

CSE_151A_Project

November 14, 2024

```
[18]: import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

1 CSV File Upload

```
[ ]: from google.colab import drive
drive.mount('/content/drive')
```

Mounted at /content/drive

```
[ ]: # all_data_csv = glob.glob("data/*.csv")
from google.colab import files
files.upload()
```

<IPython.core.display.HTML object>

Saving kaggle.json to kaggle.json

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

```
[ ]: !mkdir -p ~/.kaggle
!mv kaggle.json ~/.kaggle/
!chmod 600 ~/.kaggle/kaggle.json
```

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

Dataset URL: <https://www.kaggle.com/datasets/maxwell/nba-shots>

License(s): other

Downloading nba-shots.zip to /content

88% 71.0M/80.4M [00:00<00:00, 92.3MB/s]

100% 80.4M/80.4M [00:00<00:00, 88.2MB/s]

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

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

```
[16]: 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)
```

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

2 Exploration

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

```
[20]: 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)
```

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

```
[21]:
```

	SEASON_1	SEASON_2	TEAM_ID	TEAM_NAME	PLAYER_ID	\
0	2006	2005-06	1610612743	Denver Nuggets	2035	
1	2006	2005-06	1610612760	Seattle SuperSonics	101230	

2	2006	2005-06	1610612743	Denver Nuggets	1922
3	2006	2005-06	1610612743	Denver Nuggets	101132
4	2006	2005-06	1610612743	Denver Nuggets	2035

	PLAYER_NAME	POSITION_GROUP	POSITION	GAME_DATE	GAME_ID	...	\
0	DerMarr Johnson		G SG	04-19-2006	20501230	...	
1	Noel Felix		F SF	04-19-2006	20501230	...	
2	Francisco Elson		C C	04-19-2006	20501230	...	
3	Linus Kleiza		F PF	04-19-2006	20501230	...	
4	DerMarr Johnson		G SG	04-19-2006	20501230	...	

	BASIC_ZONE	ZONE_NAME	ZONE_ABB	ZONE_RANGE	LOC_X	\
0	Above the Break 3	Right Side Center	RC	24+ ft.	-15.6	
1	Restricted Area	Center	C	Less Than 8 ft.	-0.0	
2	Above the Break 3	Right Side Center	RC	24+ ft.	-18.9	
3	Mid-Range	Left Side	L	16-24 ft.	17.4	
4	Above the Break 3	Left Side Center	LC	24+ ft.	12.6	

	LOC_Y	SHOT_DISTANCE	QUARTER	MINS_LEFT	SECS_LEFT
0	36.15	34	4	0	1
1	5.25	0	4	0	1
2	25.45	27	4	0	8
3	4.95	17	4	0	16
4	27.45	25	4	0	29

[5 rows x 26 columns]

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

-----SEASON_1-----

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

-----SEASON_2-----

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

-----TEAM_ID-----

