In [1]:

```
import requests
import json
import pandas as pd
import numpy as np
import datetime as dt
from statsmodels.tsa.arima.model import ARIMA
from sklearn.metrics import mean_squared_error
from math import sqrt
from datetime import datetime
from statsmodels.tsa.stattools import adfuller
from statsmodels.graphics.tsaplots import plot_pacf
from statsmodels.tsa.ar_model import AutoReg
import matplotlib.pyplot as plt
from warnings import filterwarnings
filterwarnings("ignore")
```

In [2]:

```
frequency = input("Please enter the frequency (1m/5m/30m/.../1h/6h/1d/ :  ")

def get_bars(symbol, interval=frequency):
    root_url = 'https://api.binance.com/api/v1/klines'
    url = root_url + '?symbol=' + symbol + '&interval=' + interval
    data = json.loads(requests.get(url).text)
    df = pd.DataFrame(data)
    df.columns = ['open_time',
                  'o', 'h', 'l', 'c', 'v',
                  'close_time', 'qav', 'num_trades',
                  'taker_base_vol', 'taker_quote_vol', 'ignore']
    df.index = [dt.datetime.fromtimestamp(x / 1000.0) for x in df.close_time]
    return df

btcusdt = get_bars('BTCUSDT')
ethusdt = get_bars('ETHUSDT')
bnbusdt= get_bars('BNBUSDT')
adausdt = get_bars('ADAUSDT')
solusdt = get_bars('SOLUSDT')
```

```
Please enter the frequency (1m/5m/30m/.../1h/6h/1d/ :  1d
```

In [3]:

```
d_1=[]
for date in btcusdt.index:
    d=datetime.date(date)
    d_1.append(d)
d_2=[]
for date in ethusdt.index:
    d=datetime.date(date)
    d_2.append(d)
d_3=[]
for date in bnbusdt.index:
    d=datetime.date(date)
    d_3.append(d)
d_4=[]
for date in adausdt.index:
    d=datetime.date(date)
    d_4.append(d)
d_5=[]
for date in solusdt.index:
    d=datetime.date(date)
    d_5.append(d)
```

In [4]:

```
bnbusdt["date"]=d_1
```

```
bnbusdt.set_index("date")
train_data_h_1 = bnbusdt["h"].iloc[:].astype("float32")
train_data_l_1= bnbusdt["l"].iloc[:].astype("float32")
```

In [5]:

```
ethusdt["date"]=d_2
ethusdt.set_index("date")
train_data_h_2 = ethusdt["h"].iloc[:].astype("float32")
train_data_l_2= ethusdt["l"].iloc[:].astype("float32")
```

In [6]:

```
solusdt["date"]=d_5
solusdt.set_index("date")
train_data_h_3 = solusdt["h"].iloc[:].astype("float32")
train_data_l_3= solusdt["l"].iloc[:].astype("float32")
```

In [7]:

```
btcusdt["date"]=d_3
btcusdt.set_index("date")
train_data_h_4 = btcusdt["h"].iloc[:].astype("float32")
train_data_l_4= btcusdt["l"].iloc[:].astype("float32")
```

In [8]:

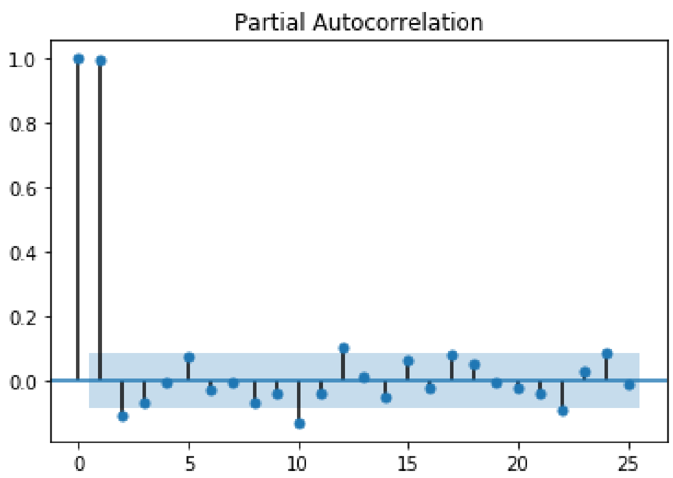
```
adausdt["date"]=d_4
adausdt.set_index("date")
train_data_h_5=adausdt["h"].iloc[:].astype("float32")
train_data_l_5= adausdt["l"].iloc[:].astype("float32")
```

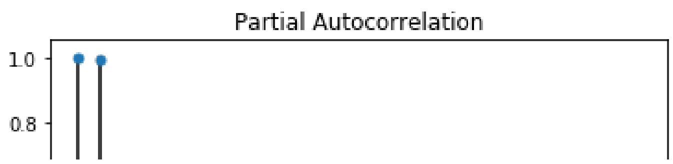
Probablity and Partical Correlation Plot

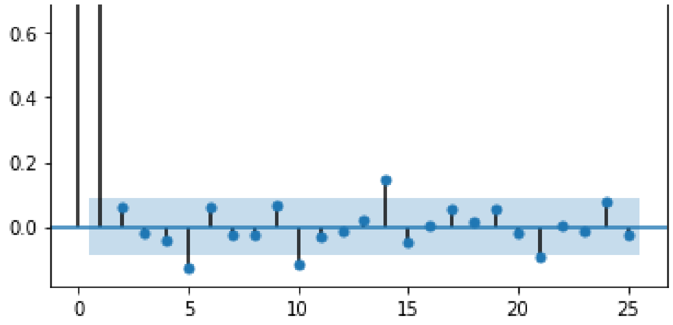
In [9]:

```
print("BNB")
df_stationarityTest_h = adfuller(bnbusdt["h"].astype("float32"), autolag='AIC')
df_stationarityTest_l= adfuller(bnbusdt["l"].astype("float32"), autolag='AIC')
print("P-value for high: ", df_stationarityTest_h[1])
print("P-value for low: ", df_stationarityTest_l[1])
pacf = plot_pacf(bnbusdt["h"], lags=25)
pacf = plot_pacf(bnbusdt["l"], lags=25)
```

```
BNB
P-value for high:  0.7226454368782608
P-value for low:  0.7766815885364831
```



