 -1.81e+01
 -1.10e+01 -2.00e-01  1.05e+01  1.63e+01 -1.66e+01  2.70e+00 -2.60e+00
  4.60e+00 -9.20e+00 -1.30e+00  5.20e+00  2.20e+01 -3.90e+00 -3.10e+00
  1.28e+01 -1.40e+01  2.40e+00  8.90e+00  1.44e+01 -1.30e+01  1.09e+01
 -1.18e+01  1.19e+01  9.70e+00 -1.47e+01  1.36e+01  1.50e+00 -2.80e+00
  1.11e+01 -2.26e+01 -4.80e+00 -1.41e+01  2.34e+01 -3.70e+00 -3.40e+00
  1.47e+01  1.46e+01  2.31e+01 -6.50e+00  1.25e+01  1.41e+01  1.27e+01
  1.17e+01  1.74e+01 -5.10e+00  1.80e+00  2.07e+01  1.90e+00 -9.90e+00
 -1.79e+01 -2.07e+01  1.38e+01  1.00e+00  9.30e+00 -1.87e+01 -2.45e+01
  1.03e+01  1.39e+01  1.87e+01 -3.20e+00  1.75e+01 -1.21e+01 -1.85e+01
 -1.44e+01 -9.10e+00 -5.00e+00 -1.05e+01  2.46e+01  1.50e+01 -2.30e+00
  9.50e+00  9.80e+00  5.60e+00 -1.19e+01  2.10e+00  2.10e+01  2.32e+01
 -1.52e+01 -2.25e+01 -1.92e+01  1.90e+01  1.30e+01 -1.00e+01 -1.65e+01
 -1.57e+01 -1.06e+01 -5.60e+00  4.90e+00  1.71e+01  4.10e+00  1.79e+01
 -2.17e+01 -2.34e+01 -1.16e+01  4.80e+00  1.22e+01  2.23e+01 -1.46e+01
  1.42e+01  2.29e+01  6.00e-01 -5.90e+00  1.64e+01  1.61e+01 -1.59e+01
 -1.55e+01 -9.50e+00 -6.90e+00 -1.54e+01  2.04e+01  6.70e+00  2.18e+01
 -2.14e+01  1.53e+01  3.40e+00 -2.00e+01 -2.28e+01  8.20e+00 -1.63e+01
  5.10e+00  6.80e+00 -1.03e+01 -1.08e+01 -6.20e+00  1.68e+01 -1.14e+01
 -1.32e+01  8.70e+00  3.80e+00 -1.84e+01 -1.22e+01 -2.23e+01  9.00e-01
  2.02e+01 -3.60e+00 -8.30e+00 -2.42e+01  1.06e+01  1.00e+01 -8.00e-01
  1.80e+01  2.15e+01  2.05e+01  2.28e+01 -1.27e+01  1.01e+01 -1.33e+01
 -1.68e+01  6.40e+00  1.12e+01  2.35e+01 -1.02e+01  2.26e+01  8.60e+00
 -4.00e+00 -4.70e+00 -1.35e+01  1.99e+01  1.58e+01 -2.22e+01 -7.70e+00
  1.83e+01 -7.20e+00 -2.11e+01  9.20e+00 -2.10e+00  2.21e+01 -2.36e+01
 -1.90e+01  2.09e+01 -1.40e+00  1.85e+01  1.23e+01 -8.10e+00 -1.49e+01
  8.40e+00 -9.70e+00  6.50e+00 -1.24e+01 -5.30e+00  7.30e+00  9.00e+00
  1.82e+01 -9.40e+00 -1.36e+01  3.00e+00  1.93e+01 -1.96e+01 -8.60e+00
  1.55e+01  7.50e+00  1.77e+01  6.00e+00 -1.98e+01  2.37e+01 -1.29e+01
 -4.20e+00  5.70e+00  3.70e+00 -1.76e+01 -1.77e+01  1.34e+01 -5.80e+00
  1.31e+01  1.91e+01  2.45e+01  3.20e+00 -1.82e+01 -1.70e+01  2.60e+00
  3.00e-01  1.88e+01 -4.50e+00 -1.13e+01 -1.89e+01 -1.73e+01  1.20e+01
```

7

```
-8.40e+00   1.16e+01   7.00e+00   4.00e+00   1.33e+01   4.50e+00   1.69e+01
 2.42e+01  -2.12e+01   7.90e+00  -5.40e+00  -2.01e+01  -2.37e+01   7.60e+00
-2.04e+01   1.00e-01   5.90e+00   2.40e+01  -2.20e+00  -4.30e+00  -1.50e+01
-2.20e+01  -1.62e+01  -1.74e+01   2.39e+01  -2.03e+01  -7.80e+00   7.10e+00
-1.90e+00   2.43e+01   1.20e+00  -1.60e+00   2.30e+01   2.01e+01   2.13e+01
 2.12e+01  -1.15e+01  -2.18e+01  -2.44e+01  -2.48e+01  -3.00e+00  -1.10e+00
-2.47e+01   1.40e+00   1.89e+01   5.00e+00   2.17e+01   3.30e+00  -2.50e+01
 2.48e+01   2.25e+01   1.76e+01   2.38e+01   2.36e+01  -9.80e+00   1.70e+00
-1.23e+01   1.21e+01   2.20e+00   4.20e+00  -1.75e+01   6.90e+00  -1.42e+01
-6.80e+00   1.86e+01  -1.78e+01   5.50e+00   2.50e+00   1.15e+01  -1.20e+01
-2.70e+00  -7.40e+00   1.97e+01   2.33e+01   1.37e+01  -1.83e+01  -2.27e+01
-6.00e+00  -1.91e+01   1.18e+01   7.20e+00  -8.20e+00  -3.50e+00   1.29e+01
 1.02e+01   6.30e+00   1.65e+01  -8.70e+00  -1.45e+01   1.73e+01   1.78e+01
 1.26e+01   5.80e+00   1.32e+01   1.40e+01  -1.67e+01   2.50e+01   1.62e+01
 7.70e+00  -1.31e+01   1.81e+01  -6.30e+00   5.30e+00  -1.07e+01  -2.35e+01
-5.50e+00  -1.58e+01  -1.39e+01   1.92e+01   6.10e+00  -7.60e+00  -1.26e+01
-1.34e+01  -1.80e+01  -1.86e+01   1.70e+01   8.00e+00   1.10e+01   1.67e+01
 8.50e+00  -1.97e+01   1.84e+01   7.40e+00  -1.28e+01  -9.00e+00   2.11e+01
-6.60e+00  -1.99e+01  -2.38e+01  -2.50e+00  -1.37e+01   1.24e+01   2.41e+01
-7.90e+00   2.00e+01  -1.88e+01  -1.94e+01   6.60e+00  -2.10e+01  -2.43e+01
 2.00e+00  -1.64e+01   1.48e+01   1.07e+01  -5.20e+00  -2.46e+01  -2.13e+01
-2.32e+01  -1.69e+01  -5.00e-01  -8.50e+00   1.54e+01  -3.80e+00   2.27e+01
-1.72e+01   1.13e+01   1.35e+01  -1.61e+01  -1.12e+01   3.10e+00   1.51e+01
 1.43e+01   1.95e+01   2.80e+00  -4.10e+00  -4.90e+00   9.90e+00  -1.48e+01
 3.60e+00  -5.70e+00  -4.40e+00  -1.56e+01   2.22e+01   1.45e+01  -3.30e+00
-2.02e+01  -7.10e+00  -1.17e+01   3.90e+00  -2.05e+01   2.14e+01  -1.53e+01
 9.40e+00   1.59e+01   1.56e+01  -4.60e+00   4.40e+00  -2.16e+01  -2.40e+01
 9.60e+00  -1.09e+01   8.30e+00   1.04e+01  -1.04e+01  -9.30e+00   8.80e+00
 9.10e+00  -2.29e+01  -1.01e+01   2.03e+01  -2.24e+01   2.16e+01   2.44e+01
 2.47e+01   4.70e+00  -9.60e+00   2.06e+01  -2.21e+01  -2.19e+01   2.08e+01
-2.08e+01   2.19e+01   2.49e+01  -2.49e+01  -2.31e+00  -1.75e+00  -2.40e-01
 1.45e+00  -1.06e+00   1.55e+00   8.50e-01   1.30e-01   1.69e+00  -1.00e-02
-1.90e-01  -1.20e-01  -9.00e-02  -2.60e-01   7.00e-02   6.00e-02   2.00e-02
-1.36e+00  -4.00e-02   5.00e-02  -1.38e+00   6.30e-01   1.07e+00  -3.00e-02
 9.80e-01   8.00e-02  -2.34e+00  -1.04e+00   2.23e+00   1.39e+00   4.80e-01
-1.59e+00   1.06e+00  -1.40e-01   1.80e-01  -3.60e-01  -1.03e+00   4.00e-02
 2.28e+00  -4.80e-01   1.19e+00  -1.77e+00  -1.80e-01   1.08e+00  -2.32e+00
-3.90e-01   2.42e+00  -5.70e-01  -2.28e+00  -8.40e-01  -8.70e-01   3.40e-01
 3.20e-01  -1.29e+00   7.50e-01  -1.25e+00  -2.30e-01  -3.10e-01   2.30e-01
-6.30e-01  -1.28e+00   1.43e+00  -1.23e+00   3.00e-02  -1.50e-01   1.72e+00
 1.82e+00  -2.24e+00   4.70e-01  -2.70e-01  -8.00e-02   2.60e-01  -1.58e+00
-3.40e-01   1.01e+00   2.25e+00   3.10e-01  -7.80e-01  -1.39e+00   5.40e-01
-1.10e-01  -2.23e+00  -1.43e+00   1.70e-01  -1.02e+00  -1.70e-01  -2.09e+00
 3.30e-01   9.00e-02  -1.30e-01  -2.00e-02  -1.88e+00  -2.26e+00  -1.64e+00
 2.34e+00  -2.90e-01  -2.04e+00  -1.14e+00  -1.66e+00   2.26e+00  -7.00e-02
-8.20e-01   2.50e-01   1.09e+00  -5.00e-02  -1.55e+00   2.31e+00   7.60e-01
 1.57e+00  -1.24e+00  -1.86e+00   1.05e+00   1.87e+00   3.50e-01  -2.21e+00
-5.30e-01   1.46e+00   4.60e-01  -1.60e-01  -1.15e+00   1.60e-01   6.60e-01
```

