Financial Engineering Lab   MA – 374   Lab – 6

Name – Rasesh Srivastava

Roll Number – 210123072

Branch – Mathematics and Computing

Consider the data in databases "bsedata1" and "nsedata1" that you have already obtained. Now for each of the stocks and for each of the market indices do the following :

The stocks used are as follows:

10 stocks included in BSE (SENSEX) index:

- RELIANCE.BO: Reliance Industries Limited
- TCS.BO: Tata Consultancy Services Limited
- HDFCBANK.BO: HDFC Bank Limited
- HINDUNILVR.BO: Hindustan Unilever Limited
- INFY.BO: Infosys Limited
- KOTAKBANK.BO: Kotak Mahindra Bank Limited
- ICICIBANK.BO: ICICI Bank Limited
- LT.BO: Larsen & Toubro Limited
- AXISBANK.BO: Axis Bank Limited
- SBIN.BO: State Bank of India

10 stocks included in NSE (NIFTY) index:

- TCS.NS: Tata Consultancy Services Limited
- HINDUNILVR.NS: Hindustan Unilever Limited
- INFY.NS: Infosys Limited
- KOTAKBANK.NS: Kotak Mahindra Bank Limited
- ICICIBANK.NS: ICICI Bank Limited
- LT.NS: Larsen & Toubro Limited
- SBIN.NS: State Bank of India
- RELIANCE.NS: Reliance Industries Limited
- ITC.NS: ITC Limited
- ONGC.NS: Oil and Natural Gas Corporation Limited

10 stocks not included in BSE (SENSEX) index:

- GOOGL: Alphabet Inc. (Google)
- AAPL: Apple Inc.
- AMZN: Amazon.com Inc.
- MSFT: Microsoft Corporation
- NVDA: NVIDIA Corporation
- ADBE: Adobe Inc.
- NFLX: Netflix Inc.
- TSLA: Tesla Inc.
- ORCL: Oracle Corporation
- CSCO: Cisco Systems Inc.

10 stocks not included in NSE (NIFTY) index:

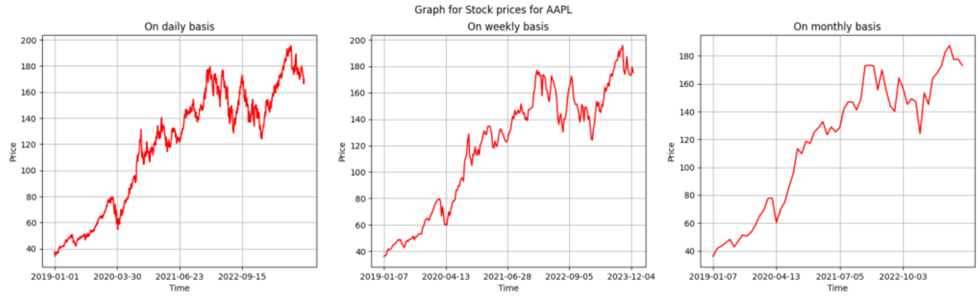
- NKE: NIKE Inc.
- BIDU: Baidu Inc.
- NVDA: NVIDIA Corporation
- KO: The Coca-Cola Company
- PYPL: PayPal Holdings Inc.
- SNAP: Snap Inc.
- MCD: McDonald's Corporation
- WMT: Walmart Inc.
- BABA: Alibaba Group Holding Limited
- PEP: PepsiCo Inc.

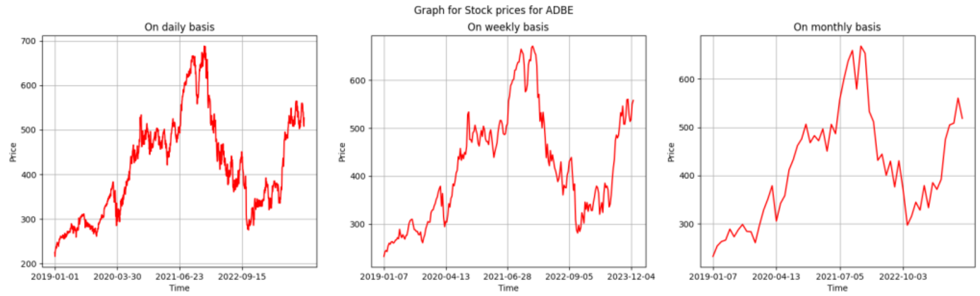
```
stocksInBSEindex = ['RELIANCE.BO', 'TCS.BO', 'HDFCBANK.BO', 'HINDUNILVR.BO', 'INFY.BO','KOTAKBANK.BO', 'ICICIBANK.BO', 'LT.BO', 'AXISBANK.BO', 'SBIN.BO']
stocksNotInBSEindex = ['GOOGL', 'AAPL', 'AMZN', 'MSFT', 'NVDA', 'ADBE', 'NFLX', 'TSLA', 'ORCL', 'CSCO']
stocksInNSEindex = ['RELIANCE.NS', 'TCS.NS', 'HINDUNILVR.NS', 'INFY.NS','KOTAKBANK.NS', 'ICICIBANK.NS', 'LT.NS', 'SBIN.NS', 'ITC.NS', 'ONGC.NS']
stocksNotInNSEindex = ['NKE', 'BIDU', 'NVDA', 'KO', 'PYPL', 'SNAP', 'MCD', 'WMT', 'BABA', 'PEP']
```

Question 1:

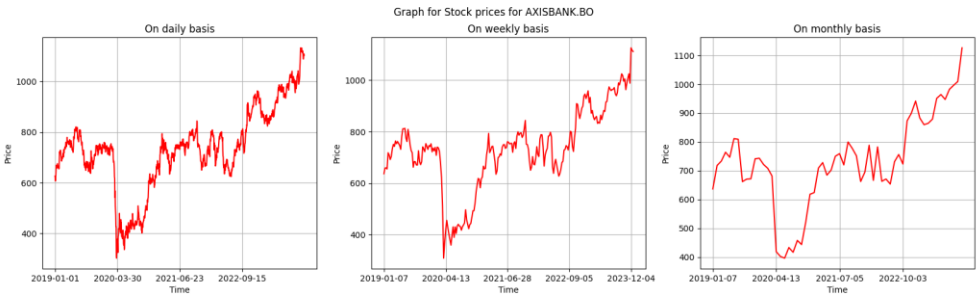
1. Plot the prices against time (daily, weekly and monthly).

The plots for the Stock Prices and BSE Index (Sensex) for the data in bsedata1.csv are as follows:

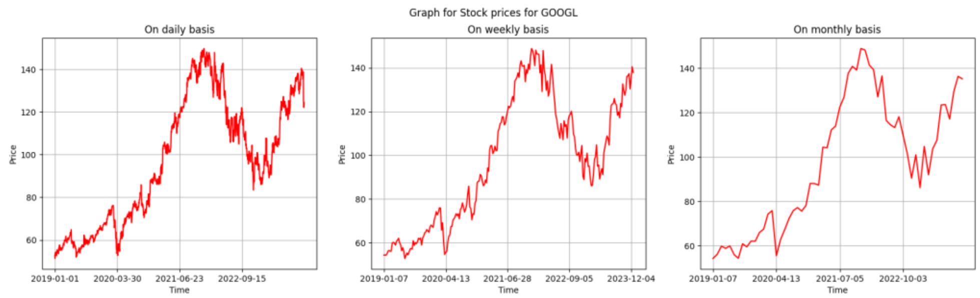

Graph for Stock prices for AAPL
On daily basis
On weekly basis
On monthly basis
Price
Time
2019-01-01 2020-03-30 2021-06-23 2022-09-15
2019-01-07 2020-04-13 2021-06-28 2022-09-05 2023-12-04
2019-01-07 2020-04-13 2021-07-05 2022-10-03

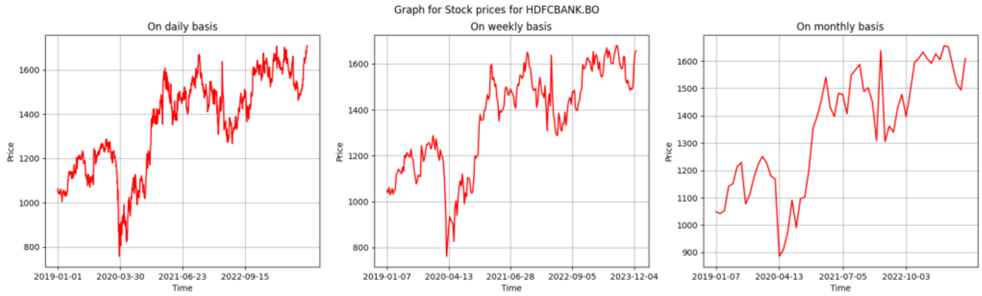

Graph for Stock prices for ADBE
On daily basis
On weekly basis
On monthly basis
Price
Time
2019-01-01 2020-03-30 2021-06-23 2022-09-15
2019-01-07 2020-04-13 2021-06-28 2022-09-05 2023-12-04
2019-01-07 2020-04-13 2021-07-05 2022-10-03

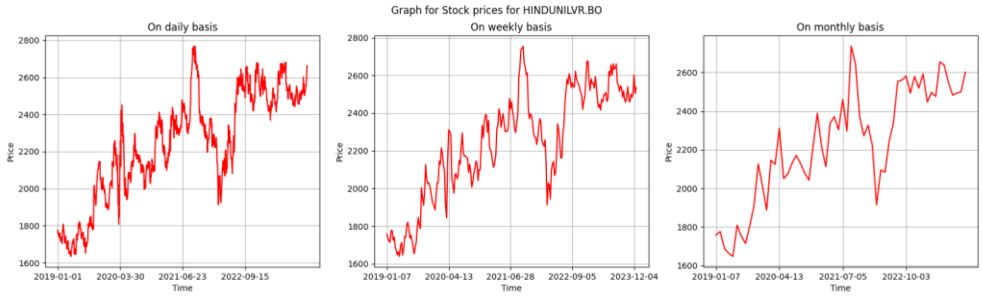

Graph for Stock prices for AMZN
On daily basis
On weekly basis
On monthly basis
Price
Time
2019-01-01 2020-03-30 2021-06-23 2022-09-15
2019-01-07 2020-04-13 2021-06-28 2022-09-05 2023-12-04
2019-01-07 2020-04-13 2021-07-05 2022-10-03

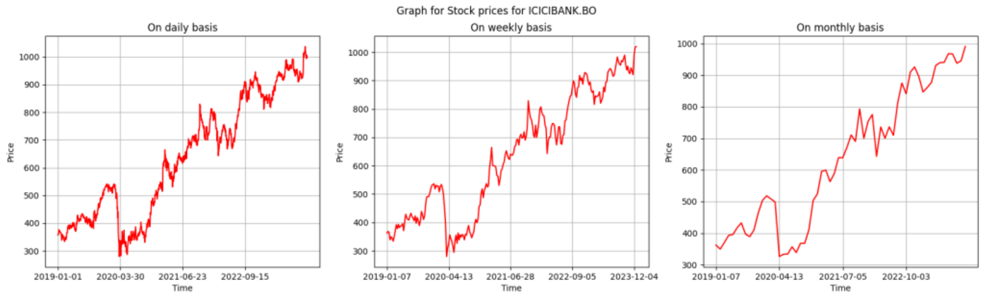

Graph for Stock prices for AXISBANK.BO
On daily basis
On weekly basis
On monthly basis
Price
Time
2019-01-01 2020-03-30 2021-06-23 2022-09-15
2019-01-07 2020-04-13 2021-06-28 2022-09-05 2023-12-04
2019-01-07 2020-04-13 2021-07-05 2022-10-03

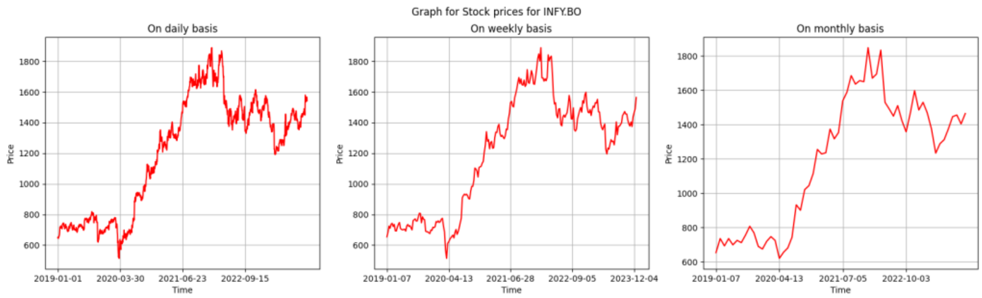

Graph for Stock prices for CSCO
On daily basis
On weekly basis
On monthly basis
Price
Time
2019-01-01 2020-03-30 2021-06-23 2022-09-15
2019-01-07 2020-04-13 2021-06-28 2022-09-05 2023-12-04
2019-01-07 2020-04-13 2021-07-05 2022-10-03

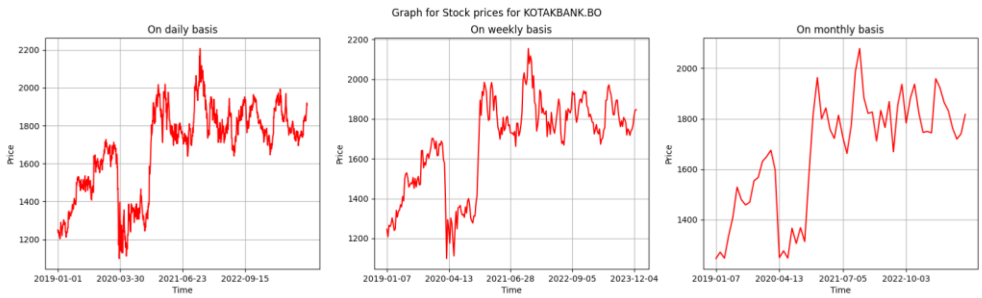

Graph for Stock prices for GOOGL
On daily basis
On weekly basis
On monthly basis
Price
Time
2019-01-01 2020-03-30 2021-06-23 2022-09-15
2019-01-07 2020-04-13 2021-06-28 2022-09-05 2023-12-04
2019-01-07 2020-04-13 2021-07-05 2022-10-03

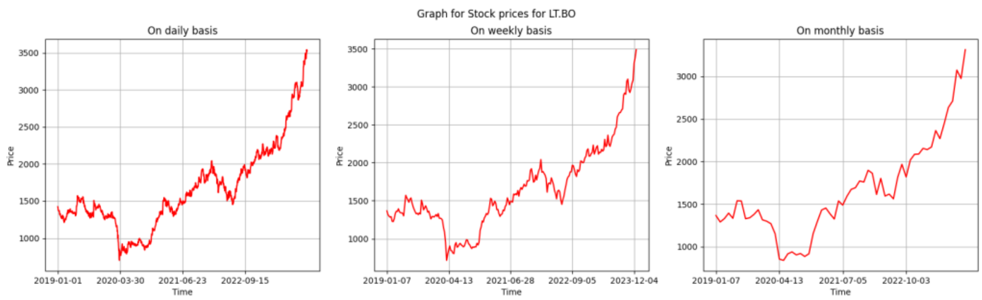

Graph for Stock prices for HDFCBANK.BO
On daily basis
On weekly basis
On monthly basis
Price
Time

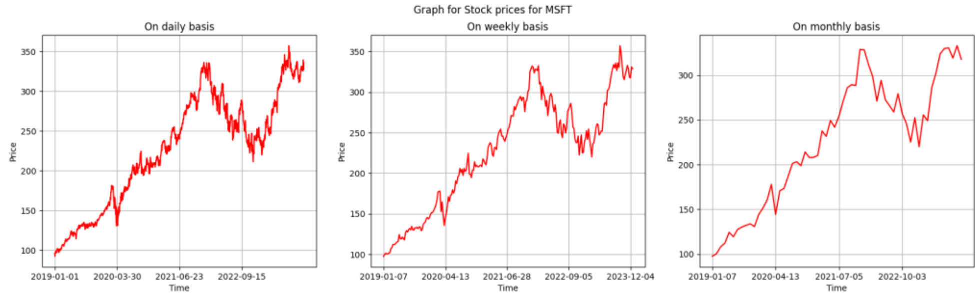

Graph for Stock prices for HINDUNILVR.BO
On daily basis
On weekly basis
On monthly basis
Price
Time

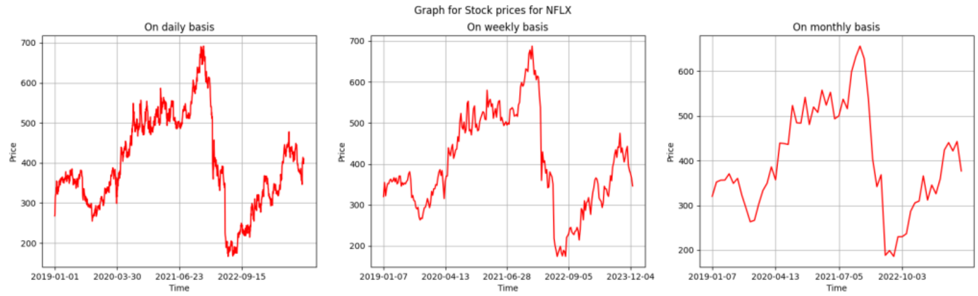

Graph for Stock prices for ICICIBANK.BO
On daily basis
On weekly basis
On monthly basis
Price
Time

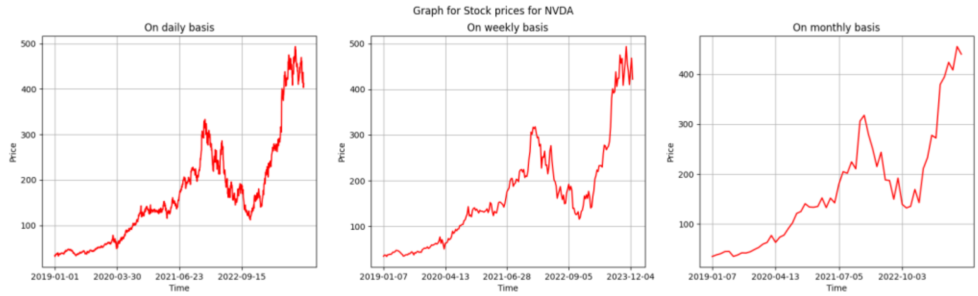

Graph for Stock prices for INFY.BO
On daily basis
On weekly basis
On monthly basis
Price
Time

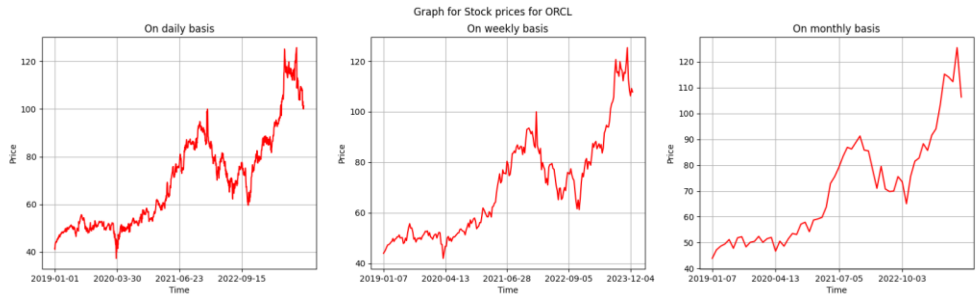

Graph for Stock prices for KOTAKBANK.BO
On daily basis
On weekly basis
On monthly basis
Price
Time

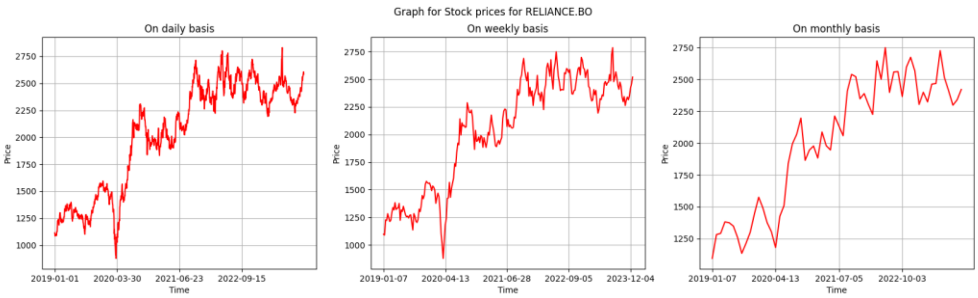

Graph for Stock prices for LT.BO
On daily basis
On weekly basis
On monthly basis
Price
Time

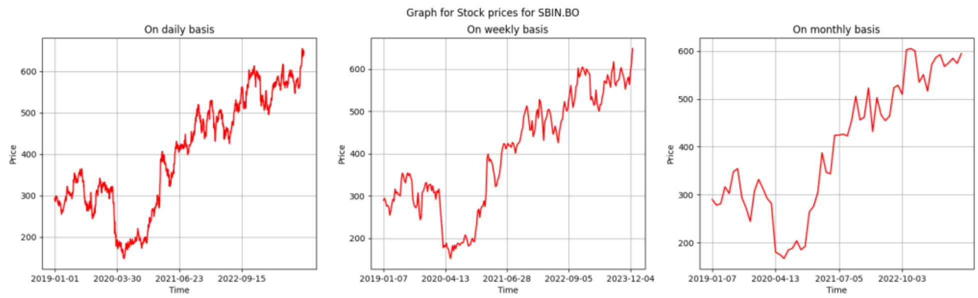

Graph for Stock prices for MSFT
On daily basis
On weekly basis
On monthly basis
Price
Time

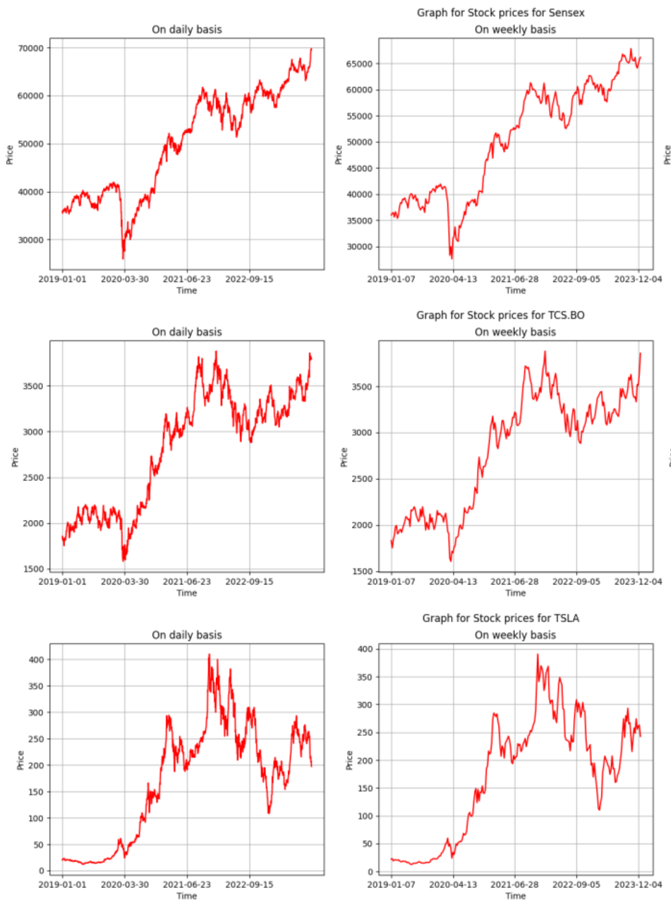

Graph for Stock prices for NFLX
On daily basis
On weekly basis
On monthly basis
Price
Time


Graph for Stock prices for NVDA
On daily basis
On weekly basis
On monthly basis
Price
Time

