

Sleep pattern analytics Sleep pattern analytics involves analyzing data related to an individual's sleep patterns to gain insights into their sleep quality, duration, and efficiency. Some of the metrics that can be analyzed as part of sleep pattern analytics include:

Sleep duration: This refers to the total amount of time an individual spends asleep each night.

Sleep efficiency: This refers to the percentage of time an individual spends asleep while in bed. A high sleep efficiency indicates that an individual is spending most of their time in bed asleep, while a low sleep efficiency may indicate that they are spending a lot of time in bed awake.

Sleep stages: There are different stages of sleep that a person goes through during the night, including light sleep, deep sleep, and REM sleep. Analyzing sleep stages can provide insights into the quality of an individual's sleep.

Sleep interruptions: This refers to any disruptions to an individual's sleep, such as waking up during the night, snoring, or other disturbances.

To perform sleep pattern analytics, data can be collected using various methods, such as wearable devices, smart mattresses, or mobile apps. The collected data can then be analyzed using data analytics tools and techniques to identify patterns, trends, and insights related to an individual's sleep patterns. This information can be useful for identifying factors that may be affecting an individual's sleep quality, such as stress, diet, or environmental factors, and can be used to develop strategies to improve their sleep.

Sleep Heart Health Study

What is the NSRR ?

**The National Sleep Research Resource* *(NSRR) is an NHLBI-supported repository for sharing large amounts of sleep data (polysomnography, actigraphy and questionnaire-based) from multiple cohorts, clinical trials, and other data sources. Launched in April 2014, the mission of the NSRR is to advance sleep and circadian science by supporting secondary data analysis, algorithmic development, and signal processing through the sharing of high-quality data sets.

**Key Resource* *- > <https://sleepdata.org/>

To Use the NSRR data sets you need to install **NSRR Ruby Gem**

**Another sleep data sets **

Sleep Heart Health Study: <https://sleepdata.org/datasets/shhs>

MIT Sleep Dataset: <https://physionet.org/content/sleep-edfx/1.0.0/>

SleepEDF Dataset: <https://physionet.org/content/sleep-edfx/1.0.0/>

SHHS Data Coordinating Center: <https://sleepdata.org/datasets/shhs-dcc>

```
import pandas as pd
```

```
sleepdata=pd.read_csv("/content/drive/MyDrive/Colab Notebooks/Sleepdata/SleepData/sleepdata_New.csv")
```

```
sleepdata
```

```
sleepdata.head()
```

	Start	End	Sleep Quality	Regularity	Mood	Heart rate (bpm)	Steps	Alarm mode	Air Pressure (Pa)	City	...	Time in bed (seconds)
0	5/12/2019 23:26	5/13/2019 6:11	60%	0%	NaN	0	8350	Normal	NaN	NaN	...	24289.2
1	5/13/2019 22:10	5/14/2019 6:10	73%	0%	NaN	0	4746	Normal	NaN	NaN	...	28810.2
2	5/14/2019 21:43	5/15/2019 6:10	86%	96%	NaN	0	4007	Normal	NaN	NaN	...	30461.5
3	5/15/2019 23:11	5/16/2019 6:13	77%	92%	NaN	0	6578	Normal	NaN	NaN	...	25327.6
4	5/16/2019 23:12	5/17/2019 6:20	78%	94%	NaN	0	4913	Normal	NaN	NaN	...	25698.4

5 rows × 21 columns



```
sleepdata.tail()
```

	Start	End	Sleep Quality	Regularity	Mood	Heart rate (bpm)	Steps	Alarm mode	Air Pressure (Pa)	City	...	Time in bed (seconds)
916	3/24/2022 21:33	3/25/2022 4:21	71%	77%	NaN	0	3903	Normal	95.2	Central Kootenay	...	24289.2
917	3/25/2022 16:48	3/25/2022 17:30	9%	14%	NaN	0	495	Normal	83.8	North Okanagan	...	28810.2
918	3/26/2022 21:14	3/27/2022 6:11	49%	-1%	NaN	0	13388	Normal	83.5	North Okanagan	...	30461.5
919	3/28/2022 22:53	3/29/2022 4:50	77%	22%	NaN	0	456	Normal	93.9	Central Kootenay	...	25327.6
920	3/29/2022 22:44	3/30/2022 5:11	68%	85%	NaN	0	5156	Normal	94.4	Central Kootenay	...	25698.4

