MA374 Lab- 6

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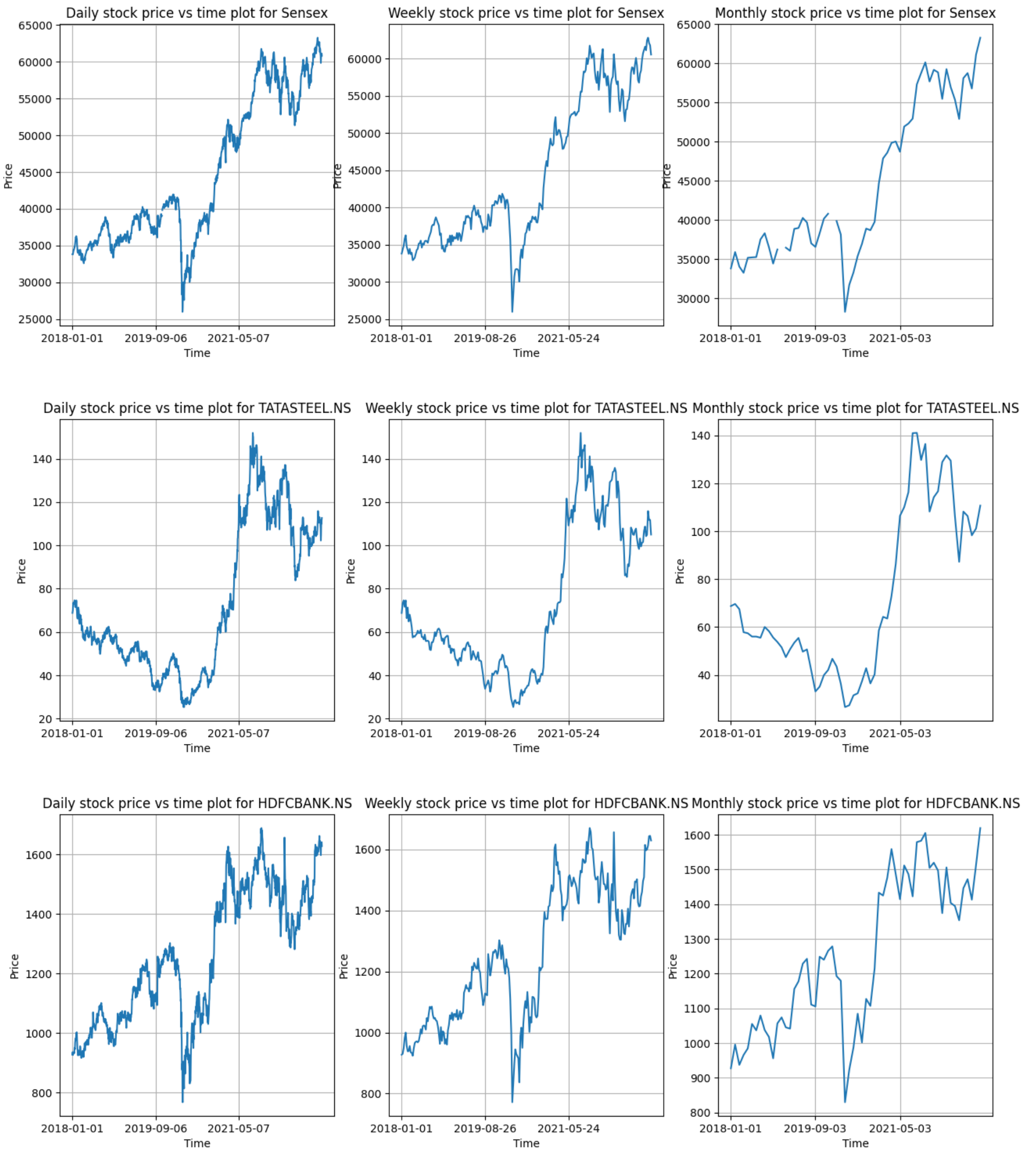
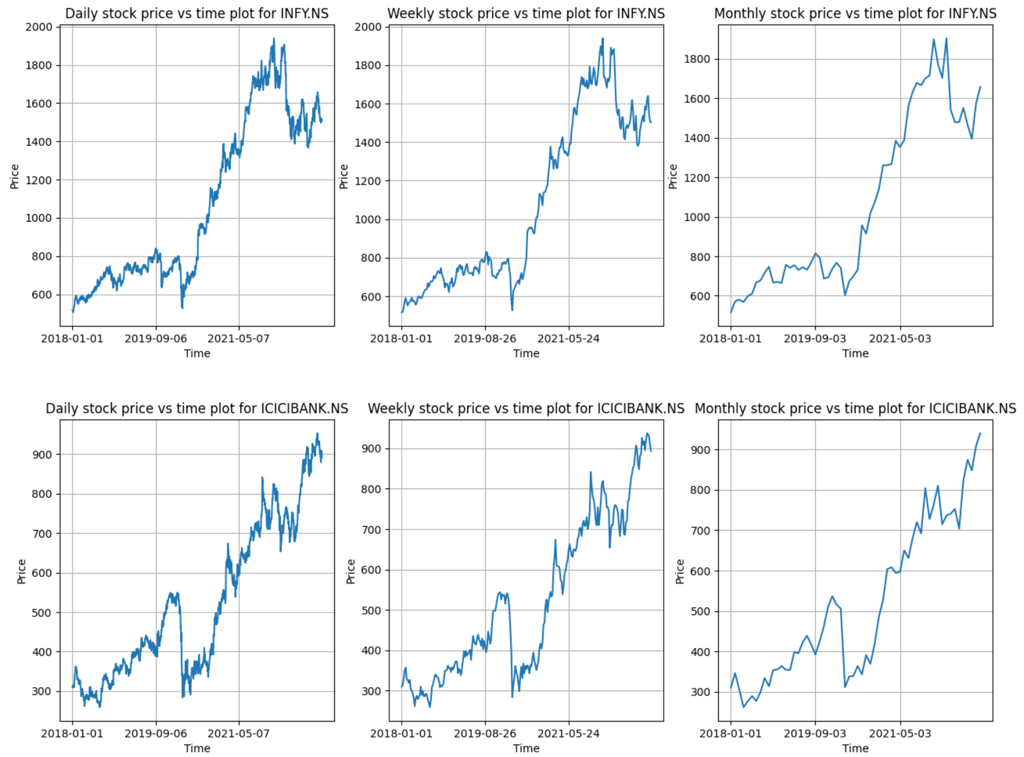
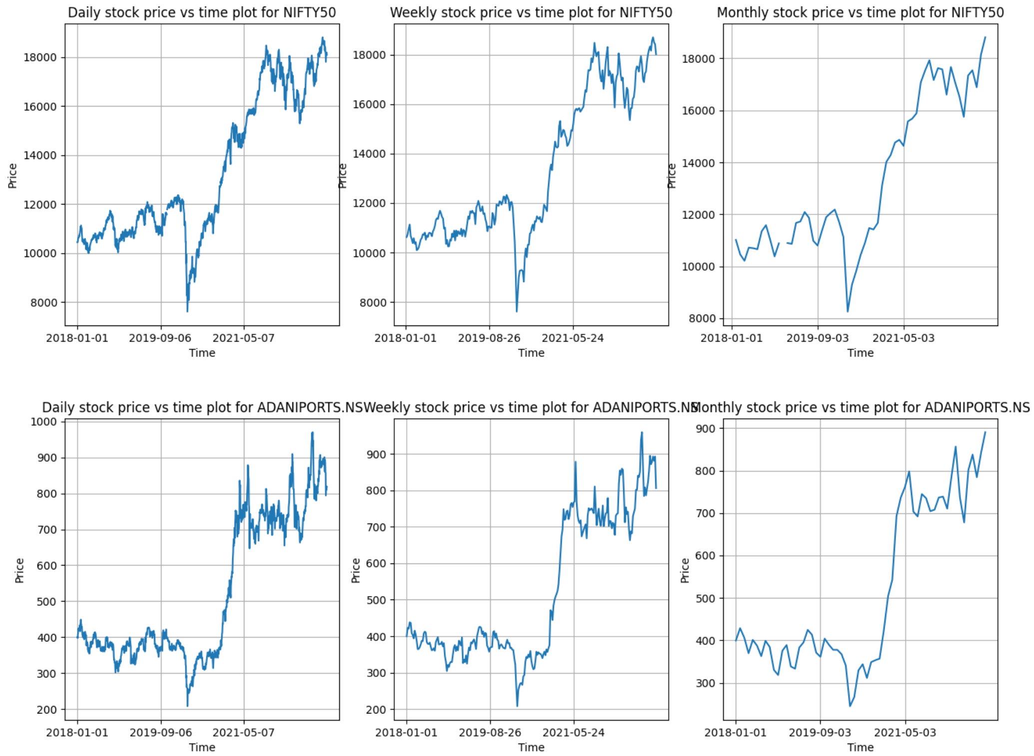
Question 1:

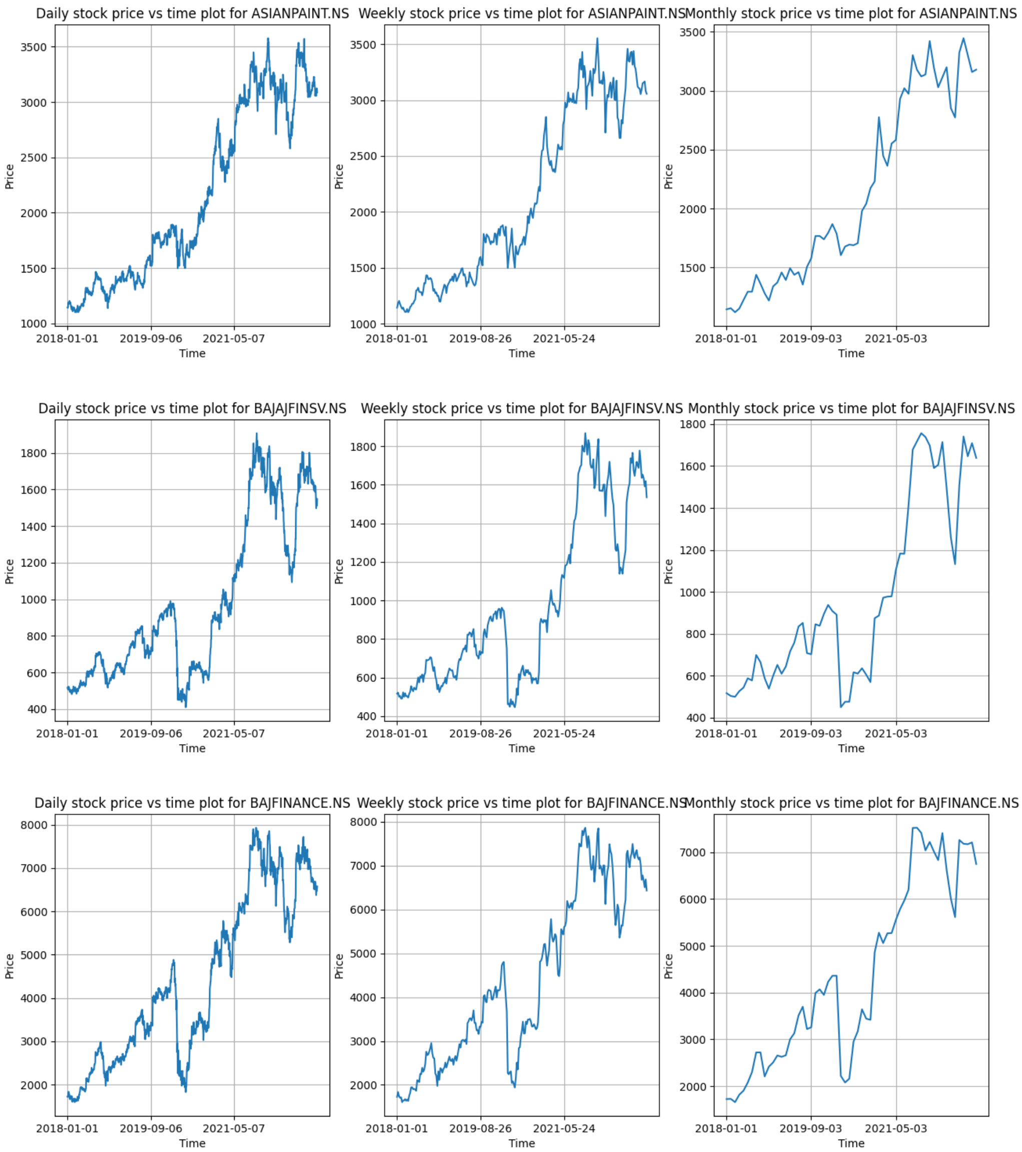
Some of the plots for the data in bsedata1 is as follows :