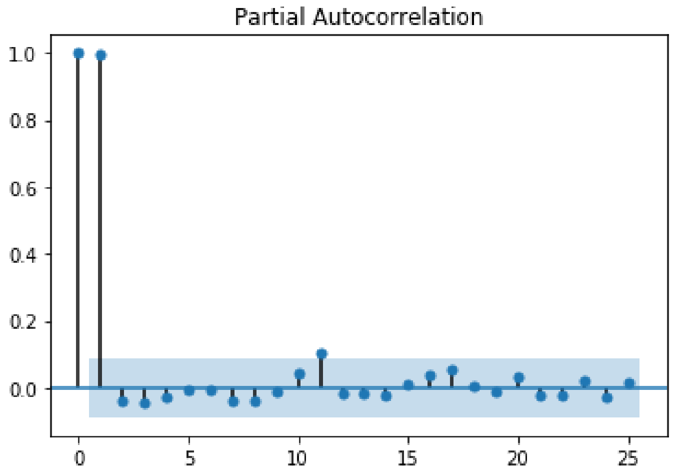


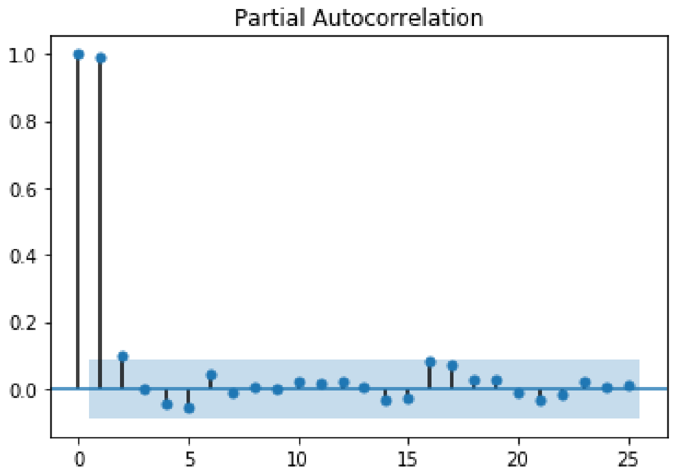


In [10]:

```
print("ETH")
df_stationarityTest_h = adfuller(ethusdt["h"].astype("float32"), autolag='AIC')
df_stationarityTest_l= adfuller(ethusdt["l"].astype("float32"), autolag='AIC')
print("P-value for high: ", df_stationarityTest_h[1])
print("P-value for low: ", df_stationarityTest_l[1])
pacf = plot_pacf(ethusdt["h"], lags=25)
pacf = plot_pacf(ethusdt["l"], lags=25)
```

```
ETH
P-value for high:  0.9453052840969027
P-value for low:  0.9449717503291432
```

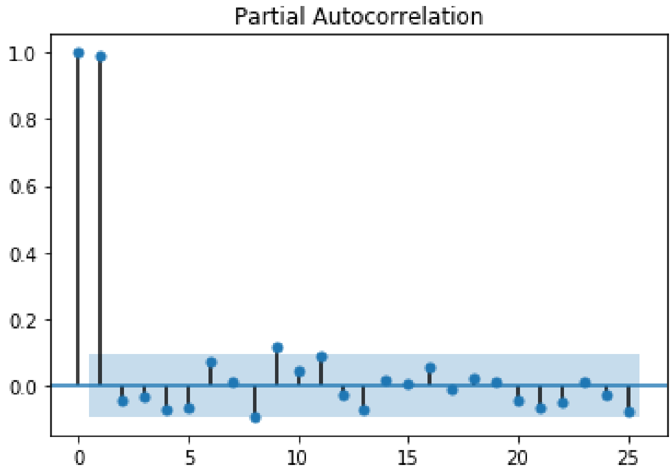


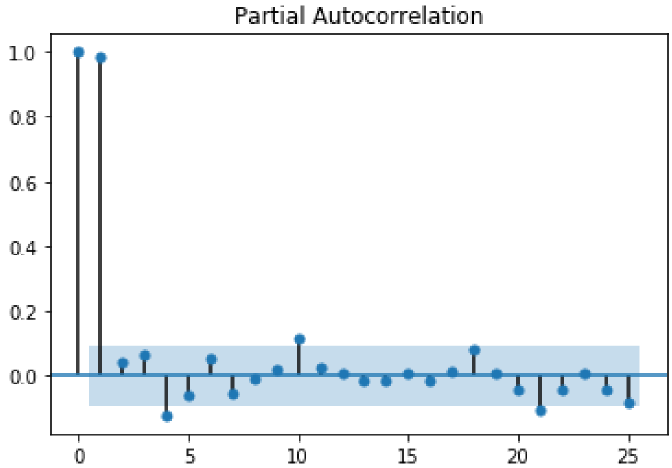


In [11]:

```
print("Sol")
df_stationarityTest_h = adfuller(solusdt["h"].astype("float32"), autolag='AIC')
df_stationarityTest_l= adfuller(solusdt["l"].astype("float32"), autolag='AIC')
print("P-value for high: ", df_stationarityTest_h[1])
print("P-value for low: ", df_stationarityTest_l[1])
pacf = plot_pacf(solusdt["h"], lags=25)
pacf = plot_pacf(solusdt["l"], lags=25)
```

```
Sol
P-value for high:  0.9962098177028296
P-value for low:  0.998758297519044
```

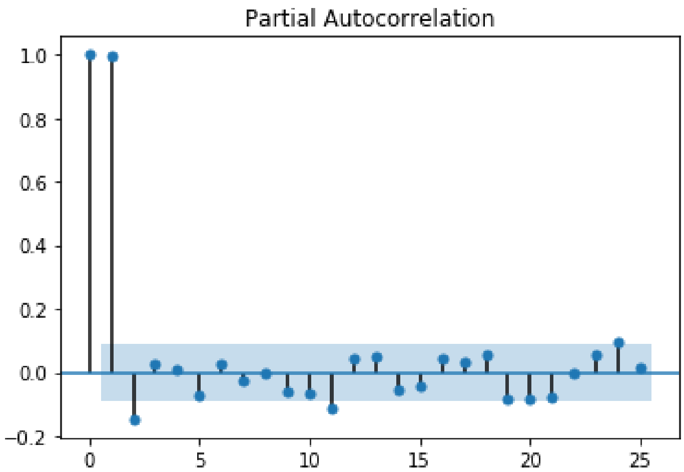


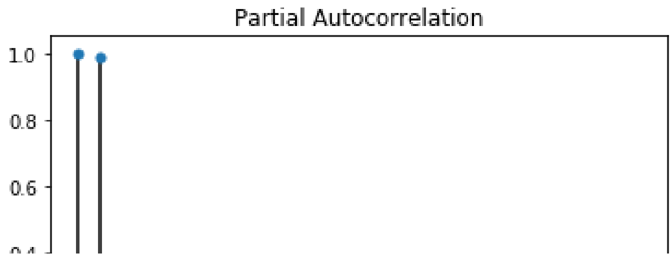


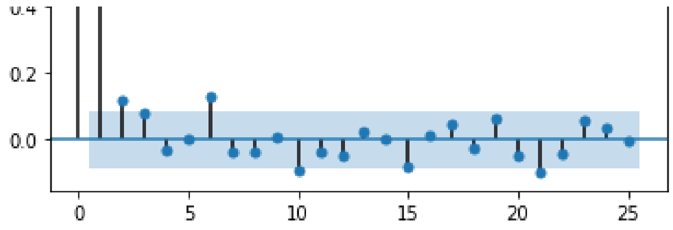
In [12]:

```
print("ADA")
df_stationarityTest_h = adfuller(adausdt["h"].astype("float32"), autolag='AIC')
df_stationarityTest_l= adfuller(adausdt["l"].astype("float32"), autolag='AIC')
print("P-value for high: ", df_stationarityTest_h[1])
print("P-value for low: ", df_stationarityTest_l[1])
pacf = plot_pacf(adausdt["h"], lags=25)
pacf = plot_pacf(adausdt["l"], lags=25)
```

```
ADA
P-value for high:  0.7162766203641826
P-value for low:  0.8810977481534017
```