```
[1610612743 1610612760 1610612761 1610612741 1610612737 1610612745
 1610612750 1610612739 1610612763 1610612744 1610612738 1610612748
 1610612753 1610612759 1610612757 1610612754 1610612756 1610612762]
```

1610612765 1610612747 1610612764 1610612740 1610612755 1610612766
1610612742 1610612746 1610612751 1610612752 1610612749 1610612758]

-----TEAM_NAME-----

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

-----PLAYER_ID-----

[2035 101230 1922 ... 1629093 1629152 1629155]

-----PLAYER_NAME-----

['DerMarr Johnson' 'Noel Felix' 'Francisco Elson' ... 'Tyler Davis'
'DeVaughn Akoon-Purcell' 'Zach Lofton']

-----POSITION_GROUP-----

['G' 'F' 'C' nan]

-----POSITION-----

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

-----GAME_DATE-----

['04-19-2006' '04-18-2006' '04-17-2006' ... '10-18-2018' '10-17-2018'
'10-16-2018']

-----GAME_ID-----

[20501230 20501225 20501217 ... 21800013 21800002 21800001]

-----HOME_TEAM-----

['SEA' 'CHI' 'CLE' 'HOU' 'MIN' 'UTA' 'BOS' 'IND' 'POR' 'DET' 'LAL' 'CHA'
'DAL' 'NJN' 'ATL' 'SAC' 'WAS' 'MEM' 'PHI' 'ORL' 'DEN' 'TOR' 'MIL' 'NYK']

'GSW' 'PHX' 'SAS' 'MIA' 'LAC' 'NOK' 'OKC' 'NOP' 'BKN' 'NOH']

-----AWAY_TEAM-----

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

-----EVENT_TYPE-----

['Missed Shot' 'Made Shot']

-----SHOT_MADE-----

[False True]

-----ACTION_TYPE-----

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

-----SHOT_TYPE-----

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

-----BASIC_ZONE-----

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

-----ZONE_NAME-----

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

-----ZONE_ABB-----

['RC' 'C' 'L' 'LC' 'R' 'BC']

-----ZONE_RANGE-----

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

-----LOC_X-----

[-1.56e+01	-0.00e+00	-1.89e+01	1.74e+01	1.26e+01	-2.04e+01	-9.70e+00
1.58e+01	1.49e+01	4.80e+00	1.54e+01	-1.77e+01	-1.25e+01	-7.10e+00
-2.27e+01	-2.33e+01	1.92e+01	1.25e+01	2.00e-01	8.00e+00	-2.36e+01
6.00e-01	1.33e+01	-3.10e+00	2.90e+00	-1.63e+01	-4.40e+00	-5.10e+00
-3.60e+00	-1.12e+01	2.25e+01	-1.99e+01	-3.00e-01	-6.40e+00	1.71e+01
1.15e+01	-1.00e+00	-1.40e+01	-1.35e+01	1.13e+01	1.41e+01	3.80e+00
-8.40e+00	-1.44e+01	-1.00e-01	-9.50e+00	-2.10e+01	1.48e+01	-1.36e+01
1.97e+01	-9.40e+00	1.12e+01	-1.48e+01	-1.28e+01	-1.82e+01	1.56e+01
-4.30e+00	-1.84e+01	-5.70e+00	-1.31e+01	1.28e+01	-1.59e+01	4.60e+00
-1.23e+01	2.46e+01	-1.18e+01	1.80e+00	1.63e+01	1.50e+00	-8.70e+00
-9.80e+00	-3.80e+00	5.00e-01	1.05e+01	1.64e+01	-2.60e+00	-1.50e+00
5.90e+00	-2.32e+01	-1.61e+01	-1.72e+01	-2.09e+01	8.50e+00	1.18e+01
2.35e+01	1.61e+01	3.90e+00	7.90e+00	5.20e+00	-2.35e+01	1.84e+01
-1.81e+01	1.86e+01	-2.20e+01	1.99e+01	1.30e+01	1.91e+01	-7.90e+00
-1.08e+01	-1.64e+01	-5.40e+00	-8.00e-01	2.22e+01	-1.30e+01	1.45e+01
8.40e+00	-1.76e+01	-2.40e+01	1.46e+01	-1.80e+00	1.69e+01	2.30e+01
1.23e+01	9.90e+00	-2.22e+01	-1.26e+01	-1.87e+01	-5.00e-01	2.28e+01
1.77e+01	-4.60e+00	1.76e+01	-1.71e+01	6.40e+00	8.90e+00	3.40e+00
-1.17e+01	2.40e+01	-6.20e+00	-2.45e+01	2.18e+01	1.38e+01	-2.17e+01
-1.86e+01	1.79e+01	6.20e+00	1.10e+01	1.68e+01	1.81e+01	-1.54e+01
1.72e+01	1.40e+01	9.70e+00	-1.10e+00	-1.49e+01	1.00e+00	1.07e+01
-2.38e+01	1.43e+01	-1.02e+01	3.60e+00	1.51e+01	-1.00e+01	-2.40e+00
-3.90e+00	7.40e+00	5.10e+00	-3.30e+00	1.10e+00	7.50e+00	-1.66e+01
2.41e+01	-1.53e+01	-8.90e+00	5.60e+00	-1.67e+01	5.70e+00	9.50e+00