5 rows × 21 columns



```
sleepdata.shape
```

(921, 21)

```
sleepdata.columns
```

```
Index(['Start', 'End', 'Sleep Quality', 'Regularity', 'Mood', 'Heart rate (bpm)', 'Steps', 'Alarm mode', 'Air Pressure (Pa)', 'City', 'Movements per hour', 'Time in bed (seconds)', 'Time asleep (seconds)', 'Time before sleep (seconds)', 'Window start', 'Window stop', 'Did snore', 'Snore time', 'Weather temperature (°C)', 'Weather type',
```

```
'Notes'],
dtype='object')
```

```
sleepdata.duplicated().sum()
```

```
0
```

```
sleepdata.isnull().sum()
```

```
Start          0
End            0
Sleep Quality  0
Regularity     0
Mood          921
Heart rate (bpm) 0
Steps         0
Alarm mode     0
Air Pressure (Pa) 429
City          434
Movements per hour 0
Time in bed (seconds) 0
Time asleep (seconds) 0
Time before sleep (seconds) 0
Window start   80
Window stop    80
Did snore      0
Snore time     0
Weather temperature (°C) 0
Weather type   0
Notes         912
dtype: int64
```

```
sleepdata.info
```

```
<bound method DataFrame.info of
0  5/12/2019 23:26  5/13/2019 6:11    60%    0%  NaN
1  5/13/2019 22:10  5/14/2019 6:10    73%    0%  NaN
2  5/14/2019 21:43  5/15/2019 6:10    86%   96%  NaN
3  5/15/2019 23:11  5/16/2019 6:13    77%   92%  NaN
4  5/16/2019 23:12  5/17/2019 6:20    78%   94%  NaN
..  ...
916  3/24/2022 21:33  3/25/2022 4:21    71%   77%  NaN
917  3/25/2022 16:48  3/25/2022 17:30     9%   14%  NaN
918  3/26/2022 21:14  3/27/2022 6:11    49%   -1%  NaN
919  3/28/2022 22:53  3/29/2022 4:50    77%   22%  NaN
920  3/29/2022 22:44  3/30/2022 5:11    68%   85%  NaN
```

```
Heart rate (bpm)  Steps  Alarm mode  Air Pressure (Pa)  City \
0                0    8350    Normal          NaN        NaN
1                0    4746    Normal          NaN        NaN
2                0    4007    Normal          NaN        NaN
3                0    6578    Normal          NaN        NaN
4                0    4913    Normal          NaN        NaN
..  ...
916  ...    3903    Normal    95.2  Central Kootenay
917  ...    495    Normal    83.8   North Okanagan
918  ...  13388    Normal    83.5   North Okanagan
919  ...    456    Normal    93.9  Central Kootenay
920  ...    5156    Normal    94.4  Central Kootenay
```

```
... Time in bed (seconds)  Time asleep (seconds) \
0  ...    24289.2    22993.8
1  ...    28810.2    25160.9
2  ...    30461.5    28430.8
3  ...    25327.6    23132.5
4  ...    25698.4    22614.6
..  ...
916  ...    24474.1    20803.0
917  ...    2536.2      0.0
918  ...    32198.1    24577.9
919  ...    21433.6    15860.8
920  ...    23225.9    18813.0
```

```
Time before sleep (seconds)  Window start  Window stop  Did snore \
0                161.9  5/13/2019 6:00  5/13/2019 6:00    True
1                192.1  5/14/2019 5:50  5/14/2019 5:50    True
2                203.1  5/15/2019 5:50  5/15/2019 5:50    True
3                168.9  5/16/2019 5:50  5/16/2019 5:50    True
4                171.3  5/17/2019 5:50  5/17/2019 5:50    True
..  ...
```

```

916          489.5  3/25/2022 4:20  3/25/2022 4:20  True
917           0.0  3/25/2022 17:30  3/25/2022 17:30  True
918        3649.1  3/27/2022 6:00  3/27/2022 6:00  True
919        428.7  3/29/2022 4:20  3/29/2022 4:20  True
920        464.5  3/30/2022 5:00  3/30/2022 5:00  True

```

```

      Snore time  Weather temperature (°C)  Weather type  Notes
0          92.0              0.0      No weather    NaN
1           0.0              0.0      No weather    NaN
2          74.0              0.0      No weather    NaN
3           0.0              0.0      No weather    NaN
4         188.0              0.0      No weather    NaN

```

sleepdata.describe

```

<bound method NDFrame.describe of
0  5/12/2019 23:26  5/13/2019 6:11      60%      0%  NaN
1  5/13/2019 22:10  5/14/2019 6:10      73%      0%  NaN
2  5/14/2019 21:43  5/15/2019 6:10      86%     96%  NaN
3  5/15/2019 23:11  5/16/2019 6:13      77%     92%  NaN
4  5/16/2019 23:12  5/17/2019 6:20      78%     94%  NaN
..
916  3/24/2022 21:33  3/25/2022 4:21      71%     77%  NaN
917  3/25/2022 16:48  3/25/2022 17:30       9%     14%  NaN
918  3/26/2022 21:14  3/27/2022 6:11      49%     -1%  NaN
919  3/28/2022 22:53  3/29/2022 4:50      77%     22%  NaN
920  3/29/2022 22:44  3/30/2022 5:11      68%     85%  NaN