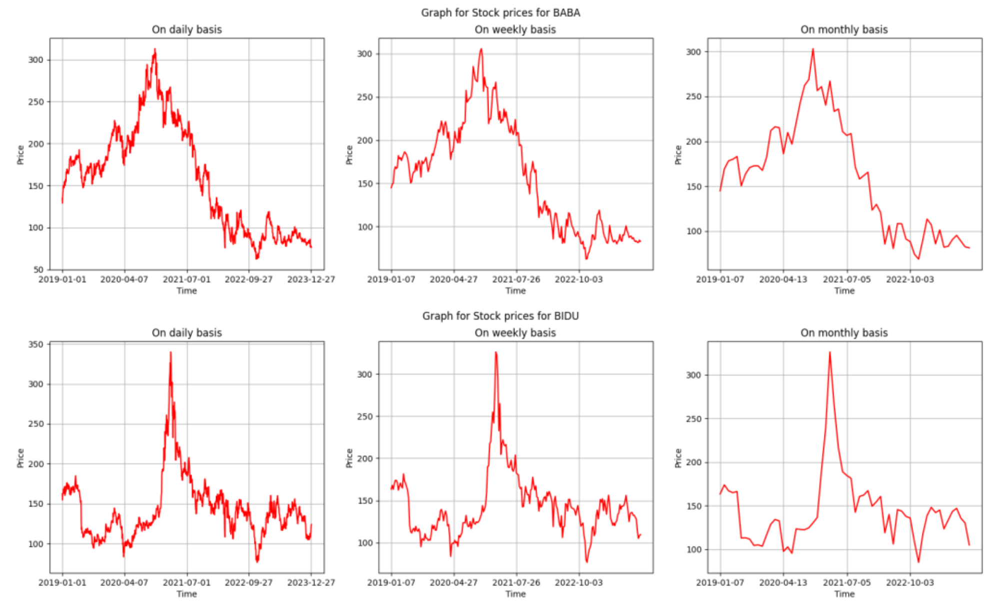

Graph for Stock prices for ORCL
On daily basis
On weekly basis
On monthly basis
Price
Time

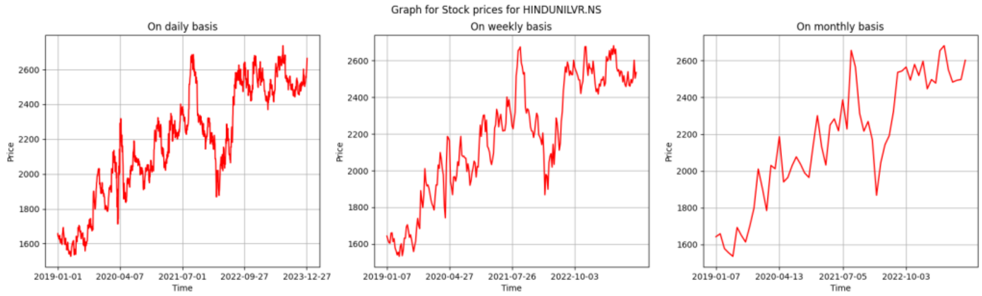

Graph for Stock prices for RELIANCE.BO
On daily basis
On weekly basis
On monthly basis
Price
Time

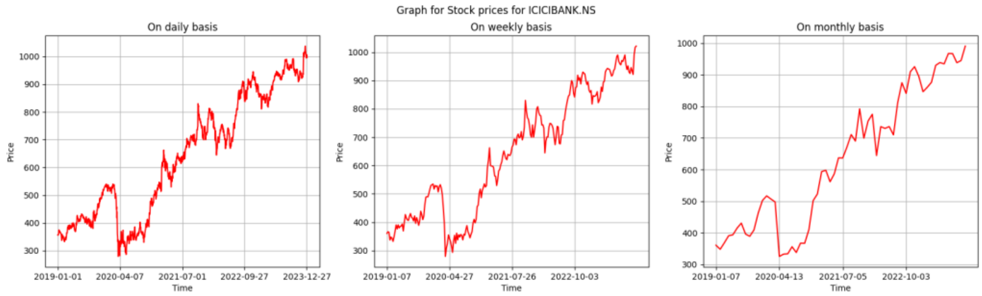

Graph for Stock prices for SBIN.BO
On daily basis
On weekly basis
On monthly basis
Price
Time

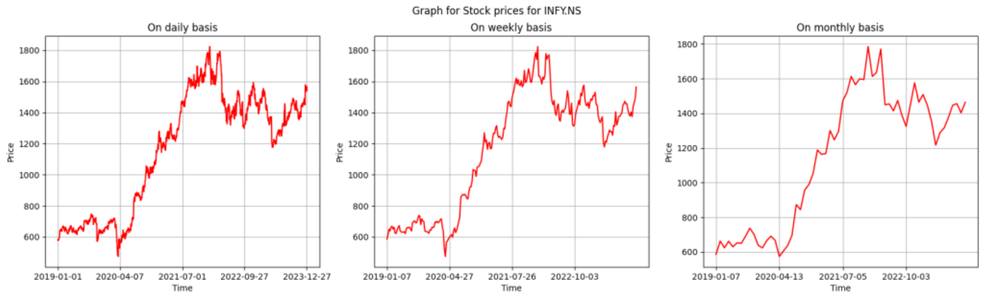


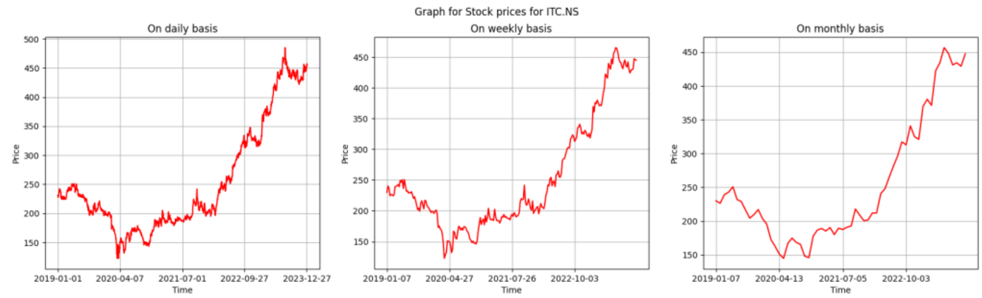
The plots for the Stock Prices and NSE Index (Nifty) for the data in nsedata1.csv are as follows:

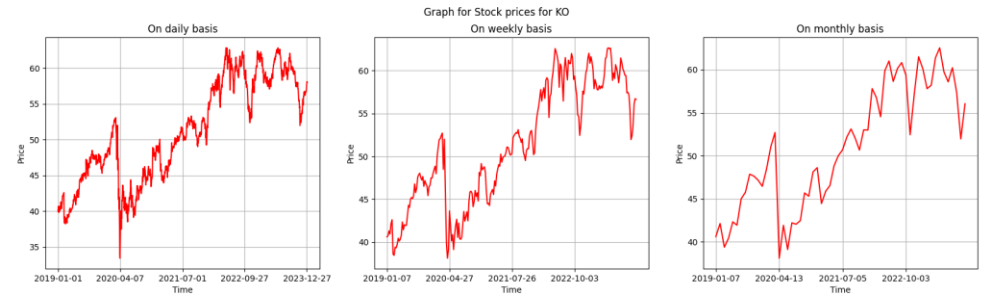


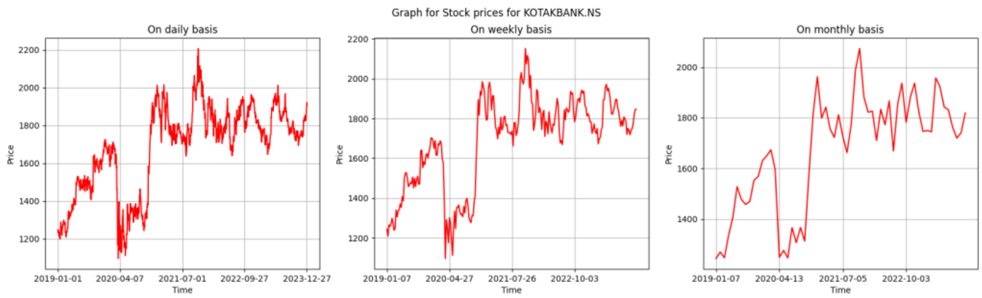

Graph for Stock prices for HINDUNILVR.NS
On daily basis
On weekly basis
On monthly basis
Price
Time


Graph for Stock prices for ICICIBANK.NS
On daily basis
On weekly basis
On monthly basis
Price
Time


Graph for Stock prices for INFY.NS
On daily basis
On weekly basis
On monthly basis
Price
Time


Graph for Stock prices for ITC.NS
On daily basis
On weekly basis
On monthly basis
Price
Time

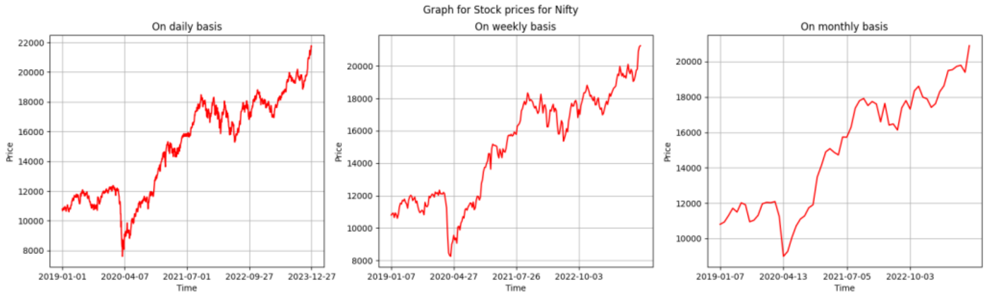

Graph for Stock prices for KO
On daily basis
On weekly basis
On monthly basis
Price
Time


Graph for Stock prices for KOTAKBANK.NS
On daily basis
On weekly basis
On monthly basis
Price
Time

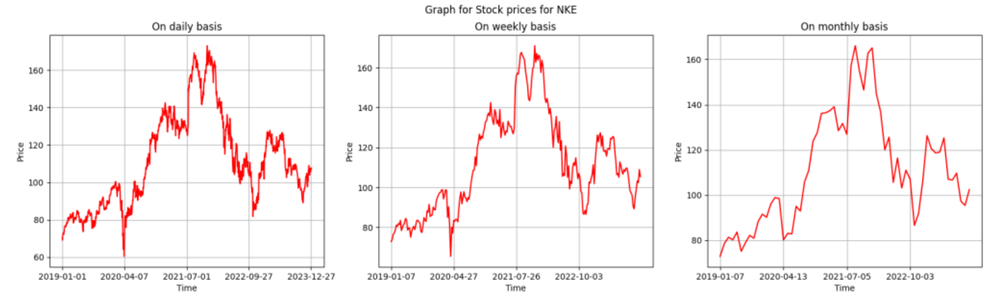
Graph for Stock prices for LT.NS

Graph for Stock prices for MCD

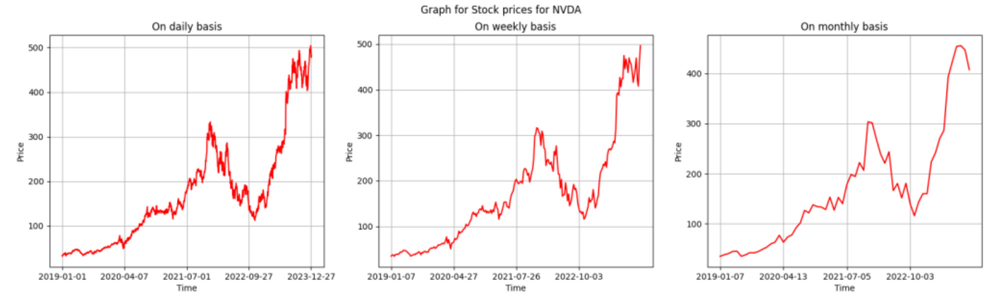
Graph for Stock prices for Nifty



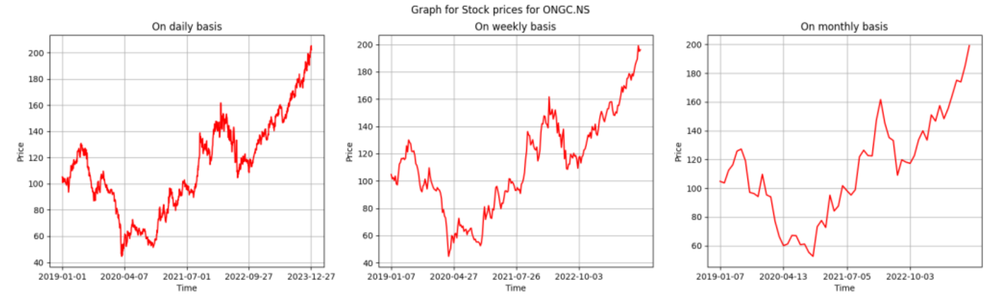
Graph for Stock prices for NKE

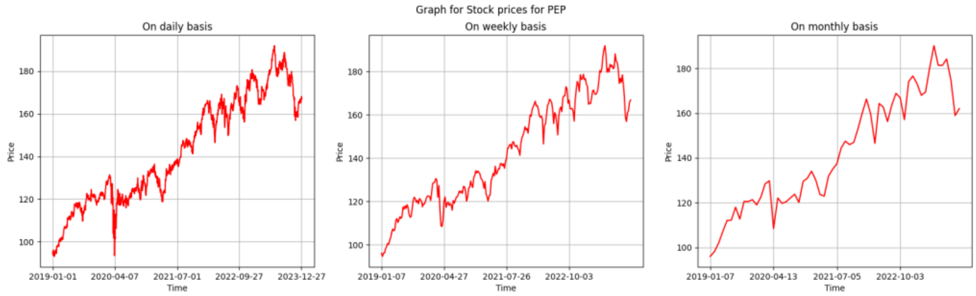


Graph for Stock prices for NVDA

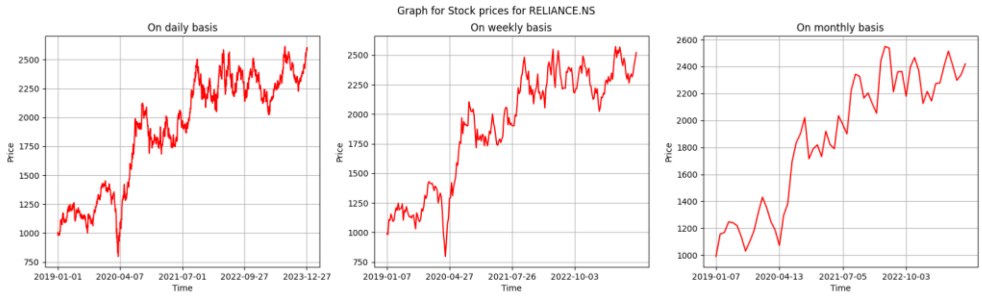


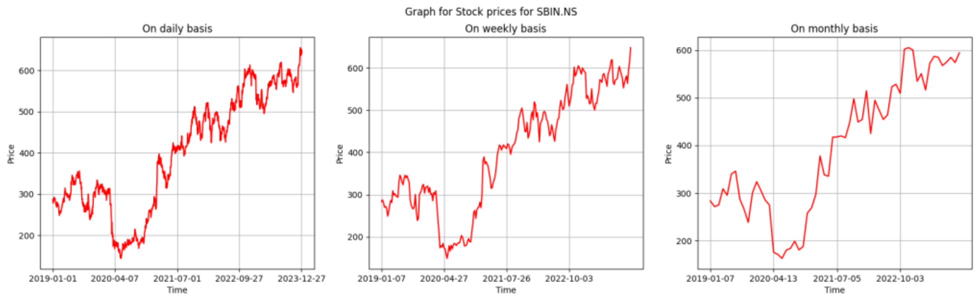
Graph for Stock prices for ONGC.NS

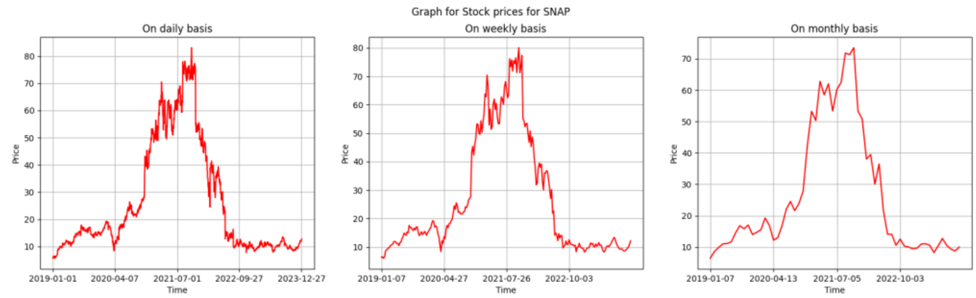


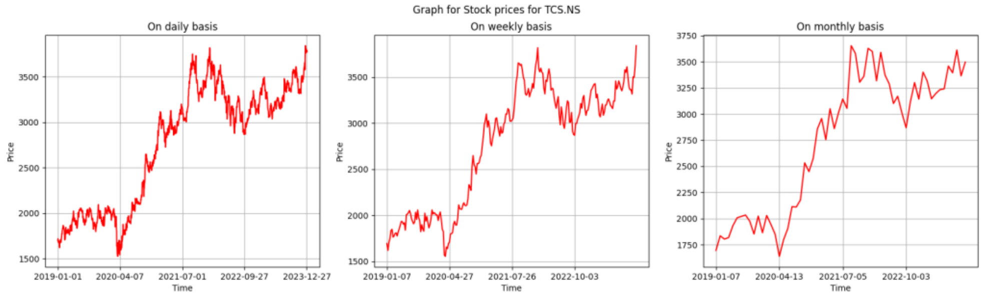

Graph for Stock prices for PEP
On daily basis
On weekly basis
On monthly basis
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2020-04-13
2021-07-05

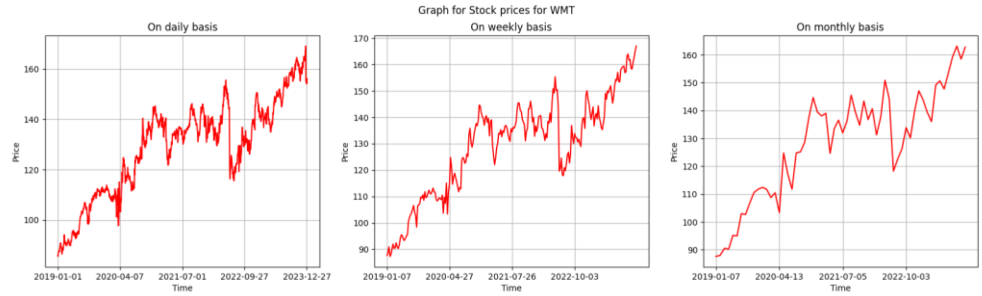

Graph for Stock prices for PYPL
On daily basis
On weekly basis
On monthly basis
Price
Time


Graph for Stock prices for RELIANCE.NS
On daily basis
On weekly basis
On monthly basis
Price
Time


Graph for Stock prices for SBIN.NS
On daily basis
On weekly basis
On monthly basis
Price
Time


Graph for Stock prices for SNAP
On daily basis
On weekly basis
On monthly basis
Price
Time





<u>Question 2</u>:

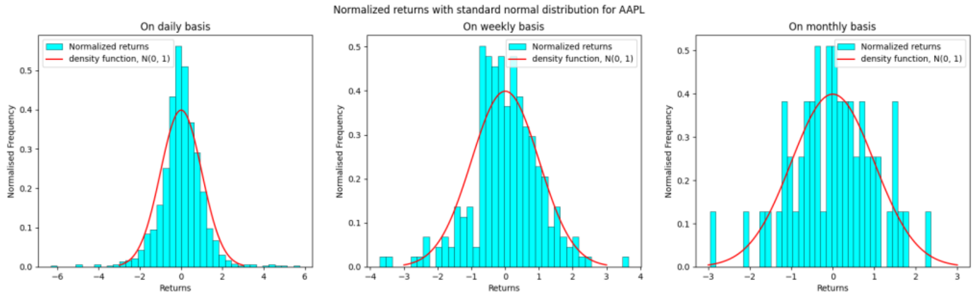
2. Compute the returns R_i (daily, weekly and monthly) and plot histograms of normalized returns

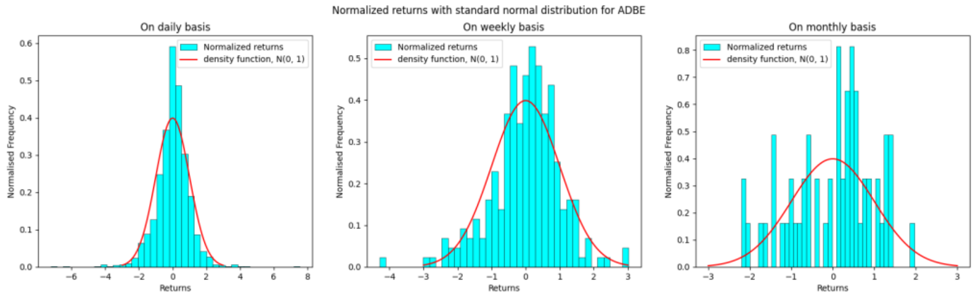
$$\widehat{R}_i = \frac{R_i - \mu}{\sigma},$$

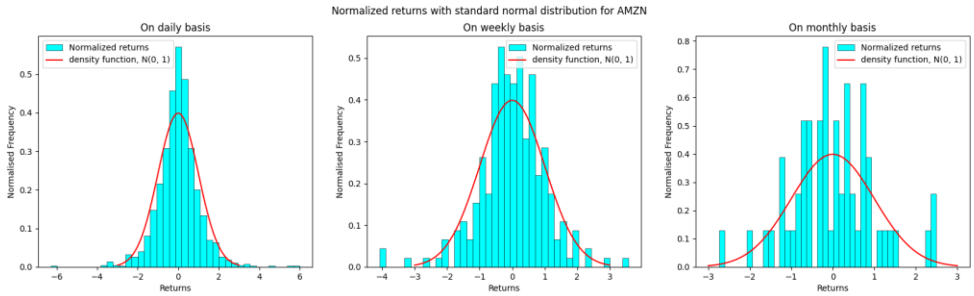
where μ and σ are sample mean and sample standard deviation respectively. Superimpose on each of these histograms a graph of the density function $\mathcal{N}(0, 1)$.

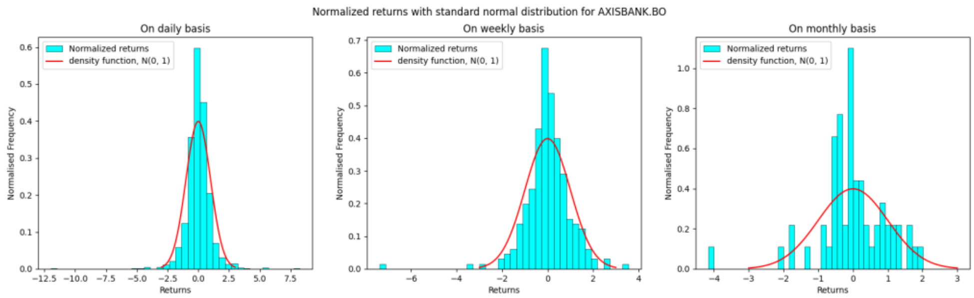
Now, zoom into the tails of all these plots. What are your observations ?

