In [1]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import os
import pandas_datareader as dr
import math
import statistics

from sklearn.linear_model import LinearRegression
from statsmodels.tsa.arima.model import ARIMA
from random import random
from statsmodels.tsa.stattools import adfuller
from statsmodels.tsa.seasonal import seasonal_decompose
from pandas.plotting import register_matplotlib_converters
register_matplotlib_converters()
```

Stock Market

In [7]:
```python
market = dr.data.get_data_yahoo('^GSPC', start = '2021-1-1', end= '2021-5-6')
market
```

Out[7]:

Date	High	Low	Open	Close	Volume	Adj Close
2021-01-04	3769.989990	3662.709961	3764.610107	3700.649902	5006680000	3700.649902
2021-01-05	3737.830078	3695.070068	3698.020020	3726.860107	4582620000	3726.860107
2021-01-06	3783.040039	3705.340088	3712.199951	3748.139893	6049970000	3748.139893
2021-01-07	3811.550049	3764.709961	3764.709961	3803.790039	5080870000	3803.790039
2021-01-08	3826.689941	3783.600098	3815.050049	3824.679932	4764180000	3824.679932
...	...	...	...	...	...	...
2021-04-30	4198.100098	4174.850098	4198.100098	4181.169922	4273680000	4181.169922
2021-05-03	4209.390137	4188.029785	4191.979980	4192.660156	4061170000	4192.660156
2021-05-04	4179.040039	4128.589844	4179.040039	4164.660156	4441080000	4164.660156
2021-05-05	4187.720215	4160.939941	4177.060059	4167.589844	4029050000	4167.589844
2021-05-06	4202.700195	4147.330078	4169.140137	4201.549805	2169544000	4201.549805

86 rows × 6 columns

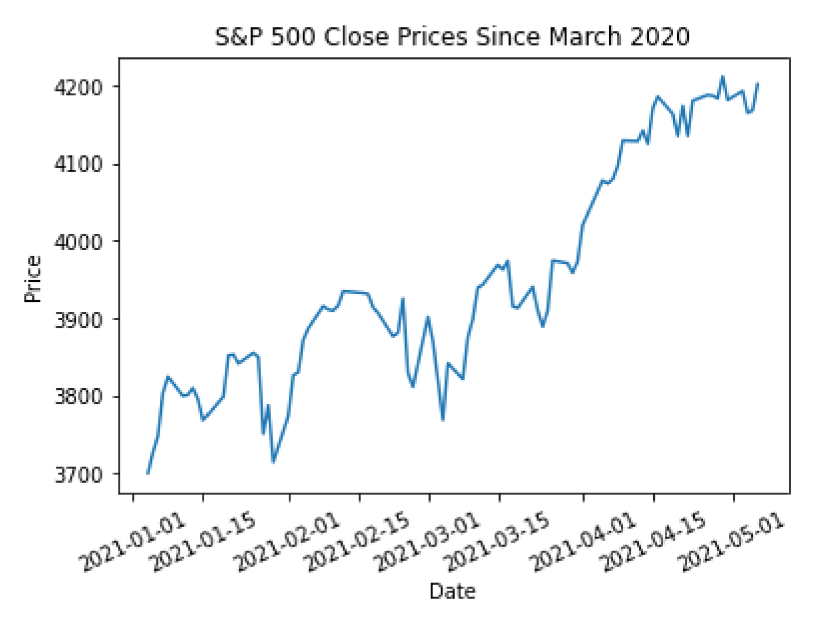
In [8]:
```python
close = market['Close']
close.head()
```

Out[8]:
```
Date
2021-01-04    3700.649902
2021-01-05    3726.860107
2021-01-06    3748.139893
2021-01-07    3803.790039
2021-01-08    3824.679932
Name: Close, dtype: float64
```

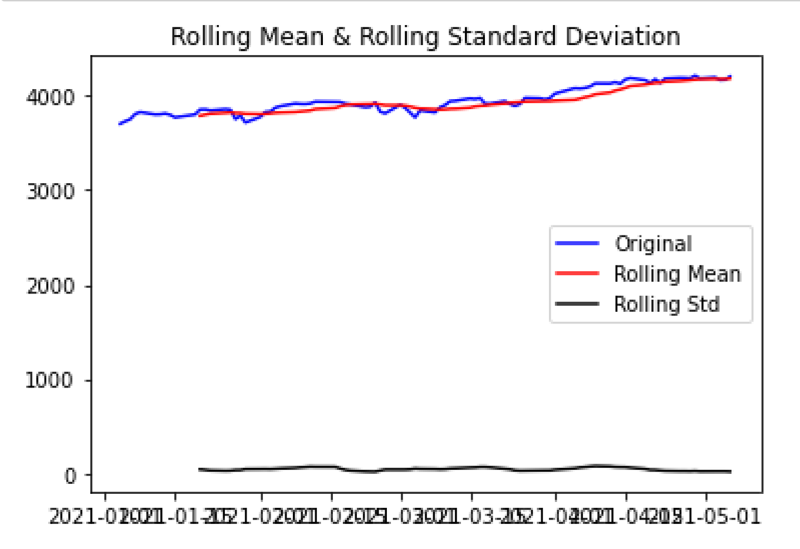
In [9]:
```python
x = round(np.mean(close),2)
x
```

Out[9]:
```
3947.67
```

In [10]:
```python
plt.xlabel('Date')
plt.ylabel('Price')
plt.title('S&P 500 Close Prices Since March 2020')
plt.xticks(rotation=25)
plt.plot(close)
plt.show()
```



In [11]:
```python
rolling_mean = close.rolling(window = 12).mean()
rolling_std = close.rolling(window = 12).std()
plt.plot(close, color = 'blue', label = 'Original')
plt.plot(rolling_mean, color = 'red', label = 'Rolling Mean')
plt.plot(rolling_std, color = 'black', label = 'Rolling Std')
plt.legend(loc = 'best')
plt.title('Rolling Mean & Rolling Standard Deviation')
plt.show()
```



As it can be seen the rolling mean and rolling standard deviation stay constant over time. Therefore it can be concluded that the time series is stationary.

In [12]:
```python
model = ARIMA(close, order=(4,0,1))
model_fit = model.fit()
results = model_fit.predict(len(close), len(close))
print(results)
```