```

```

      Heart rate (bpm)  Steps  Alarm mode  Air Pressure (Pa)      City \
0           0      8350    Normal      NaN      NaN
1           0      4746    Normal      NaN      NaN
2           0      4007    Normal      NaN      NaN
3           0      6578    Normal      NaN      NaN
4           0      4913    Normal      NaN      NaN
..
916          0      3903    Normal     95.2  Central Kootenay
917          0      495    Normal     83.8  North Okanagan
918          0     13388    Normal     83.5  North Okanagan
919          0       456    Normal     93.9  Central Kootenay
920          0      5156    Normal     94.4  Central Kootenay

```

```

... Time in bed (seconds)  Time asleep (seconds) \
0  ...      24289.2      22993.8
1  ...      28810.2      25160.9
2  ...      30461.5      28430.8
3  ...      25327.6      23132.5
4  ...      25698.4      22614.6
..
916  ...      24474.1      20803.0
917  ...      2536.2         0.0
918  ...      32198.1      24577.9
919  ...      21433.6      15860.8
920  ...      23225.9      18813.0

```

```

      Time before sleep (seconds)  Window start  Window stop  Did snore \
0          161.9  5/13/2019 6:00  5/13/2019 6:00  True
1          192.1  5/14/2019 5:50  5/14/2019 5:50  True
2          203.1  5/15/2019 5:50  5/15/2019 5:50  True
3          168.9  5/16/2019 5:50  5/16/2019 5:50  True
4          171.3  5/17/2019 5:50  5/17/2019 5:50  True
..
916          489.5  3/25/2022 4:20  3/25/2022 4:20  True
917           0.0  3/25/2022 17:30  3/25/2022 17:30  True
918        3649.1  3/27/2022 6:00  3/27/2022 6:00  True
919        428.7  3/29/2022 4:20  3/29/2022 4:20  True
920        464.5  3/30/2022 5:00  3/30/2022 5:00  True

```

```

      Snore time  Weather temperature (°C)  Weather type  Notes
0          92.0              0.0      No weather    NaN
1           0.0              0.0      No weather    NaN
2          74.0              0.0      No weather    NaN
3           0.0              0.0      No weather    NaN
4         188.0              0.0      No weather    NaN

```

sleepdata.nunique

```

<bound method DataFrame.nunique of
0  5/12/2019 23:26  5/13/2019 6:11      60%      0%  NaN
1  5/13/2019 22:10  5/14/2019 6:10      73%      0%  NaN
2  5/14/2019 21:43  5/15/2019 6:10      86%     96%  NaN
3  5/15/2019 23:11  5/16/2019 6:13      77%     92%  NaN
4  5/16/2019 23:12  5/17/2019 6:20      78%     94%  NaN
..
916  3/24/2022 21:33  3/25/2022 4:21      71%     77%  NaN

```

917	3/25/2022 16:48	3/25/2022 17:30	9%	14%	NaN
918	3/26/2022 21:14	3/27/2022 6:11	49%	-1%	NaN
919	3/28/2022 22:53	3/29/2022 4:50	77%	22%	NaN
920	3/29/2022 22:44	3/30/2022 5:11	68%	85%	NaN

	Heart rate (bpm)	Steps	Alarm mode	Air Pressure (Pa)	City \
0	0	8350	Normal	NaN	NaN
1	0	4746	Normal	NaN	NaN
2	0	4007	Normal	NaN	NaN
3	0	6578	Normal	NaN	NaN
4	0	4913	Normal	NaN	NaN
..
916	0	3903	Normal	95.2	Central Kootenay
917	0	495	Normal	83.8	North Okanagan
918	0	13388	Normal	83.5	North Okanagan
919	0	456	Normal	93.9	Central Kootenay
920	0	5156	Normal	94.4	Central Kootenay

	Time in bed (seconds)	Time asleep (seconds) \
0	...	24289.2
1	...	28810.2
2	...	30461.5
3	...	25327.6
4	...	25698.4
..
916	...	24474.1
917	...	2536.2
918	...	32198.1
919	...	21433.6
920	...	23225.9