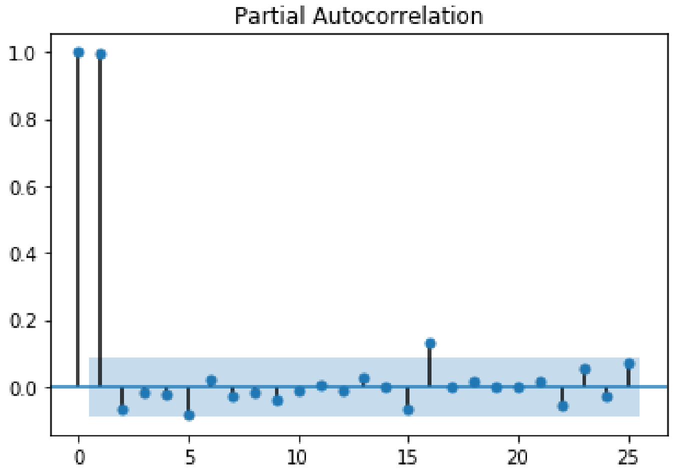


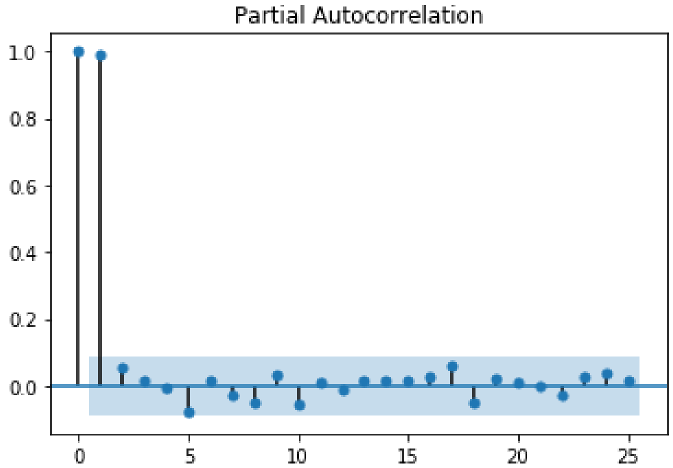


In [13]:

```
print("BTC")
df_stationarityTest_h = adfuller(btcusdt["h"].astype("float32"), autolag='AIC')
df_stationarityTest_l= adfuller(btcusdt["l"].astype("float32"), autolag='AIC')
print("P-value for high: ", df_stationarityTest_h[1])
print("P-value for low: ", df_stationarityTest_l[1])
pacf = plot_pacf(btcusdt["h"], lags=25)
pacf = plot_pacf(btcusdt["l"], lags=25)
```

```
BTC
P-value for high:  0.7878045401475804
P-value for low:  0.8122483296467151
```





AutoRegression and plot of High and Low Prices of Crypto

In [14]:

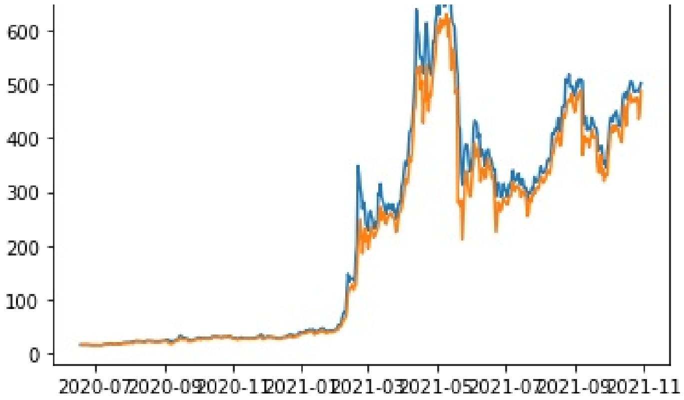
```
print("BNB")
ar_h_model = AutoReg(np.asarray(train_data_h_1), lags=8).fit()
ar_l_model = AutoReg(np.asarray(train_data_l_1), lags=8).fit()
print(ar_h_model.summary())
print(ar_l_model.summary())
plt.plot(train_data_h_1)
plt.plot(train_data_l_1)
```

```
BNB
                            AutoReg Model Results
==============================================================================
```

```
Dep. Variable:                      y   No. Observations:                  500
Model:                     AutoReg(8)   Log Likelihood               -2076.485
Method:               Conditional MLE   S.D. of innovations             16.470
Date:                Fri, 29 Oct 2021   AIC                              5.644
Time:                        17:44:24   BIC                              5.729
Sample:                             8   HQIC                             5.677
                                  500
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept      1.5760      1.109      1.421      0.155      -0.598       3.750
y.L1           1.1331      0.045     25.157      0.000       1.045       1.221
y.L2          -0.0346      0.068     -0.508      0.611      -0.168       0.099
y.L3          -0.1026      0.068     -1.508      0.132      -0.236       0.031
y.L4          -0.1041      0.068     -1.532      0.126      -0.237       0.029
y.L5           0.1427      0.068      2.101      0.036       0.010       0.276
y.L6          -0.0418      0.068     -0.613      0.540      -0.175       0.092
y.L7           0.0513      0.068      0.754      0.451      -0.082       0.185
y.L8          -0.0476      0.045     -1.055      0.291      -0.136       0.041
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1            1.0045           -0.0000j            1.0045           -0.0000
AR.2            1.5073           -0.0000j            1.5073           -0.0000
AR.3            0.9711           -1.0711j            1.4457           -0.1328
AR.4            0.9711           +1.0711j            1.4457            0.1328
AR.5           -1.2511           -0.7519j            1.4597           -0.4139
AR.6           -1.2511           +0.7519j            1.4597            0.4139
AR.7           -0.4369           -1.7097j            1.7646           -0.2898
AR.8           -0.4369           +1.7097j            1.7646            0.2898
-----------------------------------------------------------------------------
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  500
Model:                     AutoReg(8)   Log Likelihood               -2128.536
Method:               Conditional MLE   S.D. of innovations             18.308
Date:                Fri, 29 Oct 2021   AIC                              5.855
Time:                        17:44:24   BIC                              5.941
Sample:                             8   HQIC                             5.889
                                  500
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept      1.7579      1.231      1.428      0.153      -0.655       4.171
y.L1           0.9999      0.045     22.090      0.000       0.911       1.089
y.L2           0.0290      0.064      0.454      0.650      -0.096       0.154
y.L3          -0.0546      0.064     -0.852      0.394      -0.180       0.071
y.L4           0.1676      0.063      2.645      0.008       0.043       0.292
y.L5          -0.2354      0.063     -3.715      0.000      -0.360      -0.111
y.L6           0.1112      0.064      1.733      0.083      -0.015       0.237
y.L7           0.0252      0.064      0.392      0.695      -0.101       0.151
y.L8          -0.0476      0.046     -1.046      0.296      -0.137       0.042
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1           -0.2826           -1.3377j            1.3672           -0.2831
AR.2           -0.2826           +1.3377j            1.3672            0.2831
AR.3           -1.4998           -0.0000j            1.4998           -0.5000
AR.4           -1.9574           -0.0000j            1.9574           -0.5000
AR.5            1.0426           -1.2314j            1.6135           -0.1382
AR.6            1.0426           +1.2314j            1.6135            0.1382
AR.7            1.0054           -0.0000j            1.0054           -0.0000
AR.8            1.4613           -0.0000j            1.4613           -0.0000
-----------------------------------------------------------------------------
```