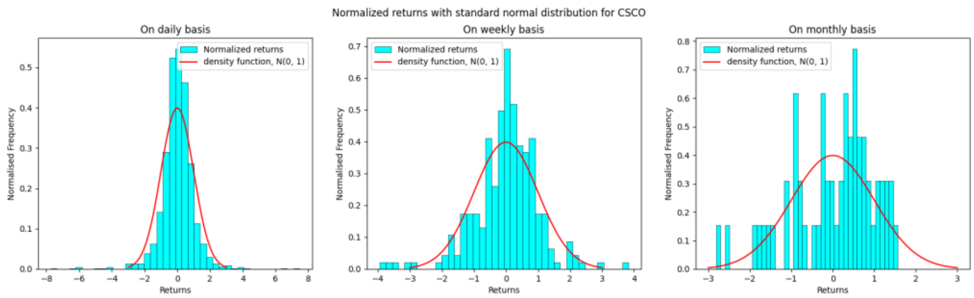
The histograms of the normalized returns superimposed by a graph of the density function N(0,1) for the data in bsedata1.csv are as follows:

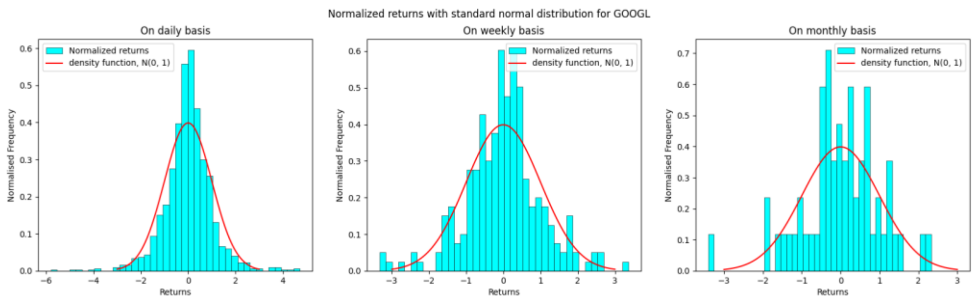

Normalized returns with standard normal distribution for AAPL
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

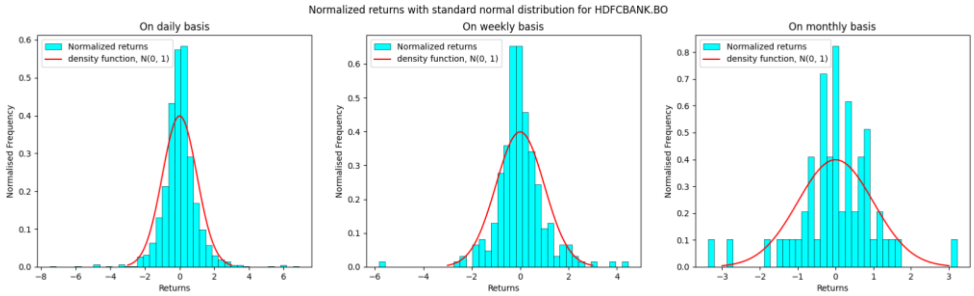

Normalized returns with standard normal distribution for ADBE
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

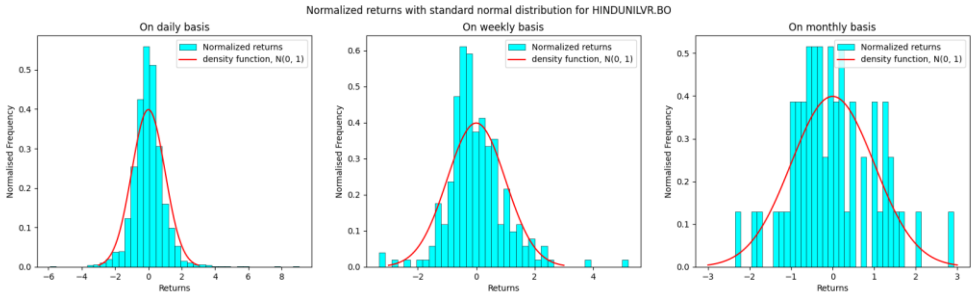

Normalized returns with standard normal distribution for AMZN
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

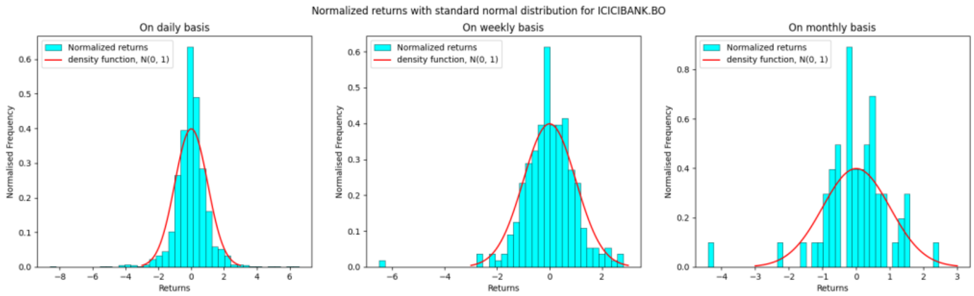

Normalized returns with standard normal distribution for AXISBANK.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

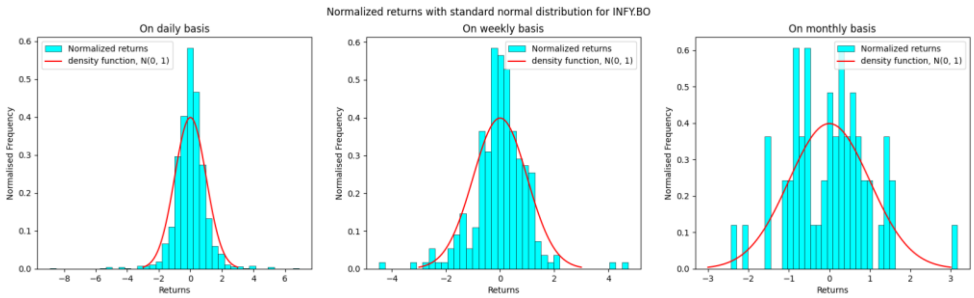

Normalized returns with standard normal distribution for CSCO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

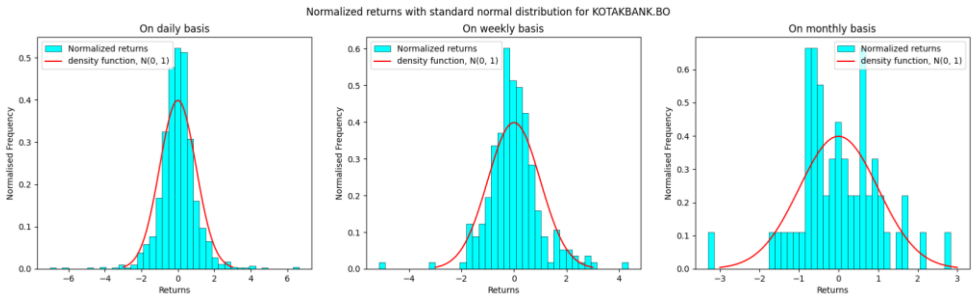

Normalized returns with standard normal distribution for GOOGL
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

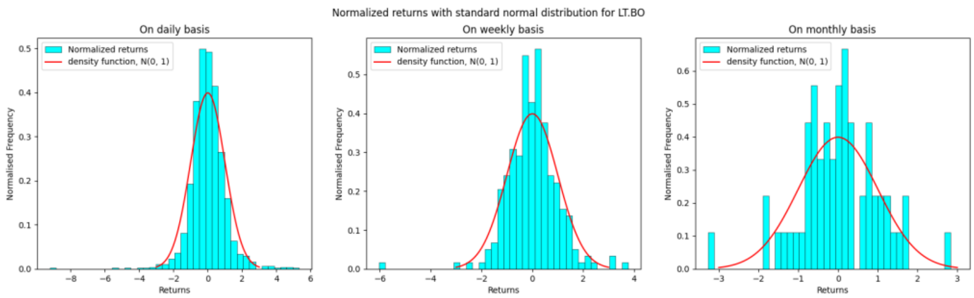

Normalized returns with standard normal distribution for HDFCBANK.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

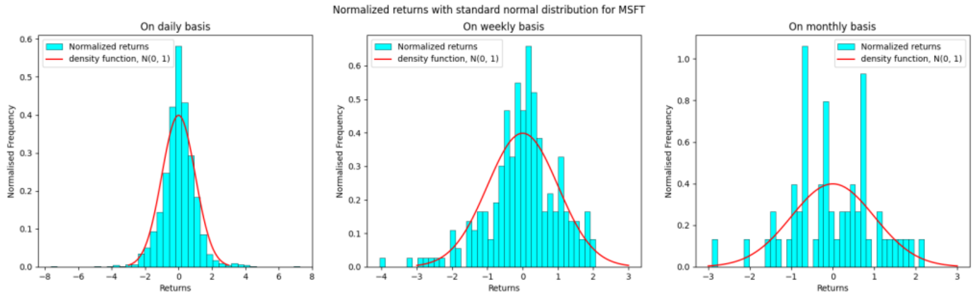

Normalized returns with standard normal distribution for HINDUNILVR.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

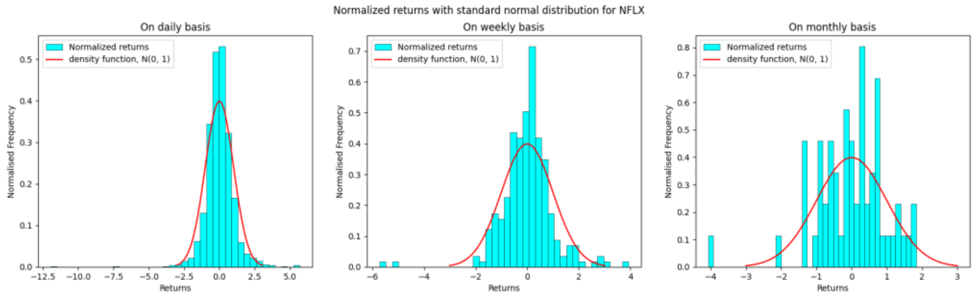

Normalized returns with standard normal distribution for ICICIBANK.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

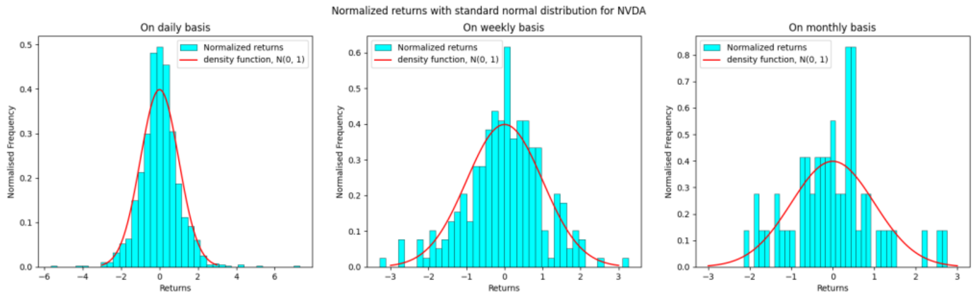

Normalized returns with standard normal distribution for INFY.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

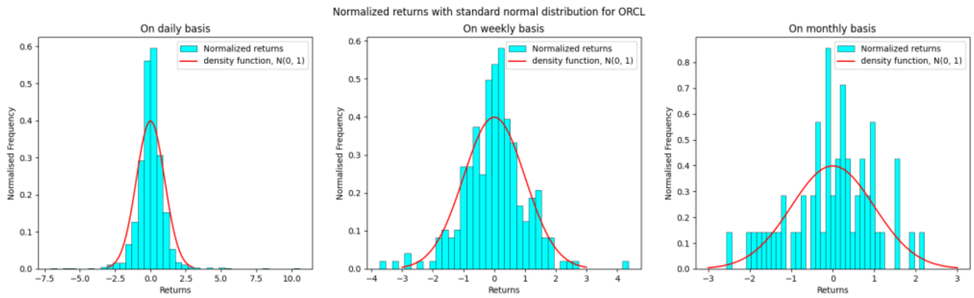

Normalized returns with standard normal distribution for KOTAKBANK.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

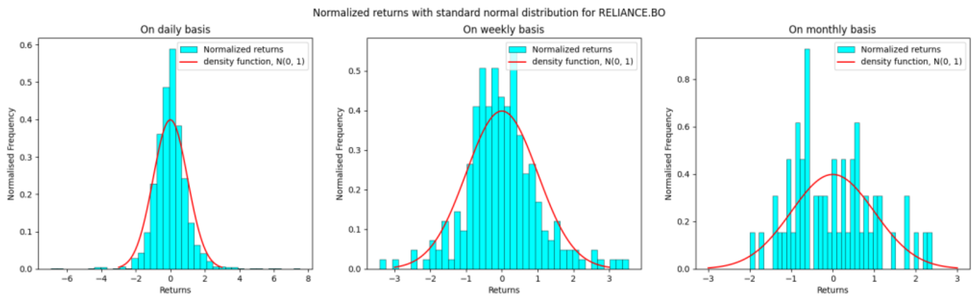

Normalized returns with standard normal distribution for LT.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

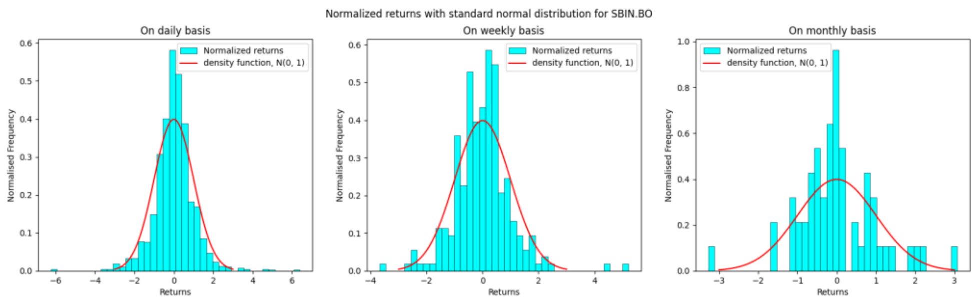

Normalized returns with standard normal distribution for MSFT
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

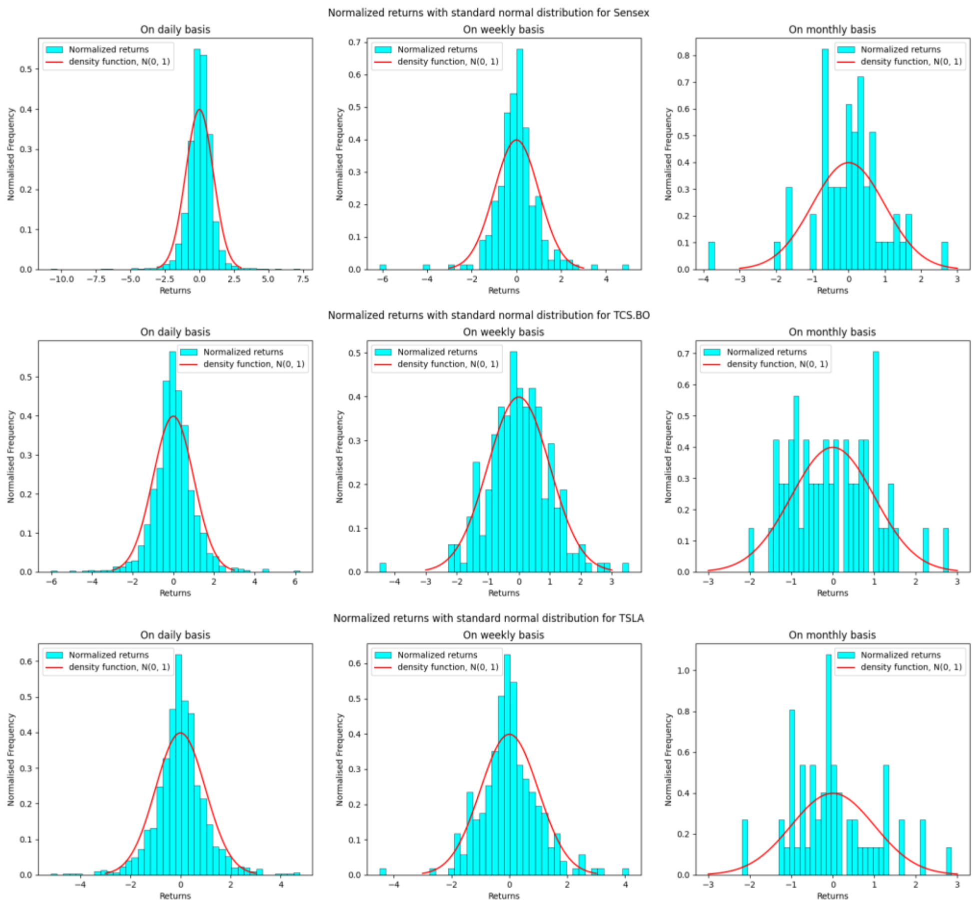

Normalized returns with standard normal distribution for NFLX
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for NVDA
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

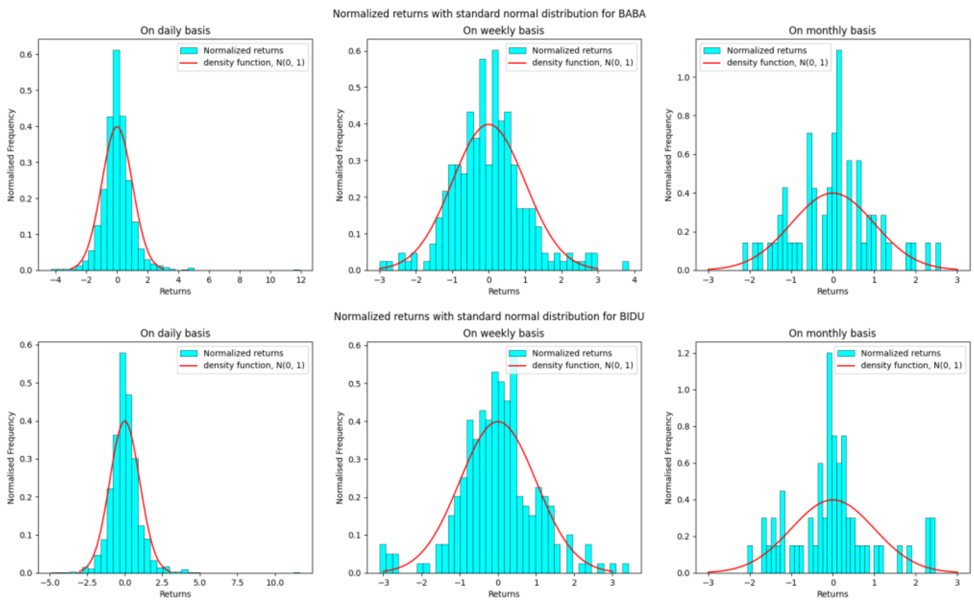

Normalized returns with standard normal distribution for ORCL
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

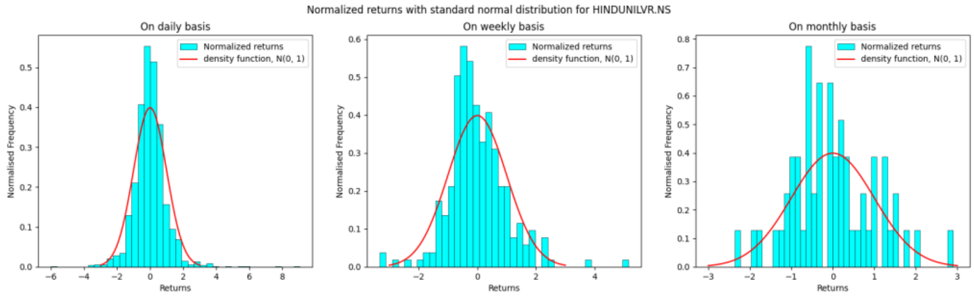

Normalized returns with standard normal distribution for RELIANCE.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

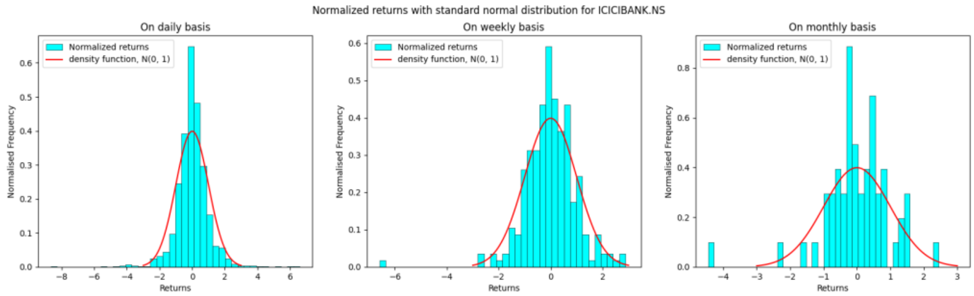

Normalized returns with standard normal distribution for SBIN.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

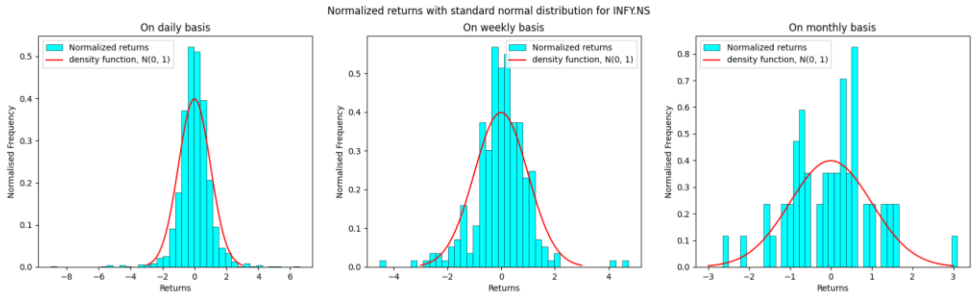


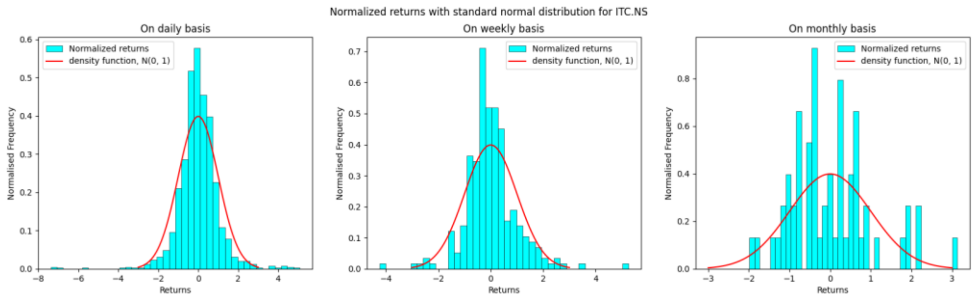
The histograms of the normalized returns superimposed by a graph of the density function N(0,1) for the data in nsedata1.csv are as follows:

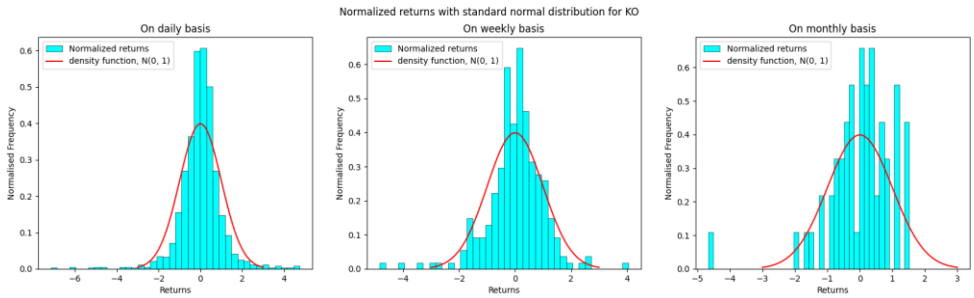


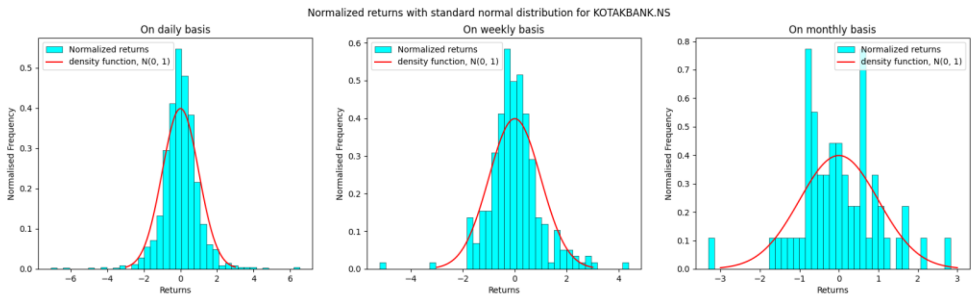

Normalized returns with standard normal distribution for HINDUNILVR.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for ICICIBANK.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

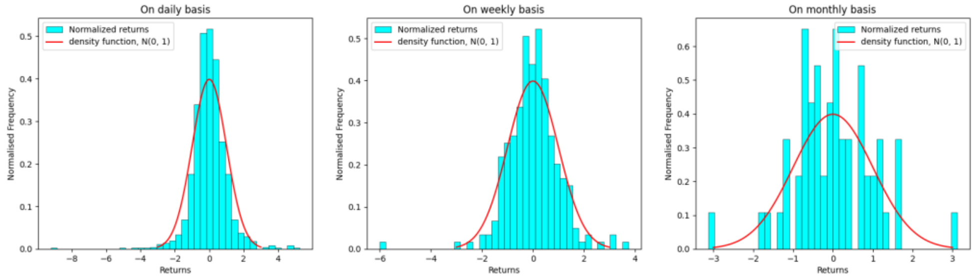

Normalized returns with standard normal distribution for INFY.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for ITC.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

