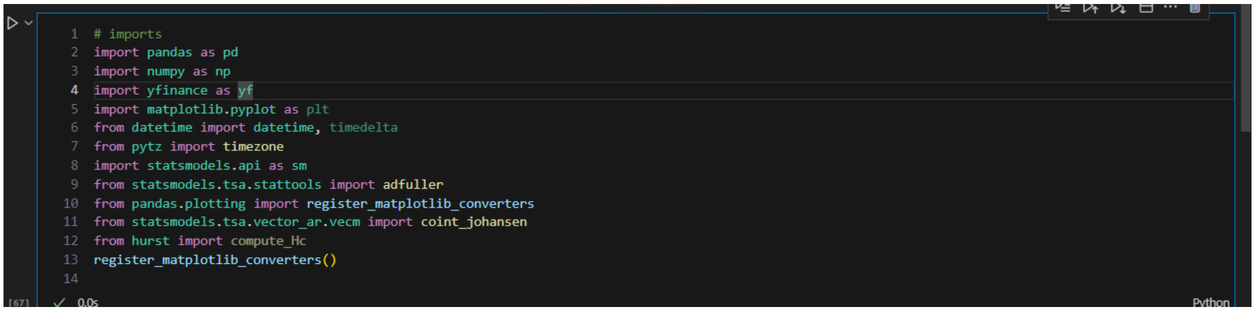
امیرعلی فرازمند

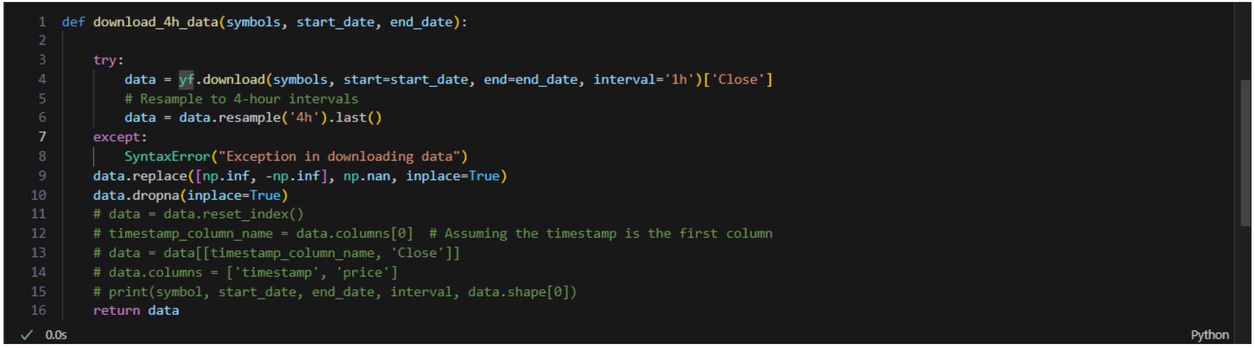
۹۹۵۲۲۳۲۹

گزارش تمرین ششم



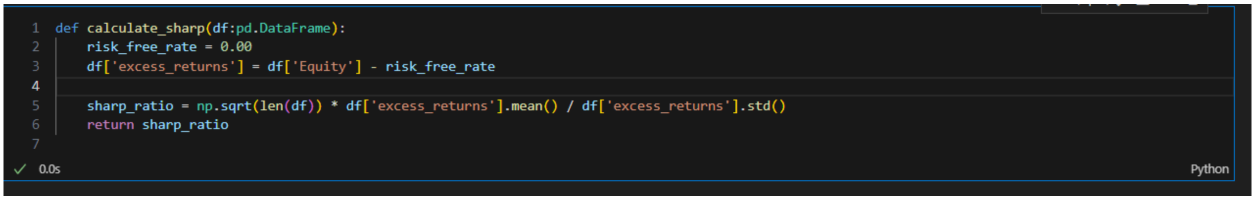
```python
# imports
import pandas as pd
import numpy as np
import yfinance as yf
import matplotlib.pyplot as plt
from datetime import datetime, timedelta
from pytz import timezone
import statsmodels.api as sm
from statsmodels.tsa.stattools import adfuller
from pandas.plotting import register_matplotlib_converters
from statsmodels.tsa.vector_ar.vecm import coint_johansen
from hurst import compute_Hc
register_matplotlib_converters()
```

از آنجا که yahoo finance در interval های ۴ساعته به ما دیتا نمیدهد، خودمان با استفاده از interval ۱ساعته دیتافریم مدنظرمان را میسازیم:



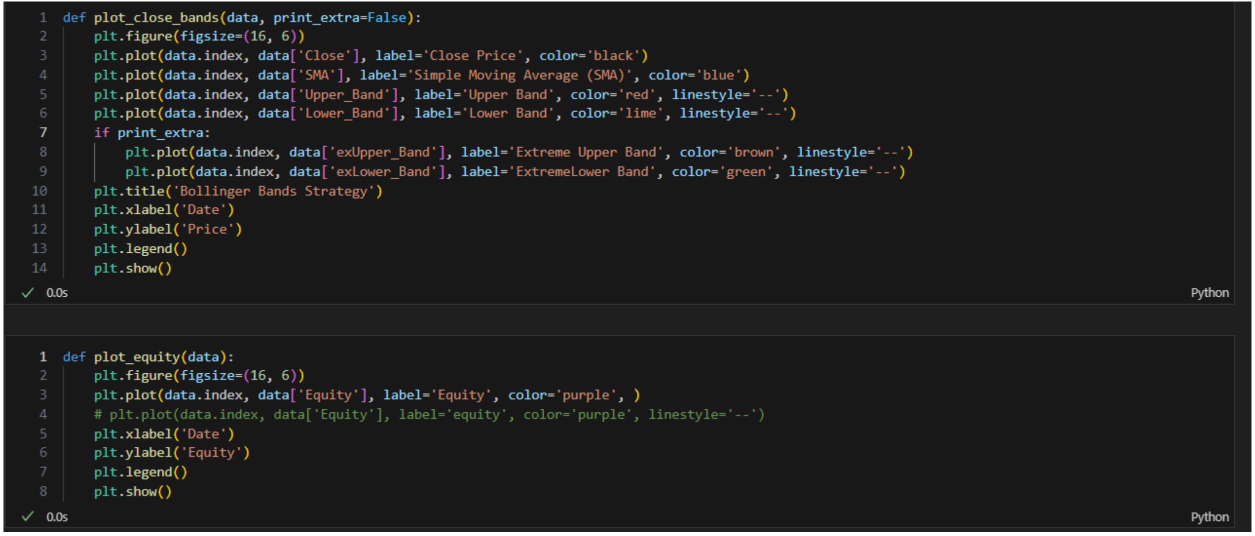
```python
def download_4h_data(symbols, start_date, end_date):

    try:
        data = yf.download(symbols, start=start_date, end=end_date, interval='1h')['Close']
        # Resample to 4-hour intervals
        data = data.resample('4h').last()
    except:
        SyntaxError("Exception in downloading data")
    data.replace([np.inf, -np.inf], np.nan, inplace=True)
    data.dropna(inplace=True)
    # data = data.reset_index()
    # timestamp_column_name = data.columns[0]  # Assuming the timestamp is the first column
    # data = data[[timestamp_column_name, 'Close']]
    # data.columns = ['timestamp', 'price']
    # print(symbol, start_date, end_date, interval, data.shape[0])
    return data
```

تابع محاسبه ی sharp ratio:



```python
def calculate_sharp(df:pd.DataFrame):
    risk_free_rate = 0.00
    df['excess_returns'] = df['Equity'] - risk_free_rate

    sharp_ratio = np.sqrt(len(df)) * df['excess_returns'].mean() / df['excess_returns'].std()
    return sharp_ratio
```

تابع های مربوط به پلات کردن دیتایی که داریم:

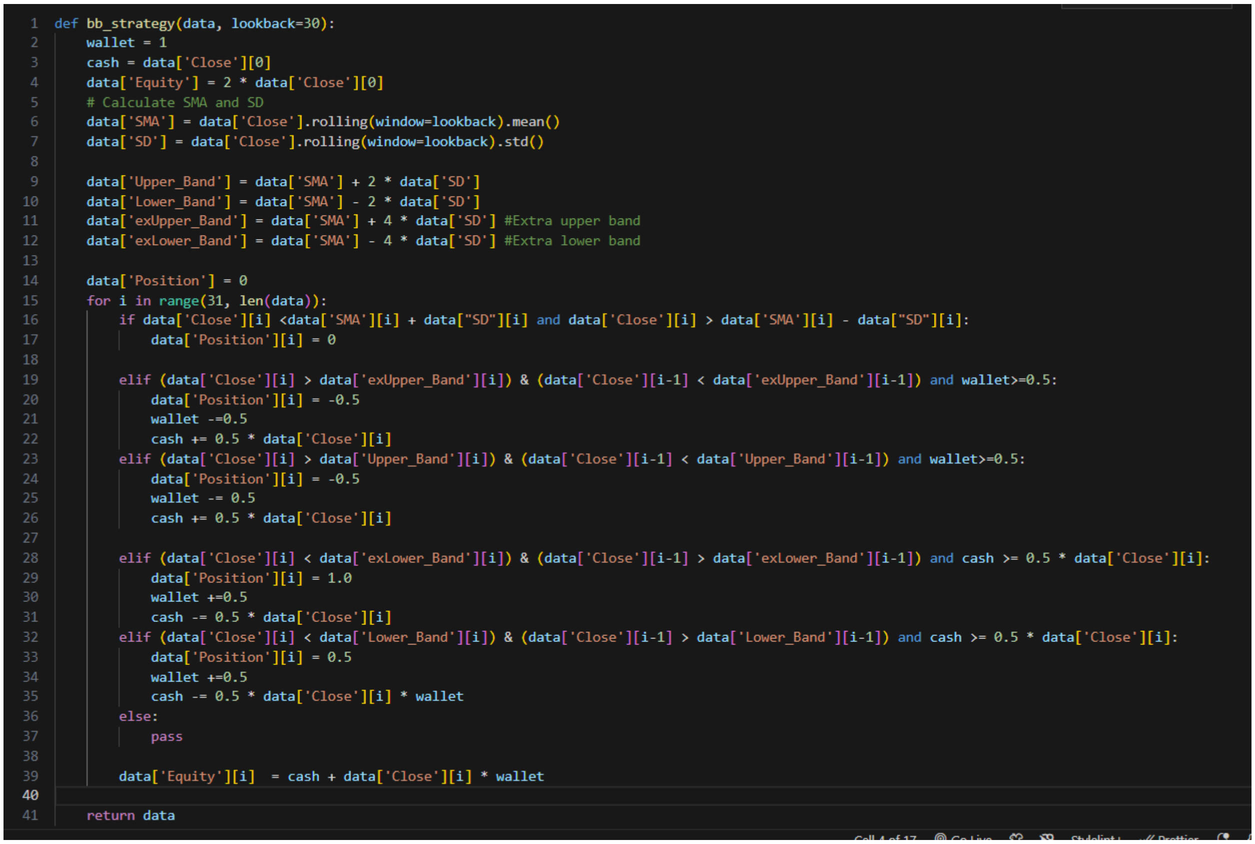


```python
def plot_close_bands(data, print_extra=False):
    plt.figure(figsize=(16, 6))
    plt.plot(data.index, data['Close'], label='Close Price', color='black')
    plt.plot(data.index, data['SMA'], label='Simple Moving Average (SMA)', color='blue')
    plt.plot(data.index, data['Upper_Band'], label='Upper Band', color='red', linestyle='--')
    plt.plot(data.index, data['Lower_Band'], label='Lower Band', color='lime', linestyle='--')
    if print_extra:
        plt.plot(data.index, data['exUpper_Band'], label='Extreme Upper Band', color='brown', linestyle='--')
        plt.plot(data.index, data['exLower_Band'], label='ExtremeLower Band', color='green', linestyle='--')
    plt.title('Bollinger Bands Strategy')
    plt.xlabel('Date')
    plt.ylabel('Price')
    plt.legend()
    plt.show()
```

```python
def plot_equity(data):
    plt.figure(figsize=(16, 6))
    plt.plot(data.index, data['Equity'], label='Equity', color='purple', )
    # plt.plot(data.index, data['Equity'], label='equity', color='purple', linestyle='--')
    plt.xlabel('Date')
    plt.ylabel('Equity')
    plt.legend()
    plt.show()
```