Out[14]:

```
[<matplotlib.lines.Line2D at 0x1b2c8e24c88>]
```



In [15]:

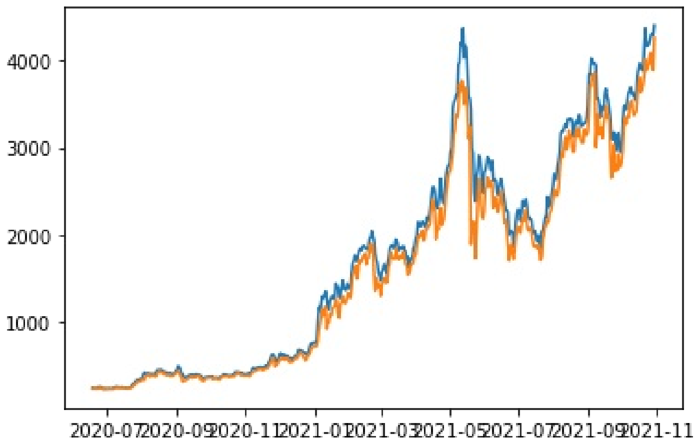
```
print("ETH")
ar_h_model = AutoReg(np.asarray(train_data_h_2), lags=8).fit()
ar_l_model = AutoReg(np.asarray(train_data_l_2), lags=8).fit()
print(ar_h_model.summary())
print(ar_l_model.summary())
plt.plot(train_data_h_2)
plt.plot(train_data_l_2)
```

```
ETH
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  500
Model:                     AutoReg(8)   Log Likelihood               -2900.828
Method:               Conditional MLE   S.D. of innovations             87.975
Date:                Fri, 29 Oct 2021   AIC                              8.995
Time:                        17:44:24   BIC                              9.080
Sample:                             8   HQIC                             9.028
                                  500
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept      8.4437      6.809      1.240      0.215      -4.903      21.790
y.L1           1.1330      0.045     25.137      0.000       1.045       1.221
y.L2          -0.0856      0.068     -1.255      0.209      -0.219       0.048
y.L3          -0.0185      0.068     -0.271      0.786      -0.152       0.115
y.L4          -0.0175      0.068     -0.256      0.798      -0.151       0.116
y.L5          -0.0048      0.068     -0.070      0.944      -0.139       0.129
y.L6           0.0636      0.068      0.931      0.352      -0.070       0.197
y.L7          -0.0133      0.068     -0.195      0.846      -0.147       0.120
y.L8          -0.0587      0.045     -1.297      0.194      -0.147       0.030
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1            1.0027           -0.0000j            1.0027           -0.0000
AR.2            1.2705           -0.0000j            1.2705           -0.0000
AR.3            0.8366           -1.1276j            1.4041           -0.1484
AR.4            0.8366           +1.1276j            1.4041            0.1484
AR.5           -0.4790           -1.4313j            1.5093           -0.3014
AR.6           -0.4790           +1.4313j            1.5093            0.3014
AR.7           -1.6075           -0.6278j            1.7257           -0.4407
AR.8           -1.6075           +0.6278j            1.7257            0.4407
-----------------------------------------------------------------------------
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  500
Model:                     AutoReg(8)   Log Likelihood               -3047.635
Method:               Conditional MLE   S.D. of innovations            118.563
Date:                Fri, 29 Oct 2021   AIC                              9.592
Time:                        17:44:24   BIC                              9.677
Sample:                             8   HQIC                             9.625
                                  500
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept     10.0718      9.168      1.099      0.272      -7.898      28.041
```

```
y.L1          0.9385      0.046     20.620      0.000       0.849       1.028
y.L2          0.0536      0.062      0.858      0.391      -0.069       0.176
y.L3          0.0062      0.062      0.099      0.921      -0.116       0.129
y.L4          0.0777      0.062      1.248      0.212      -0.044       0.200
y.L5         -0.1375      0.062     -2.208      0.027      -0.260      -0.015
y.L6          0.0886      0.063      1.416      0.157      -0.034       0.211
y.L7         -0.0353      0.063     -0.564      0.573      -0.158       0.087
y.L8          0.0071      0.046      0.156      0.876      -0.083       0.097
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1           -1.4053           -0.0000j            1.4053           -0.5000
AR.2            1.0010           -0.0000j            1.0010           -0.0000
AR.3           -0.5810           -1.5368j            1.6430           -0.3075
AR.4           -0.5810           +1.5368j            1.6430            0.3075
AR.5            0.9375           -2.3051j            2.4885           -0.1885
AR.6            0.9375           +2.3051j            2.4885            0.1885
AR.7            2.3173           -0.7619j            2.4393           -0.0506
AR.8            2.3173           +0.7619j            2.4393            0.0506
-----------------------------------------------------------------------------
```

Out[15]:

```
[<matplotlib.lines.Line2D at 0x1b2c8bf4ac8>]
```



In [16]:

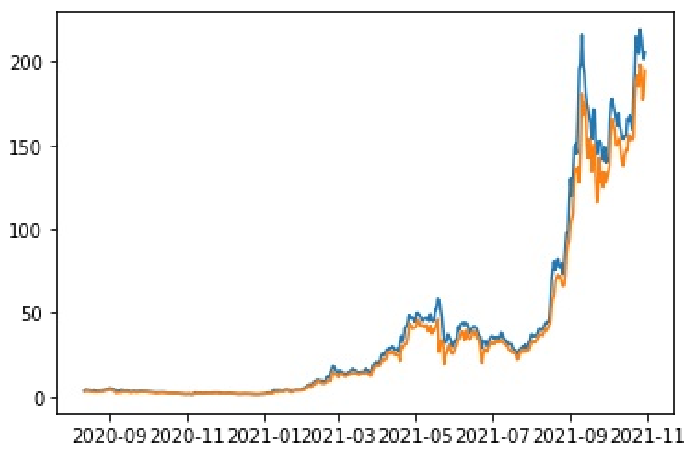
```python
print("SOL")
ar_h_model = AutoReg(np.asarray(train_data_h_3), lags=8).fit()
ar_l_model = AutoReg(np.asarray(train_data_l_3), lags=8).fit()
print(ar_h_model.summary())
print(ar_l_model.summary())
plt.plot(train_data_h_3)
plt.plot(train_data_l_3)
```

```
SOL
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  445
Model:                     AutoReg(8)   Log Likelihood               -1245.494
Method:               Conditional MLE   S.D. of innovations              4.184
Date:                Fri, 29 Oct 2021   AIC                              2.908
Time:                        17:44:24   BIC                              3.001
Sample:                             8   HQIC                             2.945
                                  445
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept      0.2214      0.248      0.892      0.372      -0.265       0.708
y.L1           1.2146      0.047     25.646      0.000       1.122       1.307
y.L2          -0.2463      0.074     -3.331      0.001      -0.391      -0.101
y.L3           0.0628      0.075      0.841      0.401      -0.084       0.209
y.L4           0.0703      0.075      0.942      0.346      -0.076       0.217
y.L5          -0.1307      0.076     -1.731      0.083      -0.279       0.017
y.L6          -0.0953      0.076     -1.250      0.211      -0.245       0.054
y.L7           0.2740      0.076      3.615      0.000       0.125       0.423
```

```
y.L8          -0.1469      0.049     -2.977      0.003     -0.244     -0.050
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1           -1.1579          -0.5783j            1.2943           -0.4263
AR.2           -1.1579          +0.5783j            1.2943            0.4263
AR.3           -0.1187          -1.2135j            1.2193           -0.2655
AR.4           -0.1187          +1.2135j            1.2193            0.2655
AR.5            1.0230          -0.9731j            1.4119           -0.1210
AR.6            1.0230          +0.9731j            1.4119            0.1210
AR.7            0.9965          -0.0000j            0.9965           -0.0000
AR.8            1.3757          -0.0000j            1.3757           -0.0000
-----------------------------------------------------------------------------
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  445
Model:                     AutoReg(8)   Log Likelihood               -1258.572
Method:               Conditional MLE   S.D. of innovations              4.311
Date:                Fri, 29 Oct 2021   AIC                              2.968
Time:                        17:44:24   BIC                              3.061
Sample:                             8   HQIC                             3.005
                                  445
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept      0.1876      0.255      0.736      0.462      -0.312       0.687
y.L1           1.0563      0.048     22.081      0.000       0.963       1.150
y.L2          -0.2290      0.070     -3.290      0.001      -0.365      -0.093
y.L3           0.2145      0.071      3.019      0.003       0.075       0.354
y.L4           0.0559      0.072      0.779      0.436      -0.085       0.196
y.L5          -0.1748      0.072     -2.428      0.015      -0.316      -0.034
y.L6           0.1717      0.073      2.361      0.018       0.029       0.314
y.L7          -0.0223      0.073     -0.305      0.760      -0.165       0.121
y.L8          -0.0663      0.050     -1.315      0.189      -0.165       0.033
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1            0.9935          -0.0000j            0.9935           -0.0000
AR.2            1.3877          -0.0000j            1.3877           -0.0000
AR.3            0.7996          -1.1610j            1.4097           -0.1540
AR.4            0.7996          +1.1610j            1.4097            0.1540
AR.5           -0.3252          -1.2264j            1.2688           -0.2913
AR.6           -0.3252          +1.2264j            1.2688            0.2913
AR.7           -1.8329          -0.2485j            1.8497           -0.4786
AR.8           -1.8329          +0.2485j            1.8497            0.4786
-----------------------------------------------------------------------------
```

Out[16]:

```
[<matplotlib.lines.Line2D at 0x1b2c8d03c88>]
```



In [17]:

```
print("BTC")
```

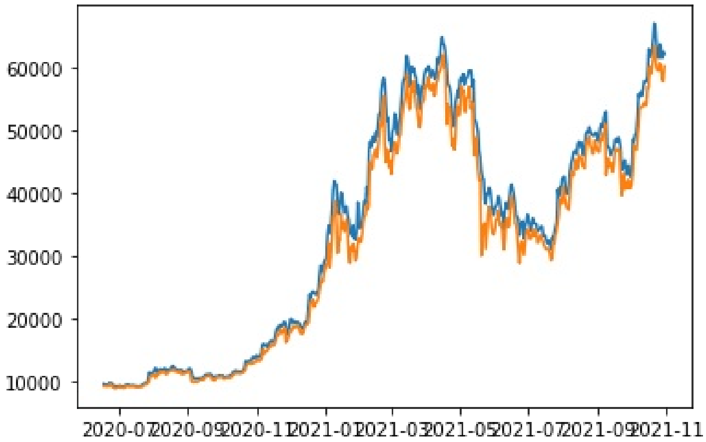
```
ar_h_model = AutoReg(np.asarray(train_data_h_4), lags=8).fit()
ar_l_model = AutoReg(np.asarray(train_data_l_4), lags=8).fit()
print(ar_h_model.summary())
print(ar_l_model.summary())
plt.plot(train_data_h_4)
plt.plot(train_data_l_4)
```

```
BTC
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  500
Model:                     AutoReg(8)   Log Likelihood               -4231.608
Method:               Conditional MLE   S.D. of innovations           1315.394
Date:                Fri, 29 Oct 2021   AIC                             14.404
Time:                        17:44:25   BIC                             14.490
Sample:                             8   HQIC                            14.438
                                  500
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept    184.2938    126.614      1.456      0.146     -63.866     432.453
y.L1           1.0837      0.045     24.053      0.000       0.995       1.172
y.L2          -0.0424      0.067     -0.637      0.524      -0.173       0.088
y.L3          -0.0849      0.067     -1.273      0.203      -0.216       0.046
y.L4           0.1642      0.067      2.462      0.014       0.033       0.295
y.L5          -0.0955      0.067     -1.429      0.153      -0.227       0.036
y.L6          -0.0188      0.067     -0.281      0.779      -0.150       0.113
y.L7          -0.0507      0.067     -0.757      0.449      -0.182       0.081
y.L8           0.0415      0.045      0.912      0.362      -0.048       0.131
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1           -1.4244           -0.0000j            1.4244           -0.5000
AR.2           -1.0735           -1.3844j            1.7518           -0.3550
AR.3           -1.0735           +1.3844j            1.7518            0.3550
AR.4            0.3181           -1.3980j            1.4338           -0.2144
AR.5            0.3181           +1.3980j            1.4338            0.2144
AR.6            1.0037           -0.0000j            1.0037           -0.0000
AR.7            1.5772           -0.4319j            1.6353           -0.0425
AR.8            1.5772           +0.4319j            1.6353            0.0425
-----------------------------------------------------------------------------
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  500
Model:                     AutoReg(8)   Log Likelihood               -4335.393
Method:               Conditional MLE   S.D. of innovations           1624.306
Date:                Fri, 29 Oct 2021   AIC                             14.826
Time:                        17:44:25   BIC                             14.912
Sample:                             8   HQIC                            14.860
                                  500
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept    225.8366    156.637      1.442      0.149     -81.167     532.840
y.L1           0.9540      0.045     21.163      0.000       0.866       1.042
y.L2           0.0038      0.062      0.060      0.952      -0.118       0.126
y.L3          -0.0062      0.062     -0.100      0.920      -0.128       0.116
y.L4           0.1400      0.062      2.252      0.024       0.018       0.262
y.L5          -0.1122      0.062     -1.805      0.071      -0.234       0.010
y.L6           0.0560      0.062      0.897      0.370      -0.066       0.178
y.L7           0.0207      0.062      0.331      0.740      -0.102       0.143
y.L8          -0.0599      0.045     -1.325      0.185      -0.149       0.029
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1            1.0043           -0.0000j            1.0043           -0.0000
AR.2            1.4080           -0.0000j            1.4080           -0.0000
AR.3            0.8287           -1.2386j            1.4903           -0.1562
AR.4            0.8287           +1.2386j            1.4903            0.1562
AR.5           -0.3141           -1.3949j            1.4299           -0.2853
```

```
AR.6            -0.3141          +1.3949j             1.4299            0.2853
AR.7            -1.5480          -0.4509j             1.6123           -0.4549
AR.8            -1.5480          +0.4509j             1.6123            0.4549
-----------------------------------------------------------------------------
```