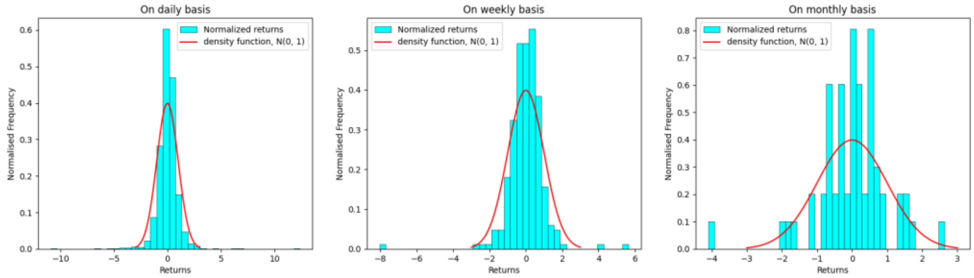

Normalized returns with standard normal distribution for KO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for KOTAKBANK.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

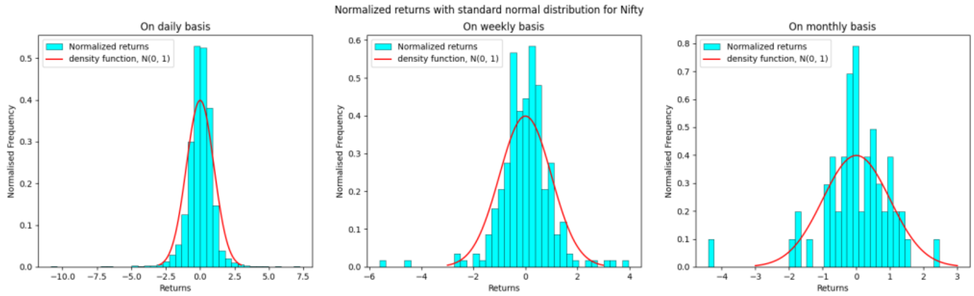
Normalized returns with standard normal distribution for LT.NS



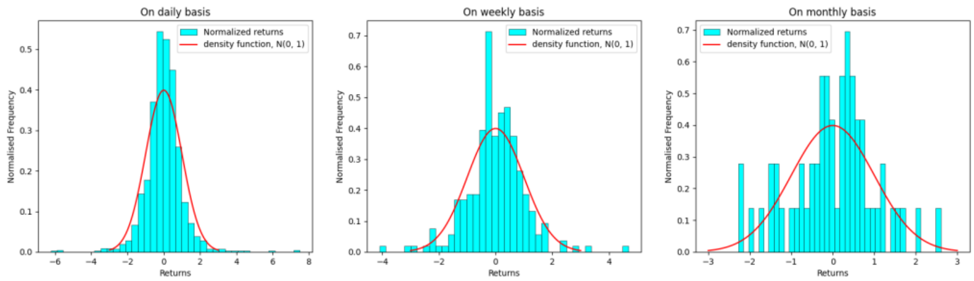
Normalized returns with standard normal distribution for MCD



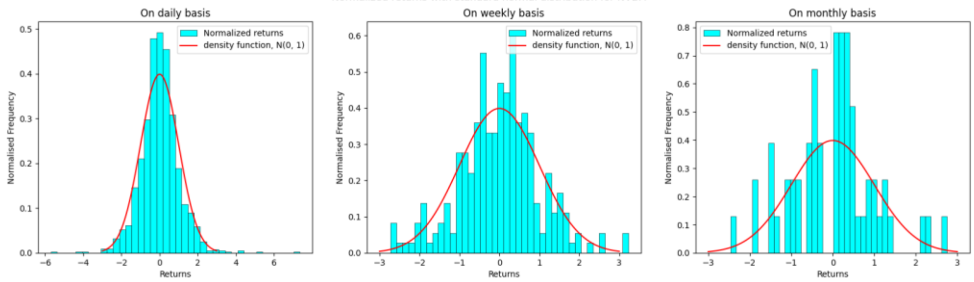
Normalized returns with standard normal distribution for Nifty



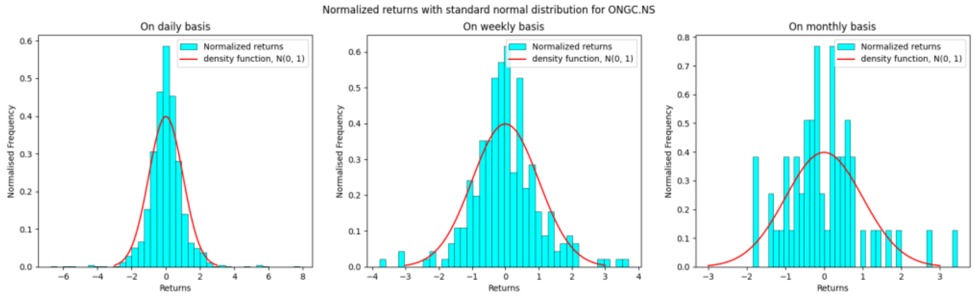
Normalized returns with standard normal distribution for NKE

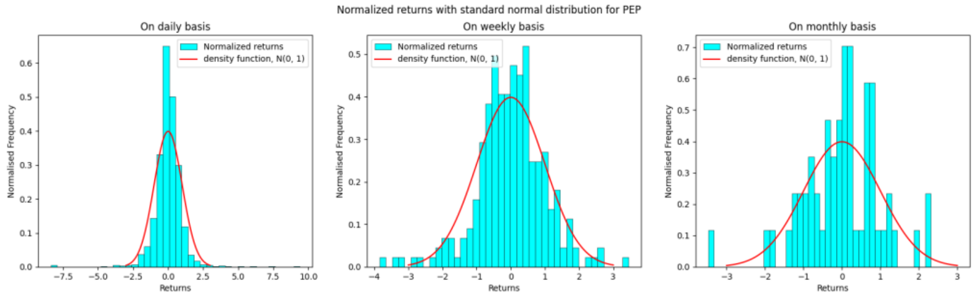


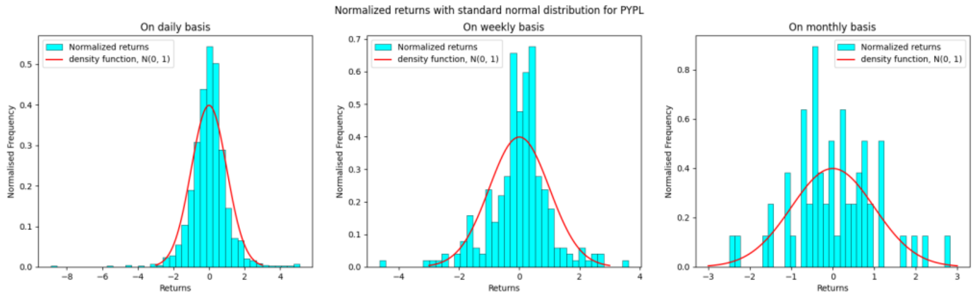
Normalized returns with standard normal distribution for NVDA

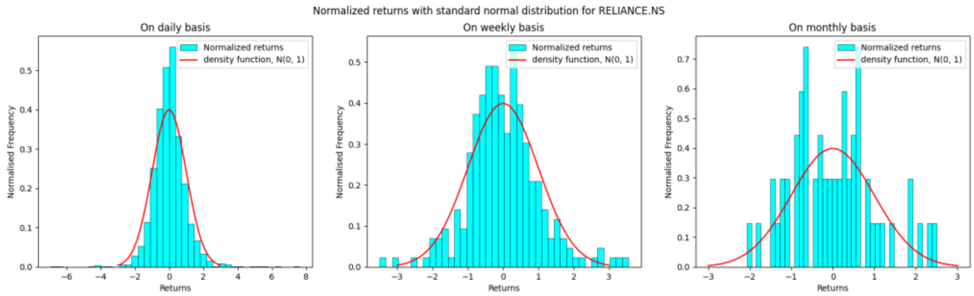


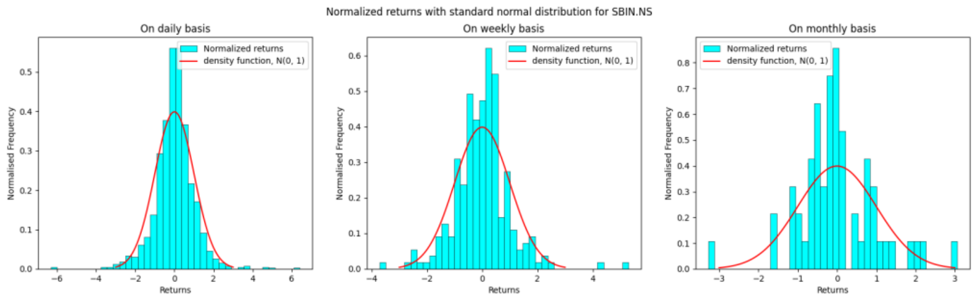
Normalized returns with standard normal distribution for ONGC.NS

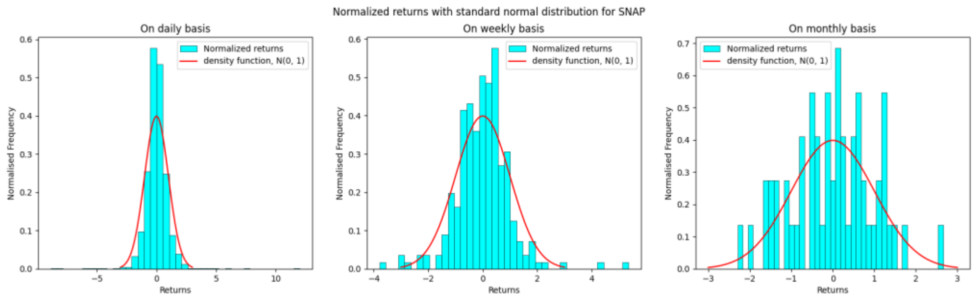


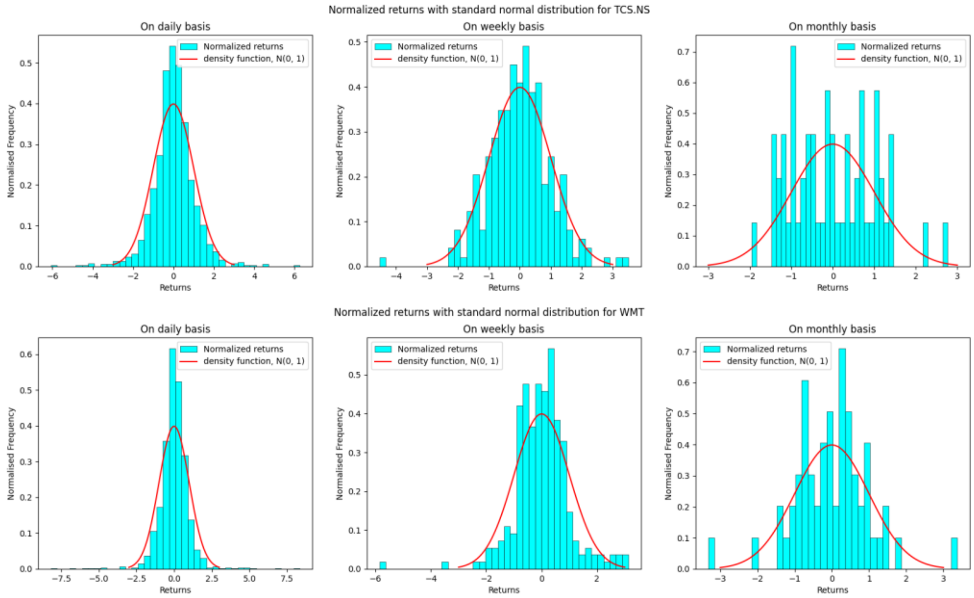

Normalized returns with standard normal distribution for PEP
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for PYPL
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for RELIANCE.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for SBIN.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for SNAP
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns



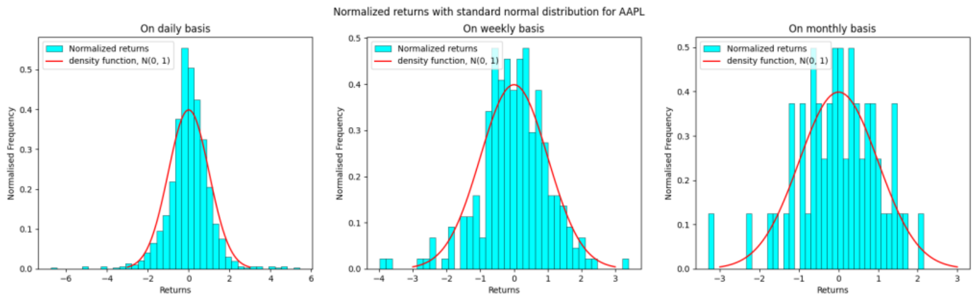
Observations:

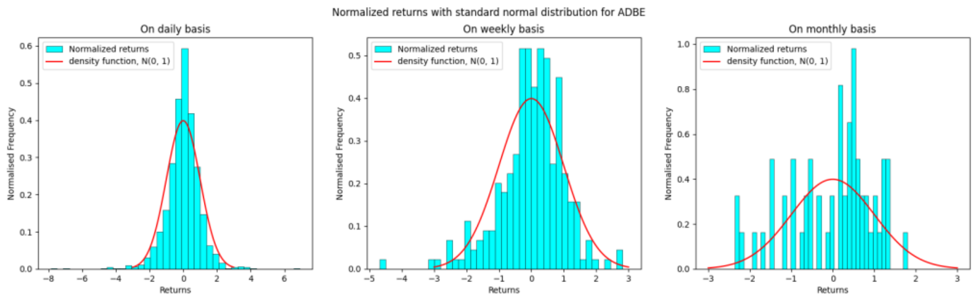
- The accuracy of the N(0, 1) in estimating normalized returns is notably higher when computed on a daily basis rather than weekly or monthly intervals.
- The deviations arise from random fluctuations in real-world market dynamics, rendering a simplistic Gaussian distribution inadequate for complete modeling.
- Examination of the tails of these distributions reveals notable discrepancies. While the N(0, 1) curve sharply declines to zero, actual returns exhibit persistence. We can observe more deviations at the tails. This suggests a need for a more sophisticated model incorporating a blend of distributions to account for these variations.
- This phenomenon, known as leptokurtic behavior, entails elevated peaks and heavier tails.

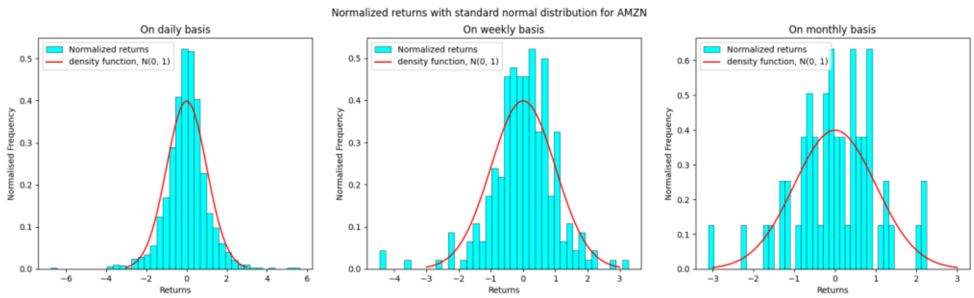
Question 3:

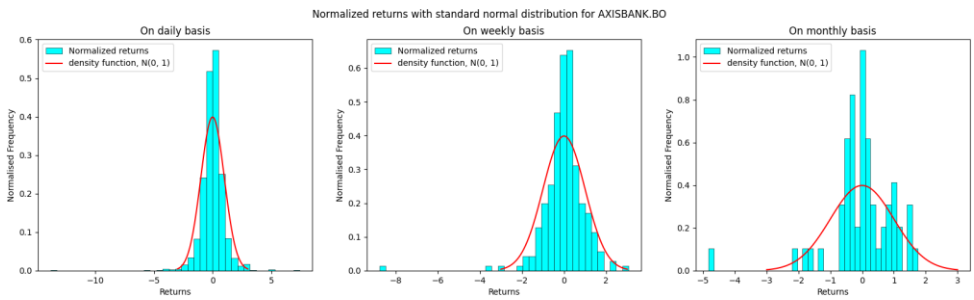
3. Will the observations be different if you instead use the log returns ?

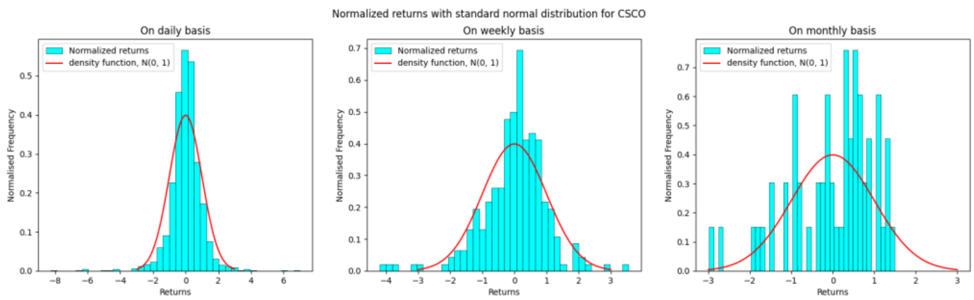
The histograms of the normalized log returns superimposed by a graph of the density function N(0,1) for the data in bsedata1.csv are as follows:

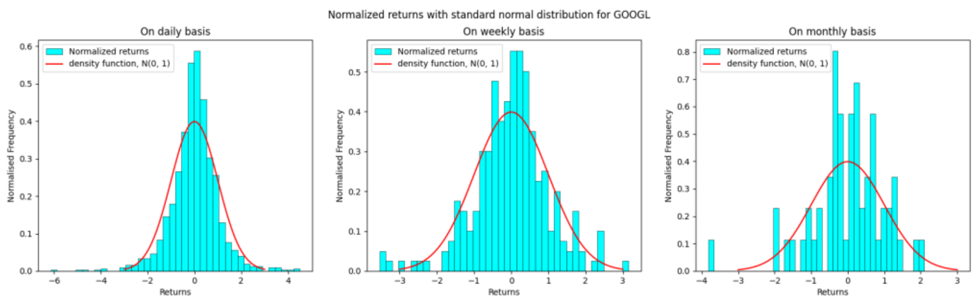

Normalized returns with standard normal distribution for AAPL
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

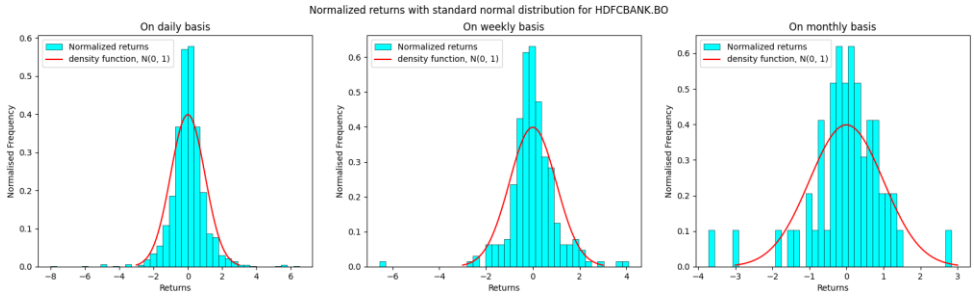

Normalized returns with standard normal distribution for ADBE
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

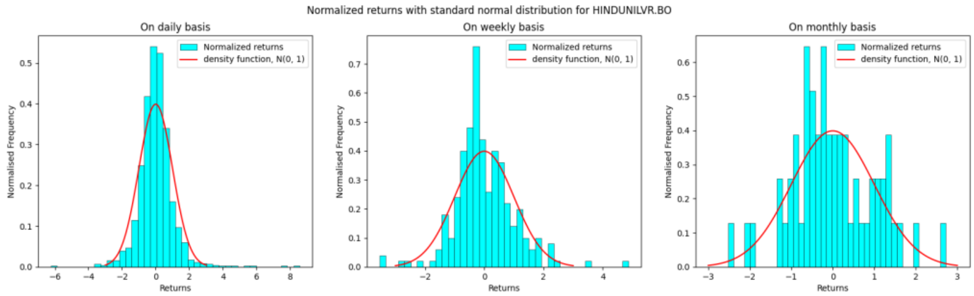

Normalized returns with standard normal distribution for AMZN
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

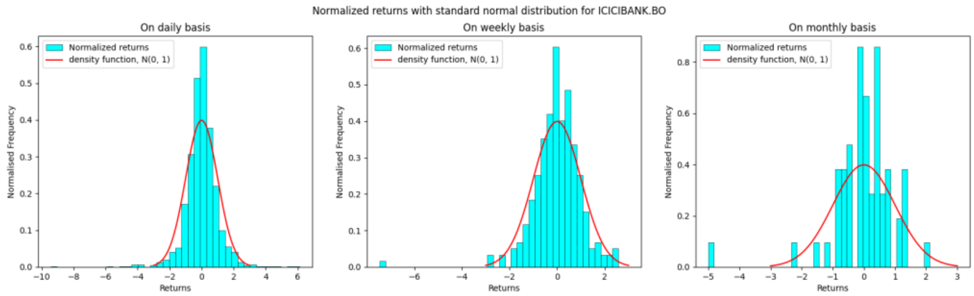

Normalized returns with standard normal distribution for AXISBANK.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

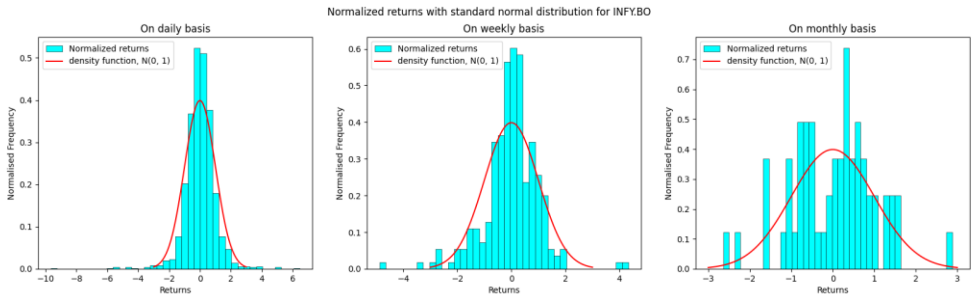

Normalized returns with standard normal distribution for CSCO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

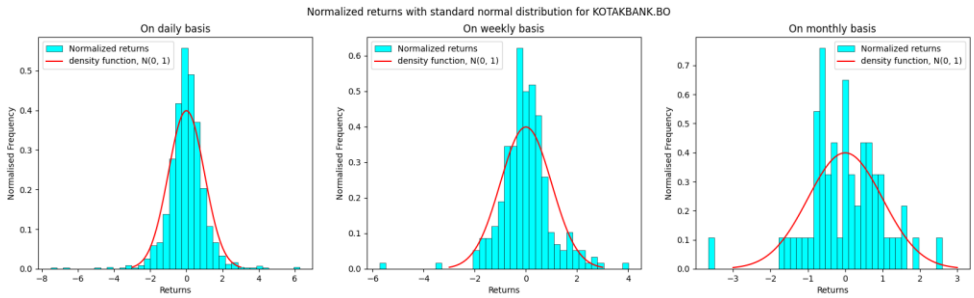

Normalized returns with standard normal distribution for GOOGL
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

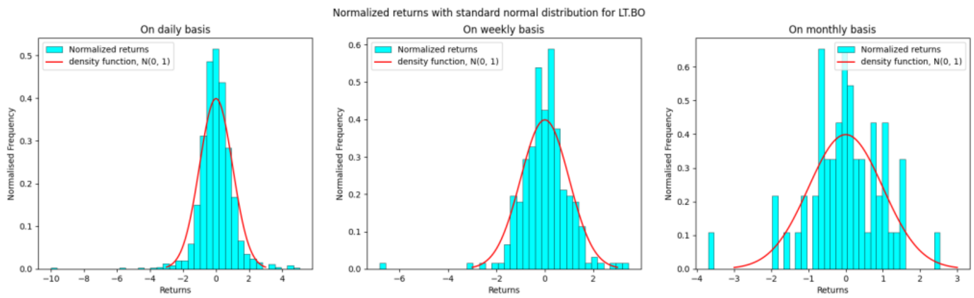

Normalized returns with standard normal distribution for HDFCBANK.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