	Time before sleep (seconds)	Window start	Window stop	Did snore \
0	161.9	5/13/2019 6:00	5/13/2019 6:00	True
1	192.1	5/14/2019 5:50	5/14/2019 5:50	True
2	203.1	5/15/2019 5:50	5/15/2019 5:50	True
3	168.9	5/16/2019 5:50	5/16/2019 5:50	True
4	171.3	5/17/2019 5:50	5/17/2019 5:50	True
..
916	489.5	3/25/2022 4:20	3/25/2022 4:20	True
917	0.0	3/25/2022 17:30	3/25/2022 17:30	True
918	3649.1	3/27/2022 6:00	3/27/2022 6:00	True
919	428.7	3/29/2022 4:20	3/29/2022 4:20	True
920	464.5	3/30/2022 5:00	3/30/2022 5:00	True

	Snore time	Weather temperature (°C)	Weather type	Notes
0	92.0	0.0	No weather	NaN
1	0.0	0.0	No weather	NaN
2	74.0	0.0	No weather	NaN
3	0.0	0.0	No weather	NaN
4	188.0	0.0	No weather	NaN

```
sleepdata["Start"] = pd.to_datetime(sleepdata["Start"])
sleepdata["End"] = pd.to_datetime(sleepdata["End"])
```

```
sleepdata.head()
```

```

Start      End      Sleep      Regularity  Mood      Heart      Steps      Alarm      Air      City  ..
Quality
(Pa)

import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
from IPython import get_ipython
import warnings
warnings.filterwarnings("ignore")

2019-01-01 2019-01-01

```

Analyse Time in Bed Vs Time asleep

```

plt.figure(figsize=(15,6))
sns.lineplot(x = sleepdata['Start'], y = sleepdata['Time asleep (seconds)'],
             data = sleepdata, palette = 'hls')
sns.lineplot(x = sleepdata['Start'], y = sleepdata['Time in bed (seconds)'],
             data = sleepdata, palette = 'hls')
plt.show()

```

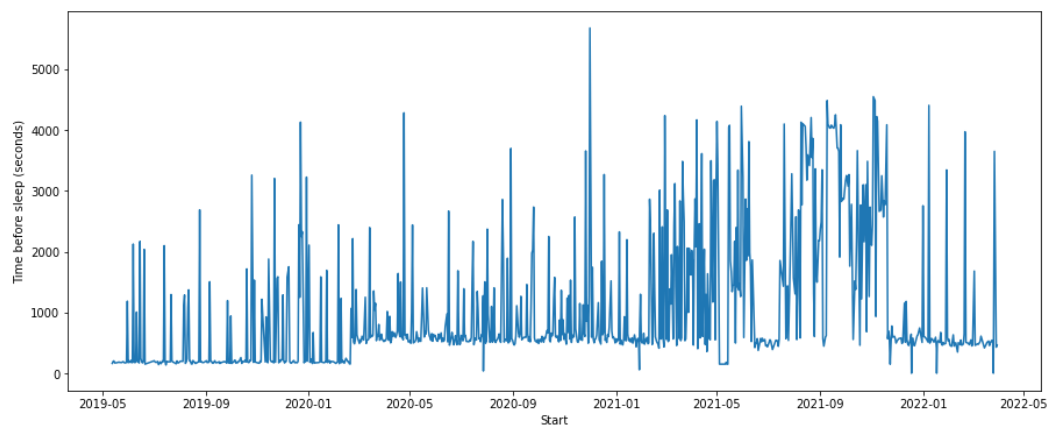


```

plt.figure(figsize=(15,6))
sns.lineplot(x = sleepdata['Start'], y = sleepdata['Time before sleep (seconds)'],
             data = sleepdata, palette = 'hls')

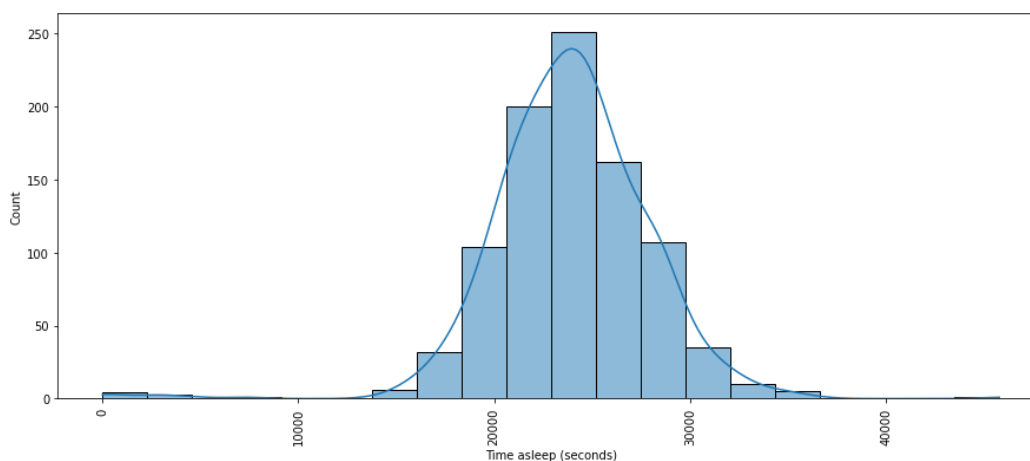
plt.show()