Out[17]:

```
[<matplotlib.lines.Line2D at 0x1b2c8ff29c8>]
```



In [18]:

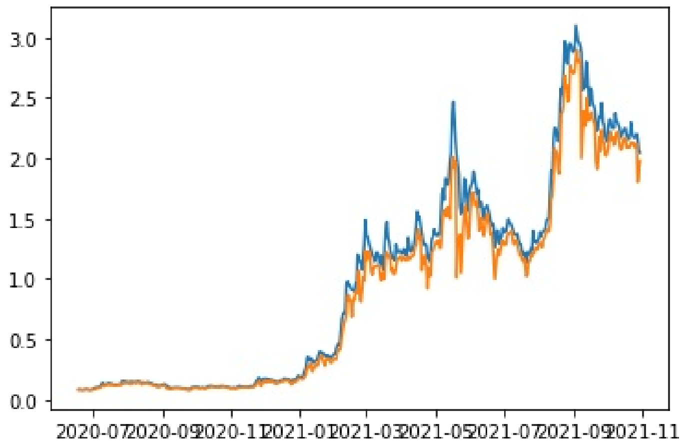
```
print("ADA")
ar_h_model = AutoReg(np.asarray(train_data_h_5), lags=8).fit()
ar_l_model = AutoReg(np.asarray(train_data_l_5), lags=8).fit()
print(ar_h_model.summary())
print(ar_l_model.summary())
plt.plot(train_data_h_5)
plt.plot(train_data_l_5)
```

```
ADA
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  500
Model:                     AutoReg(8)   Log Likelihood                 655.676
Method:               Conditional MLE   S.D. of innovations              0.064
Date:                Fri, 29 Oct 2021   AIC                             -5.463
Time:                        17:44:25   BIC                             -5.377
Sample:                             8   HQIC                            -5.429
                                  500
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept      0.0062      0.004      1.417      0.156      -0.002       0.015
y.L1           1.1845      0.045     26.277      0.000       1.096       1.273
y.L2          -0.2718      0.070     -3.888      0.000      -0.409      -0.135
y.L3           0.0430      0.071      0.607      0.544      -0.096       0.182
y.L4           0.1474      0.071      2.091      0.037       0.009       0.286
y.L5          -0.1646      0.071     -2.334      0.020      -0.303      -0.026
y.L6           0.0973      0.071      1.373      0.170      -0.042       0.236
y.L7          -0.0567      0.070     -0.810      0.418      -0.194       0.080
y.L8           0.0181      0.045      0.400      0.689      -0.071       0.107
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1            -1.4242          -0.0000j             1.4242           -0.5000
AR.2             1.0031          -0.0000j             1.0031           -0.0000
AR.3            -0.5952          -1.6635j             1.7667           -0.3047
AR.4            -0.5952          +1.6635j             1.7667            0.3047
AR.5             0.5011          -1.7052j             1.7773           -0.2045
AR.6             0.5011          +1.7052j             1.7773            0.2045
AR.7             1.8723          -0.6482j             1.9813           -0.0530
AR.8             1.8723          +0.6482j             1.9813            0.0530
-----------------------------------------------------------------------------
                            AutoReg Model Results
==============================================================================
Dep. Variable:                      y   No. Observations:                  500
```

```
Model:                       AutoReg(8)   Log Likelihood                 497.268
Method:                 Conditional MLE   S.D. of innovations              0.088
Date:                  Fri, 29 Oct 2021   AIC                             -4.819
Time:                          17:44:25   BIC                             -4.733
Sample:                               8   HQIC                            -4.785
                                    500
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
intercept      0.0083      0.006      1.388      0.165      -0.003       0.020
y.L1           0.8616      0.045     19.115      0.000       0.773       0.950
y.L2           0.0588      0.060      0.988      0.323      -0.058       0.175
y.L3           0.0145      0.060      0.243      0.808      -0.102       0.131
y.L4           0.0205      0.060      0.344      0.731      -0.097       0.138
y.L5          -0.1163      0.060     -1.947      0.051      -0.233       0.001
y.L6           0.1828      0.060      3.047      0.002       0.065       0.300
y.L7           0.0089      0.060      0.147      0.883      -0.110       0.127
y.L8          -0.0339      0.046     -0.741      0.459      -0.124       0.056
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1            1.0022           -0.0000j            1.0022           -0.0000
AR.2            0.9457           -1.0319j            1.3997           -0.1319
AR.3            0.9457           +1.0319j            1.3997            0.1319
AR.4           -0.4474           -1.2804j            1.3563           -0.3035
AR.5           -0.4474           +1.2804j            1.3563            0.3035
AR.6            2.2095           -0.0000j            2.2095           -0.0000
AR.7           -1.5287           -0.0000j            1.5287           -0.5000
AR.8           -2.4180           -0.0000j            2.4180           -0.5000
-----------------------------------------------------------------------------
```

Out[18]:

```
[&lt;matplotlib.lines.Line2D at 0x1b2c8ff26c8&gt;]
```



Augmented Dickey-Fuller test

ADF Function

In [19]:

```
def adf_test(timeseries):
    #Perform Dickey-Fuller test:
    print ('Results of Dickey-Fuller Test:')
    dftest = adfuller(timeseries, autolag='AIC')
    dfoutput = pd.Series(dftest[0:4], index=['Test Statistic','p-value','#Lags Used','Nu
mber of Observations Used'])
    for key,value in dftest[4].items():
       dfoutput['Critical Value (%s)'%key] = value
    print (dfoutput)
```

In [20]:

```
print("BNB")
print("------------------------------------------------------------")
adf_test(train_data_h_1)
adf_test(train_data_l_1)
```

```
BNB
------------------------------------------------------------
Results of Dickey-Fuller Test:
Test Statistic                  -1.080856
p-value                          0.722645
#Lags Used                      11.000000
Number of Observations Used    488.000000
Critical Value (1%)             -3.443821
Critical Value (5%)             -2.867481
Critical Value (10%)            -2.569934
dtype: float64
Results of Dickey-Fuller Test:
Test Statistic                  -0.933672
p-value                          0.776682
#Lags Used                      13.000000
Number of Observations Used    486.000000
Critical Value (1%)             -3.443877
Critical Value (5%)             -2.867505
Critical Value (10%)            -2.569947
dtype: float64
```