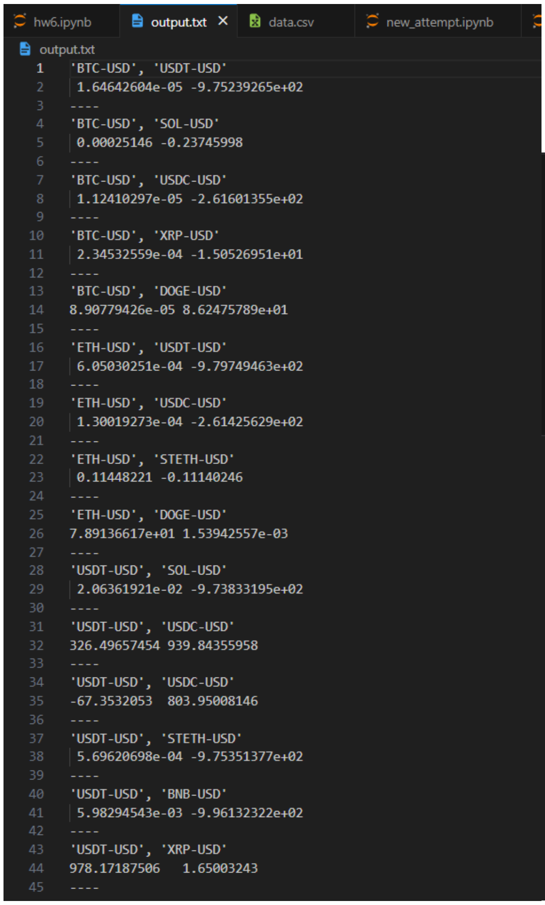
تابع استراتژی گفته شده:

پ.ن: در ابتدای کار اندازه یک واحد از cointegratian ارزهای گفته شده در ولت داریم و یک واحد از آن هم نقد فرض میکنیم داریم.(close روز اول)