```

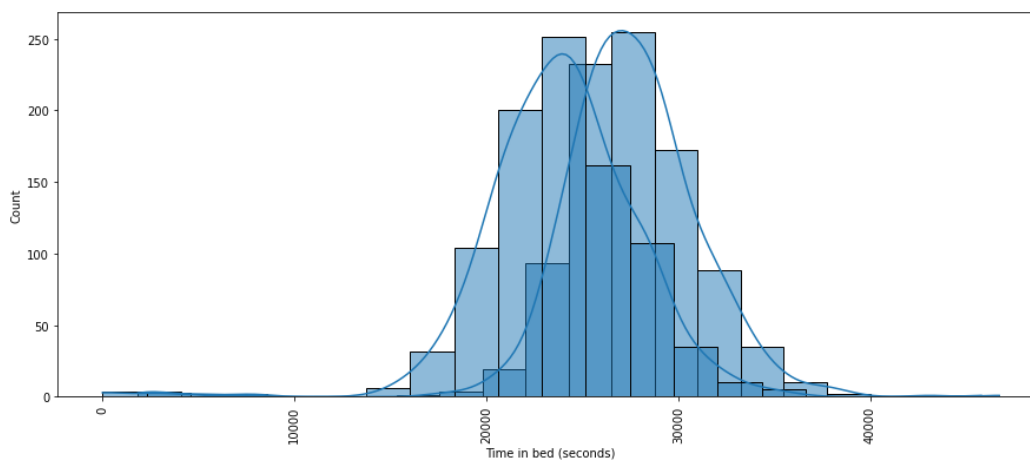


Double-click (or enter) to edit

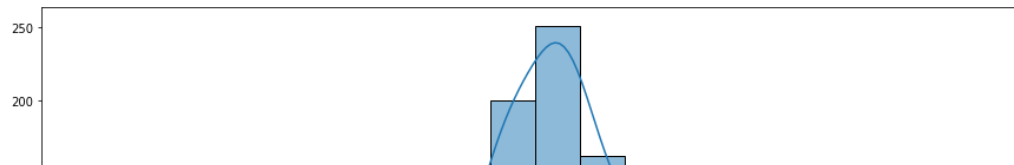
```
plt.figure(figsize=(15,6))
sns.histplot(sleepdata['Time asleep (seconds)'], bins = 20, kde = True, palette = 'hls')
plt.xticks(rotation = 90)
plt.show()
```



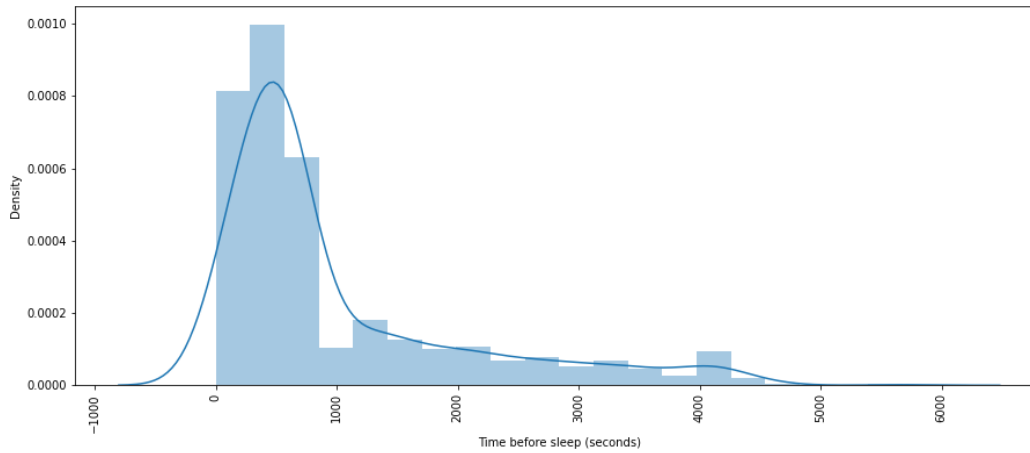
```
plt.figure(figsize=(15,6))
sns.histplot(sleepdata['Time in bed (seconds)'], bins = 20, kde = True, palette = 'hls')
plt.xticks(rotation = 90)
sns.histplot(sleepdata['Time asleep (seconds)'], bins = 20, kde = True, palette = 'hls')
plt.xticks(rotation = 90)
plt.show()
```