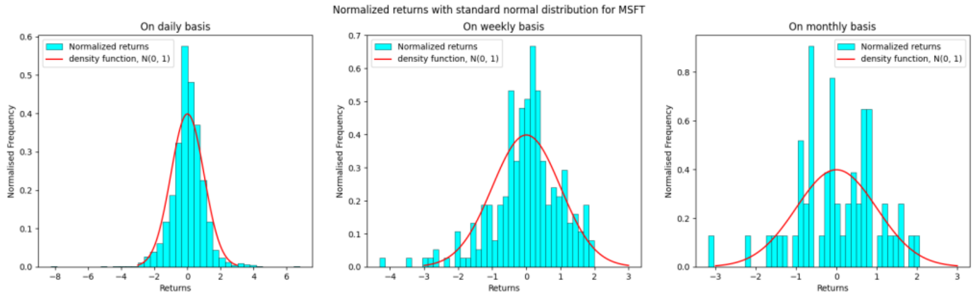

Normalized returns with standard normal distribution for HINDUNILVR.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

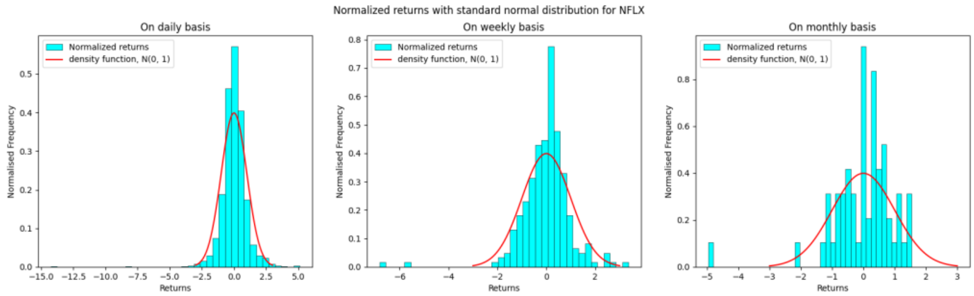

Normalized returns with standard normal distribution for ICICIBANK.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

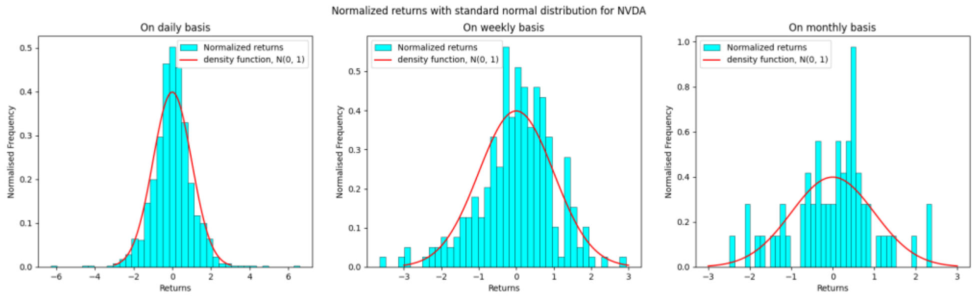

Normalized returns with standard normal distribution for INFY.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

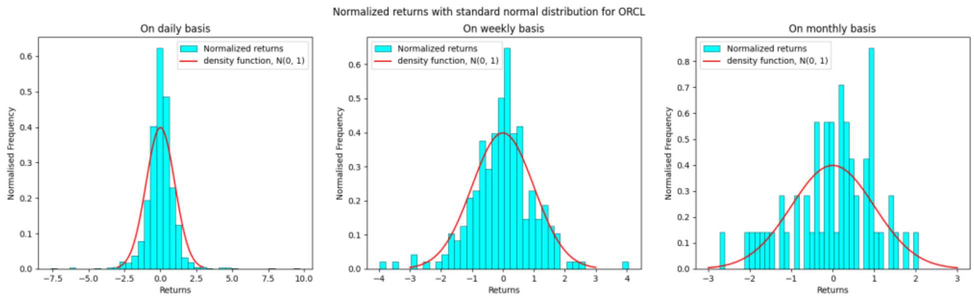

Normalized returns with standard normal distribution for KOTAKBANK.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

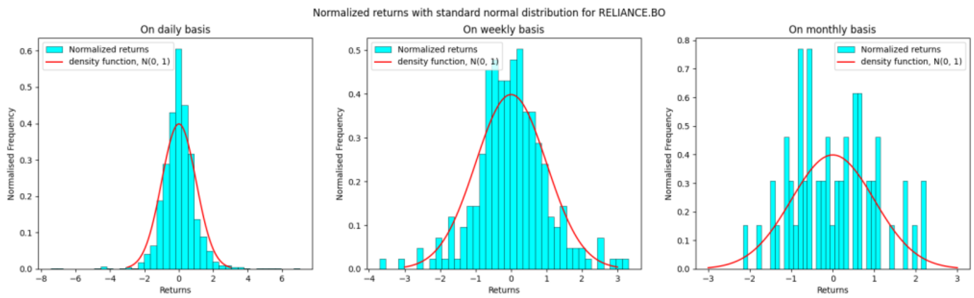

Normalized returns with standard normal distribution for LT.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

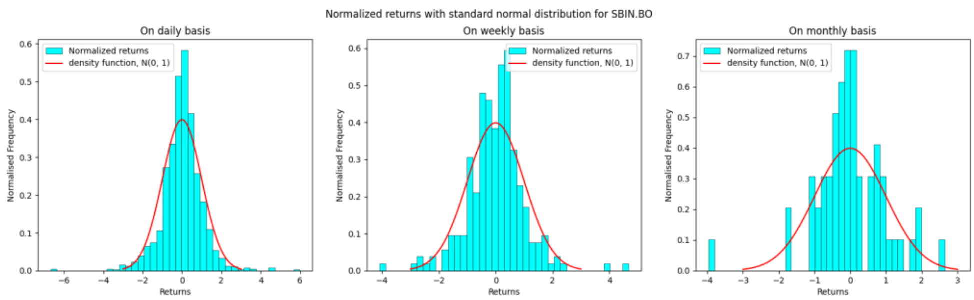

Normalized returns with standard normal distribution for MSFT
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

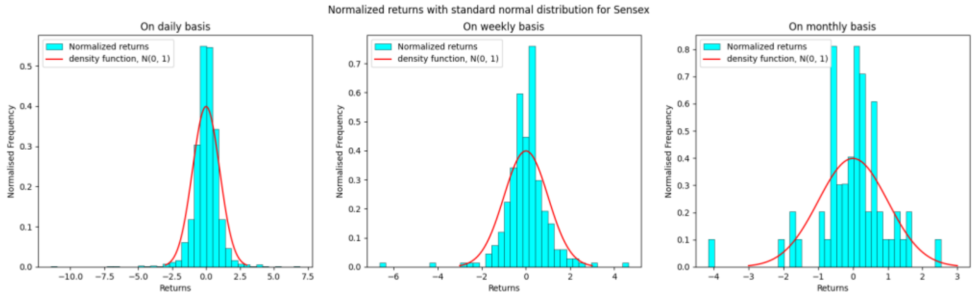

Normalized returns with standard normal distribution for NFLX
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

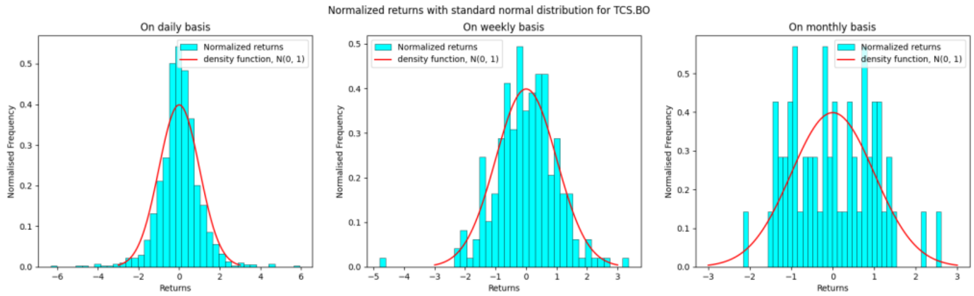

Normalized returns with standard normal distribution for NVDA
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

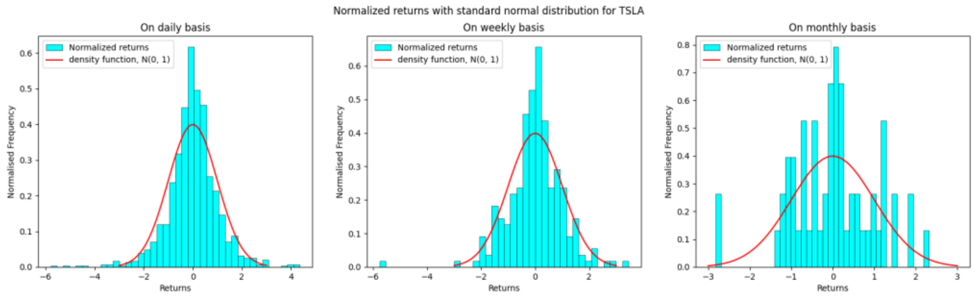

Normalized returns with standard normal distribution for ORCL
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for RELIANCE.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

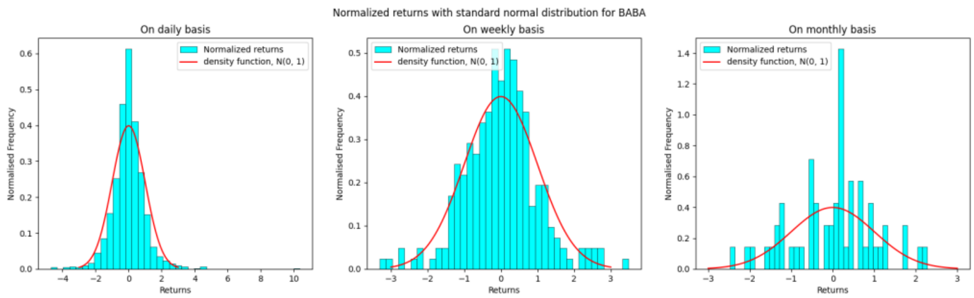

Normalized returns with standard normal distribution for SBIN.BO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

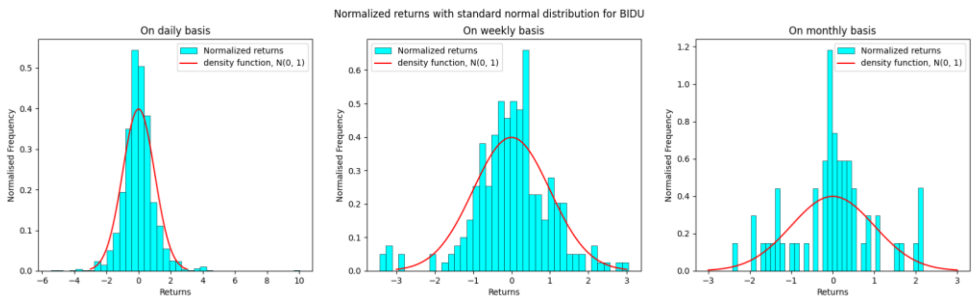


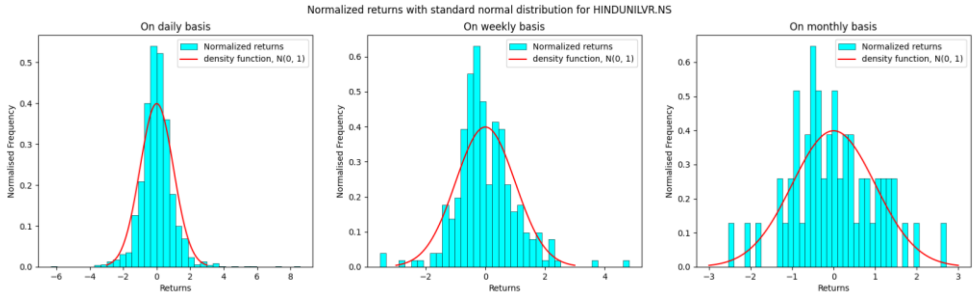


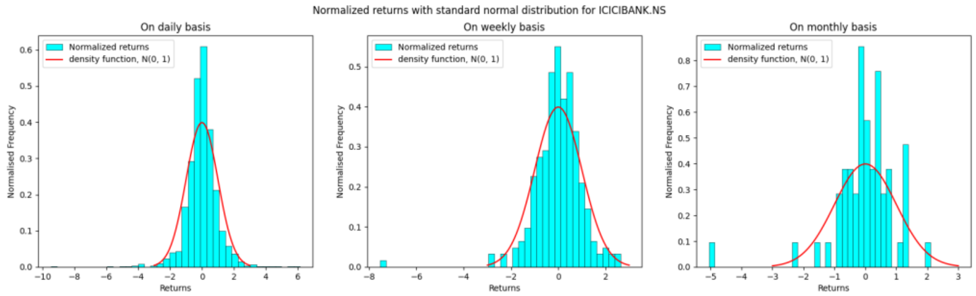


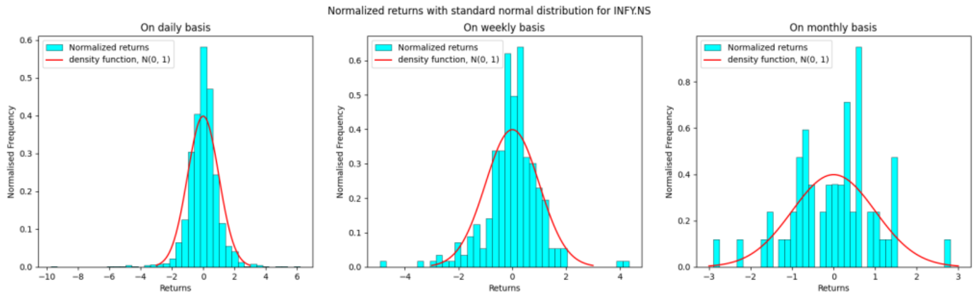
The histograms of the normalized log returns superimposed by a graph of the density function N(0,1) for the data in nsedata1.csv are as follows:

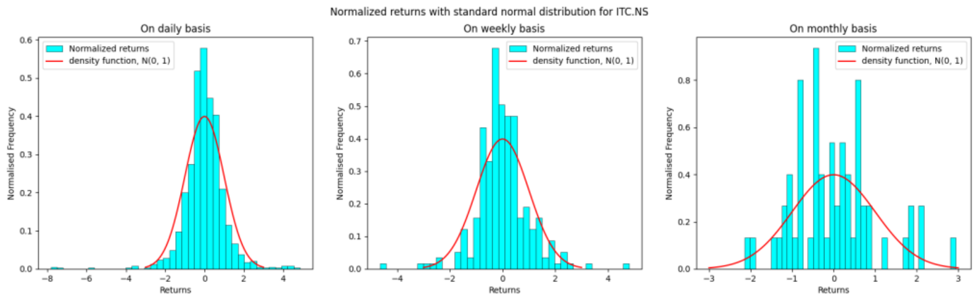


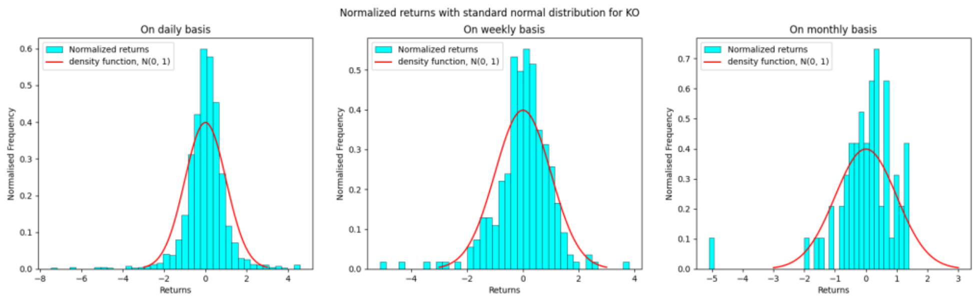


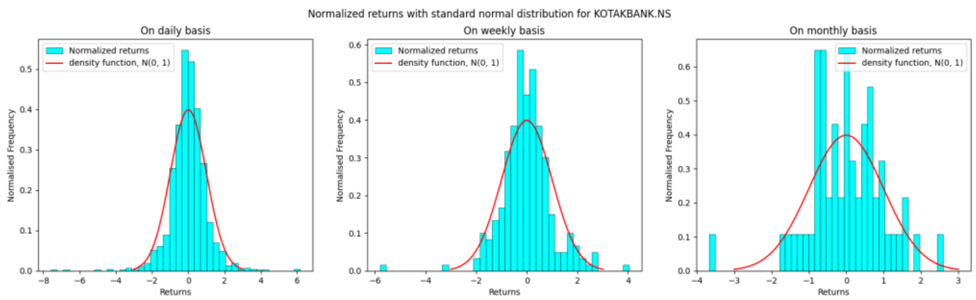

Normalized returns with standard normal distribution for HINDUNILVR.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

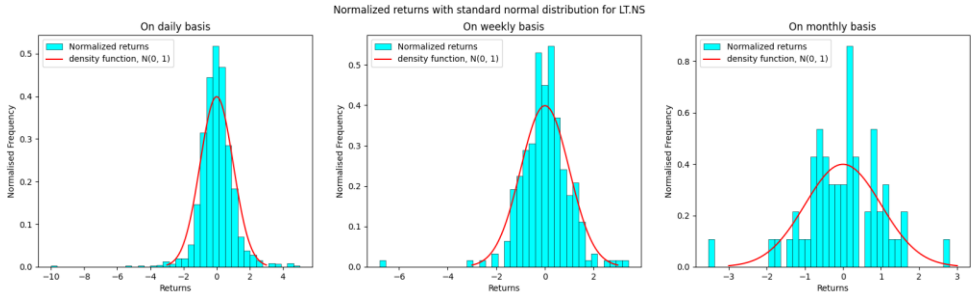

Normalized returns with standard normal distribution for ICICIBANK.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

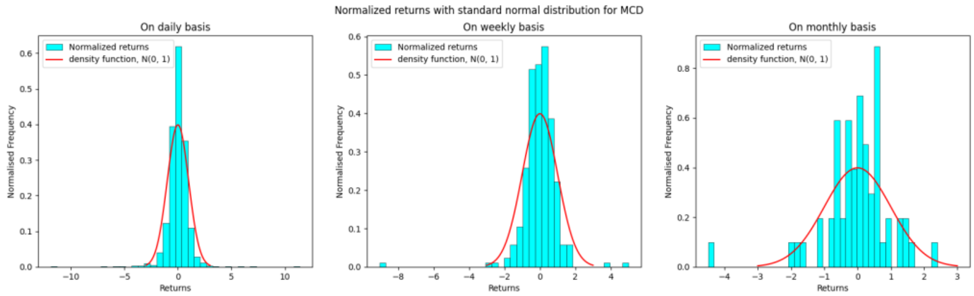

Normalized returns with standard normal distribution for INFY.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

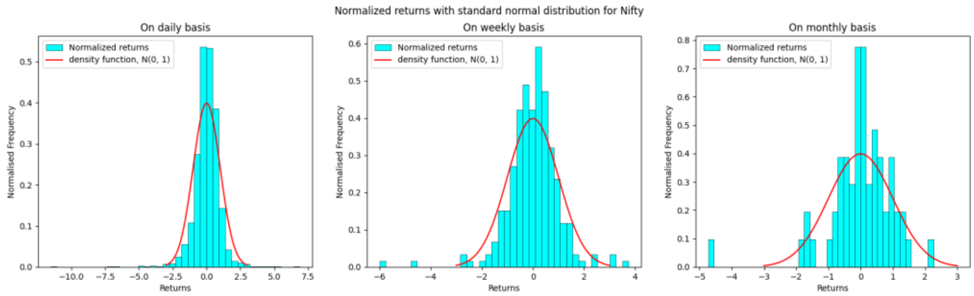

Normalized returns with standard normal distribution for ITC.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

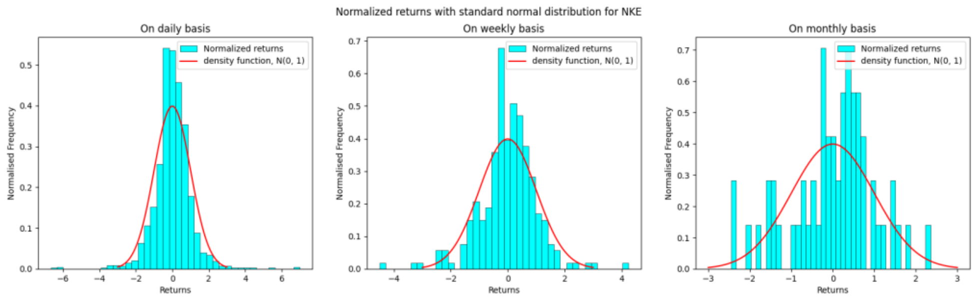

Normalized returns with standard normal distribution for KO
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

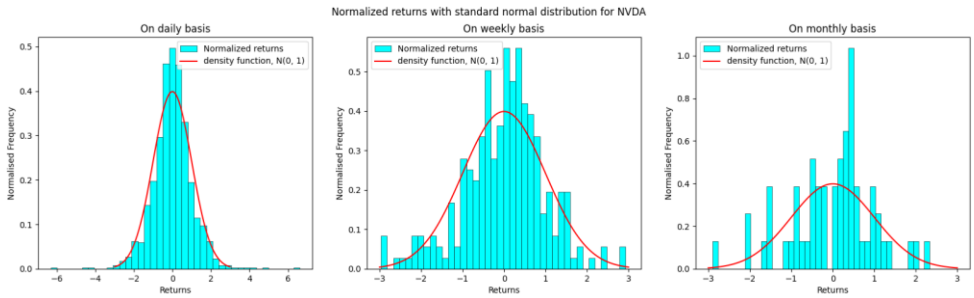

Normalized returns with standard normal distribution for KOTAKBANK.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

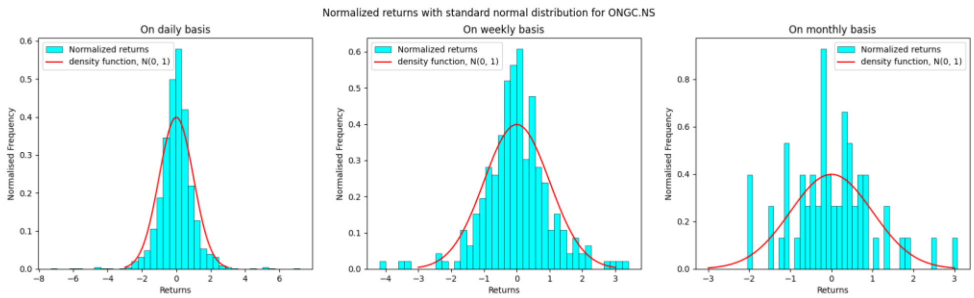

Normalized returns with standard normal distribution for LT.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

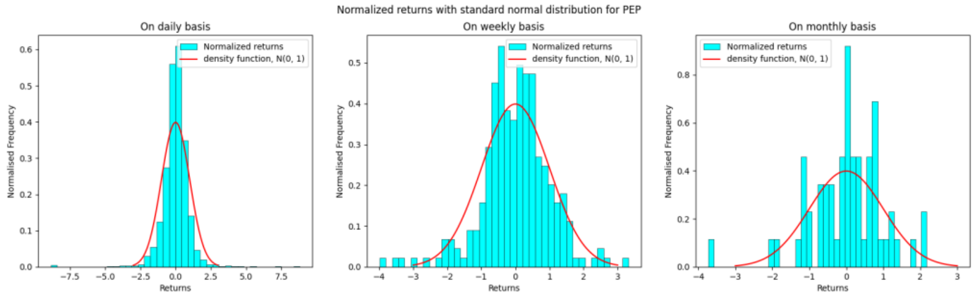

Normalized returns with standard normal distribution for MCD
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

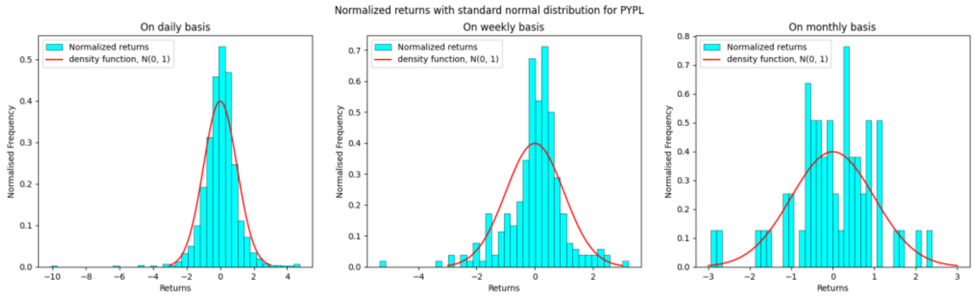

Normalized returns with standard normal distribution for Nifty
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