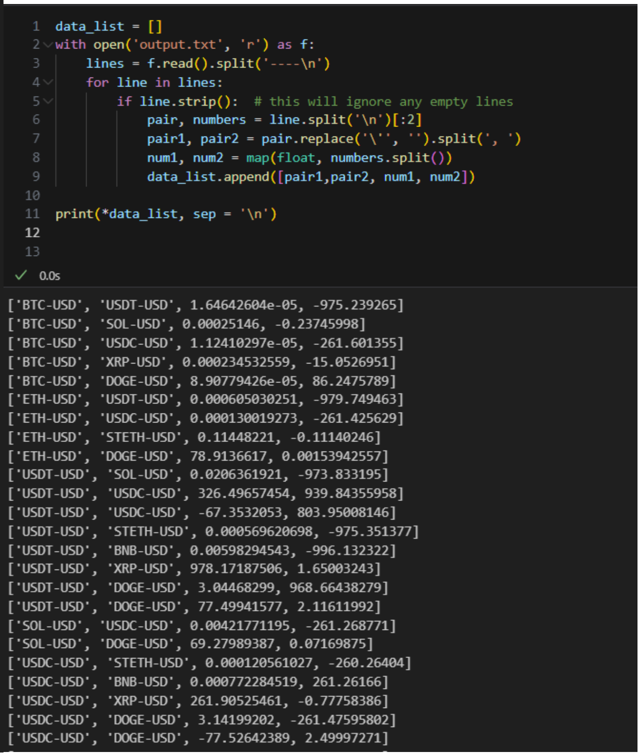


```python
def bb_strategy(data, lookback=30):
    wallet = 1
    cash = data['Close'][0]
    data['Equity'] = 2 * data['Close'][0]
    # Calculate SMA and SD
    data['SMA'] = data['Close'].rolling(window=lookback).mean()
    data['SD'] = data['Close'].rolling(window=lookback).std()

    data['Upper_Band'] = data['SMA'] + 2 * data['SD']
    data['Lower_Band'] = data['SMA'] - 2 * data['SD']
    data['exUpper_Band'] = data['SMA'] + 4 * data['SD'] #Extra upper band
    data['exLower_Band'] = data['SMA'] - 4 * data['SD'] #Extra lower band

    data['Position'] = 0
    for i in range(31, len(data)):
        if data['Close'][i] <data['SMA'][i] + data["SD"][i] and data['Close'][i] > data['SMA'][i] - data["SD"][i]:
            data['Position'][i] = 0

        elif (data['Close'][i] > data['exUpper_Band'][i]) & (data['Close'][i-1] < data['exUpper_Band'][i-1]) and wallet>=0.5:
            data['Position'][i] = -0.5
            wallet -=0.5
            cash += 0.5 * data['Close'][i]
        elif (data['Close'][i] > data['Upper_Band'][i]) & (data['Close'][i-1] < data['Upper_Band'][i-1]) and wallet>=0.5:
            data['Position'][i] = -0.5
            wallet -= 0.5
            cash += 0.5 * data['Close'][i]

        elif (data['Close'][i] < data['exLower_Band'][i]) & (data['Close'][i-1] > data['exLower_Band'][i-1]) and cash >= 0.5 * data['Close'][i]:
            data['Position'][i] = 1.0
            wallet +=0.5
            cash -= 0.5 * data['Close'][i]
        elif (data['Close'][i] < data['Lower_Band'][i]) & (data['Close'][i-1] > data['Lower_Band'][i-1]) and cash >= 0.5 * data['Close'][i]:
            data['Position'][i] = 0.5
            wallet +=0.5
            cash -= 0.5 * data['Close'][i] * wallet
        else:
            pass

        data['Equity'][i]  = cash + data['Close'][i] * wallet

    return data
```

دیتای رمزارزها را اینگونه از فایل txt. که تمرین قبلی برایمان درست کرده میخوانیم:



```
'BTC-USD', 'USDT-USD'
 1.64642604e-05 -9.75239265e+02
----
'BTC-USD', 'SOL-USD'
 0.00025146 -0.23745998
----
'BTC-USD', 'USDC-USD'
 1.12410297e-05 -2.61601355e+02
----
'BTC-USD', 'XRP-USD'
 2.34532559e-04 -1.50526951e+01
----
'BTC-USD', 'DOGE-USD'
8.90779426e-05 8.62475789e+01
----
'ETH-USD', 'USDT-USD'
 6.05030251e-04 -9.79749463e+02
----
'ETH-USD', 'USDC-USD'
 1.30019273e-04 -2.61425629e+02
----
'ETH-USD', 'STETH-USD'
 0.11448221 -0.11140246
----
'ETH-USD', 'DOGE-USD'
7.89136617e+01 1.53942557e-03
----
'USDT-USD', 'SOL-USD'
 2.06361921e-02 -9.73833195e+02
----
'USDT-USD', 'USDC-USD'
326.49657454 939.84355958
----
'USDT-USD', 'USDC-USD'
-67.3532053  803.95008146
----
'USDT-USD', 'STETH-USD'
 5.69620698e-04 -9.75351377e+02
----
'USDT-USD', 'BNB-USD'
 5.98294543e-03 -9.96132322e+02
----
'USDT-USD', 'XRP-USD'
978.17187506   1.65003243
----
```

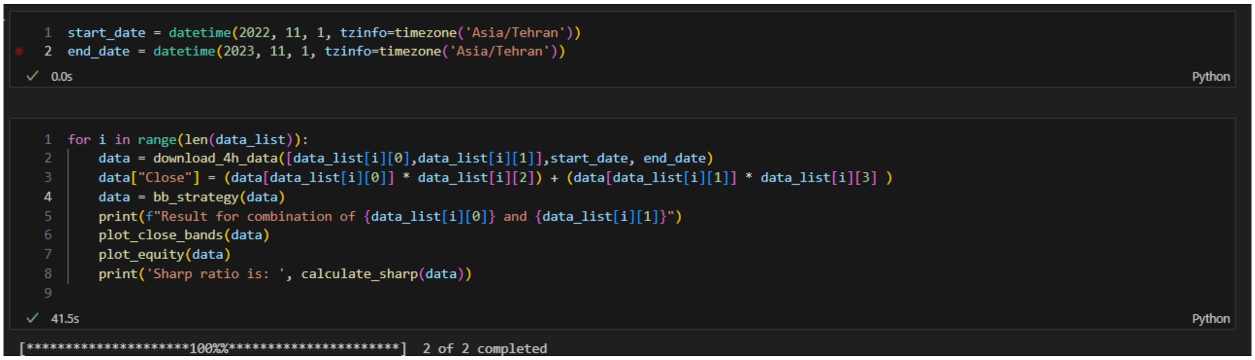


```python
data_list = []
with open('output.txt', 'r') as f:
    lines = f.read().split('----\n')
    for line in lines:
        if line.strip():  # this will ignore any empty lines
            pair, numbers = line.split('\n')[:2]
            pair1, pair2 = pair.replace('\'', '').split(', ')
            num1, num2 = map(float, numbers.split())
            data_list.append([pair1,pair2, num1, num2])

print(*data_list, sep = '\n')
```

✓ 0.0s

```
['BTC-USD', 'USDT-USD', 1.64642604e-05, -975.239265]
['BTC-USD', 'SOL-USD', 0.00025146, -0.23745998]
['BTC-USD', 'USDC-USD', 1.12410297e-05, -261.601355]
['BTC-USD', 'XRP-USD', 0.000234532559, -15.0526951]
['BTC-USD', 'DOGE-USD', 8.90779426e-05, 86.2475789]
['ETH-USD', 'USDT-USD', 0.000605030251, -979.749463]
['ETH-USD', 'USDC-USD', 0.000130019273, -261.425629]
['ETH-USD', 'STETH-USD', 0.11448221, -0.11140246]
['ETH-USD', 'DOGE-USD', 78.9136617, 0.00153942557]
['USDT-USD', 'SOL-USD', 0.0206361921, -973.833195]
['USDT-USD', 'USDC-USD', 326.49657454, 939.84355958]
['USDT-USD', 'USDC-USD', -67.3532053, 803.95008146]
['USDT-USD', 'STETH-USD', 0.000569620698, -975.351377]
['USDT-USD', 'BNB-USD', 0.00598294543, -996.132322]
['USDT-USD', 'XRP-USD', 978.17187506, 1.65003243]
['USDT-USD', 'DOGE-USD', 3.04468299, 968.66438279]
['USDT-USD', 'DOGE-USD', 77.49941577, 2.11611992]
['SOL-USD', 'USDC-USD', 0.00421771195, -261.268771]
['SOL-USD', 'DOGE-USD', 69.27989387, 0.07169875]
['USDC-USD', 'STETH-USD', 0.000120561027, -260.26404]
['USDC-USD', 'BNB-USD', 0.000772284519, 261.26166]
['USDC-USD', 'XRP-USD', 261.90525461, -0.77758386]
['USDC-USD', 'DOGE-USD', 3.14199202, -261.47595802]
['USDC-USD', 'DOGE-USD', -77.52642389, 2.49997271]
```

فرایند گفته شده را طی میکنیم:



```python
start_date = datetime(2022, 11, 1, tzinfo=timezone('Asia/Tehran'))
end_date = datetime(2023, 11, 1, tzinfo=timezone('Asia/Tehran'))
```