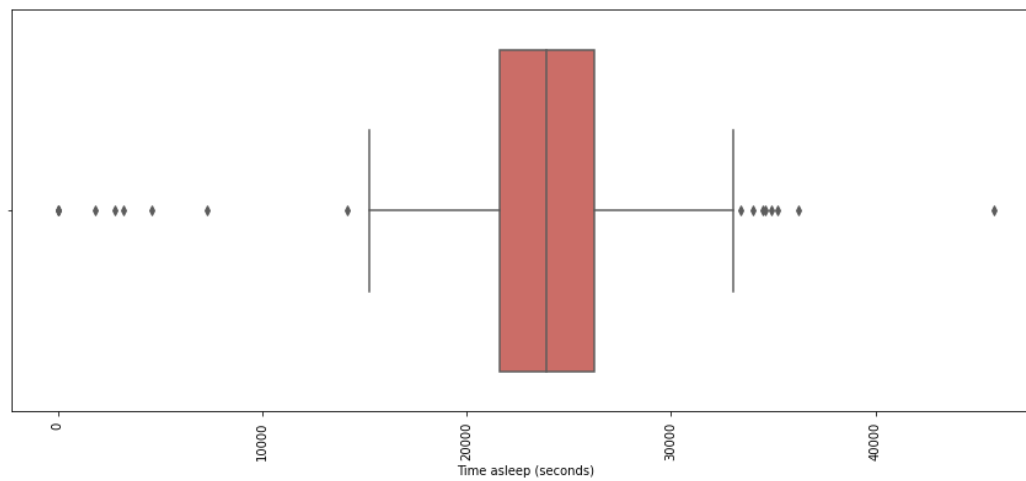
```
plt.figure(figsize=(15,6))
sns.histplot(sleepdata['Time asleep (seconds)'], bins = 20, kde = True, palette = 'hls')
plt.xticks(rotation = 90)
plt.show()
```



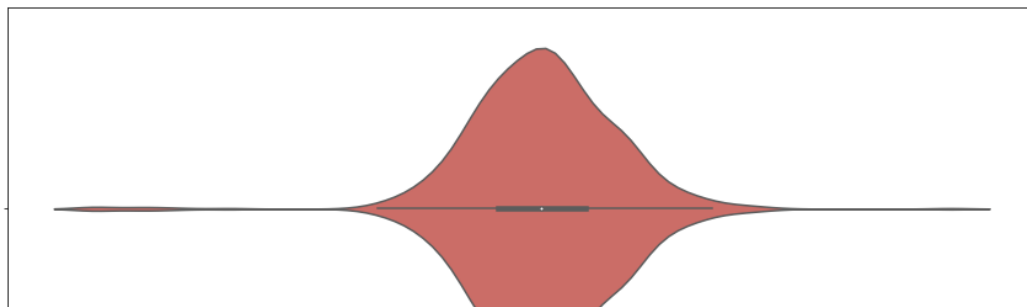
```
plt.figure(figsize=(15,6))
sns.distplot(sleepdata['Time before sleep (seconds)'], bins = 20, kde = True)
plt.xticks(rotation = 90)
plt.show()
```



```
plt.figure(figsize=(15,6))
sns.boxplot(sleepdata['Time asleep (seconds)'], palette = 'hls')
plt.xticks(rotation = 90)
plt.show()
```

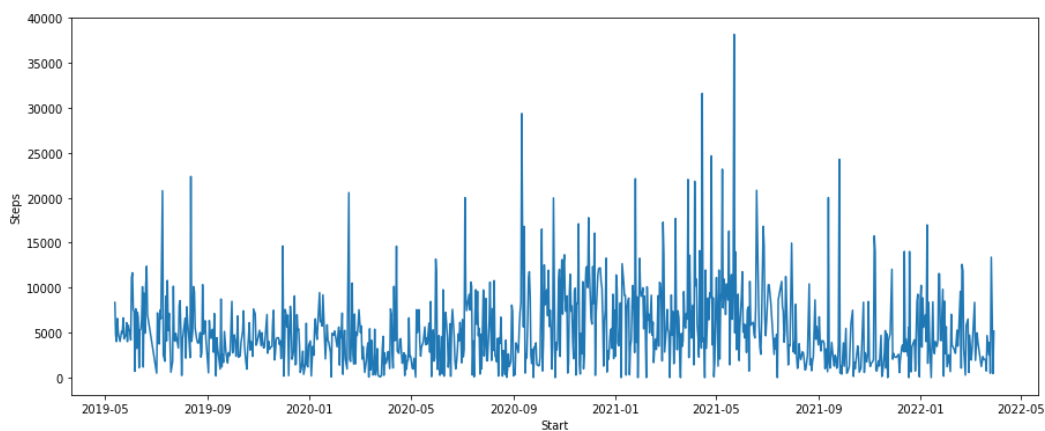


```
plt.figure(figsize=(15,6))
sns.violinplot(sleepdata['Time asleep (seconds)'], palette = 'hls')
plt.xticks(rotation = 90)
plt.show()
```