2.12e+01	1.60e+00	1.35e+01	2.60e+00	1.08e+01	2.07e+01	1.17e+01
-1.07e+01	3.00e-01	1.59e+01	-1.51e+01	9.40e+00	4.40e+00	-6.00e-01
1.89e+01	8.00e-01	-1.97e+01	2.05e+01	-1.10e+01	-1.38e+01	-1.33e+01
2.27e+01	8.70e+00	4.90e+00	-1.41e+01	-2.00e+00	1.00e+01	-2.46e+01

1.53e+01	-2.28e+01	1.87e+01	-8.00e+00	6.60e+00	-2.02e+01	1.94e+01
-1.94e+01	-1.13e+01	-9.20e+00	-1.30e+00	-6.10e+00	-1.58e+01	-2.10e+00
-2.43e+01	-8.20e+00	6.90e+00	-6.70e+00	-2.05e+01	-7.20e+00	2.15e+01
-2.30e+00	5.40e+00	-2.07e+01	-2.80e+00	-4.90e+00	1.82e+01	4.10e+00
-1.69e+01	1.20e+01	8.20e+00	2.80e+00	-7.50e+00	-2.30e+01	2.00e+01
-7.70e+00	2.10e+00	-8.50e+00	2.37e+01	2.04e+01	2.17e+01	2.33e+01
-1.60e+00	2.38e+01	9.20e+00	-2.23e+01	-5.90e+00	9.00e+00	-4.70e+00
1.31e+01	2.00e+00	1.30e+00	3.10e+00	-1.46e+01	-3.40e+00	-2.90e+00
2.09e+01	-1.74e+01	-4.10e+00	6.70e+00	1.22e+01	1.66e+01	2.50e+00
-1.20e+01	-1.15e+01	-1.79e+01	2.32e+01	-5.20e+00	-1.92e+01	1.36e+01
1.03e+01	2.23e+01	-6.90e+00	6.10e+00	-1.21e+01	-1.05e+01	2.10e+01
-2.41e+01	4.30e+00	1.95e+01	7.70e+00	-9.00e+00	-2.18e+01	-6.60e+00
1.67e+01	-7.40e+00	2.43e+01	-2.00e+01	1.02e+01	-1.95e+01	-1.43e+01
2.30e+00	-1.03e+01	7.20e+00	-2.12e+01	7.10e+00	2.02e+01	-5.60e+00
-2.25e+01	-2.15e+01	2.20e+01	2.14e+01	2.45e+01	3.30e+00	-1.90e+01
-2.13e+01	-4.00e-01	-2.00e-01	-2.50e+01	-1.70e+00	1.55e+01	-1.40e+00
1.27e+01	4.00e-01	1.34e+01	-2.50e+00	-2.48e+01	1.65e+01	1.40e+00
-1.11e+01	2.48e+01	1.00e-01	1.21e+01	2.39e+01	8.30e+00	2.26e+01
2.20e+00	-1.93e+01	-4.80e+00	-4.00e+00	1.57e+01	-3.50e+00	5.00e+00
8.10e+00	-2.14e+01	-1.55e+01	-1.90e+00	-1.42e+01	-8.80e+00	-2.31e+01
1.20e+00	1.50e+01	-1.47e+01	2.03e+01	1.32e+01	1.11e+01	3.70e+00
-9.60e+00	-2.37e+01	9.60e+00	-8.60e+00	-1.34e+01	2.36e+01	-2.70e+00
-5.00e+00	5.50e+00	-1.65e+01	1.42e+01	-1.09e+01	6.50e+00	-1.78e+01
4.20e+00	1.16e+01	1.37e+01	9.10e+00	1.78e+01	1.44e+01	-7.00e-01
-1.52e+01	1.29e+01	1.52e+01	1.14e+01	1.01e+01	2.70e+00	-1.16e+01
-1.01e+01	-1.20e+00	2.24e+01	-6.30e+00	-1.57e+01	1.90e+01	1.06e+01
-2.03e+01	-1.19e+01	-1.45e+01	7.30e+00	-1.91e+01	1.80e+01	1.19e+01
-1.32e+01	-5.80e+00	6.00e+00	-1.24e+01	-7.30e+00	2.50e+01	-1.37e+01
-1.29e+01	2.08e+01	3.50e+00	-2.26e+01	-2.24e+01	1.04e+01	9.80e+00
-6.50e+00	2.34e+01	-1.68e+01	-1.70e+01	-4.20e+00	-2.01e+01	-1.80e+01
-2.39e+01	1.88e+01	-9.00e-01	1.90e+00	-1.73e+01	7.00e-01	-1.98e+01
1.98e+01	4.50e+00	7.60e+00	1.85e+01	-7.80e+00	-8.30e+00	1.96e+01
-3.20e+00	2.29e+01	3.20e+00	-9.10e+00	1.75e+01	-5.30e+00	3.00e+00
-1.22e+01	2.31e+01	-1.85e+01	1.39e+01	-1.27e+01	1.60e+01	1.83e+01
-4.50e+00	9.30e+00	-3.70e+00	-7.00e+00	-2.34e+01	1.93e+01	2.13e+01
-1.14e+01	2.01e+01	8.60e+00	-2.06e+01	-2.20e+00	-1.62e+01	-1.06e+01
6.80e+00	2.40e+00	4.00e+00	-1.96e+01	-1.60e+01	-8.10e+00	7.80e+00
1.09e+01	7.00e+00	-9.90e+00	2.42e+01	-2.42e+01	1.47e+01	-2.11e+01
5.30e+00	2.21e+01	-2.44e+01	9.00e-01	-2.47e+01	1.70e+00	1.73e+01
2.11e+01	-2.29e+01	-7.60e+00	-6.00e+00	-3.00e+00	-1.88e+01	-5.50e+00
-1.50e+01	5.80e+00	-6.80e+00	-1.39e+01	2.44e+01	1.62e+01	1.24e+01
-1.83e+01	2.47e+01	6.30e+00	-1.75e+01	1.70e+01	4.70e+00	-1.04e+01
-2.08e+01	8.80e+00	2.19e+01	-9.30e+00	2.06e+01	2.16e+01	-2.21e+01
-2.49e+01	-2.19e+01	7.00e-02	-2.80e-01	-2.20e-01	-1.21e+00	-5.80e-01
-1.23e+00	2.28e+00	-2.90e-01	1.03e+00	5.30e-01	-3.60e-01	-1.53e+00
1.70e-01	9.80e-01	9.90e-01	1.18e+00	2.80e-01	-4.00e-02	-1.75e+00