```
-1.21e+00 -1.82e+00 -1.85e+00  1.98e+00  1.10e-01 -9.90e-01  1.94e+00
-2.25e+00 -2.03e+00 -1.91e+00 -8.10e-01 -6.00e-02 -2.27e+00 -1.37e+00
 2.27e+00  5.90e-01 -1.27e+00 -1.54e+00 -8.60e-01 -5.50e-01  2.80e-01
 3.60e-01  1.41e+00 -1.12e+00 -1.31e+00 -1.19e+00  2.70e-01 -1.72e+00
 1.40e-01  2.20e-01 -1.71e+00 -1.57e+00 -1.93e+00  5.60e-01  2.32e+00
-4.90e-01  1.71e+00 -1.81e+00 -2.22e+00 -2.33e+00 -5.60e-01  2.40e-01
-1.49e+00 -1.56e+00  2.90e-01  1.20e-01  3.90e-01 -1.78e+00  1.74e+00
-1.63e+00  1.49e+00  8.10e-01 -1.68e+00 -7.70e-01 -5.40e-01 -2.20e-01
 8.20e-01  1.03e+00  3.80e-01  1.11e+00  1.16e+00 -1.41e+00 -5.80e-01
 1.00e-02 -1.33e+00  6.20e-01 -8.50e-01 -2.14e+00  1.50e-01  8.40e-01
 2.29e+00  6.40e-01  2.14e+00  2.09e+00 -2.39e+00 -3.30e-01 -1.32e+00
 5.30e-01  1.24e+00 -6.50e-01  1.27e+00  1.66e+00  9.60e-01 -4.40e-01
 2.03e+00  1.25e+00  5.80e-01 -2.50e-01  4.40e-01 -1.52e+00  5.20e-01
 1.76e+00 -1.13e+00 -2.10e-01 -2.29e+00  1.34e+00  1.35e+00  1.90e-01
-1.76e+00  5.10e-01  1.31e+00 -4.70e-01  9.30e-01  3.70e-01  5.50e-01
 6.90e-01 -7.20e-01 -4.20e-01  6.80e-01 -3.80e-01  1.59e+00  1.04e+00
-1.98e+00 -2.02e+00  1.14e+00 -1.07e+00  1.63e+00 -1.01e+00 -1.69e+00
-4.10e-01 -6.10e-01  1.65e+00  5.70e-01 -9.10e-01 -1.51e+00 -3.20e-01
 9.70e-01  1.12e+00 -1.17e+00 -2.18e+00  8.60e-01 -7.10e-01 -4.60e-01
-2.08e+00 -9.40e-01  4.50e-01 -5.20e-01  2.07e+00 -1.79e+00 -9.30e-01
-1.22e+00  7.40e-01 -1.05e+00  7.70e-01 -9.70e-01 -2.35e+00 -1.44e+00
 1.28e+00  2.18e+00  1.33e+00 -1.83e+00 -1.11e+00  7.90e-01 -1.47e+00
 7.30e-01  8.70e-01 -9.20e-01  8.90e-01 -4.30e-01 -2.17e+00 -5.90e-01
 6.50e-01  4.10e-01 -2.15e+00 -3.50e-01 -1.61e+00  1.23e+00 -7.50e-01
-2.11e+00 -6.70e-01  1.44e+00  2.38e+00  1.52e+00 -1.16e+00 -1.34e+00
 2.37e+00  2.10e-01 -9.50e-01 -1.94e+00 -4.50e-01  1.77e+00  8.30e-01
-1.95e+00  2.01e+00  1.32e+00  2.35e+00 -2.12e+00  4.90e-01  1.68e+00
 1.85e+00 -1.42e+00  1.91e+00 -6.80e-01  9.20e-01 -2.38e+00 -1.65e+00
 2.08e+00 -5.10e-01 -2.37e+00  2.12e+00  1.36e+00  1.38e+00 -2.06e+00
 2.24e+00 -1.92e+00  9.50e-01 -2.07e+00  2.22e+00 -1.96e+00  1.83e+00
 1.92e+00 -2.36e+00 -1.53e+00 -7.60e-01  2.45e+00  2.15e+00 -8.80e-01
 7.80e-01  1.22e+00 -7.90e-01  1.17e+00  4.30e-01 -8.30e-01  9.90e-01
-1.48e+00  2.21e+00  1.21e+00  1.42e+00  1.95e+00 -9.60e-01 -1.09e+00
 1.58e+00  1.18e+00 -1.45e+00  1.13e+00  2.39e+00  1.75e+00  1.47e+00
-1.46e+00  1.56e+00  1.02e+00  1.48e+00  6.70e-01 -3.70e-01 -7.40e-01
-2.43e+00  1.29e+00  1.84e+00  1.62e+00  1.54e+00  1.99e+00  1.15e+00
-2.01e+00 -1.35e+00 -1.08e+00  1.64e+00  8.80e-01  1.79e+00  2.36e+00
 7.10e-01 -1.62e+00 -6.60e-01 -7.30e-01 -9.80e-01  1.97e+00  1.37e+00
-6.90e-01  1.86e+00 -1.18e+00  2.02e+00  4.20e-01  2.43e+00  1.67e+00
 2.16e+00 -1.87e+00  1.51e+00  2.17e+00  1.93e+00  1.88e+00  6.10e-01
-6.20e-01 -1.74e+00  9.40e-01  1.61e+00 -2.41e+00  2.33e+00 -1.26e+00
 9.10e-01  2.06e+00 -1.73e+00 -1.99e+00  1.78e+00  2.11e+00  1.73e+00
-8.90e-01  1.96e+00  1.89e+00  1.26e+00  2.04e+00  2.19e+00 -2.80e-01
-1.97e+00  1.81e+00  7.20e-01  2.13e+00 -1.67e+00  1.53e+00 -1.89e+00
-1.84e+00  2.41e+00 -6.40e-01  2.05e+00 -2.19e+00 -2.42e+00 -2.13e+00
-2.16e+00 -2.05e+00 -2.44e+00 -2.45e+00  2.49e+00  2.48e+00  2.44e+00
-2.48e+00 -2.47e+00  2.46e+00  2.47e+00 -2.49e+00 -2.46e+00]
```

```
-----LOC_Y-----
[ 7.45  5.95  6.45 … 89.55 89.85 88.55]


-----SHOT_DISTANCE-----
[12 23  1  2 26 24 16  3  0 22 25 17 38  8 27 14 20  6 77 11 13  4 10  5
 19  7 21 15 49 28 18  9 56 35 29 31 54 42 47 37 63 44 51 33 66 36 46 62
 30 67 39 72 43 82 40 41 68 53 50 34 83 60 32 71 58 64 75 65 70 81 59 61
 55 69 78 45 57 48 76 85 52 74 84 79 89 73 80 87 86 88]


-----QUARTER-----
[4 5 3 2 1 6 7 8]


-----MINS_LEFT-----
[ 0  1  2  3  4  5  6  7  8  9 10 11 12]


-----SECS_LEFT-----
[ 0  7 10 33 15 50  5 43 26 44 48 54 29 23 35  3 14 20 30 41 47 32 28 56
 27 46 58 11 18 31 21 55 13 45 12 57 19 36  9  1 34 24 59 25  8 38 53 37
 49  4  2 17 40 39 52 16 22 51  6 42]
```

[18]:
```python
# ['SEASON_1', 'SEASON_2', 'TEAM_ID', 'TEAM_NAME', 'PLAYER_ID',
#  'PLAYER_NAME', 'POSITION_GROUP', 'POSITION', 'GAME_DATE', 'GAME_ID',
#  'HOME_TEAM', 'AWAY_TEAM', 'EVENT_TYPE', 'SHOT_MADE', 'ACTION_TYPE',
#  'SHOT_TYPE', 'BASIC_ZONE', 'ZONE_NAME', 'ZONE_ABB', 'ZONE_RANGE',
#  'LOC_X', 'LOC_Y', 'SHOT_DISTANCE', 'QUARTER', 'MINS_LEFT', 'SECS_LEFT']