```
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\tsa\base\tsa_model.py:216: ValueWarning: A dat
e index has been provided, but it has no associated frequency information and so will be ignored when
e.g. forecasting.
  warnings.warn('A date index has been provided, but it has no'
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\tsa\base\tsa_model.py:216: ValueWarning: A dat
e index has been provided, but it has no associated frequency information and so will be ignored when
e.g. forecasting.
  warnings.warn('A date index has been provided, but it has no'
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\tsa\base\tsa_model.py:216: ValueWarning: A dat
e index has been provided, but it has no associated frequency information and so will be ignored when
e.g. forecasting.
  warnings.warn('A date index has been provided, but it has no'
```

```
86    4199.008032
dtype: float64
```

```
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\tsa\base\tsa_model.py:580: ValueWarning: No su
pported index is available. Prediction results will be given with an integer index beginning at `star
t`.
  warnings.warn('No supported index is available.'
```

Interest Rates

In [19]:
```python
df = dr.data.get_data_yahoo('^TNX', start = '2021-3-1', end= '2021-5-6')
df.tail()
```

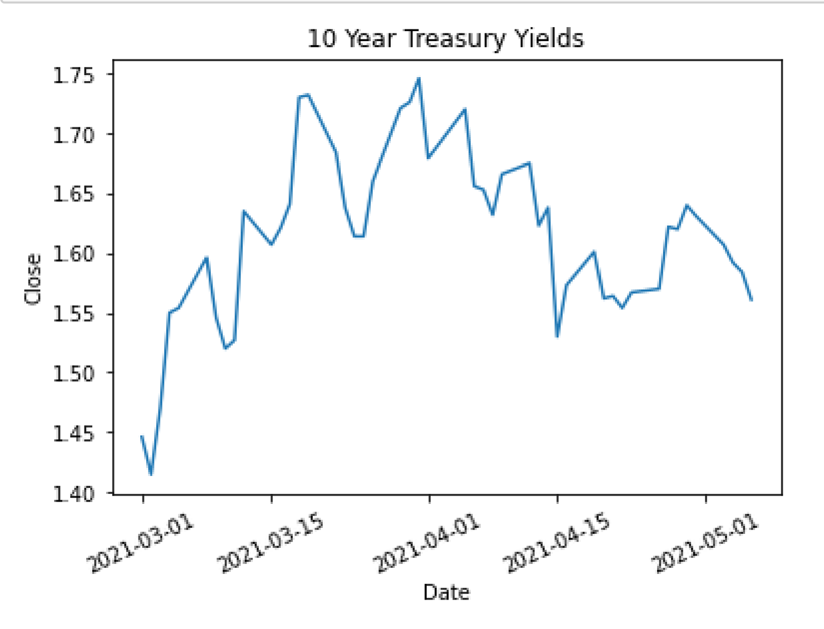
Out[19]:

Date	High	Low	Open	Close	Volume	Adj Close
2021-04-30	1.653	1.622	1.642	1.631	0.0	1.631
2021-05-03	1.651	1.578	1.651	1.607	0.0	1.607
2021-05-04	1.603	1.557	1.603	1.592	0.0	1.592
2021-05-05	1.626	1.582	1.607	1.584	0.0	1.584
2021-05-06	1.591	1.557	1.577	1.561	0.0	1.561

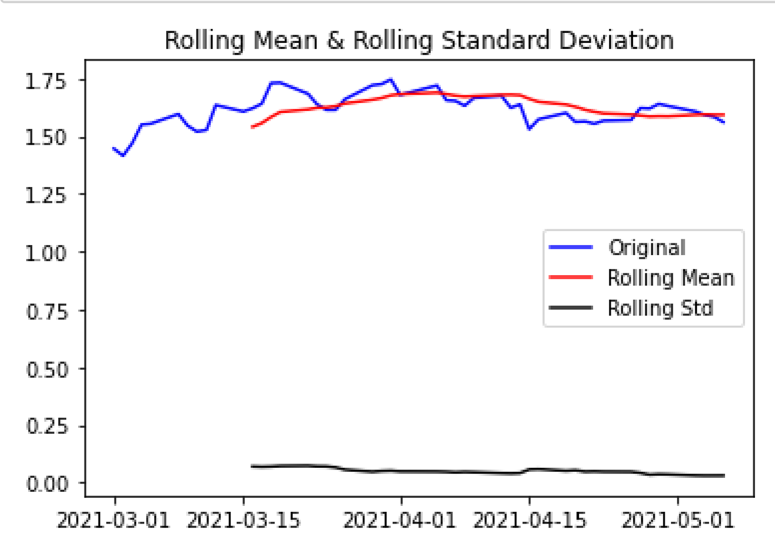
In [15]:
```python
rates = df['Close']
rates.head()
```

Out[15]:
```
Date
2021-03-01    1.446
2021-03-02    1.415
2021-03-03    1.470
2021-03-04    1.550