2.20e-01	2.07e+00	-1.56e+00	2.25e+00	-2.50e-01	9.00e-02	-8.50e-01
1.00e-02	-9.00e-02	2.33e+00	-2.37e+00	-1.70e-01	2.23e+00	-5.00e-02

4.70e-01	-2.17e+00	-2.28e+00	4.00e-02	7.20e-01	-2.34e+00	-3.40e-01
5.00e-02	-1.79e+00	-6.90e-01	-2.10e-01	-1.72e+00	2.24e+00	-2.35e+00
-1.94e+00	-1.19e+00	8.90e-01	4.40e-01	-2.33e+00	1.35e+00	2.38e+00
-1.37e+00	-5.10e-01	2.00e-02	6.10e-01	1.60e-01	-7.00e-02	-1.00e-02
6.00e-02	-1.45e+00	2.70e-01	-3.10e-01	3.80e-01	-2.30e-01	2.60e-01
3.70e-01	-1.84e+00	-9.90e-01	1.95e+00	-6.70e-01	-1.73e+00	7.80e-01
1.30e-01	-2.00e-02	-2.27e+00	2.34e+00	-8.10e-01	1.13e+00	3.60e-01
-1.26e+00	-2.22e+00	3.30e-01	-7.60e-01	-1.89e+00	1.21e+00	-6.00e-02
-5.90e-01	-5.60e-01	-3.90e-01	5.10e-01	1.36e+00	-1.30e-01	-1.42e+00
2.10e-01	-1.57e+00	-3.20e-01	1.47e+00	1.10e-01	5.90e-01	-1.08e+00
8.30e-01	9.30e-01	-1.20e-01	-1.80e-01	1.65e+00	1.56e+00	-1.50e-01
1.04e+00	2.18e+00	-1.76e+00	6.70e-01	-1.58e+00	-1.83e+00	1.81e+00
-1.03e+00	-1.96e+00	1.80e-01	8.70e-01	-2.38e+00	-2.21e+00	-2.32e+00
8.80e-01	-1.52e+00	1.84e+00	9.20e-01	-1.13e+00	1.50e-01	6.90e-01
1.86e+00	-4.40e-01	-1.10e-01	4.30e-01	-2.07e+00	-1.95e+00	-7.70e-01
2.02e+00	-1.60e-01	7.40e-01	-2.18e+00	4.20e-01	-9.70e-01	-1.78e+00
1.57e+00	-2.29e+00	-1.91e+00	-1.74e+00	-6.20e-01	-2.01e+00	1.12e+00
1.61e+00	1.43e+00	2.27e+00	1.69e+00	1.75e+00	1.79e+00	3.20e-01
-1.81e+00	1.25e+00	-6.50e-01	2.50e-01	-2.24e+00	-4.20e-01	-1.29e+00
-4.30e-01	-2.70e-01	1.20e-01	-9.30e-01	2.06e+00	-2.03e+00	-1.12e+00
1.09e+00	1.26e+00	-1.54e+00	-3.30e-01	2.35e+00	-2.02e+00	1.85e+00
1.74e+00	-7.50e-01	1.14e+00	2.29e+00	1.08e+00	-1.36e+00	9.70e-01
1.99e+00	-3.80e-01	2.30e-01	1.88e+00	1.02e+00	-1.16e+00	-8.30e-01
1.83e+00	-9.60e-01	2.32e+00	1.54e+00	1.76e+00	-2.39e+00	-5.30e-01
1.89e+00	-1.62e+00	1.19e+00	-1.92e+00	-1.65e+00	-5.40e-01	2.21e+00
-1.64e+00	-1.68e+00	1.52e+00	-1.25e+00	-9.40e-01	-1.09e+00	1.78e+00
3.90e-01	1.16e+00	4.90e-01	-3.70e-01	-2.60e-01	-2.13e+00	4.80e-01
9.10e-01	-1.40e-01	-4.80e-01	2.08e+00	9.60e-01	6.50e-01	-9.80e-01
1.53e+00	2.39e+00	-1.88e+00	1.32e+00	-9.10e-01	-1.51e+00	-9.20e-01
1.46e+00	-1.85e+00	1.73e+00	1.58e+00	-2.06e+00	3.40e-01	-1.41e+00
6.20e-01	7.50e-01	-1.35e+00	5.80e-01	-4.50e-01	5.40e-01	1.67e+00
1.38e+00	1.68e+00	2.43e+00	1.94e+00	1.64e+00	-1.47e+00	-8.70e-01
1.27e+00	6.40e-01	1.72e+00	8.10e-01	-7.10e-01	-7.80e-01	-1.18e+00
7.10e-01	1.59e+00	-1.48e+00	-6.60e-01	2.14e+00	-1.07e+00	-2.25e+00
-4.90e-01	2.90e-01	5.60e-01	-1.32e+00	-1.61e+00	7.70e-01	-2.19e+00
1.41e+00	-8.80e-01	2.11e+00	2.37e+00	-1.24e+00	-8.90e-01	-2.23e+00
-1.43e+00	-1.34e+00	1.92e+00	-1.31e+00	2.22e+00	-1.59e+00	-1.97e+00
1.45e+00	-2.14e+00	-1.05e+00	1.48e+00	1.63e+00	-1.46e+00	-1.15e+00
7.60e-01	3.10e-01	1.91e+00	-2.16e+00	1.29e+00	1.62e+00	1.05e+00
-2.11e+00	8.20e-01	1.31e+00	2.01e+00	5.50e-01	8.50e-01	-4.70e-01
9.40e-01	-6.10e-01	-1.55e+00	-1.38e+00	-5.50e-01	-2.05e+00	1.96e+00
1.23e+00	-1.69e+00	-6.40e-01	1.51e+00	-7.20e-01	-1.02e+00	-2.12e+00
2.12e+00	-1.63e+00	1.37e+00	-2.46e+00	4.50e-01	1.42e+00	1.34e+00
1.24e+00	1.15e+00	-8.60e-01	2.19e+00	2.13e+00	-1.27e+00	6.60e-01
-1.67e+00	-3.00e-02	-1.14e+00	2.17e+00	-1.99e+00	-1.01e+00	8.60e-01
2.03e+00	-1.04e+00	-7.40e-01	1.97e+00	-1.87e+00	-8.00e-02	1.07e+00
-2.31e+00	2.16e+00	-2.41e+00	-1.66e+00	-1.86e+00	-8.20e-01	-2.08e+00
3.00e-02	3.50e-01	2.05e+00	-1.90e-01	6.80e-01	-6.80e-01	-2.43e+00