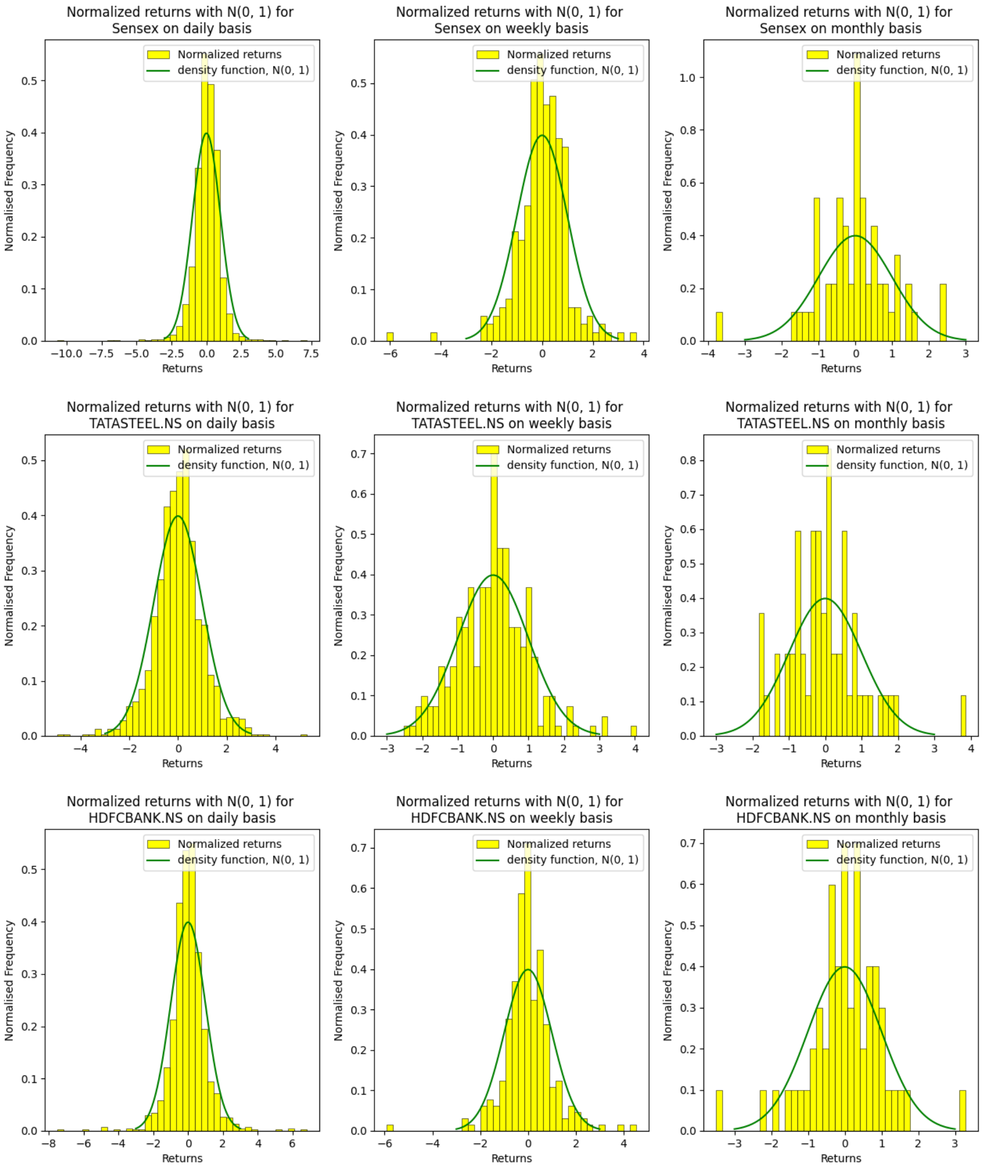
Some of the plots for nsedata1 are:



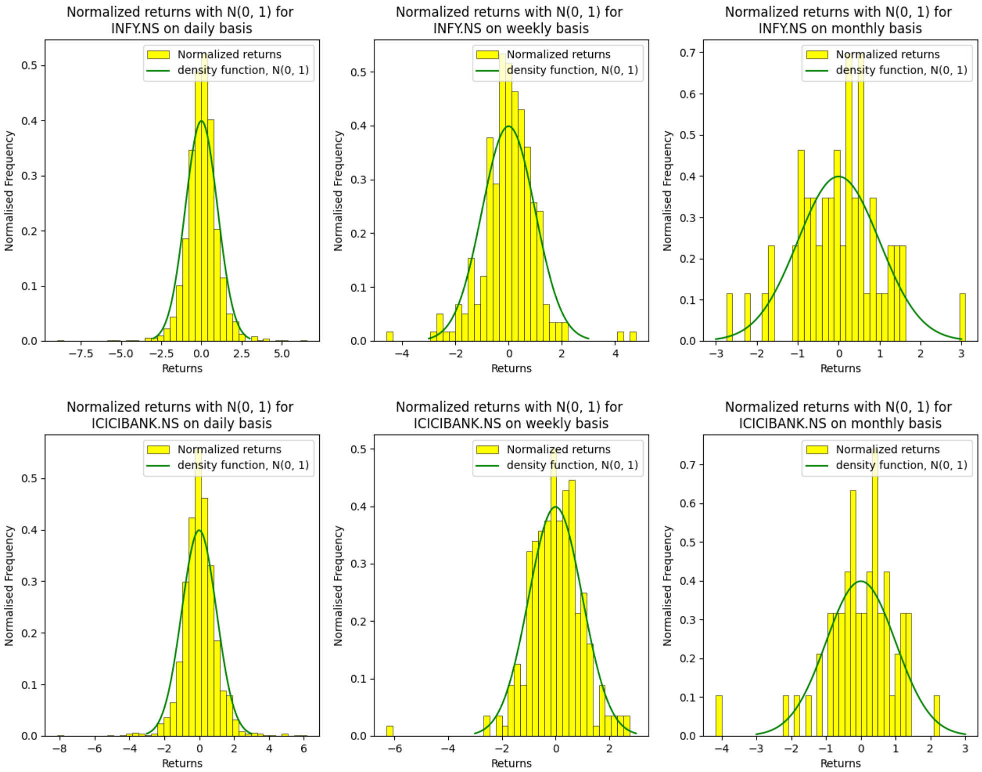


Question 2:

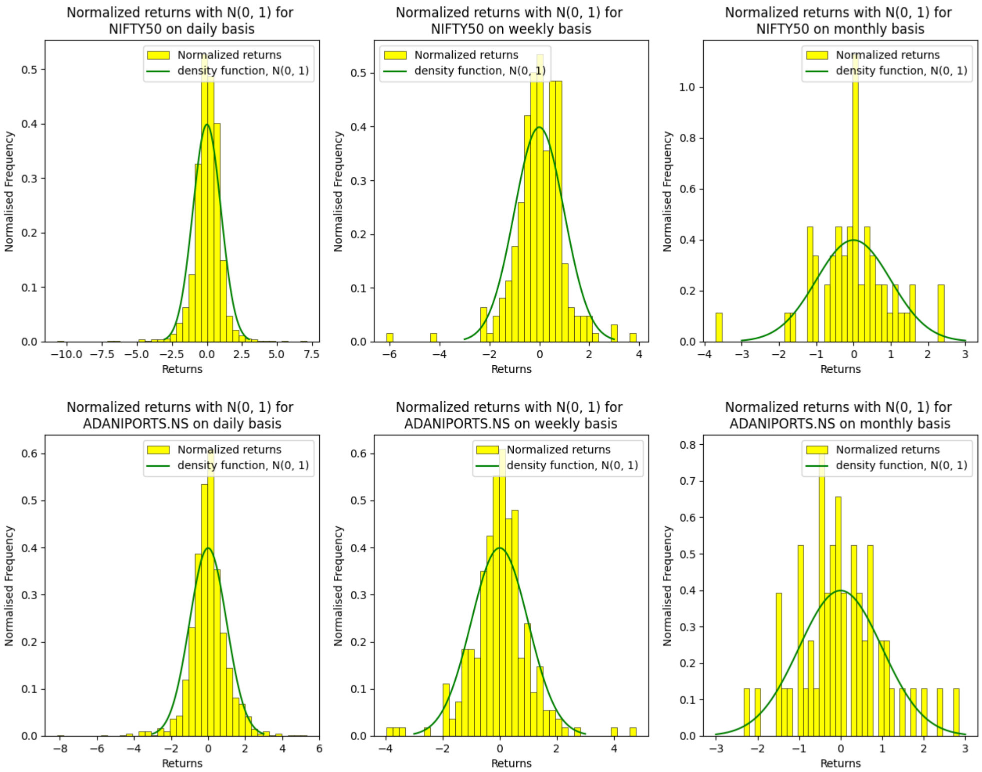
Some of the histogram plots of the normalized returns superimposing in a graph of the density function N (0, 1) for the data in bsedata1 are:

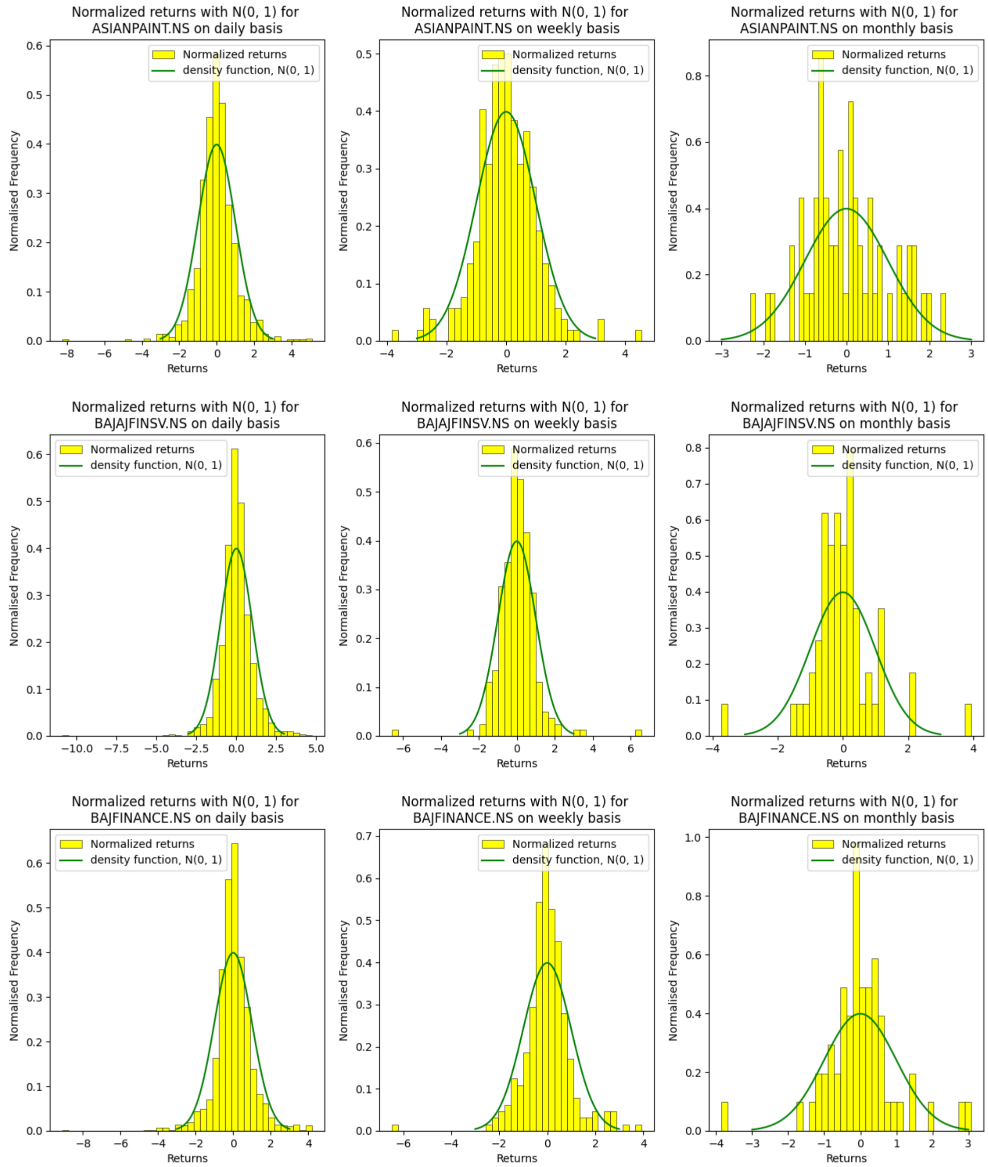


Normalized returns with N(0, 1) for Sensex on daily basis
Normalized returns with N(0, 1) for Sensex on weekly basis
Normalized returns with N(0, 1) for Sensex on monthly basis
Normalized returns with N(0, 1) for TATASTEEL.NS on daily basis
Normalized returns with N(0, 1) for TATASTEEL.NS on weekly basis
Normalized returns with N(0, 1) for TATASTEEL.NS on monthly basis
Normalized returns with N(0, 1) for HDFCBANK.NS on daily basis
Normalized returns with N(0, 1) for HDFCBANK.NS on weekly basis
Normalized returns with N(0, 1) for HDFCBANK.NS on monthly basis
Normalized returns
density function, N(0, 1)
Normalised Frequency
Returns

