```python
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')
```

Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redire

Enter your authorization code:
....
Mounted at /content/gdrive

```python
start_date = '1976-8-18'
end_date = '2019-12-3'
pred_end_date = '2020-12-3'


Toyota =  pd.read_csv('gdrive/My Drive/ToyotaKuyKuy.csv')


print(Toyota)
```

```
             Date        Open        High    ...        Close   Adj Close  Volume
0        8/18/1976    2.562200    2.562200    ...     2.562200    1.490914   19500
1        8/19/1976    2.549578    2.549578    ...     2.549578    1.483570     500
2        8/20/1976    2.536956    2.536956    ...     2.536956    1.476225    8000
3        8/23/1976    2.461226    2.461226    ...     2.461226    1.432159    1000
4        8/24/1976    2.435982    2.435982    ...     2.435982    1.417470    7500
...            ...         ...         ...    ...          ...         ...     ...
10914   11/26/2019  141.979996  142.000000    ...   141.970001  141.970001   86400
10915   11/27/2019  141.490005  141.860001    ...   141.660004  141.660004  179900
10916   11/29/2019  140.149994  140.580002    ...   140.210007  140.210007  107800
10917    12/2/2019  141.350006  141.350006    ...   140.270004  140.270004  117800
10918    12/3/2019  140.509995  140.789993    ...   140.729996  140.729996  109300

[10919 rows x 7 columns]
```

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

```
             Date        Open        High    ...        Close   Adj Close  Volume
0       1976-08-18    2.562200    2.562200    ...     2.562200    1.490914   19500
1       1976-08-19    2.549578    2.549578    ...     2.549578    1.483570     500
2       1976-08-20    2.536956    2.536956    ...     2.536956    1.476225    8000
3       1976-08-23    2.461226    2.461226    ...     2.461226    1.432159    1000
4       1976-08-24    2.435982    2.435982    ...     2.435982    1.417470    7500
...            ...         ...         ...    ...          ...         ...     ...
10914   2019-11-26  141.979996  142.000000    ...   141.970001  141.970001   86400
10915   2019-11-27  141.490005  141.860001    ...   141.660004  141.660004  179900
10916   2019-11-29  140.149994  140.580002    ...   140.210007  140.210007  107800
10917   2019-12-02  141.350006  141.350006    ...   140.270004  140.270004  117800
10918   2019-12-03  140.509995  140.789993    ...   140.729996  140.729996  109300

[10919 rows x 7 columns]
```

```python
print(Toyota.head())
print(Toyota.tail())
```

```
          Date      Open      High       Low     Close  Adj Close  Volume
0   1976-08-18  2.562200  2.562200  2.562200  2.562200   1.490914   19500
1   1976-08-19  2.549578  2.549578  2.549578  2.549578   1.483570     500
2   1976-08-20  2.536956  2.536956  2.536956  2.536956   1.476225    8000
3   1976-08-23  2.461226  2.461226  2.461226  2.461226   1.432159    1000
4   1976-08-24  2.435982  2.435982  2.435982  2.435982   1.417470    7500
            Date        Open        High    ...        Close   Adj Close  Volume
10914 2019-11-26  141.979996  142.000000    ...   141.970001  141.970001   86400
10915 2019-11-27  141.490005  141.860001    ...   141.660004  141.660004  179900
10916 2019-11-29  140.149994  140.580002    ...   140.210007  140.210007  107800
10917 2019-12-02  141.350006  141.350006    ...   140.270004  140.270004  117800
10918 2019-12-03  140.509995  140.789993    ...   140.729996  140.729996  109300

[5 rows x 7 columns]
```

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

```
[-0.004925837439315611, -0.004950895475104078, -0.02985046317465152, -0.010256542744206442, -0.010362829548420743, 0.0, 0.036649341557948016, -0.020202284155049
```

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

```
140.729996
```

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

```
[0.00041548 0.00083096 0.00124644 0.00166192 0.00207741 0.00249289
 0.00290837 0.00332385 0.00373933 0.00415481 0.00457029 0.00498577
 0.00540125 0.00581673 0.00623222 0.0066477  0.00706318 0.00747866
 0.00789414 0.00830962 0.0087251  0.00914058 0.00955606 0.00997154
 0.01038703 0.01080251 0.01121799 0.01163347 0.01204895 0.01246443
 0.01287991 0.01329539 0.01371087 0.01412636 0.01454184 0.01495732
 0.0153728  0.01578828 0.01620376 0.01661924 0.01703472 0.0174502
 0.01786568 0.01828117 0.01869665 0.01911213 0.01952761 0.01994309
 0.02035857 0.02077405 0.02118953 0.02160501 0.0220205  0.02243598
 0.02285146 0.02326694 0.02368242 0.0240979  0.02451338 0.02492886
 0.02534434 0.02575982 0.02617531 0.02659079 0.02700627 0.02742175
 0.02783723 0.02825271 0.02866819 0.02908367 0.02949915 0.02991463
 0.03033012 0.0307456  0.03116108 0.03157656 0.03199204 0.03240752
 0.032823   0.03323848 0.03365396 0.03406945 0.03448493 0.03490041
 0.03531589 0.03573137 0.03614685 0.03656233 0.03697781 0.03739329
 0.03780877 0.03822426 0.03863974 0.03905522 0.0394707  0.03988618
 0.04030166 0.04071714 0.04113262 0.0415481  0.04196358 0.04237907
 0.04279455 0.04321003 0.04362551 0.04404099 0.04445647 0.04487195
 0.04528743 0.04570291 0.0461184  0.04653388 0.04694936 0.04736484
 0.04778032 0.0481958  0.04861128 0.04902676 0.04944224 0.04985772
 0.05027321 0.05068869 0.05110417 0.05151965 0.05193513 0.05235061
 0.05276609 0.05318157 0.05359705 0.05401254 0.05442802 0.0548435
 0.05525898 0.05567446 0.05608994 0.05650542 0.0569209  0.05733638
 0.05775186 0.05816735 0.05858283 0.05899831 0.05941379 0.05982927
 0.06024475 0.06066023 0.06107571 0.06149119 0.06190667 0.06232216
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 0.08268073 0.08309621 0.08351169 0.08392717 0.08434265 0.08475813
 0.08517361 0.08558909 0.08600458 0.08642006 0.08683554 0.08725102
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 0.10262382 0.1030393  0.10345478 0.10387026 0.10428574 0.10470122
 0.1051167  0.10553218 0.10594767 0.10636315 0.10677863 0.10719411
```

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

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```python
# 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
print(S)
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  199.51906787]
 [140.729996   140.81144817 138.85010701 ... 168.1883672  168.49237002
  169.0282414 ]]
```

```python
# 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 = Toyota["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()
```

```
/usr/local/lib/python3.6/dist-packages/pandas/plotting/_matplotlib/converter.py:103: FutureWarning: Using an implicitly registered datetime converter for a matp

To register the converters:
        >>> from pandas.plotting import register_matplotlib_converters
        >>> register_matplotlib_converters()
    warnings.warn(msg, FutureWarning)
```