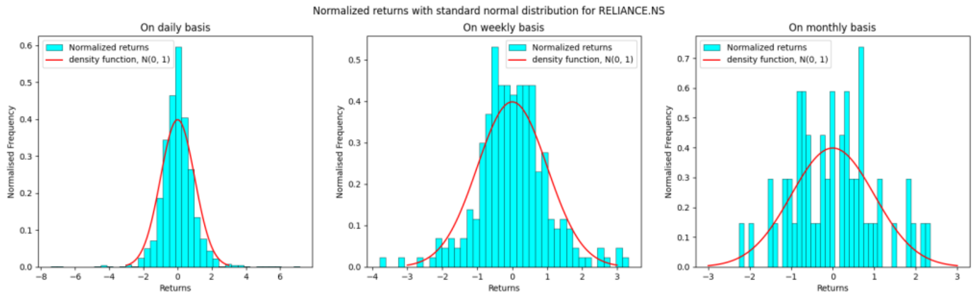

Normalized returns with standard normal distribution for NKE
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

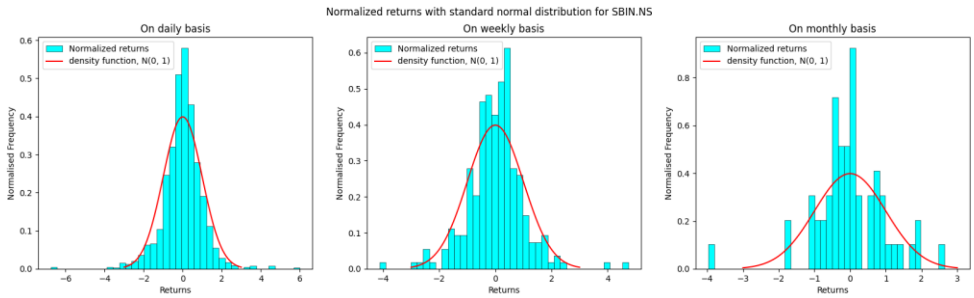

Normalized returns with standard normal distribution for NVDA
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

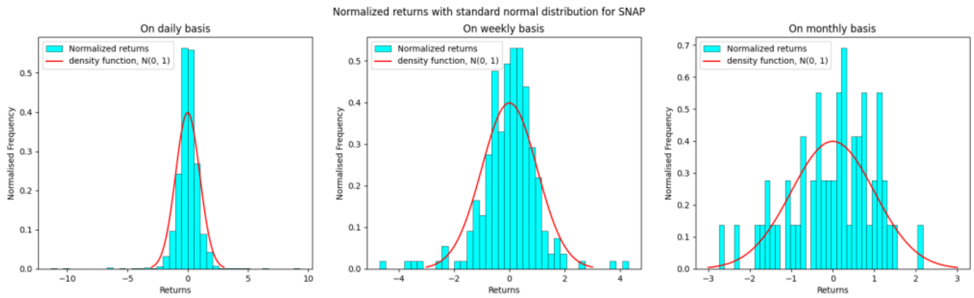

Normalized returns with standard normal distribution for ONGC.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

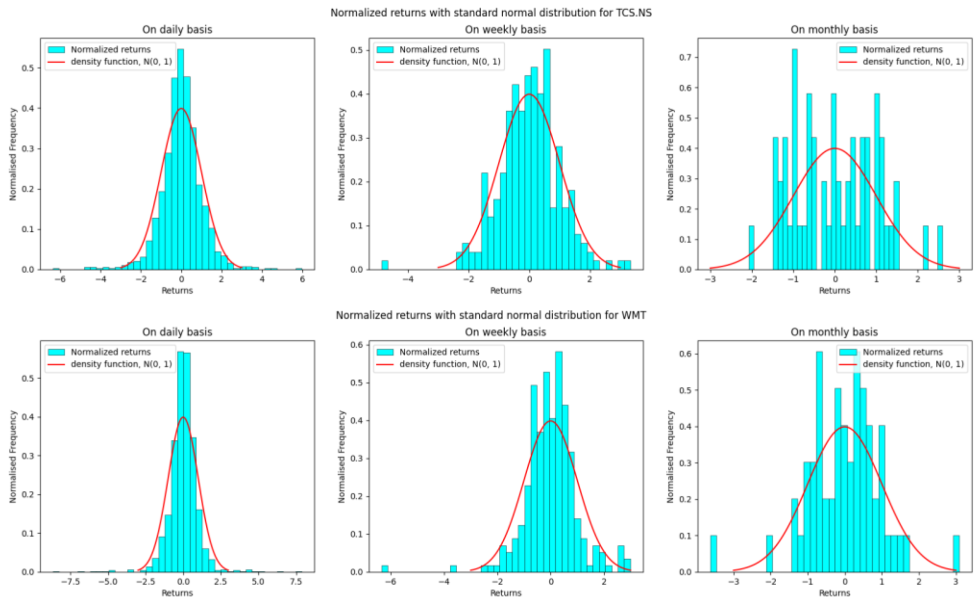

Normalized returns with standard normal distribution for PEP
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for PYPL
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for RELIANCE.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for SBIN.NS
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns


Normalized returns with standard normal distribution for SNAP
On daily basis
On weekly basis
On monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns



Observations:

The observations are not much different if we use log returns. The fundamental concept, particularly applicable to equities, revolves around the notion that the distribution of security prices follows a log-normal pattern, hence arithmetic returns mirror this trend. Nonetheless, employing a log transformation yields approximately normal returns, which facilitates analytical processes. Assuming normal distribution offers convenient outcomes for the convolution of multivariate normal series, thereby enabling smoother time-aggregation procedures.

Question 4:

4. Now, consider the daily data only for the period January 1, 2014 to December 31, 2017 and estimate the μ and σ using log returns. Using the μ and σ, generate a path of stock prices that resembles (as closely as possible) the actual path of the stock for the period of January 1, 2018 to December 31, 2018.

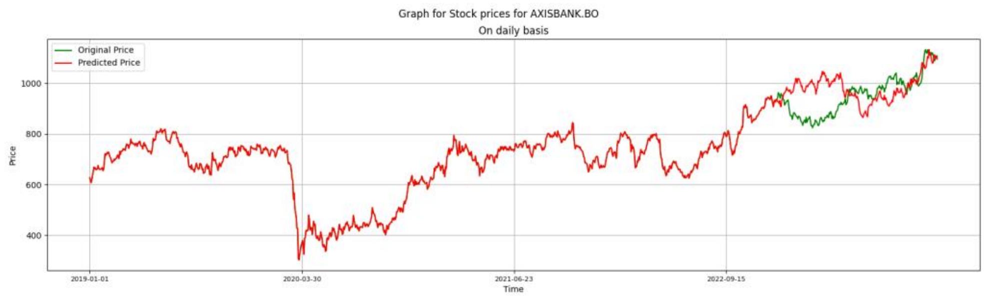
Geometric Brownian motion is used to model the scenario since stock prices behave like a stochastic process.

$$\mu - \frac{\sigma^2}{2} = \frac{1}{n}\sum_{1}^{n} u_i = E(u)$$

$$\sigma^2 = \frac{1}{n-1}\sum_{1}^{n}(u_i - E(u))^2$$

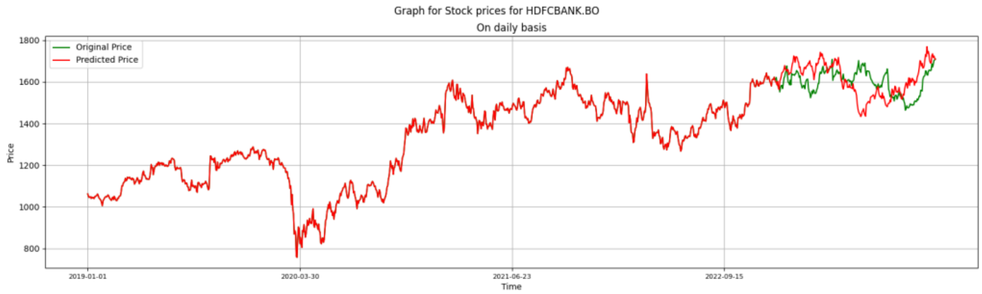
$$u_i = \ln\left(\frac{s_i}{s_{i-1}}\right)$$

For daily data, the graphs of the generated path of stock prices along with the actual path of the stock for the stocks and Sensex in bsedata1.csv are as follows:

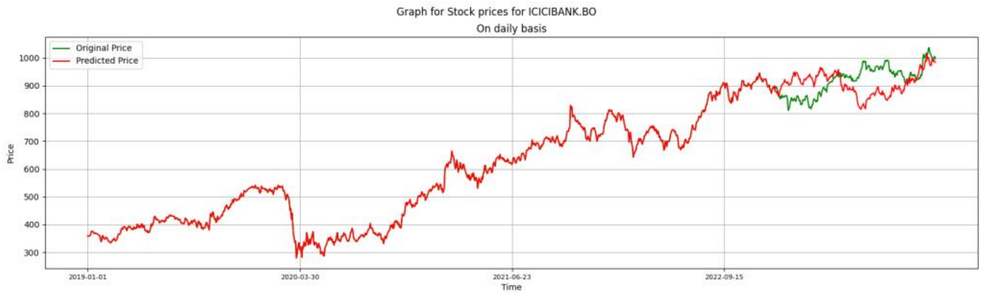


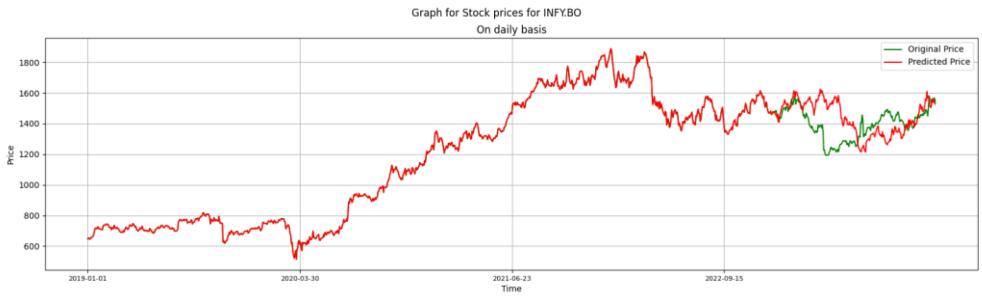

Graph for Stock prices for CSCO
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15

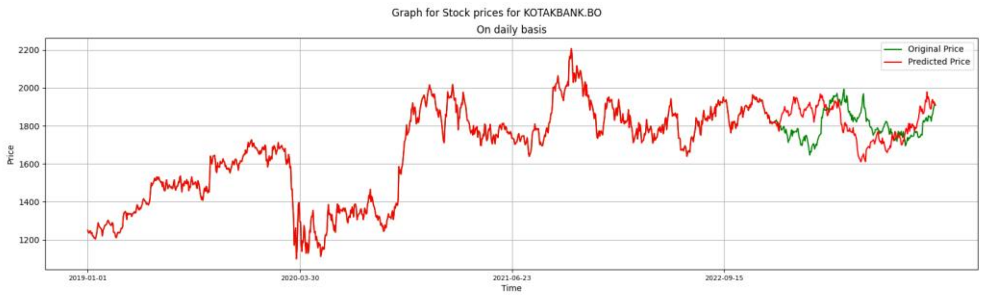

Graph for Stock prices for GOOGL
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15


Graph for Stock prices for HDFCBANK.BO
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15

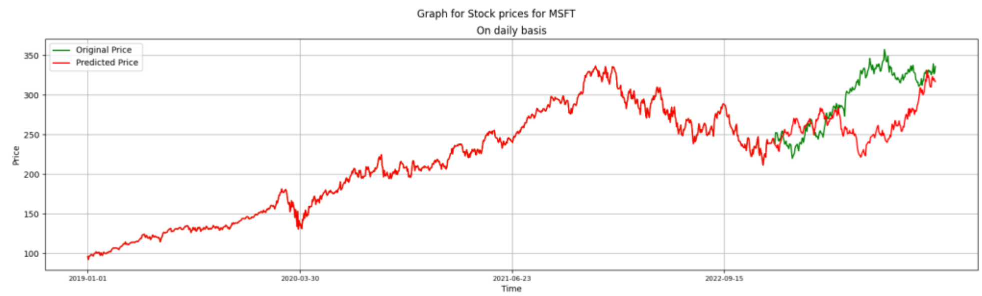

Graph for Stock prices for HINDUNILVR.BO
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15


Graph for Stock prices for ICICIBANK.BO
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15


Graph for Stock prices for INFY.BO
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15

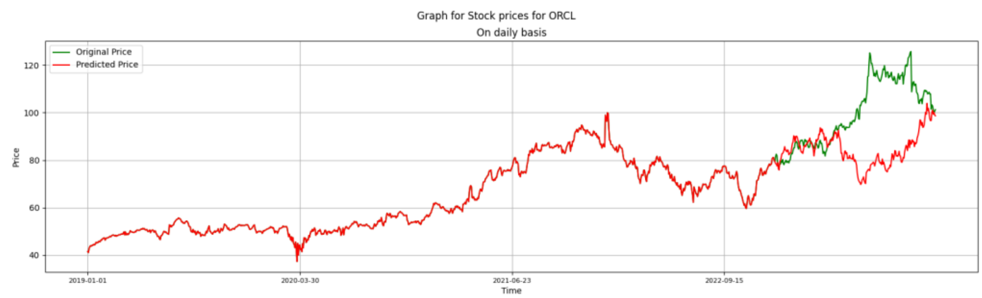

Graph for Stock prices for KOTAKBANK.BO
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15

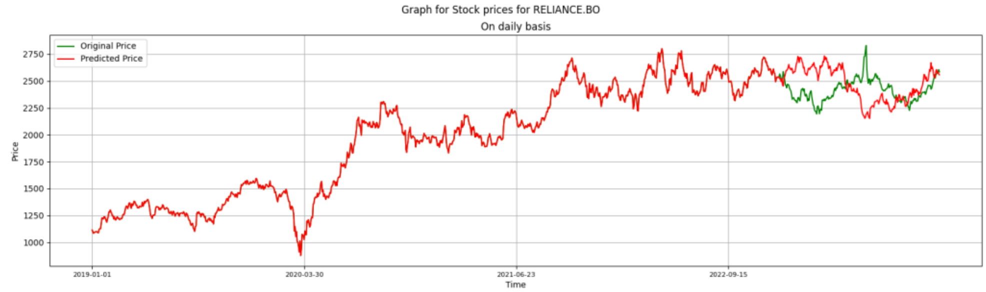

Graph for Stock prices for LT.BO
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15

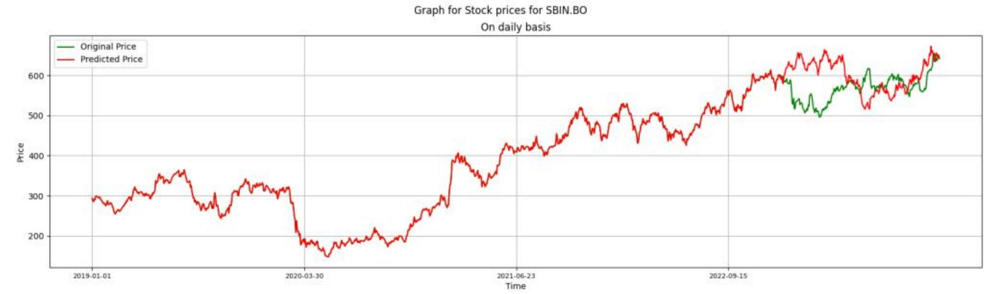

Graph for Stock prices for MSFT
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15

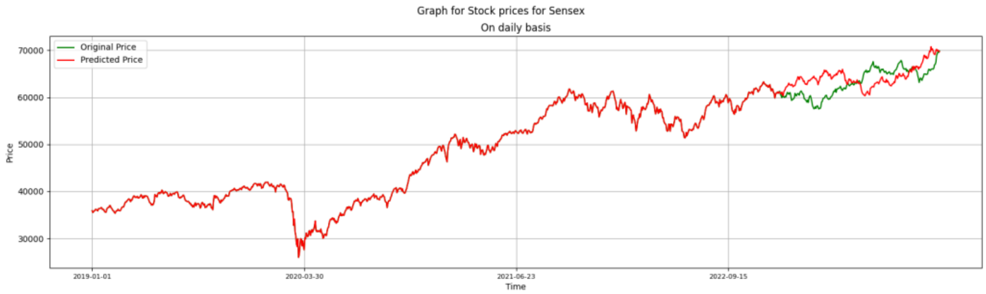

Graph for Stock prices for NFLX
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15

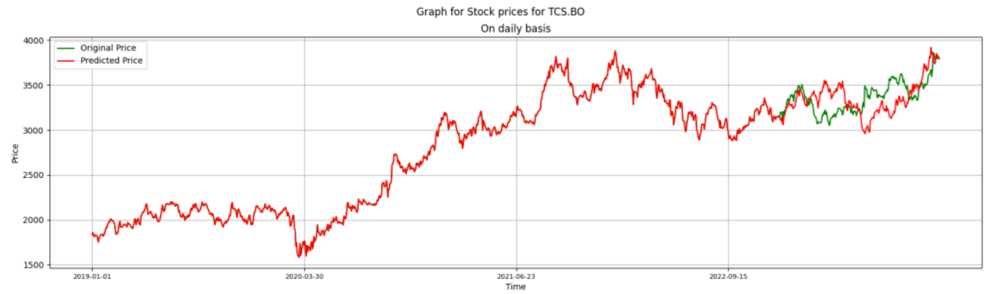

Graph for Stock prices for NVDA
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15


Graph for Stock prices for ORCL
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-03-30
2021-06-23
2022-09-15



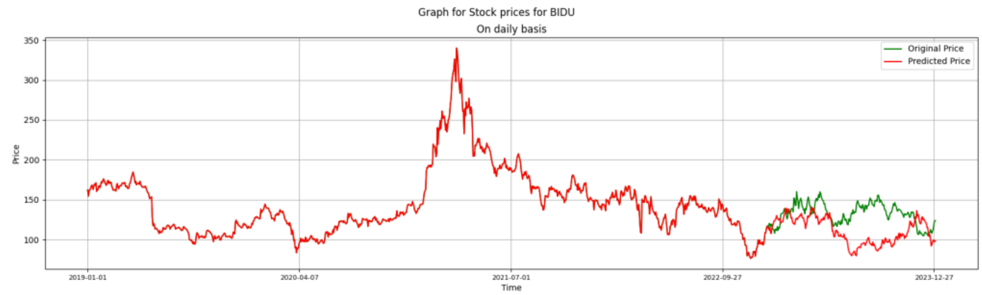


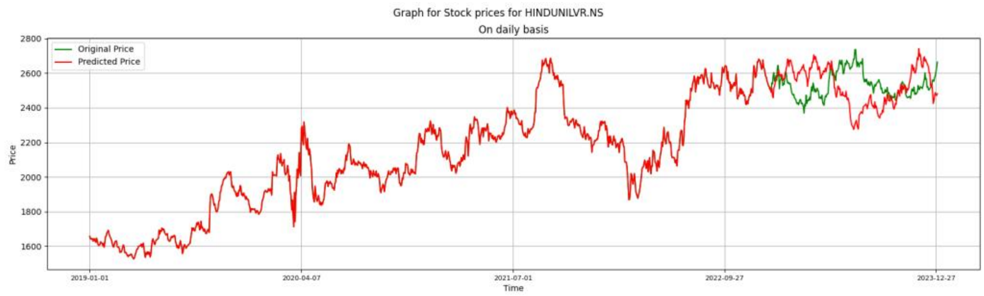


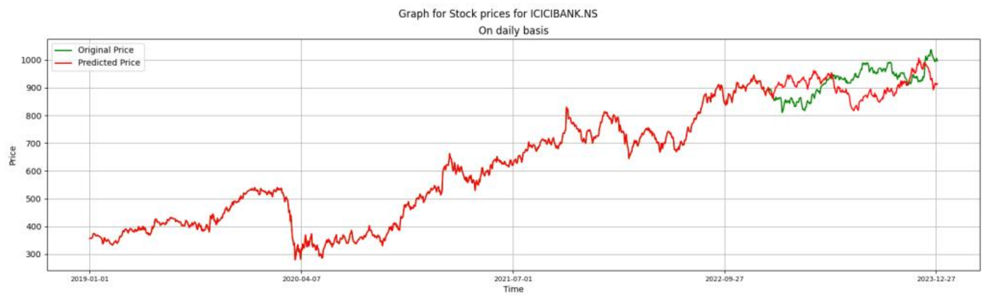


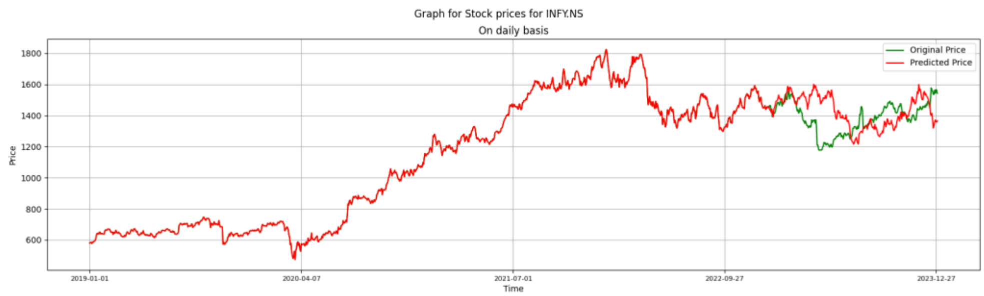
For daily data, the graphs of the generated path of stock prices along with the actual path of the stock for the stocks and Nifty in nsedata1.csv are as follows:

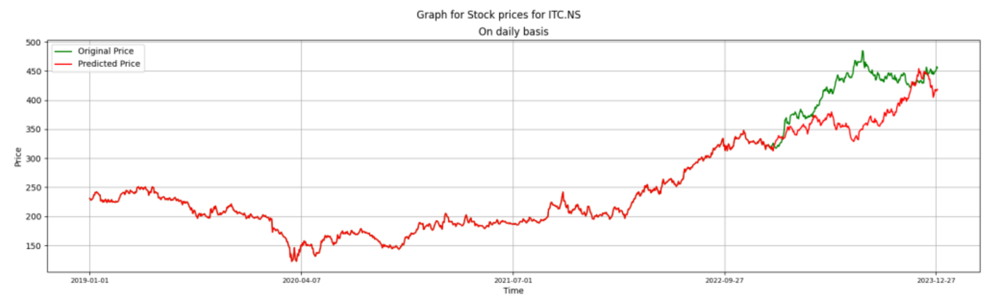

Graph for Stock prices for BABA
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27

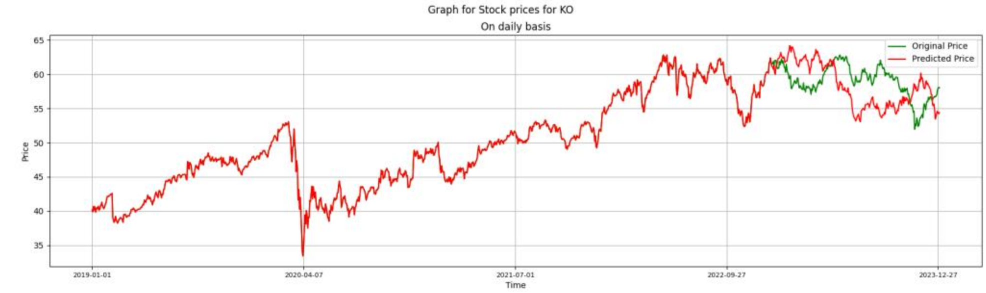

Graph for Stock prices for BIDU
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27