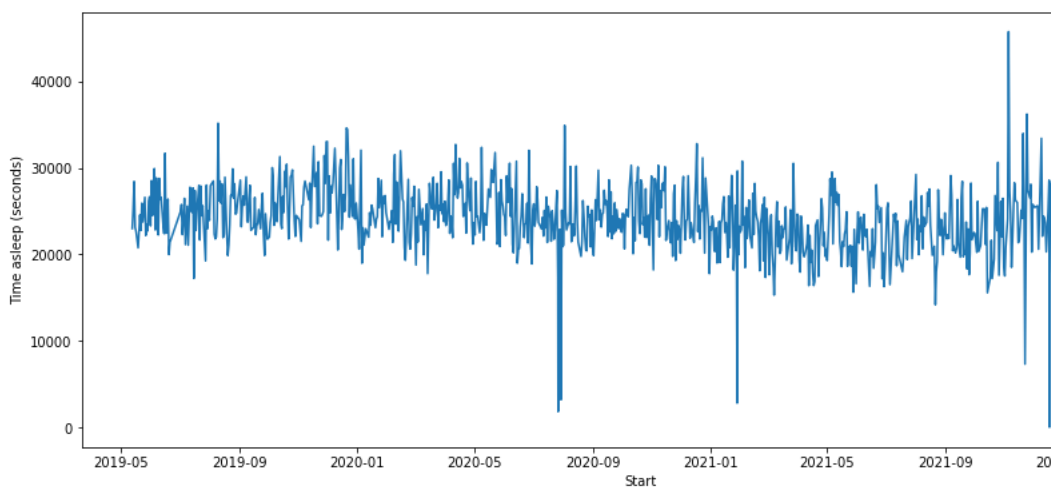



```
plt.figure(figsize=(15,6))
sns.lineplot(x = sleepdata['Start'], y = sleepdata['Steps'],
             data = sleepdata, palette = 'hls')
```

```
plt.show()
```



```
plt.figure(figsize=(15,6))
sns.lineplot(x = sleepdata['Start'], y = sleepdata['Time asleep (seconds)'],
             data = sleepdata, palette = 'hls')
plt.show()
```



```
sleepdata['Snore time'].value_counts()
```

```
0.0      291
120.0     20
240.0     18
480.0     15
180.0     15
...
471.0      1
895.0      1
```

```

693.0      1
1877.0     1
506.4      1
Name: Snore time, Length: 422, dtype: int64

```

```
sleepdata['Snore time'].value_counts()
```

```

0.0      True
120.0     True
240.0     True
480.0     True
180.0     True
...
471.0     True
895.0     True
693.0     True
1877.0    True
506.4     True
Name: Snore time, Length: 422, dtype: bool

```

```
filtered_data = sleepdata[sleepdata["Snore time"] == "Snore time"][sleepdata["Snore time"] > 0]
```

```
filtered_data.value_counts()
```

```
Series([], dtype: int64)
```

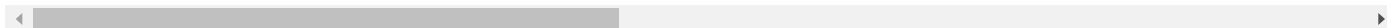
```
print(filtered_data)
```

```

Empty DataFrame
Columns: [Start, End, Sleep Quality, Regularity, Mood, Heart rate (bpm), Steps, Alarm mode, Air Pressure (Pa), City, Movements per hour
Index: []