In [21]:

```
print("ETH")
print("------------------------------------------------------------")
adf_test(train_data_h_2)
adf_test(train_data_l_2)
```

```
ETH
------------------------------------------------------------
Results of Dickey-Fuller Test:
Test Statistic                  -0.140004
p-value                          0.945305
#Lags Used                      10.000000
Number of Observations Used    489.000000
Critical Value (1%)             -3.443794
Critical Value (5%)             -2.867469
Critical Value (10%)            -2.569928
dtype: float64
Results of Dickey-Fuller Test:
Test Statistic                  -0.143110
p-value                          0.944972
#Lags Used                       1.000000
Number of Observations Used    498.000000
Critical Value (1%)             -3.443549
Critical Value (5%)             -2.867361
Critical Value (10%)            -2.569870
dtype: float64
```

In [22]:

```
print("SOL")
print("------------------------------------------------------------")
adf_test(train_data_h_3)
adf_test(train_data_l_3)
```

```
SOL
------------------------------------------------------------
Results of Dickey-Fuller Test:
Test Statistic                   1.233571
p-value                          0.996210
#Lags Used                      18.000000
Number of Observations Used    426.000000
Critical Value (1%)             -3.445794
Critical Value (5%)             -2.868349
Critical Value (10%)            -2.570397
dtype: float64
```

```
Results of Dickey-Fuller Test:
Test Statistic                   2.070911
p-value                          0.998758
#Lags Used                      17.000000
Number of Observations Used    427.000000
Critical Value (1%)             -3.445758
Critical Value (5%)             -2.868333
Critical Value (10%)            -2.570388
dtype: float64
```

In [23]:

```python
print("BTC")
print("-----------------------------------------------------------")
adf_test(train_data_h_4)
adf_test(train_data_l_4)
```

```
BTC
-----------------------------------------------------------
Results of Dickey-Fuller Test:
Test Statistic                  -0.900510
p-value                          0.787805
#Lags Used                       4.000000
Number of Observations Used    495.000000
Critical Value (1%)             -3.443630
Critical Value (5%)             -2.867397
Critical Value (10%)            -2.569889
dtype: float64
Results of Dickey-Fuller Test:
Test Statistic                  -0.823080
p-value                          0.812248
#Lags Used                       0.000000
Number of Observations Used    499.000000
Critical Value (1%)             -3.443523
Critical Value (5%)             -2.867350
Critical Value (10%)            -2.569864
dtype: float64
```

In [24]:

```python
print("ADA")
print("-----------------------------------------------------------")
adf_test(train_data_h_5)
adf_test(train_data_l_5)
```

```
ADA
-----------------------------------------------------------
Results of Dickey-Fuller Test:
Test Statistic                  -1.096975
p-value                          0.716277
#Lags Used                      11.000000
Number of Observations Used    488.000000
Critical Value (1%)             -3.443821
Critical Value (5%)             -2.867481
Critical Value (10%)            -2.569934
dtype: float64
Results of Dickey-Fuller Test:
Test Statistic                  -0.553732
p-value                          0.881098
#Lags Used                       5.000000
Number of Observations Used    494.000000
Critical Value (1%)             -3.443657
Critical Value (5%)             -2.867408
Critical Value (10%)            -2.569896
dtype: float64
```

Arima Test Accuracy For each Crypto

In [25]:

```
print("BNB")
print("--------------------------------------------------------------")
print("accruracy of high")
history = [x for x in train_data_h_1.iloc[:-5]]
test_data=train_data_h_1.iloc[-5:]
predictions = list()
# walk-forward validation
for t in range(len(test_data)):
    model = ARIMA(history, order=(5,2,1))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
print("accruracy of low")
history = [x for x in train_data_l_1.iloc[:-5]]
test_data=train_data_l_1.iloc[-5:]
predictions = list()
for t in range(len(test_data)):
    model = ARIMA(history, order=(5,2,3))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
```

```
BNB
--------------------------------------------------------------
accruracy of high
predicted=486.630131, expected=488.600006
predicted=490.525355, expected=489.799988
predicted=491.963982, expected=486.399994
predicted=486.205518, expected=494.799988
predicted=496.200329, expected=502.000000
Test RMSE: 5.345
accruracy of low
predicted=465.713966, expected=474.700012
predicted=482.372559, expected=473.500000
predicted=474.282588, expected=435.299988
predicted=427.501911, expected=446.399994
predicted=457.344015, expected=487.600006
Test RMSE: 24.297
```

In [26]:

```
print("ETH")
print("--------------------------------------------------------------")
print("accruracy of high")
history = [x for x in train_data_h_2.iloc[:-5]]
test_data=train_data_h_2.iloc[-5:]
predictions = list()
# walk-forward validation
for t in range(len(test_data)):
    model = ARIMA(history, order=(5,2,3))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
```

```
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
print("accruarcy of low")
history = [x for x in train_data_l_2.iloc[:-5]]
test_data=train_data_l_2.iloc[-5:]
predictions = list()
for t in range(len(test_data)):
    model = ARIMA(history, order=(6,3,3))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
```

```
ETH
----------------------------------------------------
accruarcy of high
predicted=4188.054968, expected=4236.000000
predicted=4254.324398, expected=4297.000000
predicted=4308.563353, expected=4307.000000
predicted=4325.221677, expected=4295.000000
predicted=4301.054819, expected=4405.500000
Test RMSE: 56.470
accruarcy of low
predicted=3980.386098, expected=4067.709961
predicted=4055.050105, expected=4090.209961
predicted=4118.170062, expected=3909.000000
predicted=3938.344607, expected=3890.169922
predicted=3906.566067, expected=4265.970215
Test RMSE: 191.888
```

In [27]:

```
print("SOL")
print("----------------------------------------------------")
print("accruarcy of high")
history = [x for x in train_data_h_3.iloc[:-5]]
test_data=train_data_h_3.iloc[-5:]
predictions = list()
# walk-forward validation
for t in range(len(test_data)):
    model = ARIMA(history, order=(5,2,1))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
print("accruarcy of low")
history = [x for x in train_data_l_3.iloc[:-5]]
test_data=train_data_l_3.iloc[-5:]
predictions = list()
for t in range(len(test_data)):
    model = ARIMA(history, order=(5,2,1))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test_data, predictions))
```

```
print('Test RMSE: %.3f' % rmse)
```

```
SOL
----------------------------------------------------
accruarcy of high
predicted=206.552501, expected=218.929993
predicted=224.627723, expected=214.199997
predicted=211.942439, expected=205.490005
predicted=205.845363, expected=201.380005
predicted=202.937105, expected=205.220001
Test RMSE: 8.108
accruarcy of low
predicted=187.077562, expected=198.000000
predicted=201.102069, expected=196.360001
predicted=195.603935, expected=176.940002
predicted=176.897629, expected=181.639999
predicted=187.582833, expected=194.449997
Test RMSE: 10.581
```