# data already clean -> separate into attribute categories

pred_attrib = ['EVENT_TYPE', 'SHOT_MADE']
numerical_attrib = ['SEASON_1', 'TEAM_ID', 'PLAYER_ID', 'GAME_ID', 'LOC_X',
 'LOC_Y', 'SHOT_DISTANCE', 'QUARTER', 'MINS_LEFT', 'SECS_LEFT']
categorical_attrib = list(set(data.columns) - set(pred_attrib) -
 set(numerical_attrib))
```
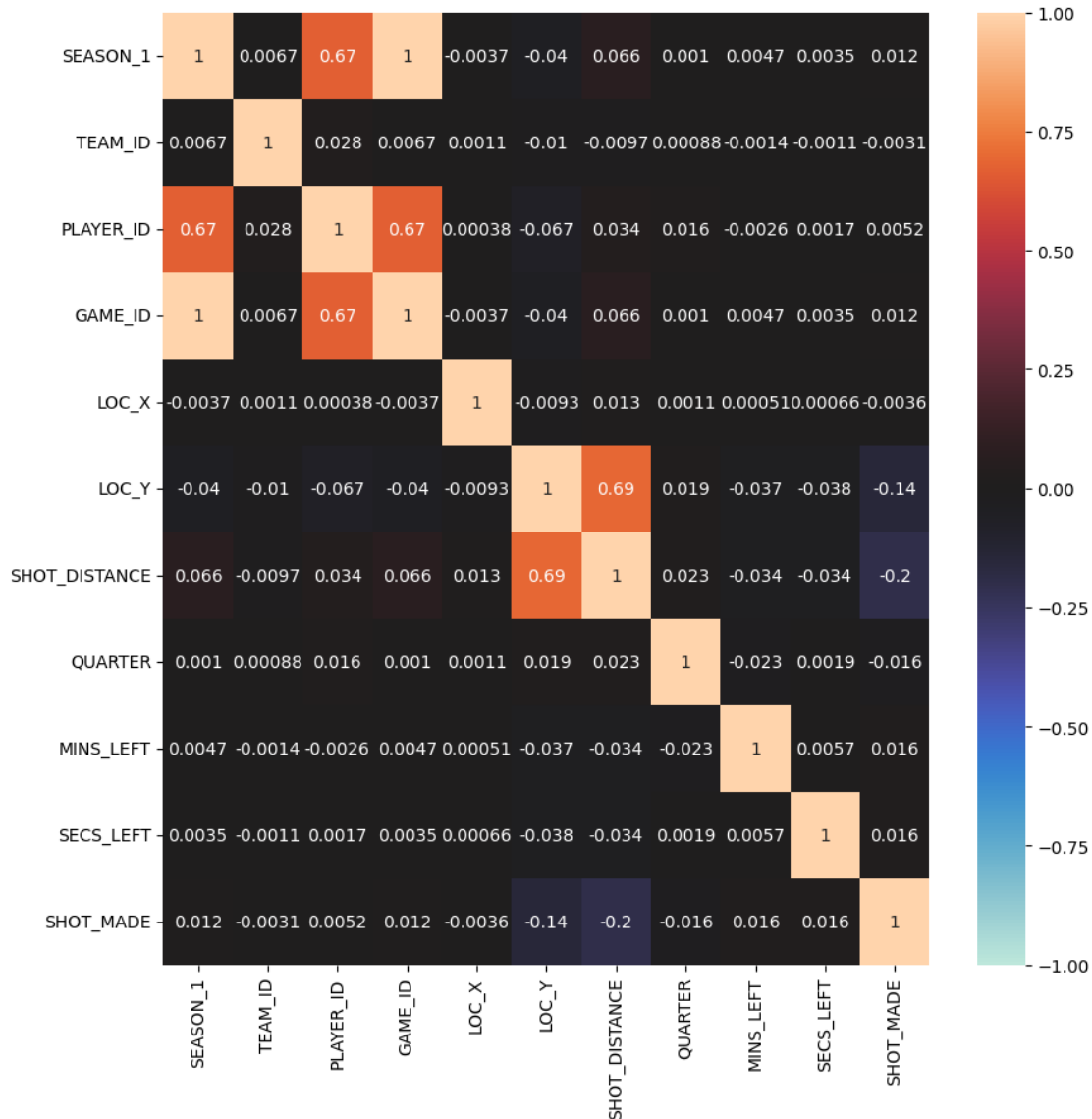
[19]:
```python
# heatmap w/ numerical attributes

# make figure larger
fig, ax = plt.subplots(figsize=(10,10))

heat_vars = numerical_attrib.copy()
```

```
heat_vars.append('SHOT_MADE')
sns.heatmap(data[heat_vars].corr(), annot=True,vmin=-1, vmax=1, center= 0,␣
  ↪ax=ax)
```

[19]: <Axes: >



[20]:
```
# pairplot with sample of data
sample = data.sample(int(len(data) * 0.0005))
sns.pairplot(sample, hue='SEASON_1', diag_kind='auto')
```

Output hidden; open in https://colab.research.google.com to view.

11

## 3 Pre-Processing

```
[21]: print(data.columns)
```

```
Index(['SEASON_1', 'SEASON_2', 'TEAM_ID', 'TEAM_NAME', 'PLAYER_ID',
       'PLAYER_NAME', 'POSITION_GROUP', 'POSITION', 'GAME_DATE', 'GAME_ID',
       'HOME_TEAM', 'AWAY_TEAM', 'EVENT_TYPE', 'SHOT_MADE', 'ACTION_TYPE',
       'SHOT_TYPE', 'BASIC_ZONE', 'ZONE_NAME', 'ZONE_ABB', 'ZONE_RANGE',
       'LOC_X', 'LOC_Y', 'SHOT_DISTANCE', 'QUARTER', 'MINS_LEFT', 'SECS_LEFT'],
      dtype='object')
```

```
[22]: # Dropping redundant attributes
      Preprocessed_Data = data.drop('SEASON_2', axis=1)
      Preprocessed_Data = Preprocessed_Data.drop('TEAM_NAME', axis=1)
      Preprocessed_Data = Preprocessed_Data.drop('PLAYER_NAME', axis=1)
      Preprocessed_Data = Preprocessed_Data.drop('POSITION', axis=1)
      Preprocessed_Data = Preprocessed_Data.drop('GAME_DATE', axis=1)
      Preprocessed_Data = Preprocessed_Data.drop('EVENT_TYPE', axis=1)
      Preprocessed_Data = Preprocessed_Data.drop('ZONE_NAME', axis=1)
```

```
[23]: # Encoding Categorical data

      attributes_to_encode = ['POSITION_GROUP', 'HOME_TEAM', 'AWAY_TEAM',
       ↪'ACTION_TYPE', 'SHOT_TYPE', 'BASIC_ZONE', 'ZONE_ABB', 'ZONE_RANGE']

      for attribute in attributes_to_encode:
        encoding = 0
        observations = Preprocessed_Data[attribute].unique()
        for observation in observations:
          if pd.isna(observation): # Checks for NAN
            Preprocessed_Data.loc[Preprocessed_Data[attribute].isna(), attribute] = -1
          else:
            Preprocessed_Data.loc[Preprocessed_Data[attribute] == observation,
      ↪attribute] = encoding
            encoding += 1
```

```
[24]: # Further Exploration

      Preprocessed_Data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4231262 entries, 0 to 4231261
Data columns (total 19 columns):
 #   Column          Dtype
---  ------          -----
 0   SEASON_1        int64
 1   TEAM_ID         int64
```

```
2   PLAYER_ID        int64
3   POSITION_GROUP   object
4   GAME_ID          int64
5   HOME_TEAM        object
6   AWAY_TEAM        object
7   SHOT_MADE        bool
8   ACTION_TYPE      object
9   SHOT_TYPE        object
10  BASIC_ZONE       object
11  ZONE_ABB         object
12  ZONE_RANGE       object
13  LOC_X            float64
14  LOC_Y            float64
15  SHOT_DISTANCE    int64
16  QUARTER          int64
17  MINS_LEFT        int64
18  SECS_LEFT        int64
dtypes: bool(1), float64(2), int64(8), object(8)
memory usage: 585.1+ MB
```

```python
[25]: # heatmap w/ preprocessed attributes

      # make figure larger
      fig, ax = plt.subplots(figsize=(20,20))

      attributes = list(Preprocessed_Data.columns)
      heat_vars = attributes.copy()
      sns.heatmap(Preprocessed_Data[heat_vars].corr(), annot=True,vmin=-1, vmax=1,␣
        ↪center= 0, ax=ax)
```

[25]: <Axes: >
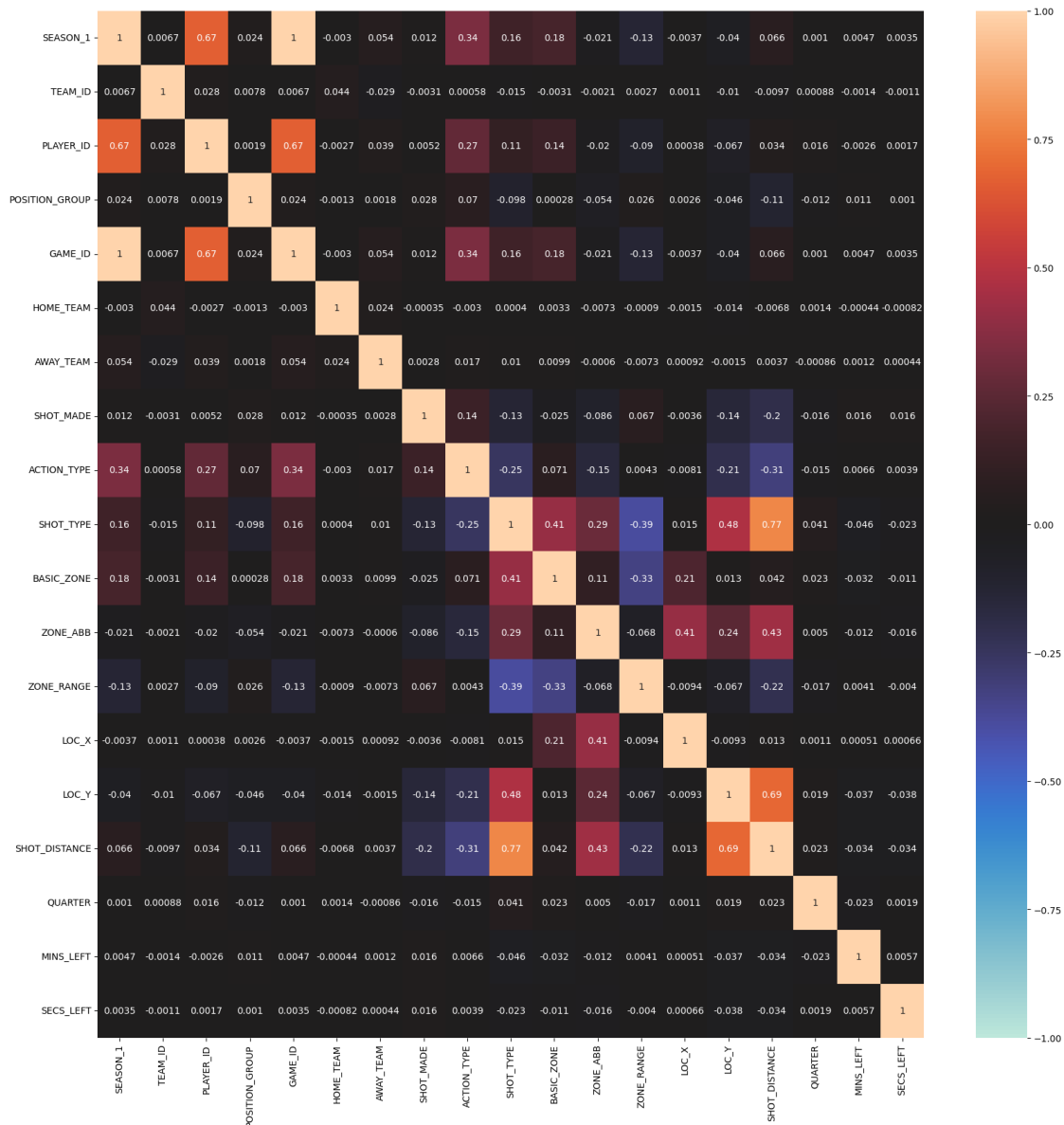
```
[26]:  # Zone Range and shot type are highly correlated, dropping shot dist
       Preprocessed_Data = Preprocessed_Data.drop(columns='SHOT_DISTANCE', axis=1)