2021-03-05    1.554
Name: Close, dtype: float64
```

In [16]:
```python
plt.xlabel('Date')
plt.ylabel('Close')
plt.title('10 Year Treasury Yields')
plt.xticks(rotation=25)
plt.plot(rates)
plt.show()
```



In [17]:
```python
rolling_mean = rates.rolling(window = 12).mean()
rolling_std = rates.rolling(window = 12).std()
plt.plot(rates, color = 'blue', label = 'Original')
plt.plot(rolling_mean, color = 'red', label = 'Rolling Mean')
plt.plot(rolling_std, color = 'black', label = 'Rolling Std')
plt.legend(loc = 'best')
plt.title('Rolling Mean & Rolling Standard Deviation')
plt.show()
```



As it can be seen the rolling mean and rolling standard deviation stay constant over time. Therefore it can be concluded that the time series is stationary.

In [18]:
```python
rates_model = ARIMA(rates, order=(4,0,1))
rates_model_fit = rates_model.fit()
rates_results = rates_model_fit.predict(len(rates), len(rates))

print(rates_results)
```

```
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\tsa\base\tsa_model.py:216: ValueWarning: A dat
e index has been provided, but it has no associated frequency information and so will be ignored when
e.g. forecasting.
  warnings.warn('A date index has been provided, but it has no'
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\tsa\base\tsa_model.py:216: ValueWarning: A dat
e index has been provided, but it has no associated frequency information and so will be ignored when
e.g. forecasting.
  warnings.warn('A date index has been provided, but it has no'
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\tsa\base\tsa_model.py:216: ValueWarning: A dat
e index has been provided, but it has no associated frequency information and so will be ignored when
e.g. forecasting.
  warnings.warn('A date index has been provided, but it has no'
```