```

-7.30e-01 -9.50e-01 -5.70e-01 -2.26e+00 8.00e-02 -1.06e+00 1.17e+00
 2.41e+00 1.11e+00 -6.30e-01 2.31e+00 1.71e+00 2.45e+00 -3.50e-01
-1.71e+00 -2.44e+00 2.44e+00 -1.22e+00 1.44e+00 5.20e-01 7.30e-01
-4.60e-01 -1.17e+00 8.40e-01 2.46e+00 -2.48e+00 4.60e-01 2.09e+00
 1.01e+00 5.70e-01 7.90e-01 1.40e-01 2.42e+00 6.30e-01 2.04e+00
-7.90e-01 -2.09e+00 -2.45e+00 -5.20e-01 -4.10e-01 -2.04e+00 2.49e+00
 1.90e-01 2.40e-01 1.28e+00 2.36e+00 -1.77e+00 -2.40e-01 -1.28e+00
-1.11e+00 -1.39e+00 2.48e+00 9.50e-01 -1.98e+00 1.66e+00 1.39e+00
-2.49e+00 4.10e-01 2.26e+00 2.15e+00 -1.93e+00 1.22e+00 1.55e+00
 1.87e+00 1.06e+00 -1.33e+00 1.77e+00 -2.36e+00 1.33e+00 -1.82e+00
 1.98e+00 -8.40e-01 -1.49e+00 1.49e+00 1.82e+00 -1.44e+00 -2.15e+00
 1.93e+00 -2.42e+00 -2.47e+00 2.47e+00 2.49e+01 -2.16e+01]

```

-----LOC_Y-----