       # Also dropping Season_1 and Game_ID
       Preprocessed_Data = Preprocessed_Data.drop(columns='GAME_ID', axis=1)
       Preprocessed_Data = Preprocessed_Data.drop(columns='SEASON_1', axis=1)
```

```
[27]:  # Second heatmap to check for other highly correlated values

       fig, ax = plt.subplots(figsize=(20,20))
```
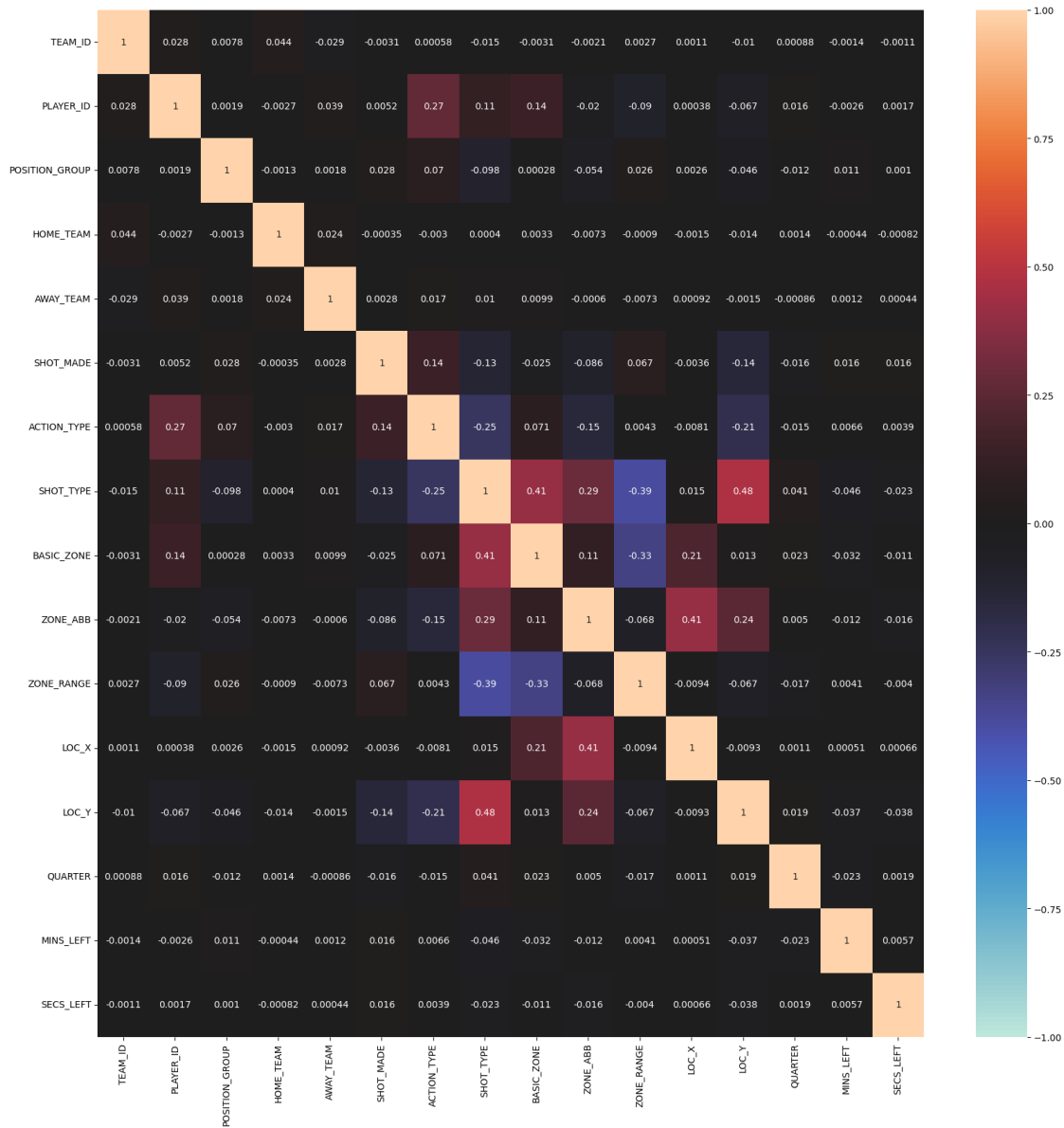
```
attributes = list(Preprocessed_Data.columns)
heat_vars = attributes.copy()
sns.heatmap(Preprocessed_Data[heat_vars].corr(), annot=True,vmin=-1, vmax=1,⊔
 ↪center= 0, ax=ax)
```

[27]: <Axes: >

## 4 First Model

```python
[28]: # Splitting data (20/80 split)
      y = Preprocessed_Data.SHOT_MADE
      x = Preprocessed_Data.drop('SHOT_MADE', axis=1)
      x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2,
       ↪random_state=21)

      # Checking if our data has the right dimensions
      print('xTrain shape:', x_train.shape)
      print('yTrain shape:', y_train.shape)
      print('xTest shape:', x_train.shape)
      print('yTest shape:', y_test.shape)
```

```
xTrain shape: (3385009, 15)
yTrain shape: (3385009,)
xTest shape: (3385009, 15)
yTest shape: (846253,)
```

```python
[30]: # Scaling data
      from sklearn.preprocessing import StandardScaler
      from sklearn.preprocessing import OneHotEncoder

      # Seperating numerical data
      x_numerical_columns = ['TEAM_ID', 'PLAYER_ID', 'LOC_X', 'LOC_Y', 'QUARTER',
       ↪'MINS_LEFT', 'SECS_LEFT']
      x_train_numerical = x_train[x_numerical_columns]
      x_test_numerical = x_test[x_numerical_columns]

      # Scaling numerical data
      scaler = StandardScaler()
      x_train_numerical = scaler.fit_transform(x_train_numerical)
      x_test_numerical = scaler.transform(x_test_numerical)

      # Seperating categorical data
      x_categorical_columns = ['POSITION_GROUP', 'HOME_TEAM', 'AWAY_TEAM',
       ↪'ACTION_TYPE', 'SHOT_TYPE', 'BASIC_ZONE', 'ZONE_ABB', 'ZONE_RANGE']
      x_test_categorical = x_test[x_categorical_columns]
      x_train_categorical = x_train[x_categorical_columns]
```

```python
[31]: print('x Test (Numerical): ', x_test_numerical.shape)
      print('x Train (Numerical): ', x_train_numerical.shape)
      print('x Test (Categorical): ', x_test_categorical.shape)
      print('x Train (Categorical): ', x_train_categorical.shape)
```

```
x Test (Numerical):   (846253, 7)
x Train (Numerical):   (3385009, 7)
x Test (Categorical):   (846253, 8)
```

```
x Train (Categorical):  (3385009, 8)
```

[32]:
```python
# Updating x_train and x_test arrays
x_train = np.concatenate((x_train_numerical, x_train_categorical), axis=1)
x_test = np.concatenate((x_test_numerical, x_test_categorical), axis=1)

# Checking if our data has the right dimensions
print('xTrain shape:', x_train.shape)
print('yTrain shape:', y_train.shape)
print('xTest shape:', x_test.shape)
print('yTest shape:', y_test.shape)
```

```
xTrain shape: (3385009, 15)
yTrain shape: (3385009,)
xTest shape: (846253, 15)
yTest shape: (846253,)
```

[33]:
```python
# Training first model (Logistic Regression)
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report

logisticModel = LogisticRegression(max_iter=1000)
logisticModel = logisticModel.fit(x_train, y_train)

# Evaluating Model
y_train_pred = logisticModel.predict(x_train)
y_test_pred = logisticModel.predict(x_test)

# Printing Reports

print(classification_report(y_test, y_test_pred))
```

```
              precision    recall  f1-score   support

       False       0.61      0.76      0.68    458090
        True       0.60      0.42      0.50    388163

    accuracy                           0.61    846253
   macro avg       0.60      0.59      0.59    846253
weighted avg       0.60      0.61      0.59    846253
```

[34]:
```python
# TODO
# Fill in NAN values (making this a seperate ) [DONE]
# Second data exploration round, i.e. heat map [DONE]
# Get rid of attributes that correlate too much [DONE]
# Scale numerical attributes [DONE]
# One-hot-encode unordered(all of them) categorical values [DONE]
```

17

```
# Run first model (logistic regression) [DONE]
# Evaluate model, compare training vs test error [DONE]
# Answer 4-6 in write up
```

## 5   Printing

[35]: `!apt-get update`