```
48    1.568787
dtype: float64
```

```
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\base\model.py:567: ConvergenceWarning: Maximum
Likelihood optimization failed to converge. Check mle_retvals
  warn("Maximum Likelihood optimization failed to converge. "
C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\tsa\base\tsa_model.py:580: ValueWarning: No su
pported index is available. Prediction results will be given with an integer index beginning at `star
t`.
  warnings.warn('No supported index is available.'
```

Unemployment Rate

In [17]:
```python
os.chdir(r'C:\Users\robtu\Downloads')
```

In [25]:
```python
ur_claims = pd.read_csv('ur_claims_data.csv')
x = ur_claims['UNRATE']
y = ur_claims['Average_Claims']
```

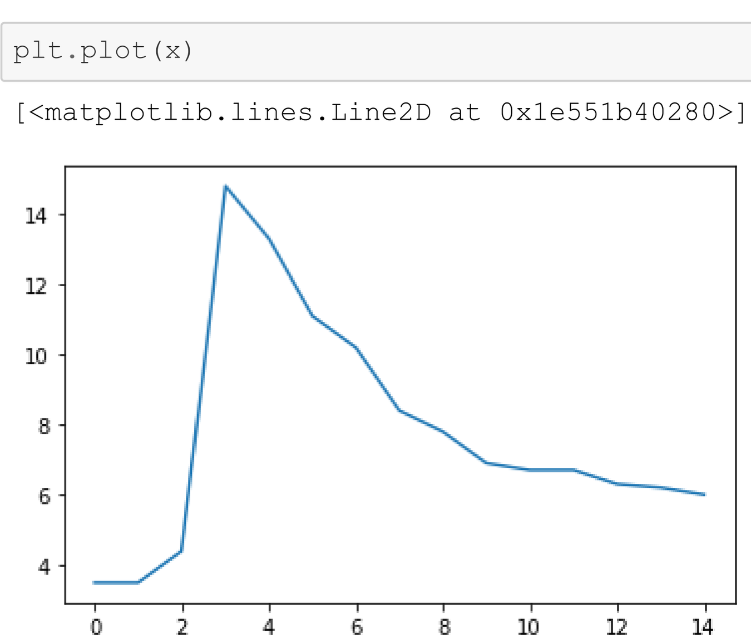
In [26]:
```python
ur_claims
```

Out[26]:

	DATE	UNRATE	Average_Claims
0	1/1/2020	3.5	211250
1	2/1/2020	3.5	212200
2	3/1/2020	4.4	2344000
3	4/1/2020	14.8	4667750
4	5/1/2020	13.3	2148000
5	6/1/2020	11.1	1476250
6	7/1/2020	10.2	1384250
7	8/1/2020	8.4	918600
8	9/1/2020	7.8	851000
9	10/1/2020	6.9	789200
10	11/1/2020	6.7	735250
11	12/1/2020	6.7	823000
12	1/1/2021	6.3	848800
13	2/1/2021	6.2	804500
14	3/1/2021	6.0	721500

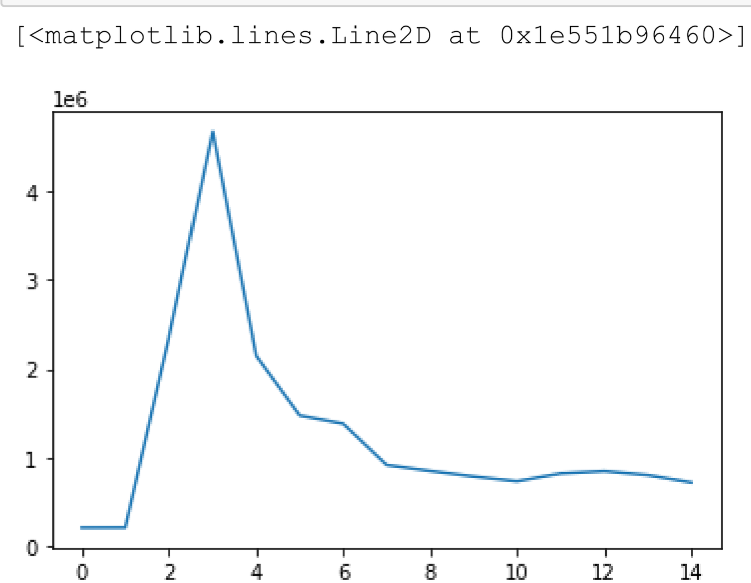
In [28]:
```python
plt.plot(x)
```

Out[28]:
```
[<matplotlib.lines.Line2D at 0x1e551b40280>]
```



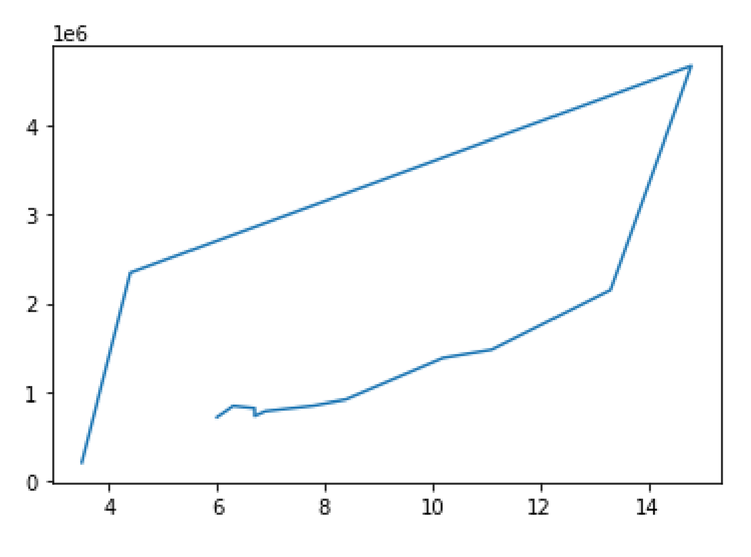
In [29]:
```python
plt.plot(y)
```

Out[29]:
```
[<matplotlib.lines.Line2D at 0x1e551b96460>]
```



In [33]:
```python
plt.plot(x,y)
```

Out[33]:
```
[<matplotlib.lines.Line2D at 0x1e551cd5190>]
```



In [ ]: