```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

```
from google.colab import drive
drive.mount('/content/gdrive')
```

```
Drive already mounted at /content/gdrive; to attempt to forcibly remount, call drive.mount("/content/gdrive", force_remount=True
```

```
start_date = '2014-11-24'
end_date = '2019-11-21'
pred_end_date = '2020-02-1'
```

```
BBCA = pd.read_csv('gdrive/My Drive/DataBCA_5tahuny.csv')
```

```
print(BBCA)
```

```
             Date    Adj Close
    0     11/24/2014  12520.87305
    1     11/25/2014  12497.29395
    2     11/26/2014  12473.71387
    3     11/27/2014  12355.81543
    4     11/28/2014  12355.81543
    ...          ...          ...
    1259  11/15/2019  31375.00000
    1260  11/18/2019         NaN
    1261  11/19/2019  31575.00000
    1262  11/20/2019  31750.00000
    1263  11/21/2019  31500.00000

    [1264 rows x 2 columns]
```

```
BBCA['Date'] = pd.to_datetime(BBCA['Date'])
print(BBCA)
```

```
            Date    Adj Close
0    2014-11-24  12520.87305
1    2014-11-25  12497.29395
2    2014-11-26  12473.71387
3    2014-11-27  12355.81543
4    2014-11-28  12355.81543
...         ...          ...
1259 2019-11-15  31375.00000
1260 2019-11-18          NaN
1261 2019-11-19  31575.00000
1262 2019-11-20  31750.00000
1263 2019-11-21  31500.00000

[1264 rows x 2 columns]
```

```
print(BBCA.head())
print(BBCA.tail())
```

```
         Date    Adj Close
0 2014-11-24  12520.87305
1 2014-11-25  12497.29395
2 2014-11-26  12473.71387
3 2014-11-27  12355.81543
4 2014-11-28  12355.81543
           Date  Adj Close
1259 2019-11-15    31375.0
1260 2019-11-18        NaN
1261 2019-11-19    31575.0
1262 2019-11-20    31750.0
1263 2019-11-21    31500.0
```

```
returns = (BBCA.loc[1:, 'Adj Close'] - \
           BBCA.shift(1).loc[1:, 'Adj Close']) / \
           BBCA.shift(1).loc[1:, 'Adj Close']
print(returns.tolist())
```

```
[-0.0018831833775361882, -0.0018868148652292625, -0.009451751196854978, 0.0, -0.0019084980779775767, 0.009560342948979915, 0.003
```

```
# Parameter Assignments

So = BBCA.loc[BBCA.shape[0] - 1, "Adj Close"]
print(So)
```

```
31500.0
```

```
dt = 1 # day   # User input
n_of_wkdays = pd.date_range(start = pd.to_datetime(end_date,
                  format = "%Y-%m-%d") + pd.Timedelta('1 days'),
                  end = pd.to_datetime(pred_end_date,
                  format = "%Y-%m-%d")).to_series().map(lambda x:
                  1 if x.isoweekday() in range(1,6) else 0).sum()
T = n_of_wkdays # days  # User input -> follows from pred_end_date
N = T / dt
t = np.arange(1, int(N) + 1)
mu = np.mean(returns)
sigma = np.std(returns)
scen_size = 50 # User input
b = {str(scen): np.random.normal(0, 1, int(N)) for scen in range(1, scen_size + 1)}
W = {str(scen): b[str(scen)].cumsum() for scen in range(1, scen_size + 1)}

# Calculating drift and diffusion components

drift = (mu - 0.5 * sigma**2) * t
print(drift)
```

```
[0.00072151 0.00144303 0.00216454 0.00288606 0.00360757 0.00432908
 0.0050506  0.00577211 0.00649363 0.00721514 0.00793665 0.00865817
 0.00937968 0.0101012  0.01082271 0.01154423 0.01226574 0.01298725
 0.01370877 0.01443028 0.0151518  0.01587331 0.01659482 0.01731634
 0.01803785 0.01875937 0.01948088 0.02020239 0.02092391 0.02164542
 0.02236694 0.02308845 0.02380996 0.02453148 0.02525299 0.02597451
 0.02669602 0.02741753 0.02813905 0.02886056 0.02958208 0.03030359
 0.0310251  0.03174662 0.03246813 0.03318965 0.03391116 0.03463268
 0.03535419 0.0360757  0.03679722]
```

```
diffusion = {str(scen): sigma * W[str(scen)] for scen in range(1, scen_size + 1)}
print(diffusion)
```

```
{'1': array([-0.01231573, -0.0036205 , -0.01107434, -0.00415084, -0.014604  ,
       -0.01443539, -0.00826593, -0.02855805, -0.03330144, -0.02835872,
       -0.04344752, -0.0429533 , -0.04109369, -0.03050433, -0.0124008 ,
       -0.01483104, -0.03225068, -0.01937994, -0.02109026, -0.01693682,
       -0.02726056, -0.00909812, -0.02569872, -0.03673246, -0.02929507,
       -0.02461025, -0.01570692, -0.00580786, -0.01945088, -0.01497803,
       -0.02869153, -0.04051239, -0.01549394, -0.01431807, -0.01158259,
       -0.00482032,  0.00641203,  0.01688834,  0.0041861 ,  0.02493844,
        0.04798367,  0.04874833,  0.04333802,  0.03961483,  0.04393973,
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        0.02525426,  0.0288245 ,  0.02071476,  0.03987284,  0.03592713,
        0.02819469,  0.00891157,  0.00571475, -0.01355669,  0.00073468,
        0.00361599,  0.00202049,  0.02216425,  0.02261019,  0.02641896,
        0.03676341,  0.03215468,  0.05530271,  0.05124922,  0.04393892,
       -0.00121977, -0.02887037, -0.03345456, -0.04431041, -0.06284567,
       -0.0902616 , -0.06948121, -0.06397328, -0.05974072, -0.05013725,
       -0.05967315, -0.05098149, -0.04649894, -0.04718838, -0.03731548,
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       0.13323159, 0.1369183 , 0.14567091, 0.16835665, 0.19336237,
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```

```
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```

```
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```

```
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```

```
# Making the predictions


S = np.array([So * np.exp(drift + diffusion[str(scen)]) for scen in range(1, scen_size + 1)])
S = np.hstack((np.array([[So] for scen in range(scen_size)]), S)) # add So to the beginning series
print(S)
```

```
      [[31500.         31136.89116916 31431.484179   ... 33602.56876795
        33300.45018952 33410.62468812]
       [31500.         31869.69973046 31323.0636201  ... 33138.75740449
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        30300.90376567 30321.81653749]]
```
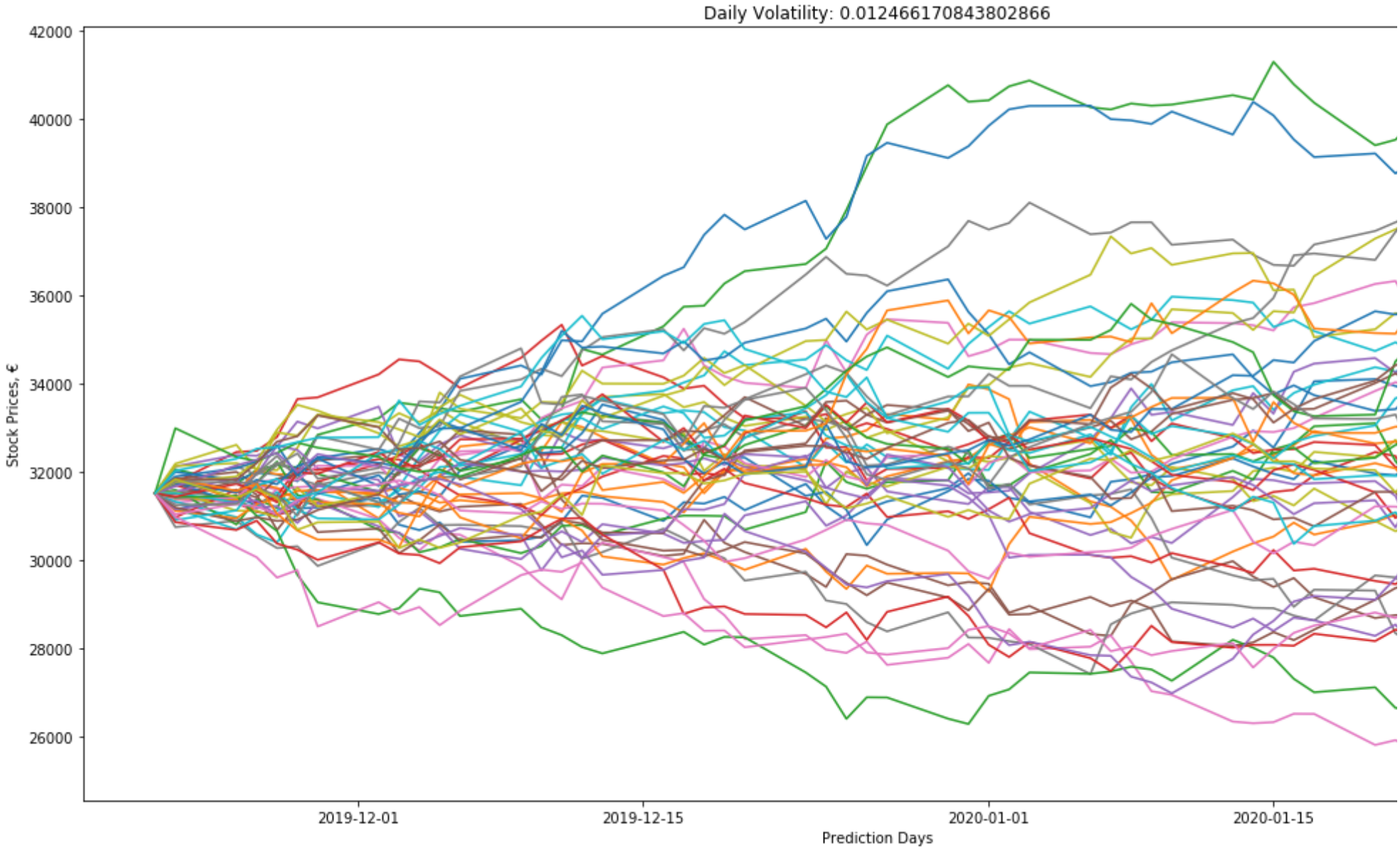

```
# Plotting the simulations
```

```
plt.figure(figsize = (20,10))
for i in range(scen_size):
    plt.title("Daily Volatility: " + str(sigma))
    plt.plot(pd.date_range(start = BBCA["Date"].max(),
                end = pred_end_date, freq = 'D').map(lambda x:
                x if x.isoweekday() in range(1, 6) else np.nan).dropna(), S[i, :])
    plt.ylabel('Stock Prices, RP')
    plt.xlabel('Prediction Days')
plt.show()
```


Daily Volatility: 0.012466170843802866
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40000
38000
36000
34000
32000
30000
28000
26000
Stock Prices, €
2019-12-01
2019-12-15
2020-01-01
2020-01-15
Prediction Days