```
[36.15 5.25 25.45 ... 5.285 12.045 67.45 ]
```

-----SHOT_DISTANCE-----

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

-----QUARTER-----

```
[4 6 5 3 2 1 7 8]
```

-----MINS_LEFT-----

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

-----SECS_LEFT-----

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

```
[23]: # ['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))

```

[24]: *# heatmap w/ numerical attributes*

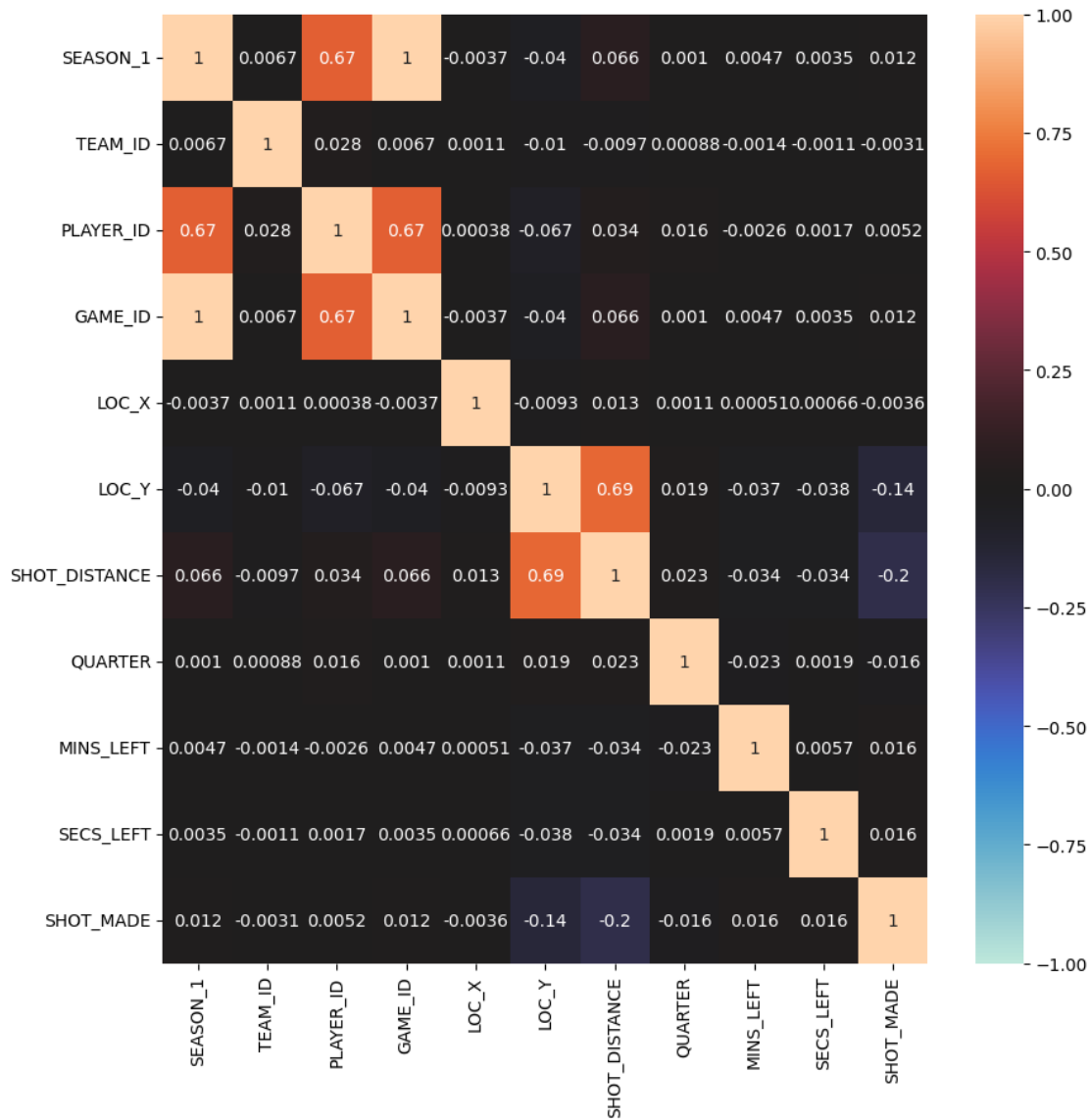
```

# 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)

```

[24]: <Axes: >



```
[25]: # 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.

[25]:

3 Pre-Processing

```
[27]: 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')
```

```
[48]: # 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)
```

```
[49]: # 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
```

```
[51]: # 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

```

```

[57]: # heatmap w/ preprocessed attributes

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

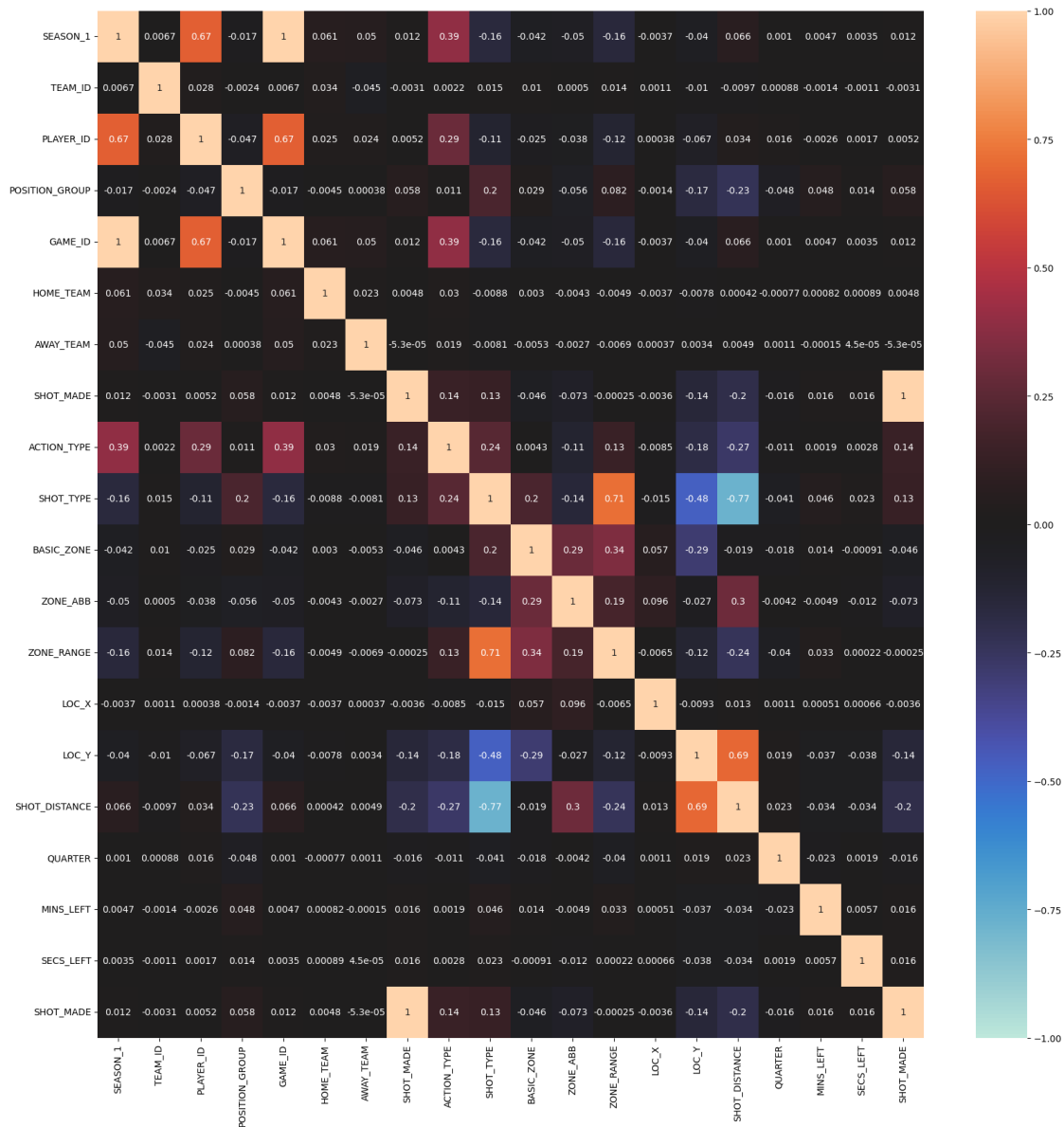
attributes = list(Preprocessed_Data.columns)
heat_vars = attributes.copy()
heat_vars.append('SHOT_MADE')
sns.heatmap(Preprocessed_Data[heat_vars].corr(), annot=True, vmin=-1, vmax=1,
            center= 0, ax=ax)