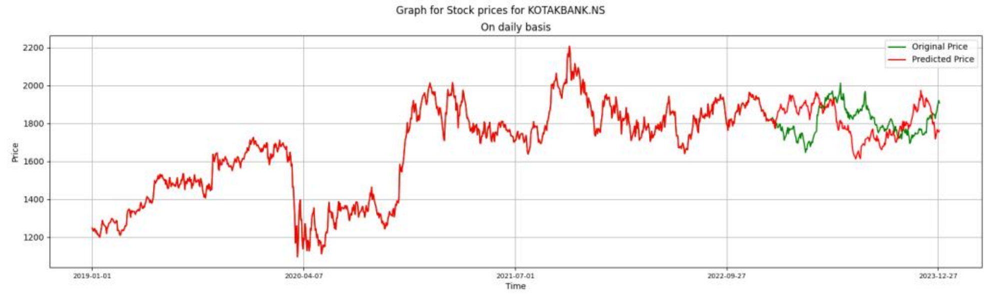

Graph for Stock prices for HINDUNILVR.NS
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27


Graph for Stock prices for ICICIBANK.NS
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27

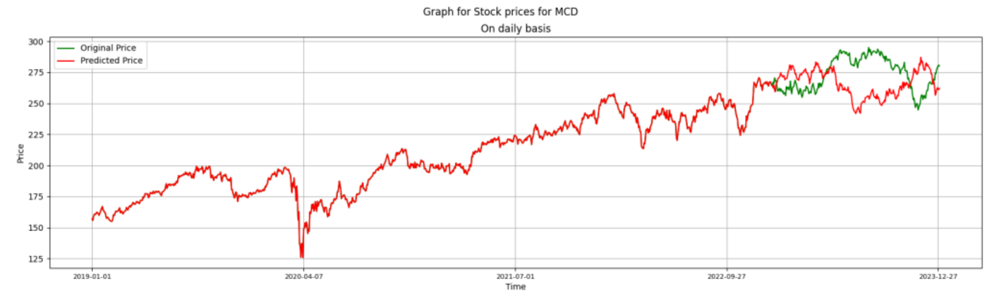

Graph for Stock prices for INFY.NS
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27

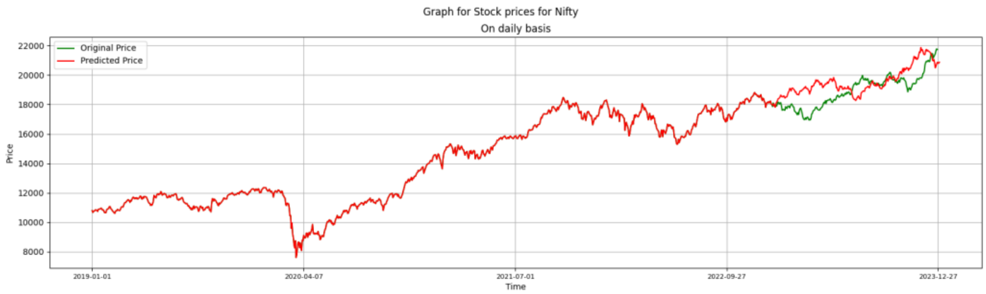

Graph for Stock prices for ITC.NS
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27

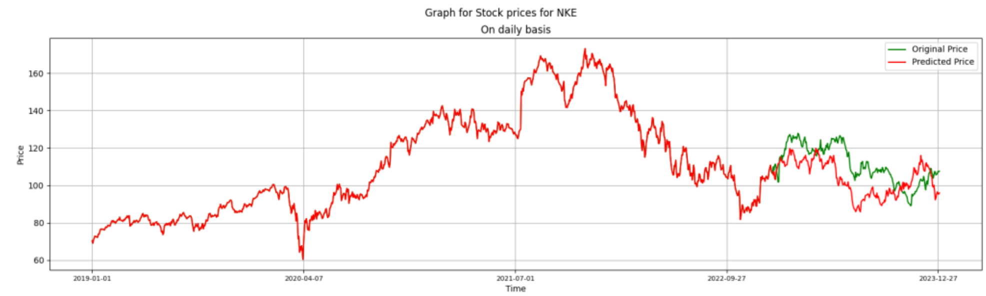

Graph for Stock prices for KO
On daily basis
Original Price
Predicted Price
Price
65
60
55
50
45
40
35
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27
Time


Graph for Stock prices for KOTAKBANK.NS
On daily basis
Original Price
Predicted Price
Price
2200
2000
1800
1600
1400
1200
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27
Time


Graph for Stock prices for LT.NS
On daily basis
Original Price
Predicted Price
Price
3500
3000
2500
2000
1500
1000
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27
Time


Graph for Stock prices for MCD
On daily basis
Original Price
Predicted Price
Price
300
275
250
225
200
175
150
125
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27
Time


Graph for Stock prices for Nifty
On daily basis
Original Price
Predicted Price
Price
22000
20000
18000
16000
14000
12000
10000
8000
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27
Time


Graph for Stock prices for NKE
On daily basis
Original Price
Predicted Price
Price
160
140
120
100
80
60
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27
Time


Graph for Stock prices for NVDA
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27


Graph for Stock prices for ONGC.NS
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27


Graph for Stock prices for PEP
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27


Graph for Stock prices for PYPL
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27


Graph for Stock prices for RELIANCE.NS
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27


Graph for Stock prices for SBIN.NS
On daily basis
Original Price
Predicted Price
Price
Time
2019-01-01
2020-04-07
2021-07-01
2022-09-27
2023-12-27

Question 5:

5. Repeat the above with weekly and monthly data.

Summarize your observations in your report. Remember that you need not put all the figures in the report. General representative figures are sufficient, along with figures which show different behaviours.

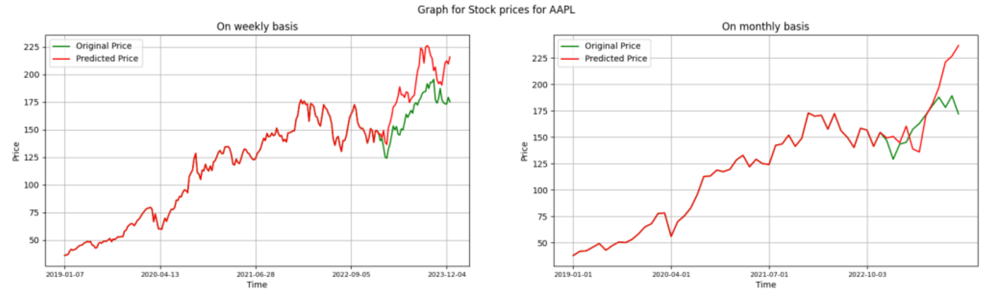
Geometric Brownian motion is used to model the scenario since stock prices behave like a stochastic process.

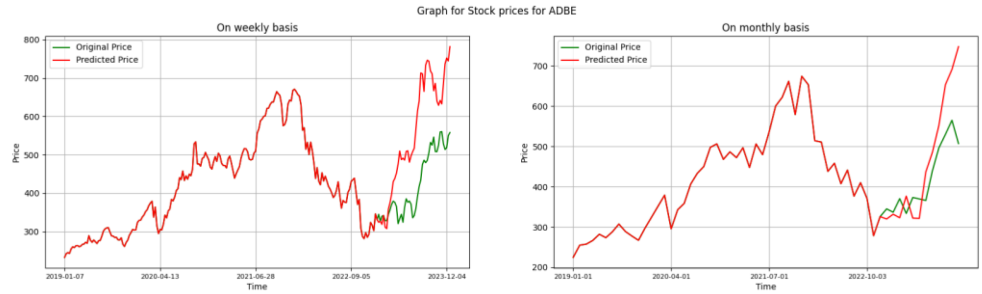
$$\mu - \frac{\sigma^2}{2} = \frac{1}{n}\sum_{1}^{n} u_i = E(u)$$

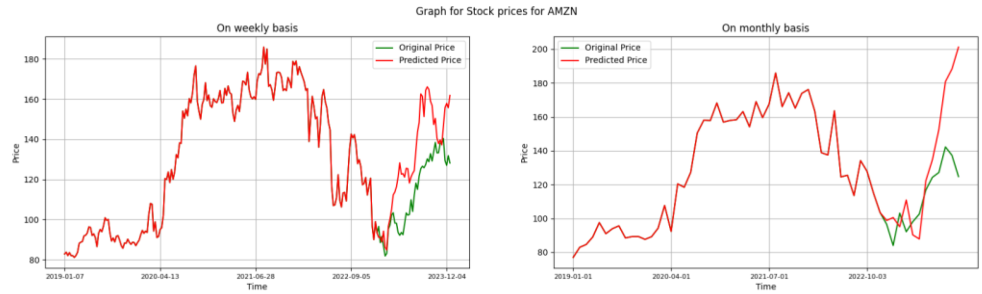
$$\sigma^2 = \frac{1}{n-1}\sum_{1}^{n}(u_i - E(u))^2$$

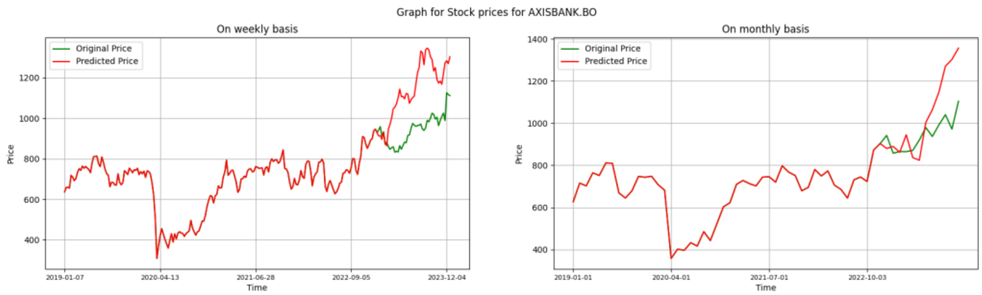
$$u_i = \ln(\frac{S_i}{S_{i-1}})$$

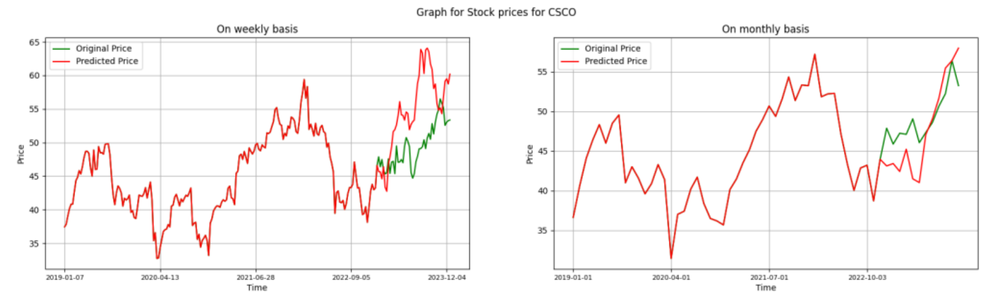
For weekly and monthly data, the graphs of the generated path of stock prices along with the actual path of the stock for the stocks and Sensex in bsedata1.csv are as follows:



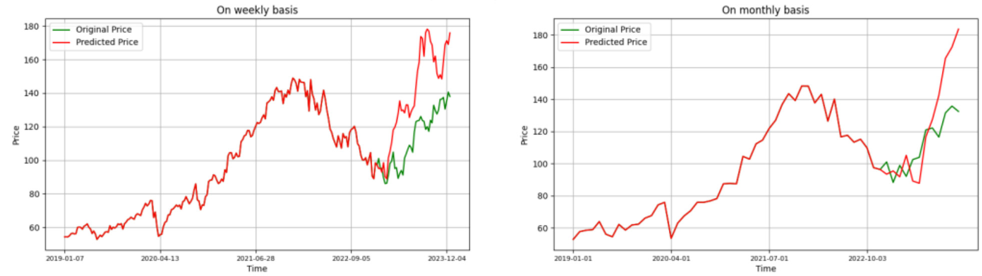




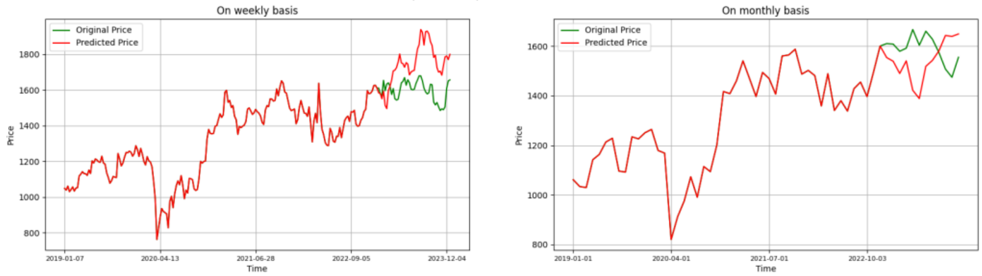




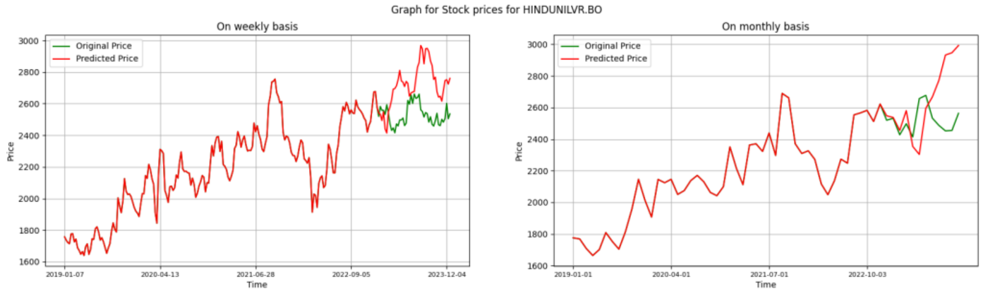
Graph for Stock prices for GOOGL



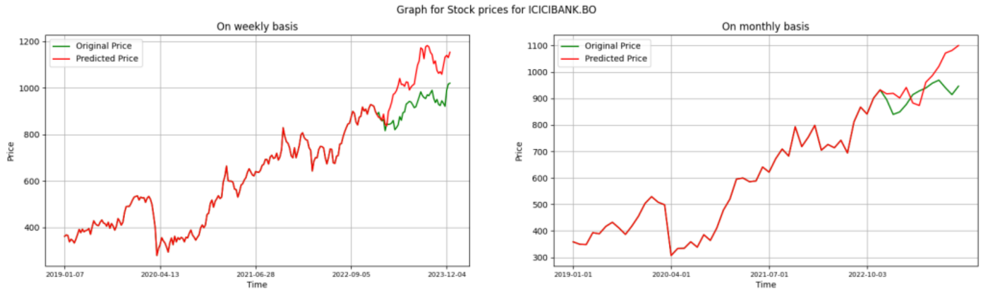
Graph for Stock prices for HDFCBANK.BO



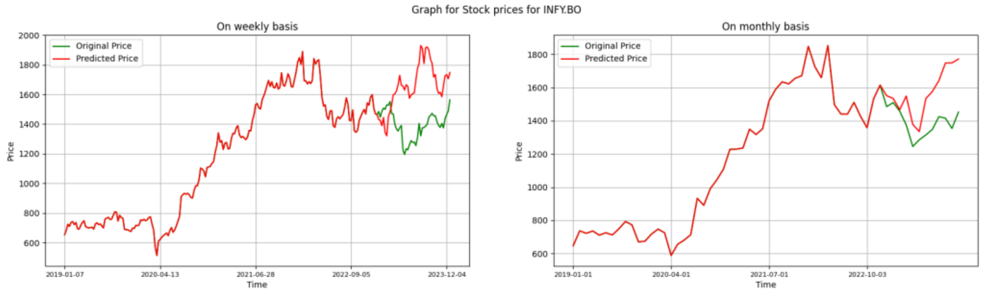
Graph for Stock prices for HINDUNILVR.BO



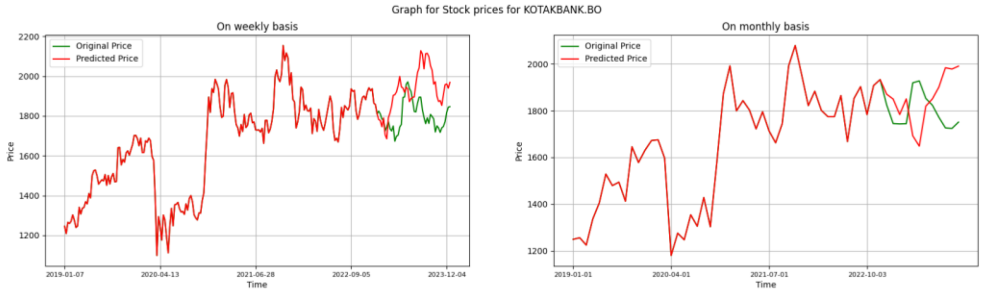
Graph for Stock prices for ICICIBANK.BO

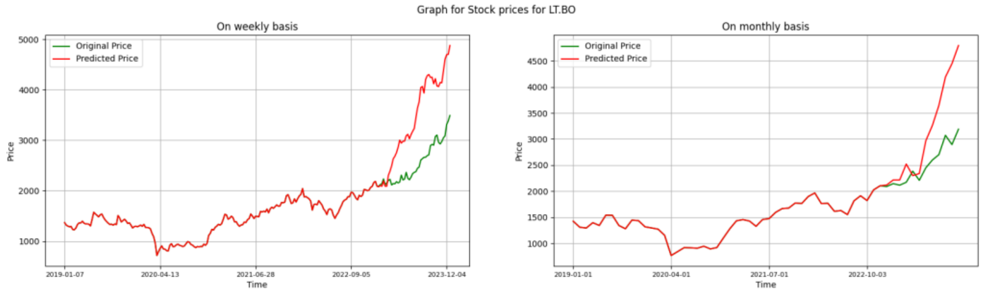


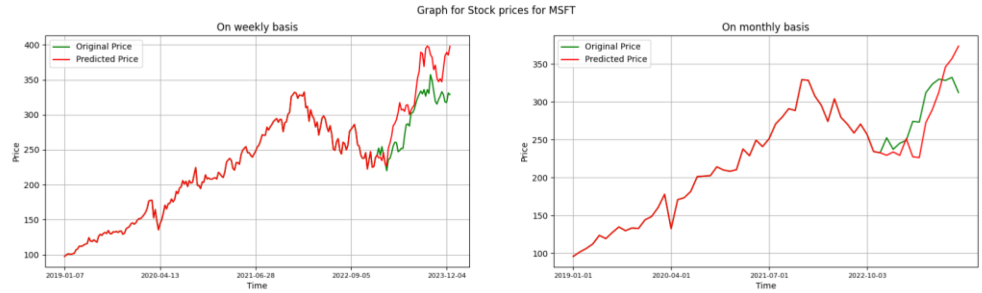
Graph for Stock prices for INFY.BO

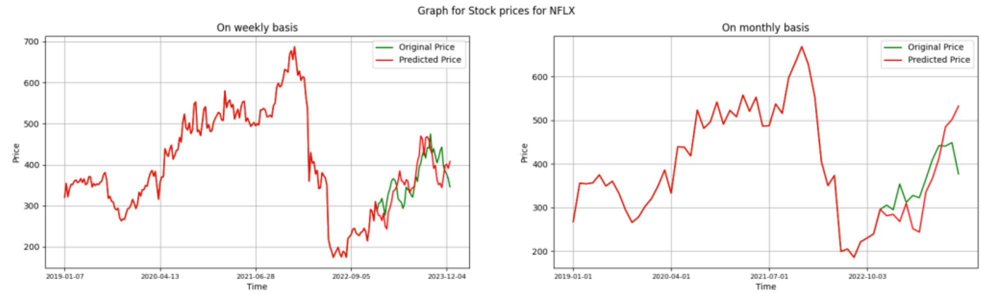


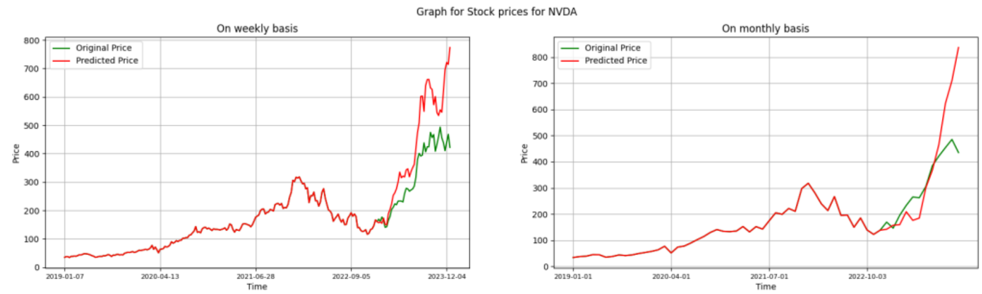
Graph for Stock prices for KOTAKBANK.BO

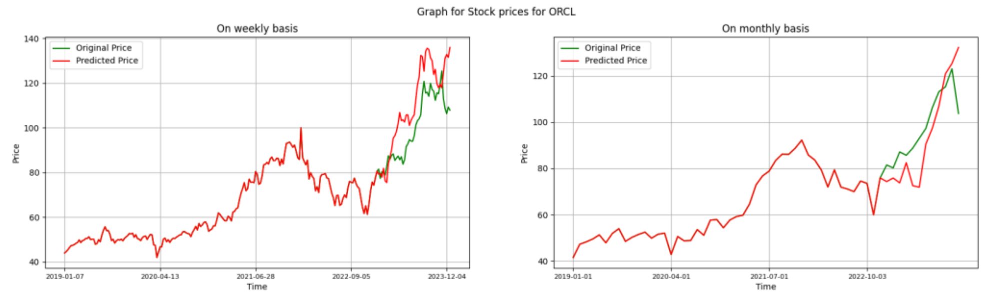


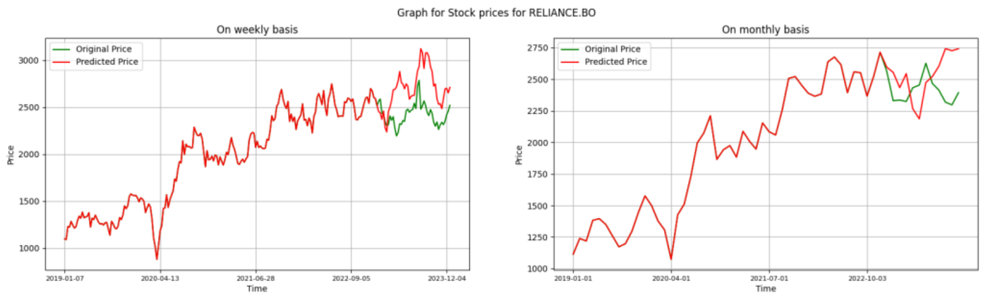

Graph for Stock prices for LT.BO
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-13
2021-06-28
2022-09-05
2023-12-04
2019-01-01
2020-04-01
2021-07-01
2022-10-03

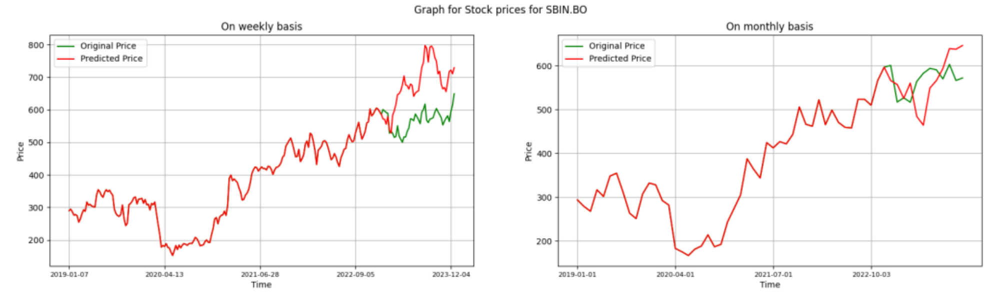

Graph for Stock prices for MSFT
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-13
2021-06-28
2022-09-05
2023-12-04
2019-01-01
2020-04-01
2021-07-01
2022-10-03

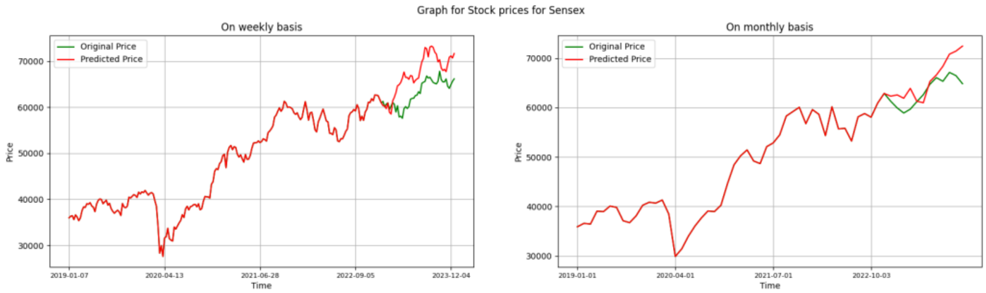

Graph for Stock prices for NFLX
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-13
2021-06-28
2022-09-05
2023-12-04
2019-01-01
2020-04-01
2021-07-01
2022-10-03