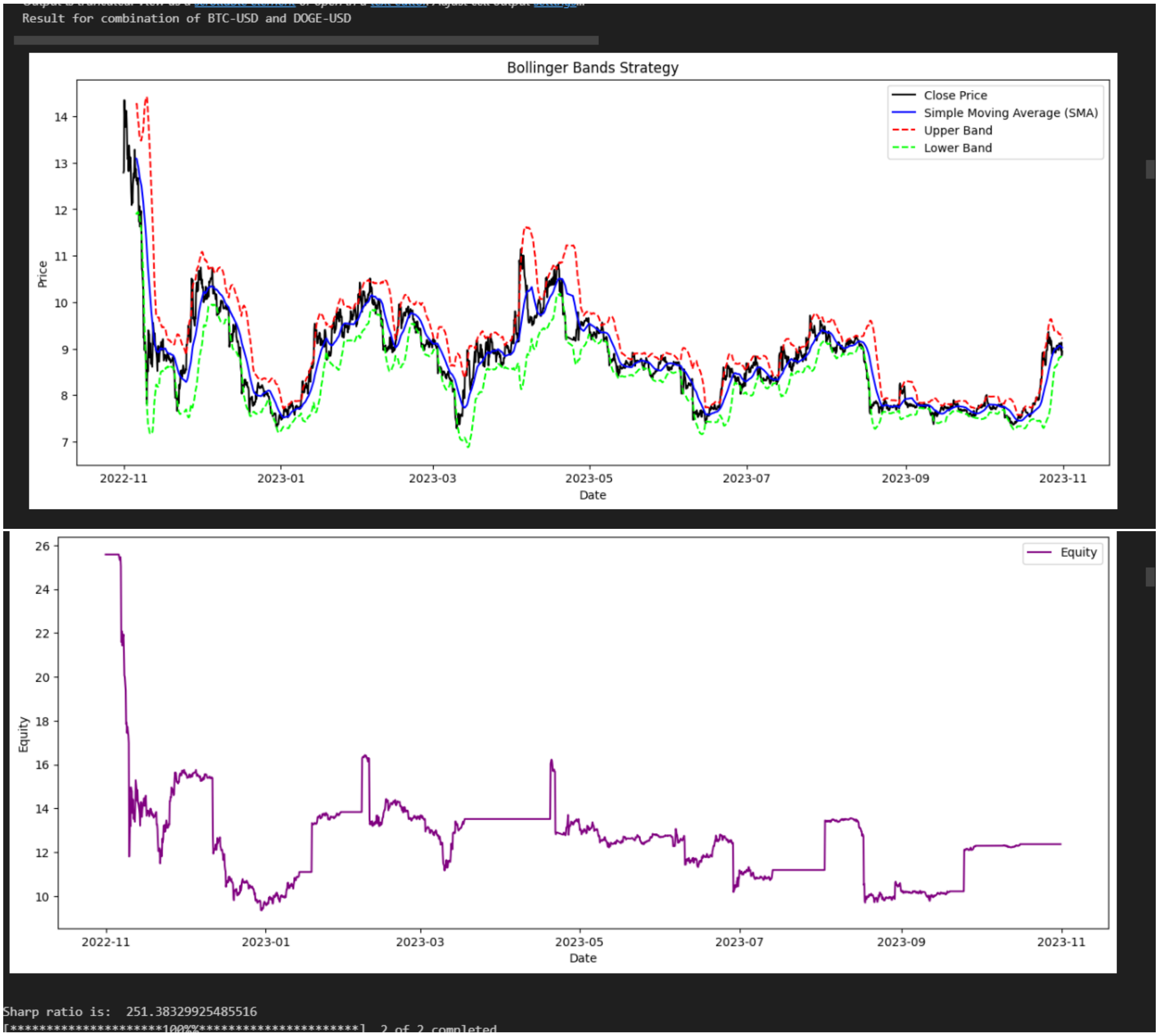
✓ 0.0s Python

```python
for i in range(len(data_list)):
    data = download_4h_data([data_list[i][0],data_list[i][1]],start_date, end_date)
    data["Close"] = (data[data_list[i][0]] * data_list[i][2]) + (data[data_list[i][1]] * data_list[i][3] )
    data = bb_strategy(data)
    print(f"Result for combination of {data_list[i][0]} and {data_list[i][1]}")
    plot_close_bands(data)
    plot_equity(data)
    print('Sharp ratio is: ', calculate_sharp(data))
```

✓ 41.5s Python

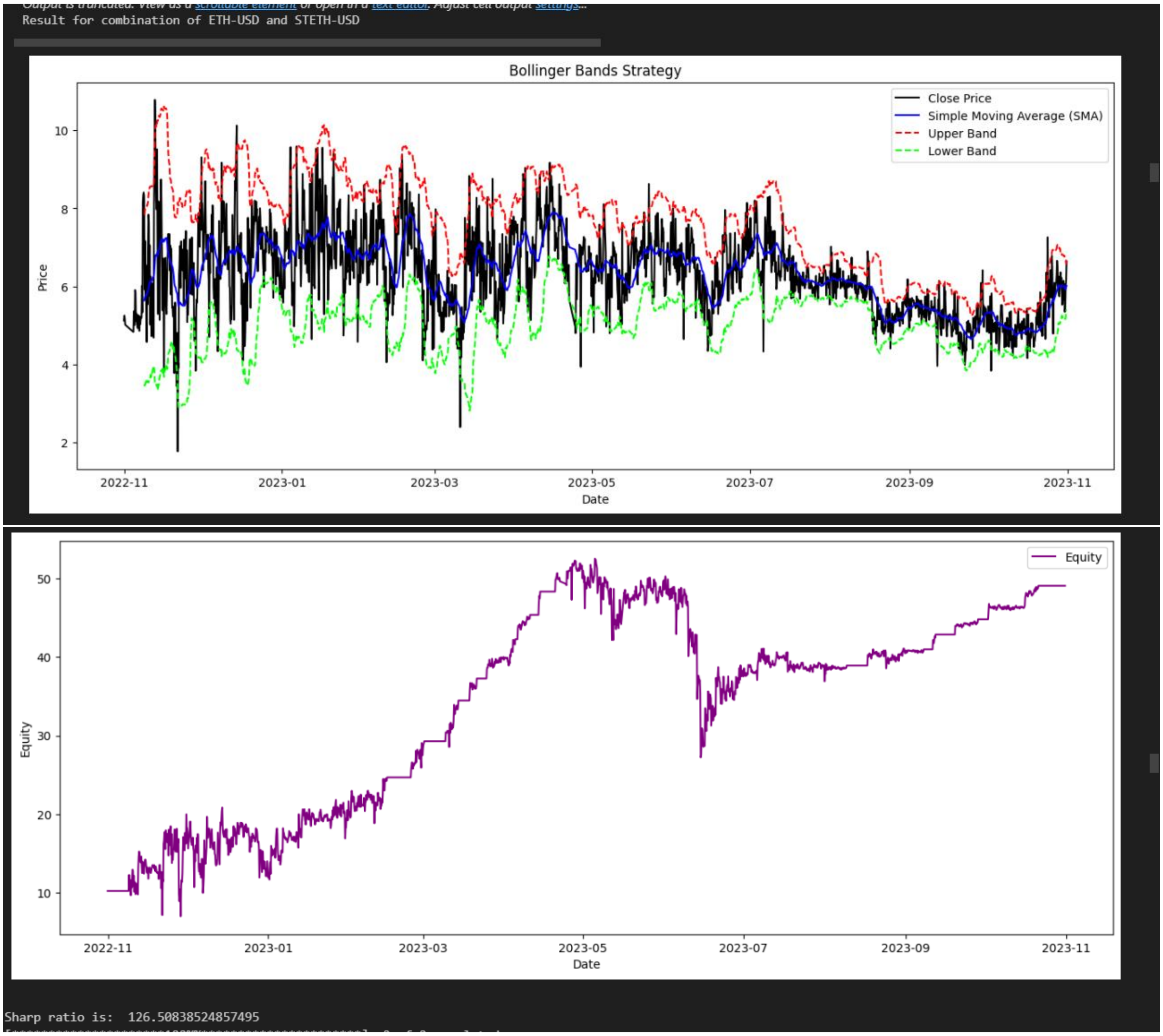
```
[*********************100%%**********************]  2 of 2 completed
```

در output به ما ۲ نمودار گفته شده و sharp ratio را به تفکیک میدهد که اینجا چندتا از آنها را نشان داده ایم:



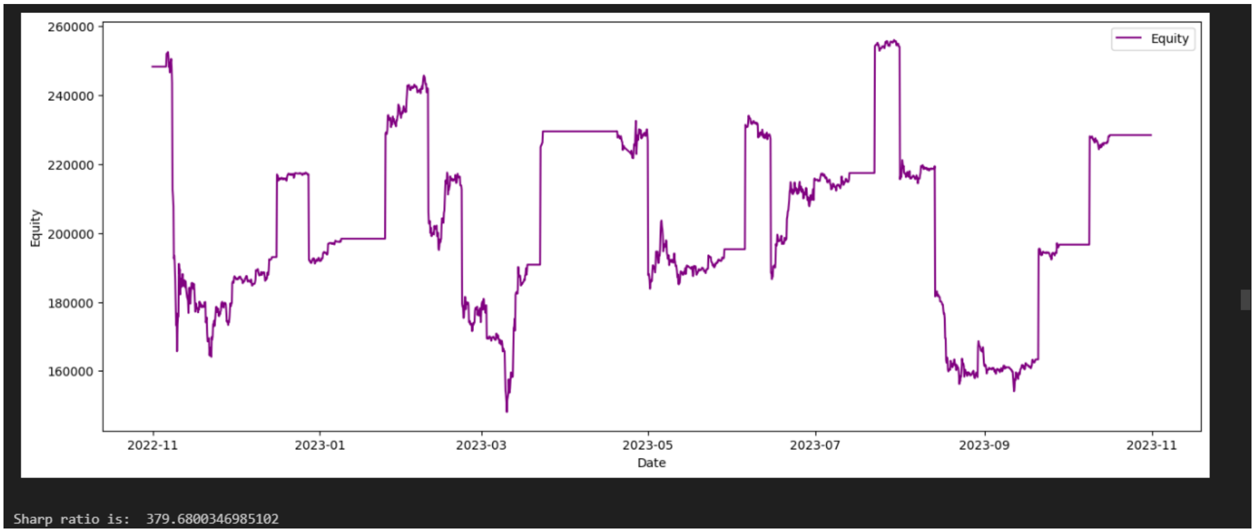
```
Output is truncated. View as a scrollable element or open in a text editor. Adjust cell output settings...
Result for combination of BTC-USD and DOGE-USD
```

```
Sharp ratio is:  251.38329925485516
[*********************100%%**********************]  2 of 2 completed
```

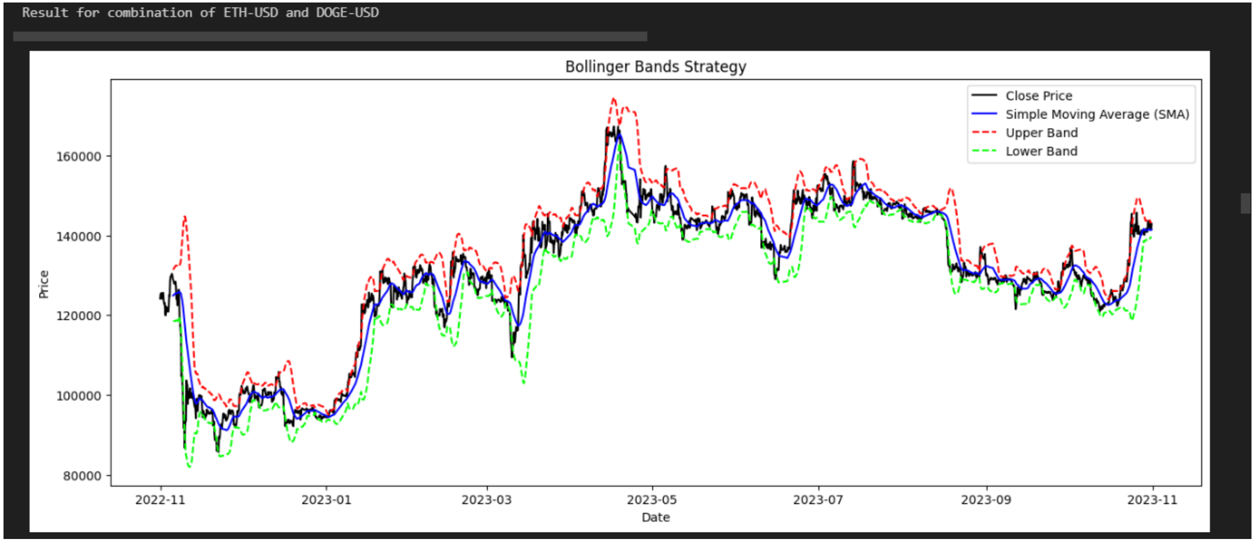


```
Output is truncated. View as a scrollable element or open in a text editor. Adjust cell output settings...
Result for combination of ETH-USD and STETH-USD
```

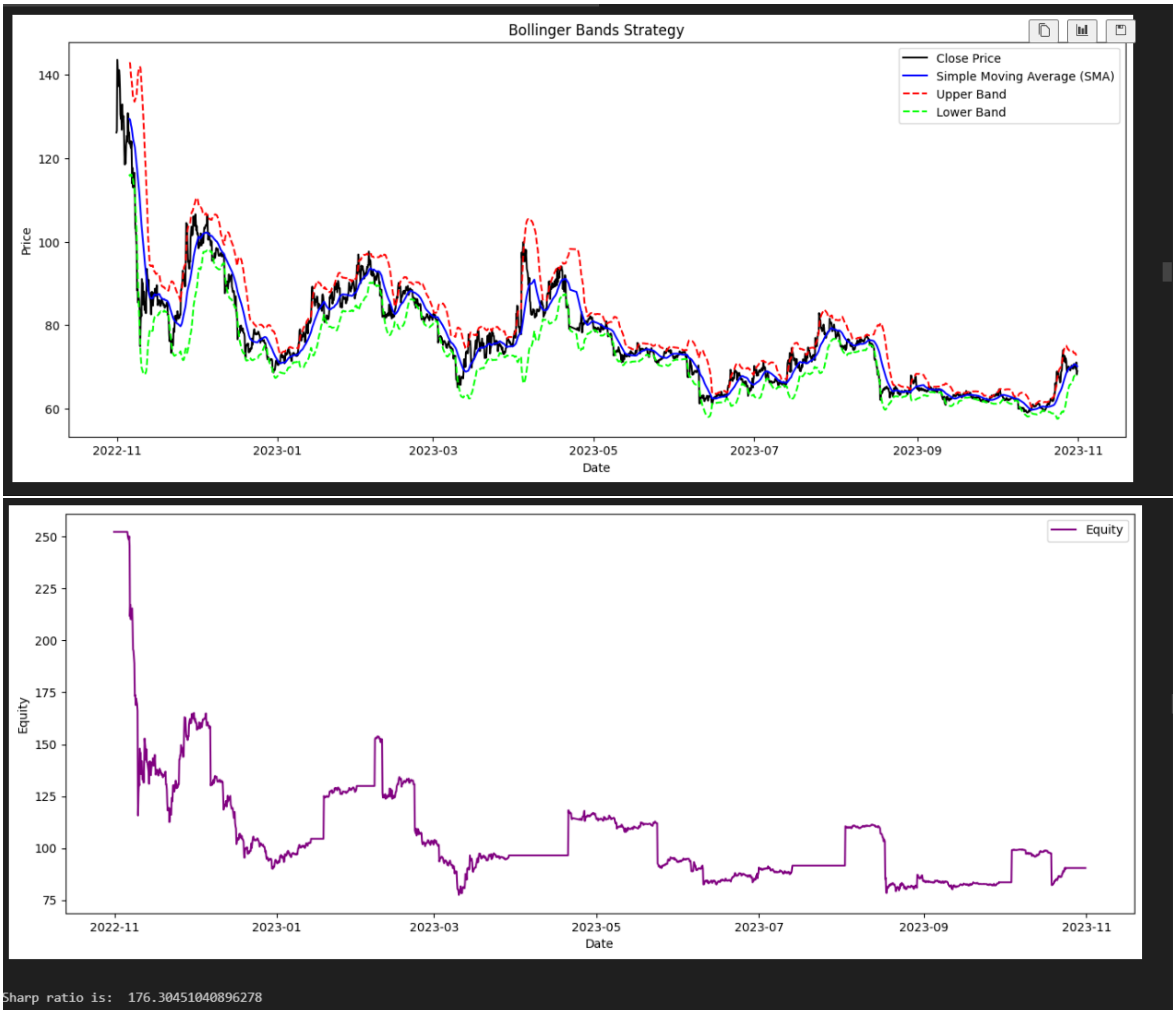
```
Sharp ratio is:  126.50838524857495
```



```
Sharp ratio is:  379.6800346985102
```



```
 Result for combination of ETH-USD and DOGE-USD
```



```
Sharp ratio is:  176.30451040896278
```

منابع:

کد تمرین های قبلی

Chat-GPT