```

```
[0 rows x 21 columns]
```

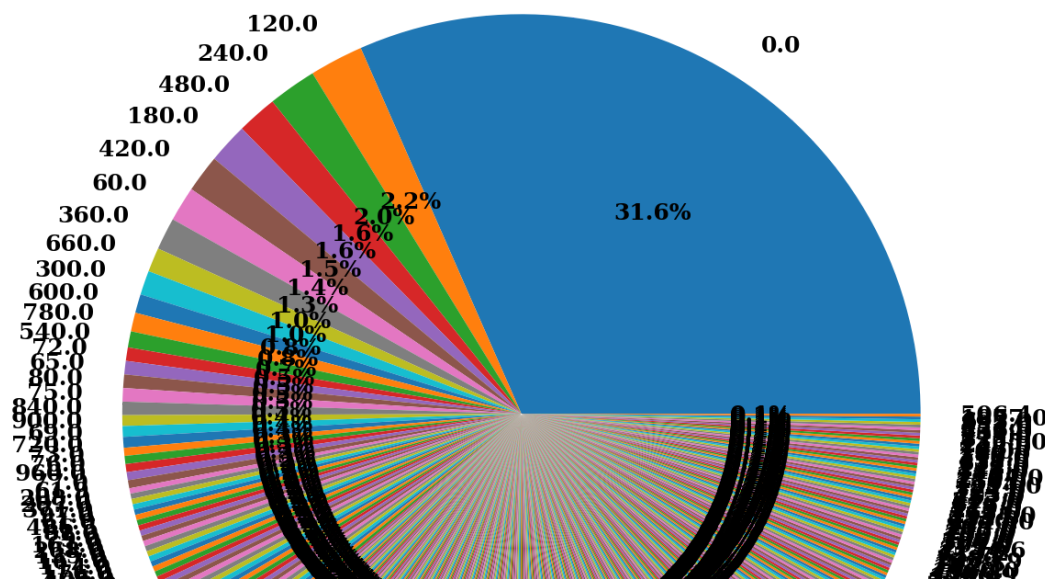


```

plt.figure(figsize=(30,20))
plt.pie(sleepdata['Snore time'].value_counts(), labels=sleepdata['Snore time'].value_counts().index,
        autopct='%1.1f%%', textprops={ 'fontsize': 25,
        'color': 'black',
        'weight': 'bold',
        'family': 'serif' })
hfont = {'fontname':'serif', 'weight': 'bold'}
plt.title('Source Name', size=20, **hfont)
plt.show()

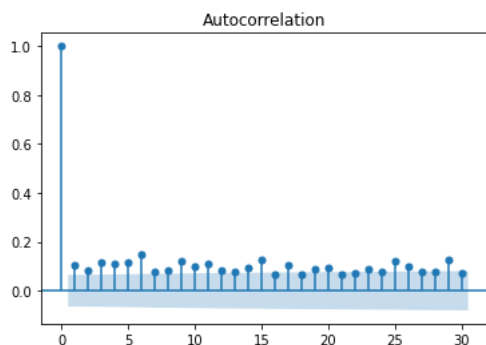
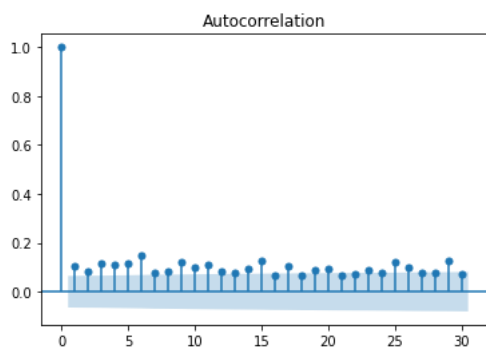
```

Source Name

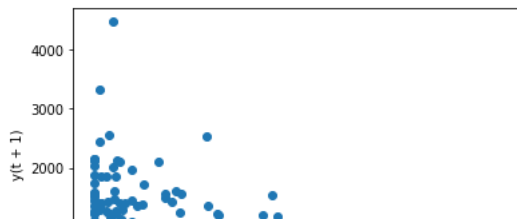


```
import statsmodels.api as sm
```

```
sm.graphics.tsa.plot_acf(sleepdata["Snore time"])
plt.show()
sm.graphics.tsa.plot_acf(sleepdata["Snore time"], lags=30)
plt.show()
```



```
from matplotlib import pyplot
from pandas.plotting import lag_plot
lag_plot(sleepdata["Snore time"])
pyplot.show()
```



```
from statsmodels.tsa.ar_model import AutoReg
from sklearn.metrics import mean_squared_error
```

```
model = AutoReg(sleepdata["Snore time"], lags=20)
model_fit = model.fit()
print('Coefficients: %s' % model_fit.params)
```

```
Coefficients: intercept          107.994730
Snore time.L1          0.044360
Snore time.L2          0.015420
Snore time.L3          0.050829
Snore time.L4          0.043813
Snore time.L5          0.052948
Snore time.L6          0.090120
Snore time.L7          0.008706
Snore time.L8          0.016095
Snore time.L9          0.054439
Snore time.L10         0.030587
Snore time.L11         0.040114
Snore time.L12         0.013508
Snore time.L13         0.010720
Snore time.L14         0.023518
Snore time.L15         0.062724
Snore time.L16         0.000602
Snore time.L17         0.044652
Snore time.L18         0.001586
Snore time.L19         0.033034
Snore time.L20         0.030806
dtype: float64
```

✓ 0s completed at 6:48 AM

● ✕