```
 0% [Working]                         Hit:1 http://archive.ubuntu.com/ubuntu jammy
InRelease
 0% [Waiting for headers] [Waiting for headers] [Connected to
cloud.r-project.org (18.239.18.73)] [Co
Get:2 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
                         Get:3 http://security.ubuntu.com/ubuntu jammy-security
InRelease [129 kB]
 0% [Waiting for headers] [Waiting for headers] [Connecting to
r2u.stat.illinois.edu (192.17.190.167)
Get:4 https://cloud.r-project.org/bin/linux/ubuntu jammy-cran40/ InRelease
[3,626 B]
 0% [Waiting for headers] [4 InRelease 0 B/3,626 B 0%] [Connecting to
r2u.stat.illinois.edu (192.17.1 0% [Waiting for headers] [Connecting to
r2u.stat.illinois.edu (192.17.190.167)] [Waiting for headers
Get:5 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [127 kB]
 0% [5 InRelease 15.6 kB/127 kB 12%] [Connecting to r2u.stat.illinois.edu
(192.17.190.167)] [Waiting  0% [Connecting to r2u.stat.illinois.edu
(192.17.190.167)] [Waiting for headers] [Waiting for headers
Get:6 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64
InRelease [1,581 B]
                         0% [Connected to r2u.stat.illinois.edu (192.17.190.167)]
[Waiting for headers]
Hit:7 https://ppa.launchpadcontent.net/deadsnakes/ppa/ubuntu jammy InRelease
 0% [Connected to r2u.stat.illinois.edu (192.17.190.167)] [Waiting for headers]
Hit:8 https://ppa.launchpadcontent.net/graphics-drivers/ppa/ubuntu jammy
InRelease
Hit:9 https://ppa.launchpadcontent.net/ubuntugis/ppa/ubuntu jammy InRelease
Get:10 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages
[1,453 kB]
Get:11 https://r2u.stat.illinois.edu/ubuntu jammy InRelease [6,555 B]
Get:12 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [2,701
kB]
Get:13 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages
[2,425 kB]
Get:14 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages
[1,164 kB]
Get:15
https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64
```

Packages [1,110 kB]
Get:16 https://r2u.stat.illinois.edu/ubuntu jammy/main amd64 Packages [2,616 kB]
Get:17 https://r2u.stat.illinois.edu/ubuntu jammy/main all Packages [8,482 kB]
Fetched 20.3 MB in 3s (5,855 kB/s)
Reading package lists… Done
W: Skipping acquire of configured file 'main/source/Sources' as repository
'https://r2u.stat.illinois.edu/ubuntu jammy InRelease' does not seem to provide
it (sources.list entry misspelt?)

[36]:
```
!pip install nbconvert
!apt-get install pandoc
!apt-get install texlive-xetex texlive-fonts-recommended texlive-plain-generic␣
 ↪-y
```

Requirement already satisfied: nbconvert in /usr/local/lib/python3.10/dist-
packages (7.16.4)
Requirement already satisfied: beautifulsoup4 in /usr/local/lib/python3.10/dist-
packages (from nbconvert) (4.12.3)
Requirement already satisfied: bleach!=5.0.0 in /usr/local/lib/python3.10/dist-
packages (from nbconvert) (6.2.0)
Requirement already satisfied: defusedxml in /usr/local/lib/python3.10/dist-
packages (from nbconvert) (0.7.1)
Requirement already satisfied: jinja2>=3.0 in /usr/local/lib/python3.10/dist-
packages (from nbconvert) (3.1.4)
Requirement already satisfied: jupyter-core>=4.7 in
/usr/local/lib/python3.10/dist-packages (from nbconvert) (5.7.2)
Requirement already satisfied: jupyterlab-pygments in
/usr/local/lib/python3.10/dist-packages (from nbconvert) (0.3.0)
Requirement already satisfied: markupsafe>=2.0 in
/usr/local/lib/python3.10/dist-packages (from nbconvert) (3.0.2)
Requirement already satisfied: mistune<4,>=2.0.3 in
/usr/local/lib/python3.10/dist-packages (from nbconvert) (3.0.2)
Requirement already satisfied: nbclient>=0.5.0 in
/usr/local/lib/python3.10/dist-packages (from nbconvert) (0.10.0)
Requirement already satisfied: nbformat>=5.7 in /usr/local/lib/python3.10/dist-
packages (from nbconvert) (5.10.4)
Requirement already satisfied: packaging in /usr/local/lib/python3.10/dist-
packages (from nbconvert) (24.2)
Requirement already satisfied: pandocfilters>=1.4.1 in
/usr/local/lib/python3.10/dist-packages (from nbconvert) (1.5.1)
Requirement already satisfied: pygments>=2.4.1 in
/usr/local/lib/python3.10/dist-packages (from nbconvert) (2.18.0)
Requirement already satisfied: tinycss2 in /usr/local/lib/python3.10/dist-
packages (from nbconvert) (1.4.0)
Requirement already satisfied: traitlets>=5.1 in /usr/local/lib/python3.10/dist-
packages (from nbconvert) (5.7.1)
Requirement already satisfied: webencodings in /usr/local/lib/python3.10/dist-
packages (from bleach!=5.0.0->nbconvert) (0.5.1)

Requirement already satisfied: platformdirs>=2.5 in
/usr/local/lib/python3.10/dist-packages (from jupyter-core>=4.7->nbconvert)
(4.3.6)
Requirement already satisfied: jupyter-client>=6.1.12 in
/usr/local/lib/python3.10/dist-packages (from nbclient>=0.5.0->nbconvert)
(6.1.12)
Requirement already satisfied: fastjsonschema>=2.15 in
/usr/local/lib/python3.10/dist-packages (from nbformat>=5.7->nbconvert) (2.20.0)
Requirement already satisfied: jsonschema>=2.6 in
/usr/local/lib/python3.10/dist-packages (from nbformat>=5.7->nbconvert) (4.23.0)
Requirement already satisfied: soupsieve>1.2 in /usr/local/lib/python3.10/dist-
packages (from beautifulsoup4->nbconvert) (2.6)
Requirement already satisfied: attrs>=22.2.0 in /usr/local/lib/python3.10/dist-
packages (from jsonschema>=2.6->nbformat>=5.7->nbconvert) (24.2.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in
/usr/local/lib/python3.10/dist-packages (from
jsonschema>=2.6->nbformat>=5.7->nbconvert) (2024.10.1)
Requirement already satisfied: referencing>=0.28.4 in
/usr/local/lib/python3.10/dist-packages (from
jsonschema>=2.6->nbformat>=5.7->nbconvert) (0.35.1)
Requirement already satisfied: rpds-py>=0.7.1 in /usr/local/lib/python3.10/dist-
packages (from jsonschema>=2.6->nbformat>=5.7->nbconvert) (0.21.0)
Requirement already satisfied: pyzmq>=13 in /usr/local/lib/python3.10/dist-
packages (from jupyter-client>=6.1.12->nbclient>=0.5.0->nbconvert) (24.0.1)
Requirement already satisfied: python-dateutil>=2.1 in
/usr/local/lib/python3.10/dist-packages (from jupyter-
client>=6.1.12->nbclient>=0.5.0->nbconvert) (2.8.2)
Requirement already satisfied: tornado>=4.1 in /usr/local/lib/python3.10/dist-
packages (from jupyter-client>=6.1.12->nbclient>=0.5.0->nbconvert) (6.3.3)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-
packages (from python-dateutil>=2.1->jupyter-
client>=6.1.12->nbclient>=0.5.0->nbconvert) (1.16.0)
Reading package lists… Done
Building dependency tree… Done
Reading state information… Done
The following additional packages will be installed:
  libcmark-gfm-extensions0.29.0.gfm.3 libcmark-gfm0.29.0.gfm.3 pandoc-data
Suggested packages:
  texlive-latex-recommended texlive-xetex texlive-luatex pandoc-citeproc
texlive-latex-extra
  context wkhtmltopdf librsvg2-bin groff ghc nodejs php python ruby libjs-
mathjax libjs-katex
  citation-style-language-styles
The following NEW packages will be installed:
  libcmark-gfm-extensions0.29.0.gfm.3 libcmark-gfm0.29.0.gfm.3 pandoc pandoc-
data
0 upgraded, 4 newly installed, 0 to remove and 55 not upgraded.
Need to get 20.6 MB of archives.

After this operation, 156 MB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libcmark-gfm0.29.0.gfm.3 amd64 0.29.0.gfm.3-3 [115 kB]
Get:2 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libcmark-gfm-extensions0.29.0.gfm.3 amd64 0.29.0.gfm.3-3 [25.1 kB]
Get:3 http://archive.ubuntu.com/ubuntu jammy/universe amd64 pandoc-data all 2.9.2.1-3ubuntu2 [81.8 kB]
Get:4 http://archive.ubuntu.com/ubuntu jammy/universe amd64 pandoc amd64 2.9.2.1-3ubuntu2 [20.3 MB]
Fetched 20.6 MB in 0s (56.2 MB/s)
Selecting previously unselected package libcmark-gfm0.29.0.gfm.3:amd64.
(Reading database … 123629 files and directories currently installed.)
Preparing to unpack …/libcmark-gfm0.29.0.gfm.3_0.29.0.gfm.3-3_amd64.deb …
Unpacking libcmark-gfm0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) …
Selecting previously unselected package libcmark-gfm-extensions0.29.0.gfm.3:amd64.
Preparing to unpack …/libcmark-gfm-extensions0.29.0.gfm.3_0.29.0.gfm.3-3_amd64.deb …
Unpacking libcmark-gfm-extensions0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) …
Selecting previously unselected package pandoc-data.
Preparing to unpack …/pandoc-data_2.9.2.1-3ubuntu2_all.deb …
Unpacking pandoc-data (2.9.2.1-3ubuntu2) …
Selecting previously unselected package pandoc.
Preparing to unpack …/pandoc_2.9.2.1-3ubuntu2_amd64.deb …
Unpacking pandoc (2.9.2.1-3ubuntu2) …
Setting up libcmark-gfm0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) …
Setting up libcmark-gfm-extensions0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) …
Setting up pandoc-data (2.9.2.1-3ubuntu2) …
Setting up pandoc (2.9.2.1-3ubuntu2) …
Processing triggers for man-db (2.10.2-1) …
Processing triggers for libc-bin (2.35-0ubuntu3.4) …
/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_opencl.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_loader.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libumf.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link