```

```

[57]: <Axes: >

```



```
[ ]: # 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
# Scale numerical attributes
# Run first model
# Evaluate model, compare training vs test error
# Answer 4-6 in write up
```

4 Printing

```
[61]: !apt-get update
```

```
0% [Working] Hit:1 http://archive.ubuntu.com/ubuntu jammy
InRelease
0% [Waiting for headers] [Connecting to security.ubuntu.com (185.125.190.81)]
[Connected to cloud.r-
Get:2 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
0% [2 InRelease 15.6 kB/128 kB 12%] [Connecting to security.ubuntu.com
(185.125.190.81)] [Waiting fo
Get:3 https://cloud.r-project.org/bin/linux/ubuntu jammy-cran40/ InRelease
[3,626 B]
0% [2 InRelease 15.6 kB/128 kB 12%] [Connecting to security.ubuntu.com
(185.125.190.81)] [3 InReleas 0% [2 InRelease 15.6 kB/128 kB 12%] [Connecting to
security.ubuntu.com (185.125.190.81)] [Connected
Get:4 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64
InRelease [1,581 B]
0% [2 InRelease 79.3 kB/128 kB 62%] [Waiting for headers] [Waiting for headers]
[4 InRelease 1,581 B 0% [2 InRelease 92.4 kB/128 kB 72%] [Waiting for headers]
[Waiting for headers] [Connected to ppa.la 0% [Waiting for headers] [Waiting for
headers] [Waiting for headers] [Connected to ppa.launchpadcont
Get:5 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [127 kB]
0% [5 InRelease 5,484 B/127 kB 4%] [Waiting for headers] [Waiting for headers]
[Connected to ppa.lau
Get:6 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Get:7 https://r2u.stat.illinois.edu/ubuntu jammy InRelease [6,555 B]
Hit:8 https://ppa.launchpadcontent.net/deadsnakes/ppa/ubuntu jammy InRelease
Hit:9 https://ppa.launchpadcontent.net/graphics-drivers/ppa/ubuntu jammy
InRelease
Get:10
https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64
Packages [1,108 kB]
Hit:11 https://ppa.launchpadcontent.net/ubuntugis/ppa/ubuntu jammy InRelease
Get:12 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages
[1,452 kB]
Get:13 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [2,700
kB]
Get:14 https://r2u.stat.illinois.edu/ubuntu jammy/main amd64 Packages [2,612 kB]
Get:15 https://r2u.stat.illinois.edu/ubuntu jammy/main all Packages [8,472 kB]
Get:16 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages
[2,424 kB]
Fetched 19.2 MB in 3s (7,653 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?)
```

```
[62]: !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

pandoc is already the newest version (2.9.2.1-3ubuntu2).

0 upgraded, 0 newly installed, 0 to remove and 49 not upgraded.

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 libsyntaxtex2 libteckit0 libtexlua53 libtexluajit2 libwoff1
- libzip-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 libsynchronet2 libteckit0 libtexlua53
libtexluajit2 libwoff1
libzip-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 49 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 libsinctex2
 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 3s (66.8 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 ...

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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.

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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 libsyntax2:amd64.
Preparing to unpack .../30-libsyntax2_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libsyntax2: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 libtexlua53:amd64.
Preparing to unpack
.../33-libtexlua53_2021.20210626.59705-1ubuntu0.2_amd64.deb ...
Unpacking libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libzip-0-13:amd64.
Preparing to unpack .../34-libzip-0-13_0.13.72+dfsg.1-1.1_amd64.deb ...
Unpacking libzip-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) ...

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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 libzip-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) ...

```



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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-xmllrpc (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) ...

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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/libhwloc.so.15 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/libtbbbind_2_5.so.3 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/libtcm.so.1 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/libur_loader.so.0 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/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

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

/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 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.

```

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

```
[NbConvertApp] Converting notebook
/content/drive/MyDrive/CSE-151A-Project/CSE_151A_Project.ipynb to pdf
[NbConvertApp] Support files will be in CSE_151A_Project_files/
[NbConvertApp] Making directory ./CSE_151A_Project_files
[NbConvertApp] Writing 76086 bytes to notebook.tex
[NbConvertApp] Building PDF
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 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 120, in run_command
    raise OSError(msg)
OSError: xelatex not found on PATH, if you have not installed xelatex you may
need to do so. Find further instructions at
https://nbconvert.readthedocs.io/en/latest/install.html#installing-tex.
```