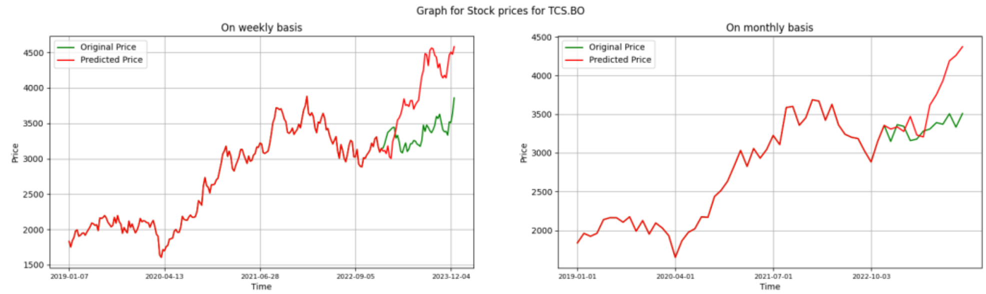

Graph for Stock prices for NVDA
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-13
2021-06-28
2022-09-05
2023-12-04
2019-01-01
2020-04-01
2021-07-01
2022-10-03

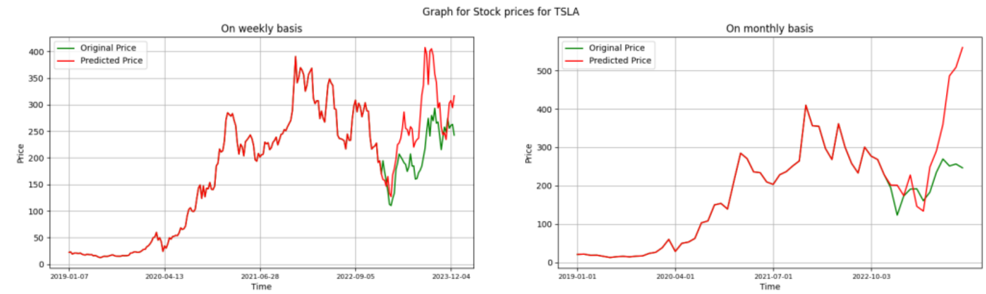

Graph for Stock prices for ORCL
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-13
2021-06-28
2022-09-05
2023-12-04
2019-01-01
2020-04-01
2021-07-01
2022-10-03


Graph for Stock prices for RELIANCE.BO
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-13
2021-06-28
2022-09-05
2023-12-04
2019-01-01
2020-04-01
2021-07-01
2022-10-03

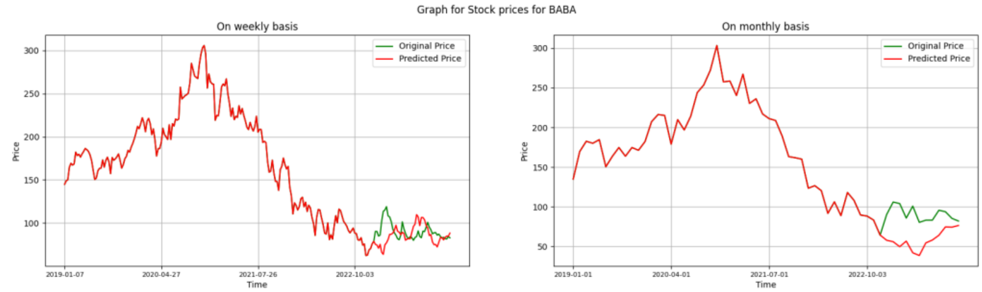


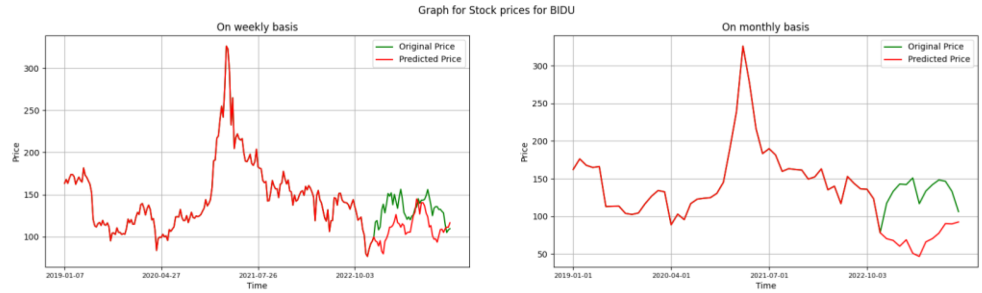


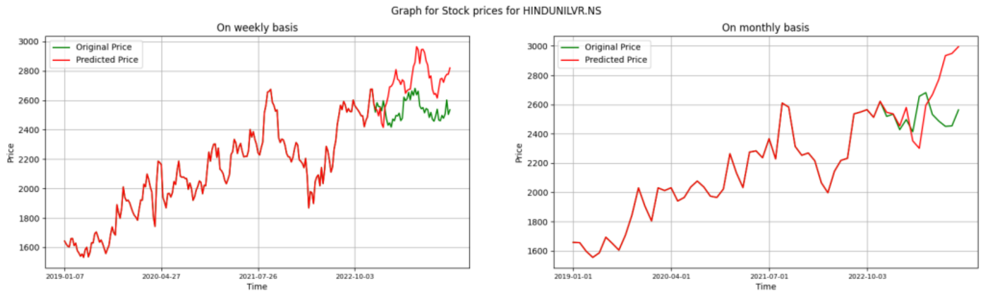


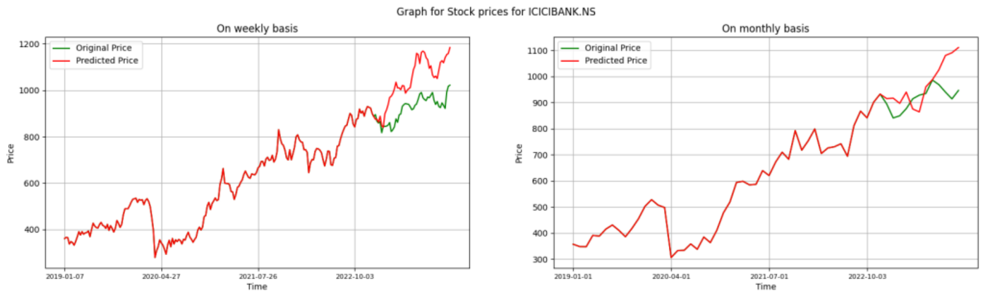


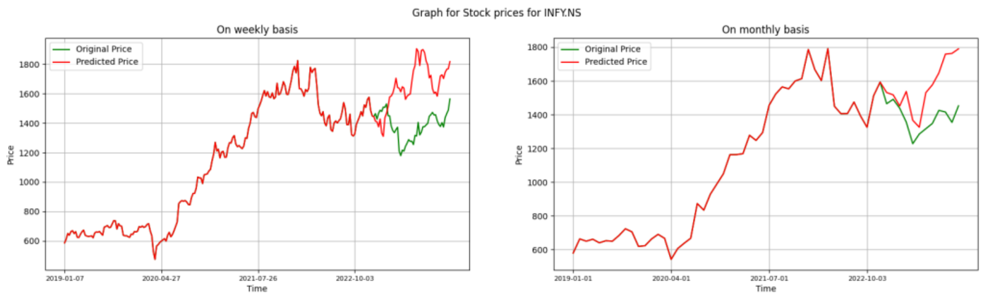
For weekly and monthly data, the graphs of the generated path of stock prices along with the actual path of the stock for the stocks and Nifty in nsedata1.csv are as follows:

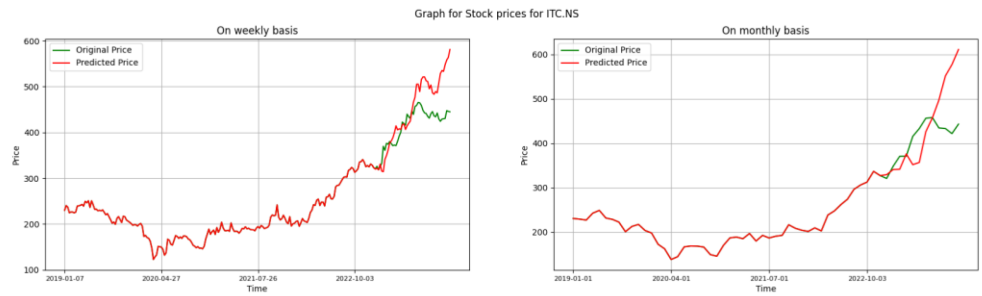

Graph for Stock prices for BABA
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03

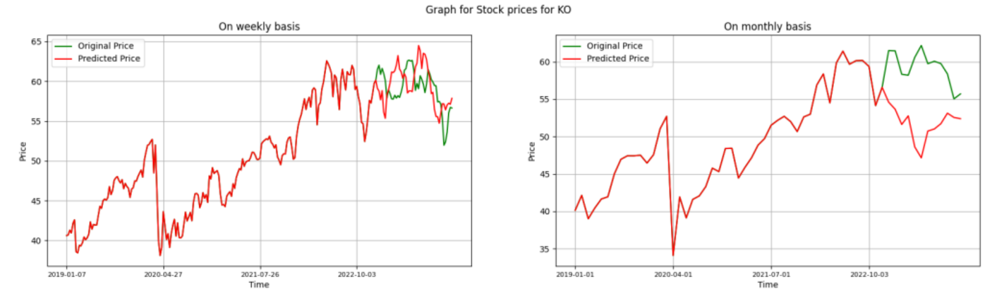

Graph for Stock prices for BIDU
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03

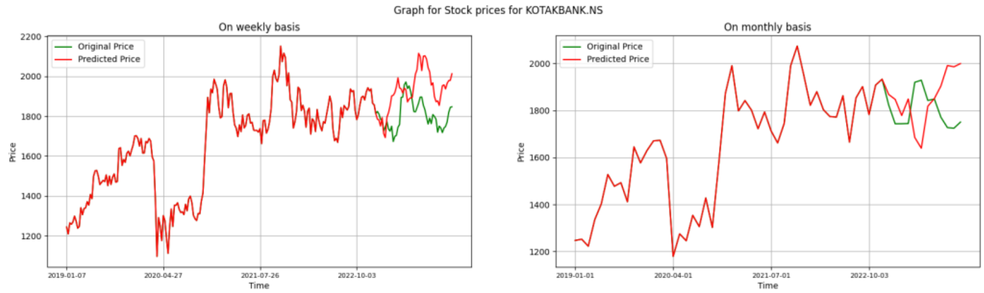

Graph for Stock prices for HINDUNILVR.NS
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03

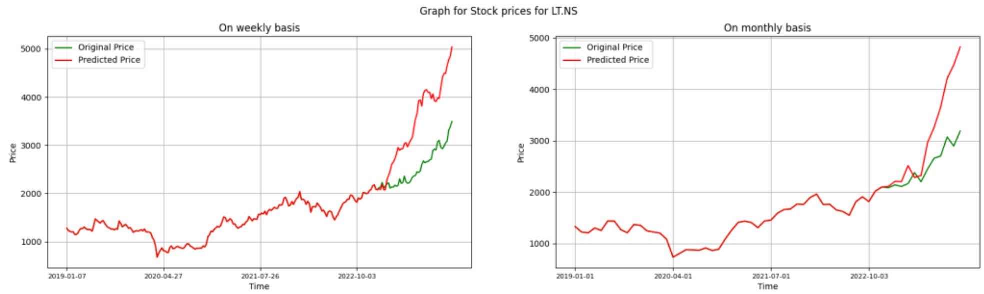

Graph for Stock prices for ICICIBANK.NS
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03

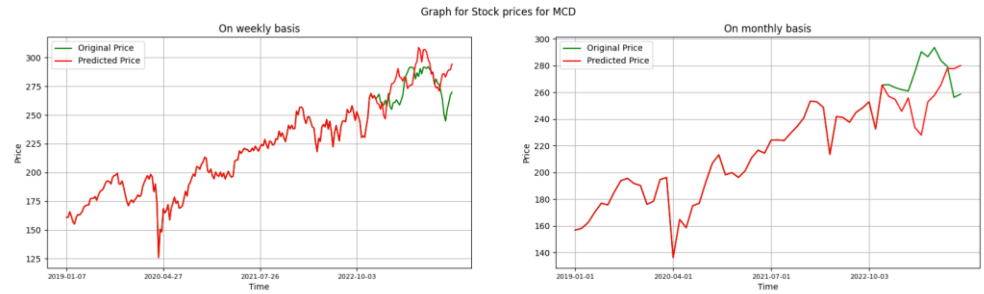

Graph for Stock prices for INFY.NS
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03

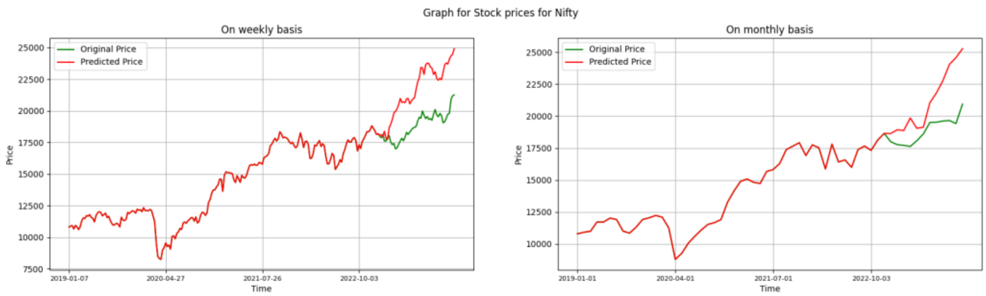

Graph for Stock prices for ITC.NS
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03

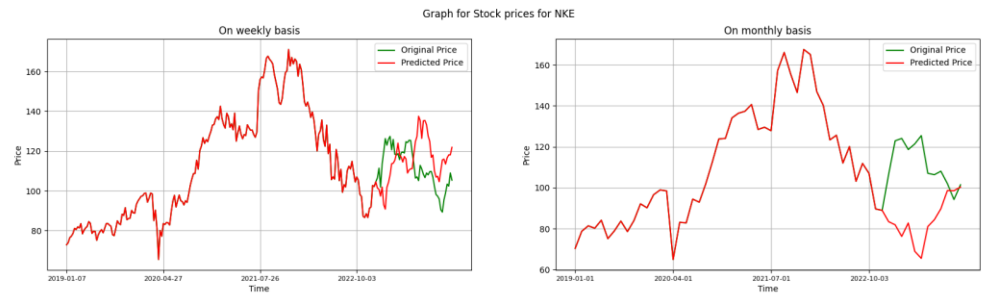

Graph for Stock prices for KO
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time


Graph for Stock prices for KOTAKBANK.NS
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time

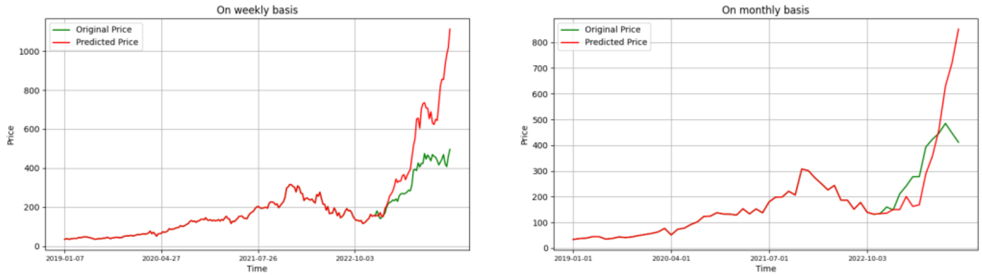

Graph for Stock prices for LT.NS
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time


Graph for Stock prices for MCD
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time

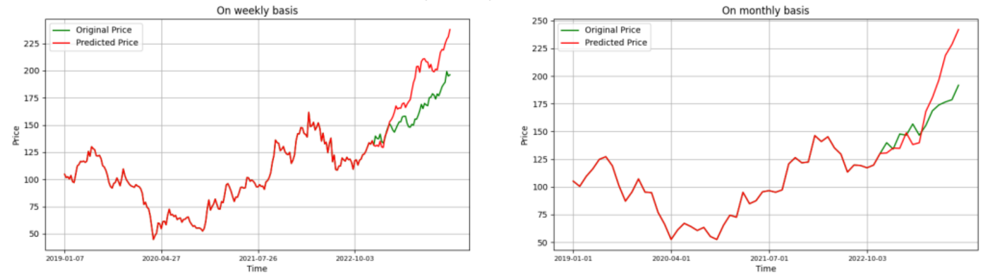

Graph for Stock prices for Nifty
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time


Graph for Stock prices for NKE
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time

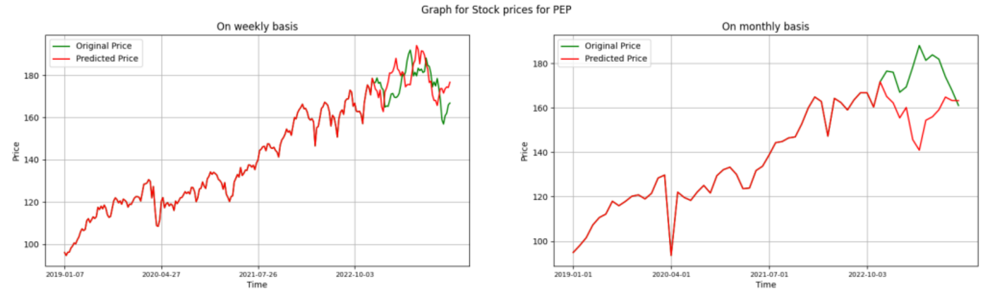
Graph for Stock prices for NVDA



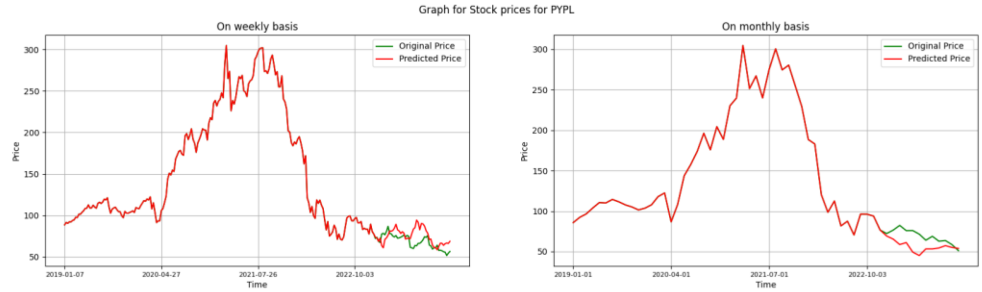
Graph for Stock prices for ONGC.NS



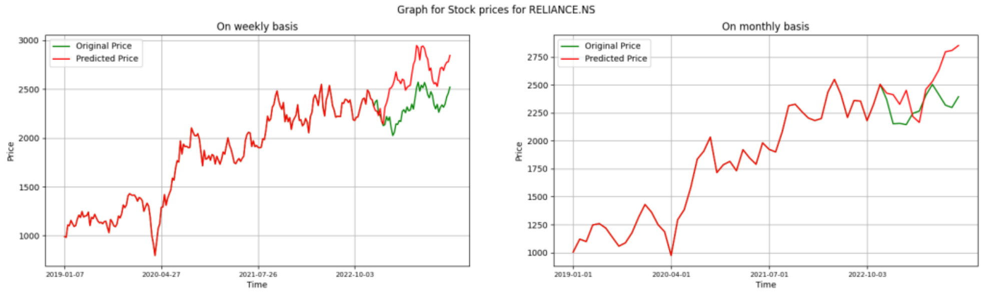
Graph for Stock prices for PEP



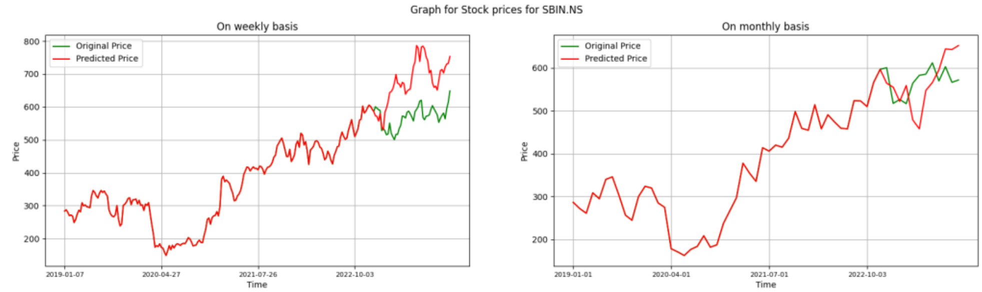
Graph for Stock prices for PYPL

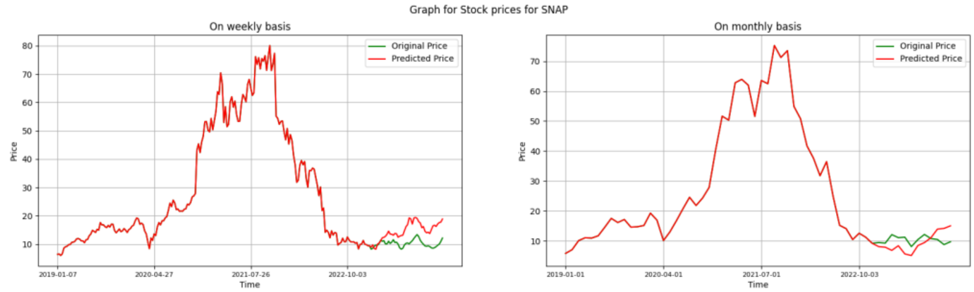


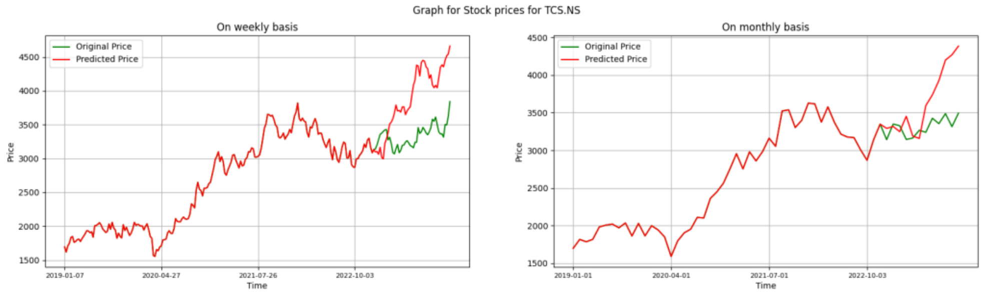
Graph for Stock prices for RELIANCE.NS

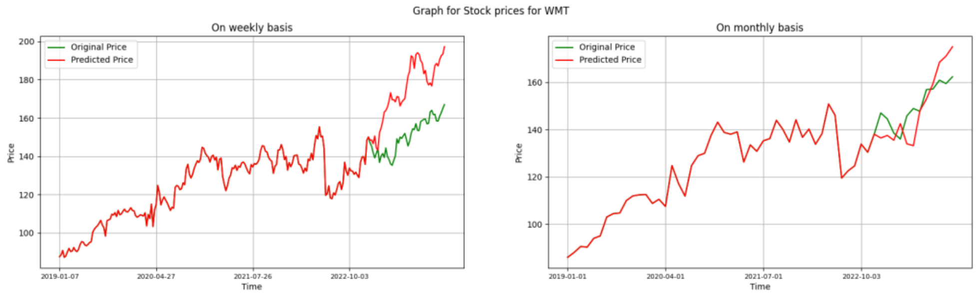


Graph for Stock prices for SBIN.NS




Graph for Stock prices for SNAP
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03


Graph for Stock prices for TCS.NS
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03


Graph for Stock prices for WMT
On weekly basis
On monthly basis
Original Price
Predicted Price
Price
Time
2019-01-07
2020-04-27
2021-07-26
2022-10-03
2019-01-01
2020-04-01
2021-07-01
2022-10-03