In [28]:

```
print("BTC")
print("----------------------------------------------------")
print("accruarcy of high")
history = [x for x in train_data_h_4.iloc[:-5]]
test_data=train_data_h_4.iloc[-5:]
predictions = list()
# walk-forward validation
for t in range(len(test_data)):
    model = ARIMA(history, order=(10,4,2))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
print("accruarcy of low")
history = [x for x in train_data_l_4.iloc[:-5]]
test_data=train_data_l_4.iloc[-5:]
predictions = list()
for t in range(len(test_data)):
    model = ARIMA(history, order=(10,2,1))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
```

```
BTC
----------------------------------------------------
accruarcy of high
predicted=62264.852360, expected=63710.628906
predicted=64056.499777, expected=63293.480469
predicted=62808.896413, expected=61496.000000
predicted=60995.054301, expected=62499.000000
predicted=63223.919174, expected=62100.000000
Test RMSE: 1258.667
accruarcy of low
predicted=59863.222759, expected=60650.000000
predicted=60654.372268, expected=59817.550781
predicted=59864.962552, expected=58000.000000
predicted=57802.670701, expected=57820.000000
predicted=58276.940585, expected=60174.808594
Test RMSE: 1296.116
```

In [29]:

```
print("ADA")
print("-----------------------------------------------------")
print("accruarcy of high")
history = [x for x in train_data_h_5.iloc[:-5]]
test_data=train_data_h_5.iloc[-5:]
predictions = list()
# walk-forward validation
for t in range(len(test_data)):
    model = ARIMA(history, order=(5,2,1))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
print("accruarcy of low")
history = [x for x in train_data_l_5.iloc[:-5]]
test_data=train_data_l_5.iloc[-5:]
predictions = list()
for t in range(len(test_data)):
    model = ARIMA(history, order=(5,2,1))
    model_fit = model.fit()
    output = model_fit.forecast()
    yhat = output[0]
    predictions.append(yhat)
    obs = test_data[t]
    history.append(obs)
    print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test_data, predictions))
print('Test RMSE: %.3f' % rmse)
```

```
ADA
-----------------------------------------------------
accruarcy of high
predicted=2.185643, expected=2.178000
predicted=2.171305, expected=2.202000
predicted=2.211027, expected=2.156000
predicted=2.150181, expected=2.058000
predicted=2.046819, expected=2.048000
Test RMSE: 0.050
accruarcy of low
predicted=2.102552, expected=2.114000
predicted=2.113767, expected=2.122000
predicted=2.128805, expected=1.804000
predicted=1.851007, expected=1.905000
predicted=1.926178, expected=1.979000
Test RMSE: 0.149
```

Future Prediction

In [30]:

```
print("BNB")
print("----------------------------------------------")
history = [x for x in train_data_h_1]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(5,2,1))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_h_1 = output
print("high_prediction")
```

```
print(yhat_h_1)
history = [x for x in train_data_l_1]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(5,2,3))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_l_1 = output
print("low_prediction")
print(yhat_l_1)
```

```
BNB
---------------------------------------------
high_prediction
[504.64507531 506.91190131 507.23477341 507.9097058 ]
low_prediction
[483.03673314 481.26367727 489.30128311 488.19469979]
```

In [31]:

```
print("ETH")
print("---------------------------------------------")
history = [x for x in train_data_h_2]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(10,4,2))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_h_2 = output
print("high_prediction")
print(yhat_h_2)
history = [x for x in train_data_l_2]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(6,3,3))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_l_2 = output
print("low_prediction")
print(yhat_l_2)
```

```
ETH
---------------------------------------------
high_prediction
[4474.47751522 4479.47104476 4552.17896845 4634.99167878]
low_prediction
[4308.69786043 4319.95765647 4406.08132972 4511.22440219]
```

In [32]:

```
print("SOL")
print("---------------------------------------------")
history = [x for x in train_data_h_3]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(5,2,1))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_h_3 = output
print("high_prediction")
print(yhat_h_3)
history = [x for x in train_data_l_3]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(5,2,1))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_l_3 = output
print("low_prediction")
print(yhat_l_3)
```

```
SOL
```

```
---------------------------------------------
high_prediction
[205.35517344 205.06722979 205.87561345 207.41084163]
low_prediction
[193.58617906 191.49579288 195.55852001 198.11147413]
```

In [33]:

```
print("BTC")
print("---------------------------------------------")
history = [x for x in train_data_h_4]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(10,4,2))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_h_4 = output
print("high_prediction")
print(yhat_h_4)
history = [x for x in train_data_l_4]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(10,2,1))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_l_4 = output
print("low_prediction")
print(yhat_l_4)
```

```
BTC
---------------------------------------------
high_prediction
[62644.61437552 62487.78609096 62032.32109951 61264.2525689 ]
low_prediction
[60369.9445797  60226.00075934 60258.81613409 60383.26840963]
```

In [34]:

```
print("ADA")
print("---------------------------------------------")
history = [x for x in train_data_h_5]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(5,2,1))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_h_5 = output
print("high_prediction")
print(yhat_h_5)
history = [x for x in train_data_l_5]
predictions = list()
# walk-forward validation
model = ARIMA(history, order=(5,2,1))
model_fit = model.fit()
output = model_fit.forecast(4)
yhat_l_5 = output
print("low_prediction")
print(yhat_l_5)
```

```
ADA
---------------------------------------------
high_prediction
[2.06149737 2.06649061 2.06244569 2.06830927]
low_prediction
[1.98297252 1.98833374 2.03487589 2.01398478]
```

In [35]:

```
option=int(input("What do you want to do 1.Buy Or 2.Sell :"))
if option==1:
    crypto=int(input("Which Crypto 1.BNB 2.BTC 3.ADA 4.SOL 5.ETH :"))
    if crypto==1:
```

```
        print("This is the lowest prize that you should buy your crypto at ",min(yhat_h_1
),"in the next 4 days")
    elif crypto==2:
        print("This is the lowest prize that you should buy your crypto at ",min(yhat_h_3
),"in the next 4 days")
    elif crypto==3:
        print("This is the lowest prize that you should buy your crypto at ",min(yhat_h_4
),"in the next 4 days")
    elif crypto==4:
        print("This is the lowest prize that you should buy your crypto at ",min(yhat_h_5
),"in the next 4 days")
    elif crypto==5:
        print("This is the lowest prize that you should buy your crypto at ",min(yhat_h_2
),"in the next 4 days")
else:
    crypto=int(input("Which Crypto 1.BNB 2.BTC 3.ADA 4.SOL 5.ETH :"))
    if crypto==1:
        print("This is the highest prize that you should sell your crypto at ",max(yhat_h
_1),"in the next 4 days")
    elif crypto==2:
        print("This is the highest prize that you should sell your crypto at ",max(yhat_h
_3),"in the next 4 days")
    elif crypto==3:
        print("This is the highest prize that you should sell your crypto at ",max(yhat_h
_4),"in the next 4 days")
    elif crypto==4:
        print("This is the highest prize that you should sell your crypto at ",max(yhat_h
_5),"in the next 4 days")
    elif crypto==5:
        print("This is the highest prize that you should sell your crypto at ",max(yhat_h
_2),"in the next 4 days")
```

```
What do you want to do 1.Buy Or 2.Sell :1
Which Crypto 1.BNB 2.BTC 3.ADA 4.SOL 5.ETH :1
This is the lowest prize that you should buy your crypto at  504.6450753095979 in the nex
t 4 days
```