```
/sbin/ldconfig.real: /usr/local/lib/libtcm.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libhwloc.so.15 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero.so.0 is not a
symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link

Reading package lists… Done
Building dependency tree… Done
Reading state information… Done
The following additional packages will be installed:
  dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono fonts-
texgyre
  fonts-urw-base35 libapache-pom-java libcommons-logging-java libcommons-parent-
java
  libfontbox-java libfontenc1 libgs9 libgs9-common libidn12 libijs-0.35
libjbig2dec0 libkpathsea6
  libpdfbox-java libptexenc1 libruby3.0 libsynctex2 libteckit0 libtexlua53
libtexluajit2 libwoff1
  libzzip-0-13 lmodern poppler-data preview-latex-style rake ruby ruby-net-
telnet ruby-rubygems
  ruby-webrick ruby-xmlrpc ruby3.0 rubygems-integration t1utils teckit tex-
common tex-gyre
  texlive-base texlive-binaries texlive-latex-base texlive-latex-extra texlive-
latex-recommended
  texlive-pictures tipa xfonts-encodings xfonts-utils
Suggested packages:
  fonts-noto fonts-freefont-otf | fonts-freefont-ttf libavalon-framework-java
  libcommons-logging-java-doc libexcalibur-logkit-java liblog4j1.2-java poppler-
utils ghostscript
  fonts-japanese-mincho | fonts-ipafont-mincho fonts-japanese-gothic | fonts-
ipafont-gothic
  fonts-arphic-ukai fonts-arphic-uming fonts-nanum ri ruby-dev bundler debhelper
gv
  | postscript-viewer perl-tk xpdf | pdf-viewer xzdec texlive-fonts-recommended-
doc
  texlive-latex-base-doc python3-pygments icc-profiles libfile-which-perl
  libspreadsheet-parseexcel-perl texlive-latex-extra-doc texlive-latex-
recommended-doc
  texlive-luatex texlive-pstricks dot2tex prerex texlive-pictures-doc vprerex
default-jre-headless
  tipa-doc
The following NEW packages will be installed:
```

```
  dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono fonts-
texgyre
  fonts-urw-base35 libapache-pom-java libcommons-logging-java libcommons-parent-
java
  libfontbox-java libfontenc1 libgs9 libgs9-common libidn12 libijs-0.35
libjbig2dec0 libkpathsea6
  libpdfbox-java libptexenc1 libruby3.0 libsynctex2 libteckit0 libtexlua53
libtexluajit2 libwoff1
  libzzip-0-13 lmodern poppler-data preview-latex-style rake ruby ruby-net-
telnet ruby-rubygems
  ruby-webrick ruby-xmlrpc ruby3.0 rubygems-integration t1utils teckit tex-
common tex-gyre
  texlive-base texlive-binaries texlive-fonts-recommended texlive-latex-base
texlive-latex-extra
  texlive-latex-recommended texlive-pictures texlive-plain-generic texlive-xetex
tipa
  xfonts-encodings xfonts-utils
0 upgraded, 54 newly installed, 0 to remove and 55 not upgraded.
Need to get 182 MB of archives.
After this operation, 571 MB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy/main amd64 fonts-droid-fallback all
1:6.0.1r16-1.1build1 [1,805 kB]
Get:2 http://archive.ubuntu.com/ubuntu jammy/main amd64 fonts-lato all 2.0-2.1
[2,696 kB]
Get:3 http://archive.ubuntu.com/ubuntu jammy/main amd64 poppler-data all
0.4.11-1 [2,171 kB]
Get:4 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tex-common all 6.17
[33.7 kB]
Get:5 http://archive.ubuntu.com/ubuntu jammy/main amd64 fonts-urw-base35 all
20200910-1 [6,367 kB]
Get:6 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libgs9-common
all 9.55.0~dfsg1-0ubuntu5.10 [752 kB]
Get:7 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libidn12 amd64
1.38-4ubuntu1 [60.0 kB]
Get:8 http://archive.ubuntu.com/ubuntu jammy/main amd64 libijs-0.35 amd64
0.35-15build2 [16.5 kB]
Get:9 http://archive.ubuntu.com/ubuntu jammy/main amd64 libjbig2dec0 amd64
0.19-3build2 [64.7 kB]
Get:10 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libgs9 amd64
9.55.0~dfsg1-0ubuntu5.10 [5,031 kB]
Get:11 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libkpathsea6
amd64 2021.20210626.59705-1ubuntu0.2 [60.4 kB]
Get:12 http://archive.ubuntu.com/ubuntu jammy/main amd64 libwoff1 amd64
1.0.2-1build4 [45.2 kB]
Get:13 http://archive.ubuntu.com/ubuntu jammy/universe amd64 dvisvgm amd64
2.13.1-1 [1,221 kB]
Get:14 http://archive.ubuntu.com/ubuntu jammy/universe amd64 fonts-lmodern all
2.004.5-6.1 [4,532 kB]
```

```
Get:15 http://archive.ubuntu.com/ubuntu jammy/main amd64 fonts-noto-mono all
20201225-1build1 [397 kB]
Get:16 http://archive.ubuntu.com/ubuntu jammy/universe amd64 fonts-texgyre all
20180621-3.1 [10.2 MB]
Get:17 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libapache-pom-java
all 18-1 [4,720 B]
Get:18 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libcommons-parent-
java all 43-1 [10.8 kB]
Get:19 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libcommons-logging-
java all 1.2-2 [60.3 kB]
Get:20 http://archive.ubuntu.com/ubuntu jammy/main amd64 libfontenc1 amd64
1:1.1.4-1build3 [14.7 kB]
Get:21 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libptexenc1
amd64 2021.20210626.59705-1ubuntu0.2 [39.1 kB]
Get:22 http://archive.ubuntu.com/ubuntu jammy/main amd64 rubygems-integration
all 1.18 [5,336 B]
Get:23 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 ruby3.0 amd64
3.0.2-7ubuntu2.8 [50.1 kB]
Get:24 http://archive.ubuntu.com/ubuntu jammy/main amd64 ruby-rubygems all
3.3.5-2 [228 kB]
Get:25 http://archive.ubuntu.com/ubuntu jammy/main amd64 ruby amd64 1:3.0~exp1
[5,100 B]
Get:26 http://archive.ubuntu.com/ubuntu jammy/main amd64 rake all 13.0.6-2 [61.7
kB]
Get:27 http://archive.ubuntu.com/ubuntu jammy/main amd64 ruby-net-telnet all
0.1.1-2 [12.6 kB]
Get:28 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 ruby-webrick
all 1.7.0-3ubuntu0.1 [52.1 kB]
Get:29 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 ruby-xmlrpc all
0.3.2-1ubuntu0.1 [24.9 kB]
Get:30 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libruby3.0
amd64 3.0.2-7ubuntu2.8 [5,113 kB]
Get:31 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libsynctex2
amd64 2021.20210626.59705-1ubuntu0.2 [55.6 kB]
Get:32 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libteckit0 amd64
2.5.11+ds1-1 [421 kB]
Get:33 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libtexlua53
amd64 2021.20210626.59705-1ubuntu0.2 [120 kB]
Get:34 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libtexluajit2
amd64 2021.20210626.59705-1ubuntu0.2 [267 kB]
Get:35 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libzzip-0-13 amd64
0.13.72+dfsg.1-1.1 [27.0 kB]
Get:36 http://archive.ubuntu.com/ubuntu jammy/main amd64 xfonts-encodings all
1:1.0.5-0ubuntu2 [578 kB]
Get:37 http://archive.ubuntu.com/ubuntu jammy/main amd64 xfonts-utils amd64
1:7.7+6build2 [94.6 kB]
Get:38 http://archive.ubuntu.com/ubuntu jammy/universe amd64 lmodern all
2.004.5-6.1 [9,471 kB]
```

```
Get:39 http://archive.ubuntu.com/ubuntu jammy/universe amd64 preview-latex-style
all 12.2-1ubuntu1 [185 kB]
Get:40 http://archive.ubuntu.com/ubuntu jammy/main amd64 t1utils amd64
1.41-4build2 [61.3 kB]
Get:41 http://archive.ubuntu.com/ubuntu jammy/universe amd64 teckit amd64
2.5.11+ds1-1 [699 kB]
Get:42 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tex-gyre all
20180621-3.1 [6,209 kB]
Get:43 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 texlive-
binaries amd64 2021.20210626.59705-1ubuntu0.2 [9,860 kB]
Get:44 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-base all
2021.20220204-1 [21.0 MB]
Get:45 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-fonts-
recommended all 2021.20220204-1 [4,972 kB]
Get:46 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-base
all 2021.20220204-1 [1,128 kB]
Get:47 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libfontbox-java all
1:1.8.16-2 [207 kB]
Get:48 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libpdfbox-java all
1:1.8.16-2 [5,199 kB]
Get:49 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-
recommended all 2021.20220204-1 [14.4 MB]
Get:50 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-pictures
all 2021.20220204-1 [8,720 kB]
Get:51 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-extra
all 2021.20220204-1 [13.9 MB]
Get:52 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-plain-
generic all 2021.20220204-1 [27.5 MB]
Get:53 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tipa all 2:1.3-21
[2,967 kB]
Get:54 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-xetex all
2021.20220204-1 [12.4 MB]
Fetched 182 MB in 6s (31.5 MB/s)
Extracting templates from packages: 100%
Preconfiguring packages …
Selecting previously unselected package fonts-droid-fallback.
(Reading database … 123854 files and directories currently installed.)
Preparing to unpack …/00-fonts-droid-fallback_1%3a6.0.1r16-1.1build1_all.deb
…
Unpacking fonts-droid-fallback (1:6.0.1r16-1.1build1) …
Selecting previously unselected package fonts-lato.
Preparing to unpack …/01-fonts-lato_2.0-2.1_all.deb …
Unpacking fonts-lato (2.0-2.1) …
Selecting previously unselected package poppler-data.
Preparing to unpack …/02-poppler-data_0.4.11-1_all.deb …
Unpacking poppler-data (0.4.11-1) …
Selecting previously unselected package tex-common.
Preparing to unpack …/03-tex-common_6.17_all.deb …
```

```
Unpacking tex-common (6.17) …
Selecting previously unselected package fonts-urw-base35.
Preparing to unpack …/04-fonts-urw-base35_20200910-1_all.deb …
Unpacking fonts-urw-base35 (20200910-1) …
Selecting previously unselected package libgs9-common.
Preparing to unpack …/05-libgs9-common_9.55.0~dfsg1-0ubuntu5.10_all.deb …
Unpacking libgs9-common (9.55.0~dfsg1-0ubuntu5.10) …
Selecting previously unselected package libidn12:amd64.
Preparing to unpack …/06-libidn12_1.38-4ubuntu1_amd64.deb …
Unpacking libidn12:amd64 (1.38-4ubuntu1) …
Selecting previously unselected package libijs-0.35:amd64.
Preparing to unpack …/07-libijs-0.35_0.35-15build2_amd64.deb …
Unpacking libijs-0.35:amd64 (0.35-15build2) …
Selecting previously unselected package libjbig2dec0:amd64.
Preparing to unpack …/08-libjbig2dec0_0.19-3build2_amd64.deb …
Unpacking libjbig2dec0:amd64 (0.19-3build2) …
Selecting previously unselected package libgs9:amd64.
Preparing to unpack …/09-libgs9_9.55.0~dfsg1-0ubuntu5.10_amd64.deb …
Unpacking libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.10) …
Selecting previously unselected package libkpathsea6:amd64.
Preparing to unpack …/10-libkpathsea6_2021.20210626.59705-1ubuntu0.2_amd64.deb
…
Unpacking libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package libwoff1:amd64.
Preparing to unpack …/11-libwoff1_1.0.2-1build4_amd64.deb …
Unpacking libwoff1:amd64 (1.0.2-1build4) …
Selecting previously unselected package dvisvgm.
Preparing to unpack …/12-dvisvgm_2.13.1-1_amd64.deb …
Unpacking dvisvgm (2.13.1-1) …
Selecting previously unselected package fonts-lmodern.
Preparing to unpack …/13-fonts-lmodern_2.004.5-6.1_all.deb …
Unpacking fonts-lmodern (2.004.5-6.1) …
Selecting previously unselected package fonts-noto-mono.
Preparing to unpack …/14-fonts-noto-mono_20201225-1build1_all.deb …
Unpacking fonts-noto-mono (20201225-1build1) …
Selecting previously unselected package fonts-texgyre.
Preparing to unpack …/15-fonts-texgyre_20180621-3.1_all.deb …
Unpacking fonts-texgyre (20180621-3.1) …
Selecting previously unselected package libapache-pom-java.
Preparing to unpack …/16-libapache-pom-java_18-1_all.deb …
Unpacking libapache-pom-java (18-1) …
Selecting previously unselected package libcommons-parent-java.
Preparing to unpack …/17-libcommons-parent-java_43-1_all.deb …
Unpacking libcommons-parent-java (43-1) …
Selecting previously unselected package libcommons-logging-java.
Preparing to unpack …/18-libcommons-logging-java_1.2-2_all.deb …
Unpacking libcommons-logging-java (1.2-2) …
Selecting previously unselected package libfontenc1:amd64.
```

```
Preparing to unpack …/19-libfontenc1_1%3a1.1.4-1build3_amd64.deb …
Unpacking libfontenc1:amd64 (1:1.1.4-1build3) …
Selecting previously unselected package libptexenc1:amd64.
Preparing to unpack …/20-libptexenc1_2021.20210626.59705-1ubuntu0.2_amd64.deb
…
Unpacking libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package rubygems-integration.
Preparing to unpack …/21-rubygems-integration_1.18_all.deb …
Unpacking rubygems-integration (1.18) …
Selecting previously unselected package ruby3.0.
Preparing to unpack …/22-ruby3.0_3.0.2-7ubuntu2.8_amd64.deb …
Unpacking ruby3.0 (3.0.2-7ubuntu2.8) …
Selecting previously unselected package ruby-rubygems.
Preparing to unpack …/23-ruby-rubygems_3.3.5-2_all.deb …
Unpacking ruby-rubygems (3.3.5-2) …
Selecting previously unselected package ruby.
Preparing to unpack …/24-ruby_1%3a3.0~exp1_amd64.deb …
Unpacking ruby (1:3.0~exp1) …
Selecting previously unselected package rake.
Preparing to unpack …/25-rake_13.0.6-2_all.deb …
Unpacking rake (13.0.6-2) …
Selecting previously unselected package ruby-net-telnet.
Preparing to unpack …/26-ruby-net-telnet_0.1.1-2_all.deb …
Unpacking ruby-net-telnet (0.1.1-2) …
Selecting previously unselected package ruby-webrick.
Preparing to unpack …/27-ruby-webrick_1.7.0-3ubuntu0.1_all.deb …
Unpacking ruby-webrick (1.7.0-3ubuntu0.1) …
Selecting previously unselected package ruby-xmlrpc.
Preparing to unpack …/28-ruby-xmlrpc_0.3.2-1ubuntu0.1_all.deb …
Unpacking ruby-xmlrpc (0.3.2-1ubuntu0.1) …
Selecting previously unselected package libruby3.0:amd64.
Preparing to unpack …/29-libruby3.0_3.0.2-7ubuntu2.8_amd64.deb …
Unpacking libruby3.0:amd64 (3.0.2-7ubuntu2.8) …
Selecting previously unselected package libsynctex2:amd64.
Preparing to unpack …/30-libsynctex2_2021.20210626.59705-1ubuntu0.2_amd64.deb
…
Unpacking libsynctex2:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package libteckit0:amd64.
Preparing to unpack …/31-libteckit0_2.5.11+ds1-1_amd64.deb …
Unpacking libteckit0:amd64 (2.5.11+ds1-1) …
Selecting previously unselected package libtexlua53:amd64.
Preparing to unpack …/32-libtexlua53_2021.20210626.59705-1ubuntu0.2_amd64.deb
…
Unpacking libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package libtexluajit2:amd64.
Preparing to unpack
…/33-libtexluajit2_2021.20210626.59705-1ubuntu0.2_amd64.deb …
Unpacking libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.2) …
```

```
Selecting previously unselected package libzzip-0-13:amd64.
Preparing to unpack …/34-libzzip-0-13_0.13.72+dfsg.1-1.1_amd64.deb …
Unpacking libzzip-0-13:amd64 (0.13.72+dfsg.1-1.1) …
Selecting previously unselected package xfonts-encodings.
Preparing to unpack …/35-xfonts-encodings_1%3a1.0.5-0ubuntu2_all.deb …
Unpacking xfonts-encodings (1:1.0.5-0ubuntu2) …
Selecting previously unselected package xfonts-utils.
Preparing to unpack …/36-xfonts-utils_1%3a7.7+6build2_amd64.deb …
Unpacking xfonts-utils (1:7.7+6build2) …
Selecting previously unselected package lmodern.
Preparing to unpack …/37-lmodern_2.004.5-6.1_all.deb …
Unpacking lmodern (2.004.5-6.1) …
Selecting previously unselected package preview-latex-style.
Preparing to unpack …/38-preview-latex-style_12.2-1ubuntu1_all.deb …
Unpacking preview-latex-style (12.2-1ubuntu1) …
Selecting previously unselected package t1utils.
Preparing to unpack …/39-t1utils_1.41-4build2_amd64.deb …
Unpacking t1utils (1.41-4build2) …
Selecting previously unselected package teckit.
Preparing to unpack …/40-teckit_2.5.11+ds1-1_amd64.deb …
Unpacking teckit (2.5.11+ds1-1) …
Selecting previously unselected package tex-gyre.
Preparing to unpack …/41-tex-gyre_20180621-3.1_all.deb …
Unpacking tex-gyre (20180621-3.1) …
Selecting previously unselected package texlive-binaries.
Preparing to unpack …/42-texlive-
binaries_2021.20210626.59705-1ubuntu0.2_amd64.deb …
Unpacking texlive-binaries (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package texlive-base.
Preparing to unpack …/43-texlive-base_2021.20220204-1_all.deb …
Unpacking texlive-base (2021.20220204-1) …
Selecting previously unselected package texlive-fonts-recommended.
Preparing to unpack …/44-texlive-fonts-recommended_2021.20220204-1_all.deb …
Unpacking texlive-fonts-recommended (2021.20220204-1) …
Selecting previously unselected package texlive-latex-base.
Preparing to unpack …/45-texlive-latex-base_2021.20220204-1_all.deb …
Unpacking texlive-latex-base (2021.20220204-1) …
Selecting previously unselected package libfontbox-java.
Preparing to unpack …/46-libfontbox-java_1%3a1.8.16-2_all.deb …
Unpacking libfontbox-java (1:1.8.16-2) …
Selecting previously unselected package libpdfbox-java.
Preparing to unpack …/47-libpdfbox-java_1%3a1.8.16-2_all.deb …
Unpacking libpdfbox-java (1:1.8.16-2) …
Selecting previously unselected package texlive-latex-recommended.
Preparing to unpack …/48-texlive-latex-recommended_2021.20220204-1_all.deb …
Unpacking texlive-latex-recommended (2021.20220204-1) …
Selecting previously unselected package texlive-pictures.
Preparing to unpack …/49-texlive-pictures_2021.20220204-1_all.deb …
```

```
Unpacking texlive-pictures (2021.20220204-1) …
Selecting previously unselected package texlive-latex-extra.
Preparing to unpack …/50-texlive-latex-extra_2021.20220204-1_all.deb …
Unpacking texlive-latex-extra (2021.20220204-1) …
Selecting previously unselected package texlive-plain-generic.
Preparing to unpack …/51-texlive-plain-generic_2021.20220204-1_all.deb …
Unpacking texlive-plain-generic (2021.20220204-1) …
Selecting previously unselected package tipa.
Preparing to unpack …/52-tipa_2%3a1.3-21_all.deb …
Unpacking tipa (2:1.3-21) …
Selecting previously unselected package texlive-xetex.
Preparing to unpack …/53-texlive-xetex_2021.20220204-1_all.deb …
Unpacking texlive-xetex (2021.20220204-1) …
Setting up fonts-lato (2.0-2.1) …
Setting up fonts-noto-mono (20201225-1build1) …
Setting up libwoff1:amd64 (1.0.2-1build4) …
Setting up libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) …
Setting up libijs-0.35:amd64 (0.35-15build2) …
Setting up libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.2) …
Setting up libfontbox-java (1:1.8.16-2) …
Setting up rubygems-integration (1.18) …
Setting up libzzip-0-13:amd64 (0.13.72+dfsg.1-1.1) …
Setting up fonts-urw-base35 (20200910-1) …
Setting up poppler-data (0.4.11-1) …
Setting up tex-common (6.17) …
update-language: texlive-base not installed and configured, doing nothing!
Setting up libfontenc1:amd64 (1:1.1.4-1build3) …
Setting up libjbig2dec0:amd64 (0.19-3build2) …
Setting up libteckit0:amd64 (2.5.11+ds1-1) …
Setting up libapache-pom-java (18-1) …
Setting up ruby-net-telnet (0.1.1-2) …
Setting up xfonts-encodings (1:1.0.5-0ubuntu2) …
Setting up t1utils (1.41-4build2) …
Setting up libidn12:amd64 (1.38-4ubuntu1) …
Setting up fonts-texgyre (20180621-3.1) …
Setting up libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) …
Setting up ruby-webrick (1.7.0-3ubuntu0.1) …
Setting up fonts-lmodern (2.004.5-6.1) …
Setting up fonts-droid-fallback (1:6.0.1r16-1.1build1) …
Setting up ruby-xmlrpc (0.3.2-1ubuntu0.1) …
Setting up libsynctex2:amd64 (2021.20210626.59705-1ubuntu0.2) …
Setting up libgs9-common (9.55.0~dfsg1-0ubuntu5.10) …
Setting up teckit (2.5.11+ds1-1) …
Setting up libpdfbox-java (1:1.8.16-2) …
Setting up libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.10) …
Setting up preview-latex-style (12.2-1ubuntu1) …
Setting up libcommons-parent-java (43-1) …
Setting up dvisvgm (2.13.1-1) …
```

```
Setting up libcommons-logging-java (1.2-2) …
Setting up xfonts-utils (1:7.7+6build2) …
Setting up libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) …
Setting up texlive-binaries (2021.20210626.59705-1ubuntu0.2) …
update-alternatives: using /usr/bin/xdvi-xaw to provide /usr/bin/xdvi.bin
(xdvi.bin) in auto mode
update-alternatives: using /usr/bin/bibtex.original to provide /usr/bin/bibtex
(bibtex) in auto mode
Setting up lmodern (2.004.5-6.1) …
Setting up texlive-base (2021.20220204-1) …
/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
mktexlsr: Updating /var/lib/texmf/ls-R-TEXLIVEDIST…
mktexlsr: Updating /var/lib/texmf/ls-R-TEXMFMAIN…
mktexlsr: Updating /var/lib/texmf/ls-R…
mktexlsr: Done.
tl-paper: setting paper size for dvips to a4:
/var/lib/texmf/dvips/config/config-paper.ps
tl-paper: setting paper size for dvipdfmx to a4:
/var/lib/texmf/dvipdfmx/dvipdfmx-paper.cfg
tl-paper: setting paper size for xdvi to a4: /var/lib/texmf/xdvi/XDvi-paper
tl-paper: setting paper size for pdftex to a4: /var/lib/texmf/tex/generic/tex-
ini-files/pdftexconfig.tex
Setting up tex-gyre (20180621-3.1) …
Setting up texlive-plain-generic (2021.20220204-1) …
Setting up texlive-latex-base (2021.20220204-1) …
Setting up texlive-latex-recommended (2021.20220204-1) …
Setting up texlive-pictures (2021.20220204-1) …
Setting up texlive-fonts-recommended (2021.20220204-1) …
Setting up tipa (2:1.3-21) …
Setting up texlive-latex-extra (2021.20220204-1) …
Setting up texlive-xetex (2021.20220204-1) …
Setting up rake (13.0.6-2) …
Setting up libruby3.0:amd64 (3.0.2-7ubuntu2.8) …
Setting up ruby3.0 (3.0.2-7ubuntu2.8) …
Setting up ruby (1:3.0~exp1) …
Setting up ruby-rubygems (3.3.5-2) …
Processing triggers for man-db (2.10.2-1) …
Processing triggers for fontconfig (2.13.1-4.2ubuntu5) …
Processing triggers for libc-bin (2.35-0ubuntu3.4) …
/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link
```

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_opencl.so.0 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libur_loader.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libumf.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libhwloc.so.15 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero.so.0 is not a
symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link

Processing triggers for tex-common (6.17) …
Running updmap-sys. This may take some time… done.
Running mktexlsr /var/lib/texmf … done.
Building format(s) --all.
        This may take some time… done.

```
[37]: !jupyter nbconvert --to pdf "/content/drive/MyDrive/CSE-151A-Project/
      ↪CSE_151A_Project(Cheese).ipynb"
```

[NbConvertApp] Converting notebook
/content/drive/MyDrive/CSE-151A-Project/CSE_151A_Project(Cheese).ipynb to pdf
[NbConvertApp] Support files will be in CSE_151A_Project(Cheese)_files/
[NbConvertApp] Making directory ./CSE_151A_Project(Cheese)_files
[NbConvertApp] Writing 104956 bytes to notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running xelatex 3 times: ['xelatex', 'notebook.tex', '-quiet']
Traceback (most recent call last):
  File "/usr/local/lib/python3.10/dist-packages/nbconvert/exporters/pdf.py",
line 197, in from_notebook_node
    self.run_latex(tex_file)
  File "/usr/local/lib/python3.10/dist-packages/nbconvert/exporters/pdf.py",
line 166, in run_latex
    return self.run_command(
  File "/usr/local/lib/python3.10/dist-packages/nbconvert/exporters/pdf.py",
line 144, in run_command

```
    out, _ = p.communicate()
  File "/usr/lib/python3.10/subprocess.py", line 1141, in communicate
    stdout = self.stdout.read()
KeyboardInterrupt

During handling of the above exception, another exception occurred:

Traceback (most recent call last):
  File "/usr/local/bin/jupyter-nbconvert", line 8, in <module>
    sys.exit(main())
  File "/usr/local/lib/python3.10/dist-packages/jupyter_core/application.py",
line 283, in launch_instance
    super().launch_instance(argv=argv, **kwargs)
  File "/usr/local/lib/python3.10/dist-
packages/traitlets/config/application.py", line 992, in launch_instance
    app.start()
  File "/usr/local/lib/python3.10/dist-packages/nbconvert/nbconvertapp.py", line
420, in start
    self.convert_notebooks()
  File "/usr/local/lib/python3.10/dist-packages/nbconvert/nbconvertapp.py", line
597, in convert_notebooks
    self.convert_single_notebook(notebook_filename)
  File "/usr/local/lib/python3.10/dist-packages/nbconvert/nbconvertapp.py", line
563, in convert_single_notebook
    output, resources = self.export_single_notebook(
  File "/usr/local/lib/python3.10/dist-packages/nbconvert/nbconvertapp.py", line
487, in export_single_notebook
    output, resources = self.exporter.from_filename(
  File "/usr/local/lib/python3.10/dist-
packages/nbconvert/exporters/templateexporter.py", line 386, in from_filename
    return super().from_filename(filename, resources, **kw)  #
type:ignore[return-value]
  File "/usr/local/lib/python3.10/dist-
packages/nbconvert/exporters/exporter.py", line 201, in from_filename
    return self.from_file(f, resources=resources, **kw)
  File "/usr/local/lib/python3.10/dist-
packages/nbconvert/exporters/templateexporter.py", line 392, in from_file
    return super().from_file(file_stream, resources, **kw)  #
type:ignore[return-value]
  File "/usr/local/lib/python3.10/dist-
packages/nbconvert/exporters/exporter.py", line 220, in from_file
    return self.from_notebook_node(
  File "/usr/local/lib/python3.10/dist-packages/nbconvert/exporters/pdf.py",
line 192, in from_notebook_node
    with TemporaryDirectory() as td, _contextlib_chdir.chdir(td):
  File "/usr/lib/python3.10/tempfile.py", line 1017, in __exit__
    self.cleanup()
  File "/usr/lib/python3.10/tempfile.py", line 1021, in cleanup
```

```
        self._rmtree(self.name, ignore_errors=self._ignore_cleanup_errors)
  File "/usr/lib/python3.10/tempfile.py", line 1003, in _rmtree
    _rmtree(name, onerror=onerror)
  File "/usr/lib/python3.10/shutil.py", line 725, in rmtree
    _rmtree_safe_fd(fd, path, onerror)
  File "/usr/lib/python3.10/shutil.py", line 679, in _rmtree_safe_fd
    os.unlink(entry.name, dir_fd=topfd)
KeyboardInterrupt
^C
```