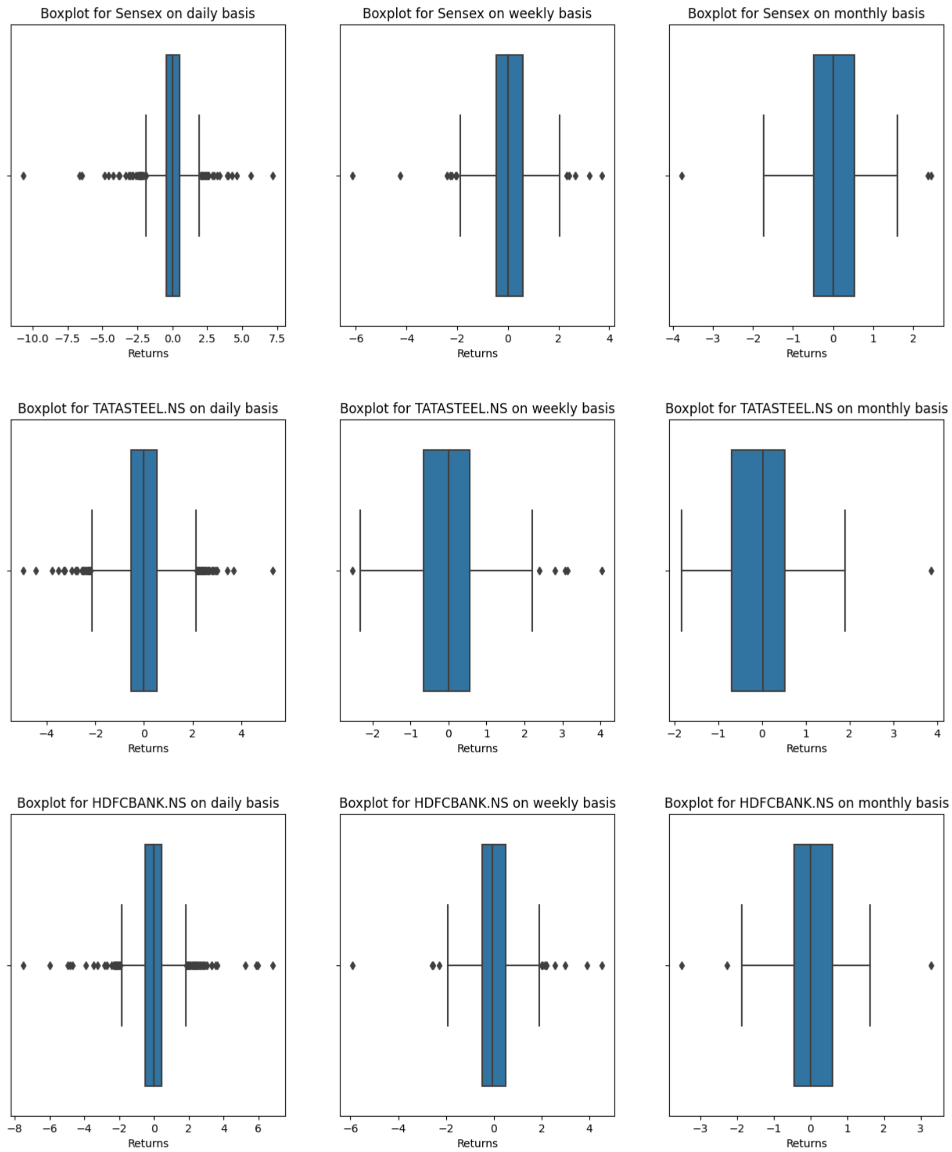


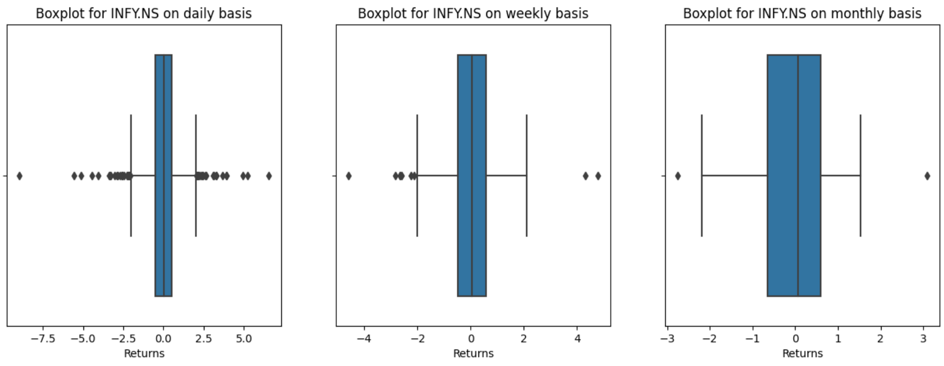
and the same for nsedata1 are:



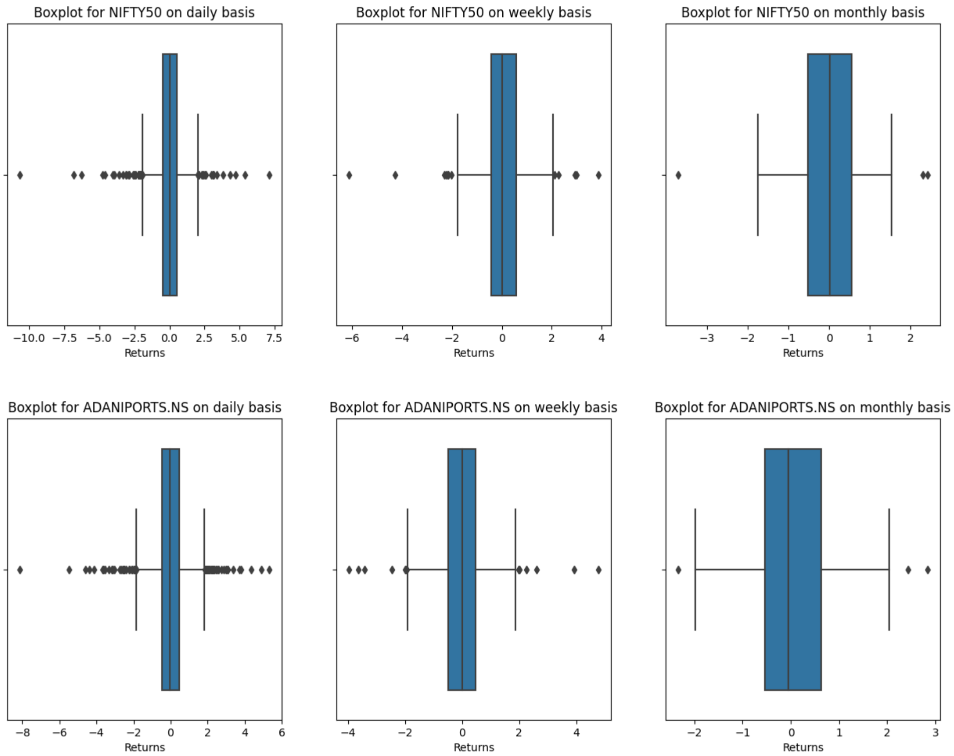


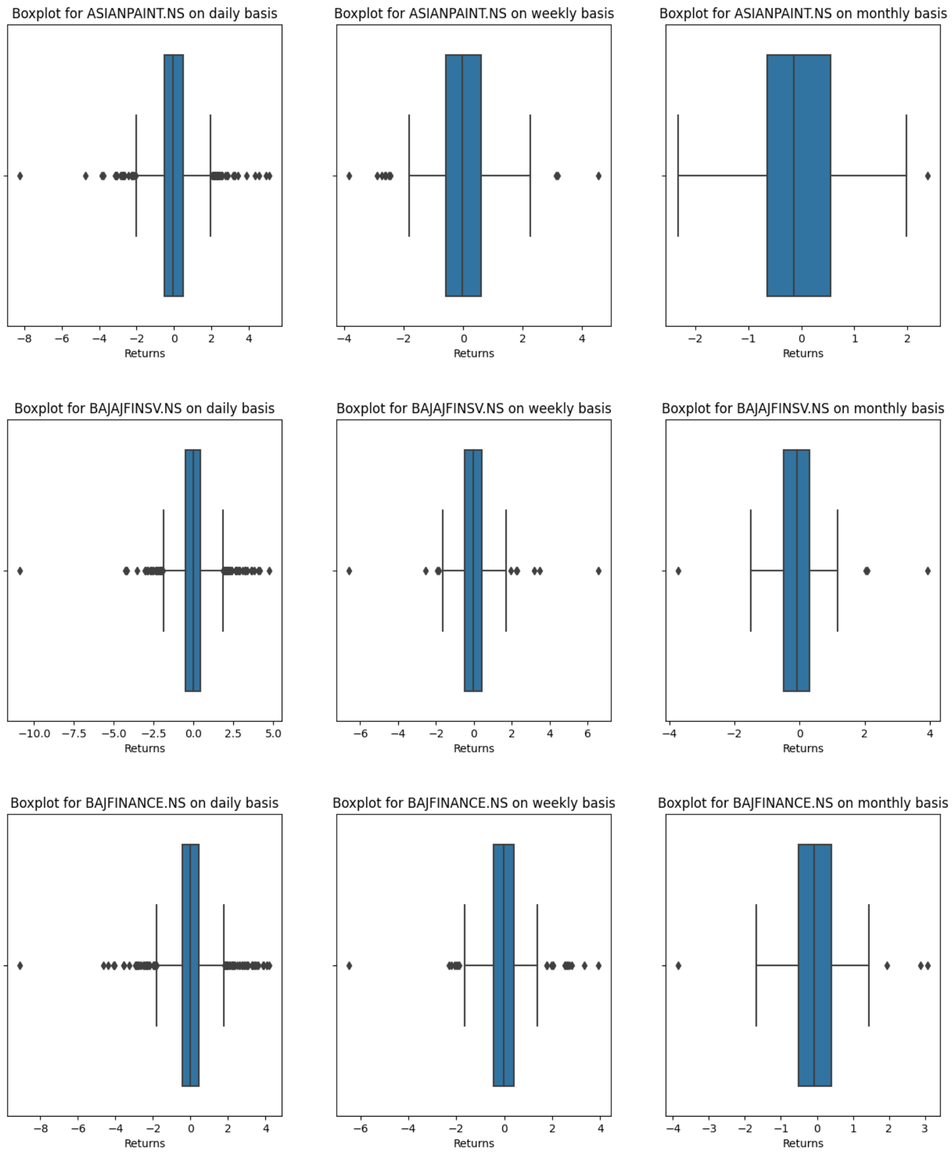
Now the corresponding boxplot of the normalized return of some of the stocks of bsedata1 are as follows:


Boxplot for Sensex on daily basis
Returns
Boxplot for Sensex on weekly basis
Returns
Boxplot for Sensex on monthly basis
Returns
Boxplot for TATASTEEL.NS on daily basis
Returns
Boxplot for TATASTEEL.NS on weekly basis
Returns
Boxplot for TATASTEEL.NS on monthly basis
Returns
Boxplot for HDFCBANK.NS on daily basis
Returns
Boxplot for HDFCBANK.NS on weekly basis
Returns
Boxplot for HDFCBANK.NS on monthly basis
Returns



And the same for nsedata1 are:



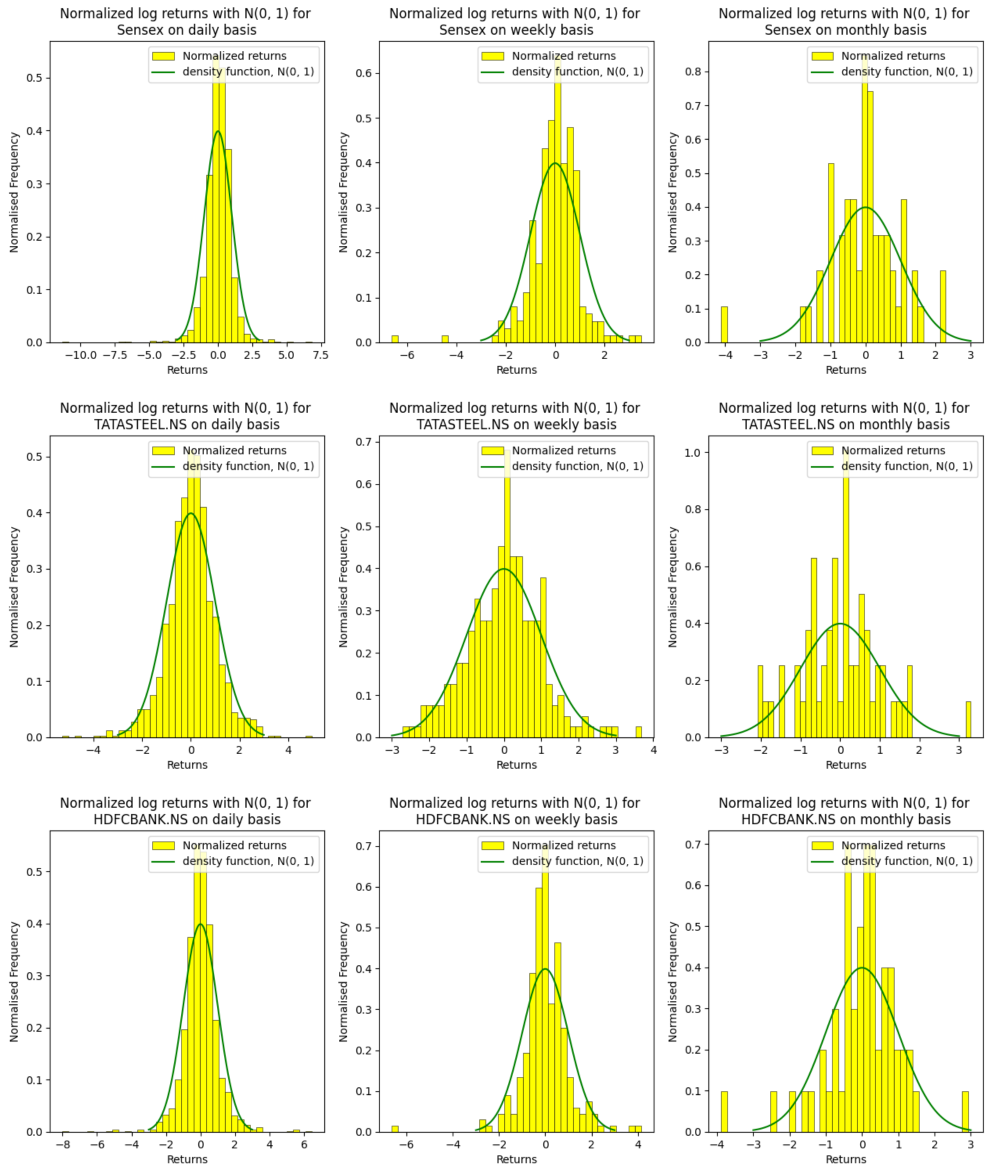


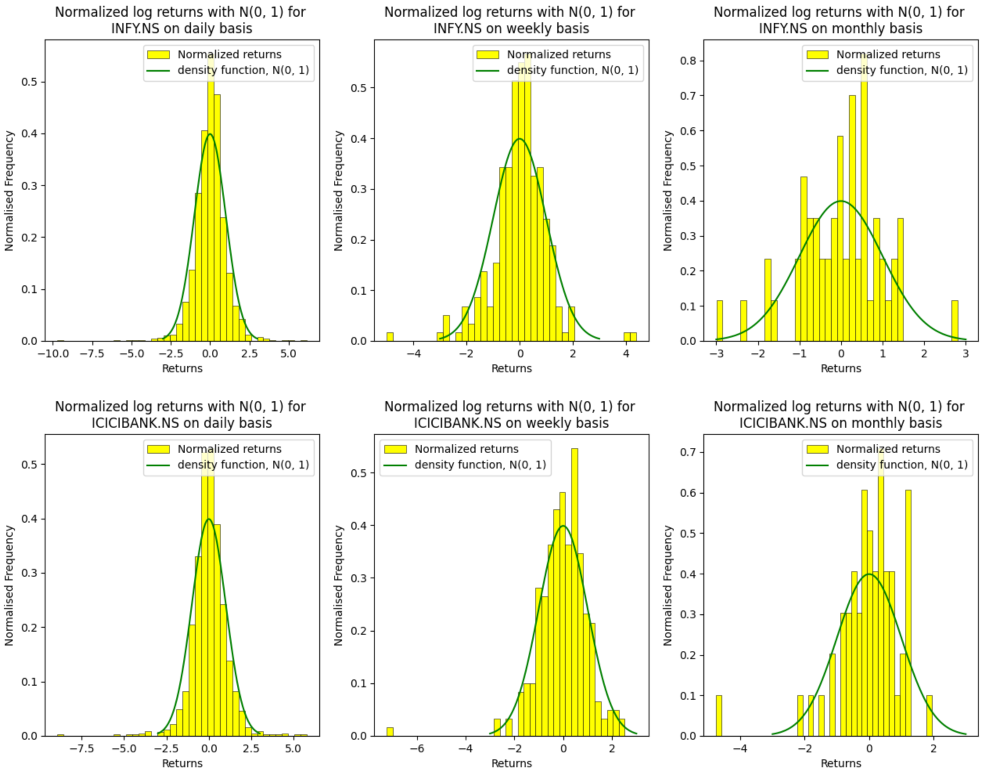
Observations –

1. We can observe that the N(0, 1) roughly estimates the normalized returns, which is more accurate if the returns are computed on daily basis instead of weekly or monthly.
2. The deviations are due to the random fluctuations in the real world market, so, naïve Gaussian distribution can't completely model it.
3. It is more evident when a closer look is taken at the tails of these plots. The curve for N(0, 1) steeply decreases to 0, but the returns on the prices does not. At the tails, there seem to be more deviations, and more proper model using a mix of different distributions is required to capture those changes.
4. Such a behaviour is called as leptokurtic, i.e., high peaks and heavy tails. Jump diffusion model (by Merton) take these so called jumps at the tails into account.

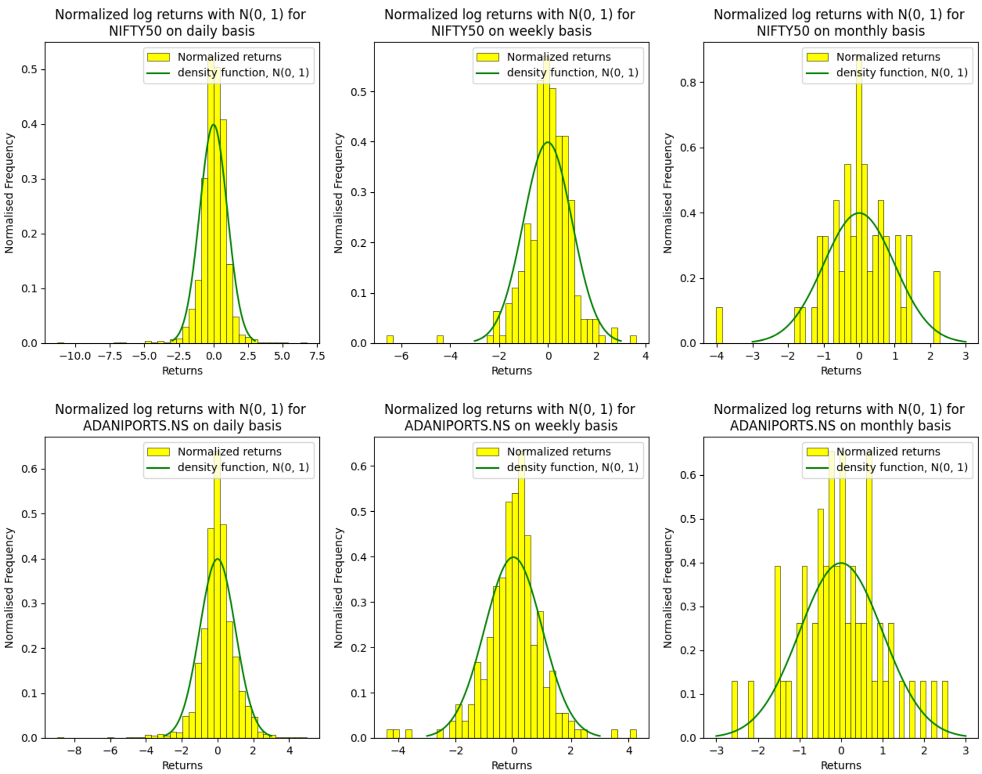
Question 3:

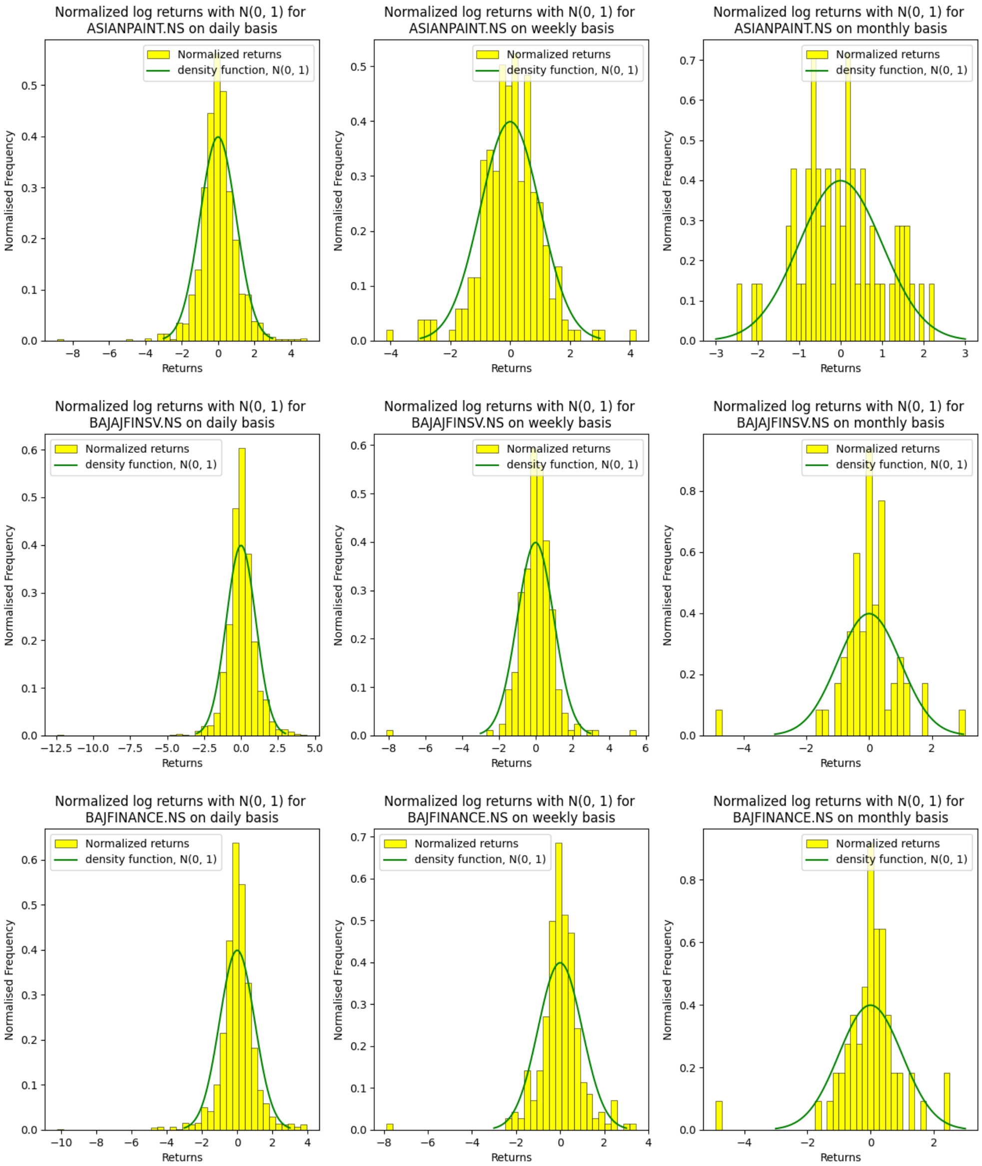
The similar plots for the log returns for the data in bsedata1 are:





And for the data of nsedata1 are:





Question 4 and 5:

Formulae used –

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

$$S(t_{i+1}) = S(t_i)\exp((\mu - 0.5\,\sigma^2)(t_{i+1} - t_i) + \sigma\sqrt{t_{i+1} - t_i}\,Z_{i+1})$$

$$\mu - \frac{\sigma^2}{2} = \frac{1}{n}\sum_1^n u_i = E(u)$$

$$\sigma^2 = \frac{1}{n-1}\sum_1^n (u_i - E(u))^2$$

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

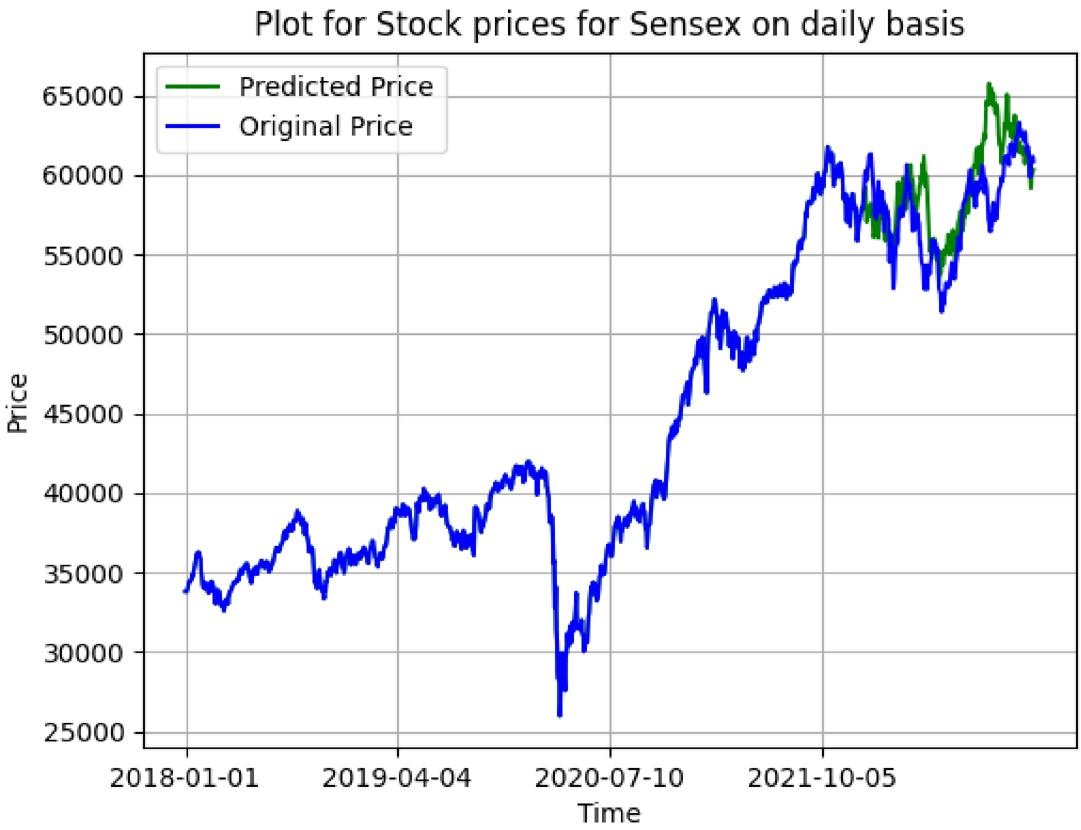
-

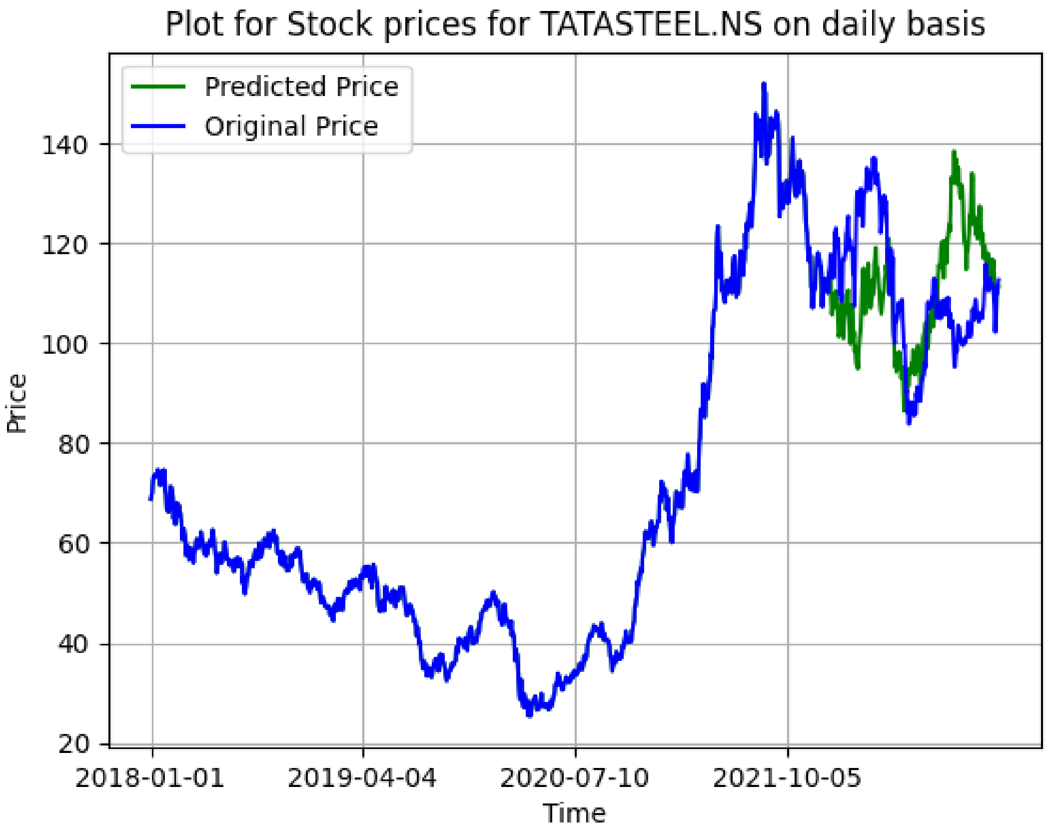
where,

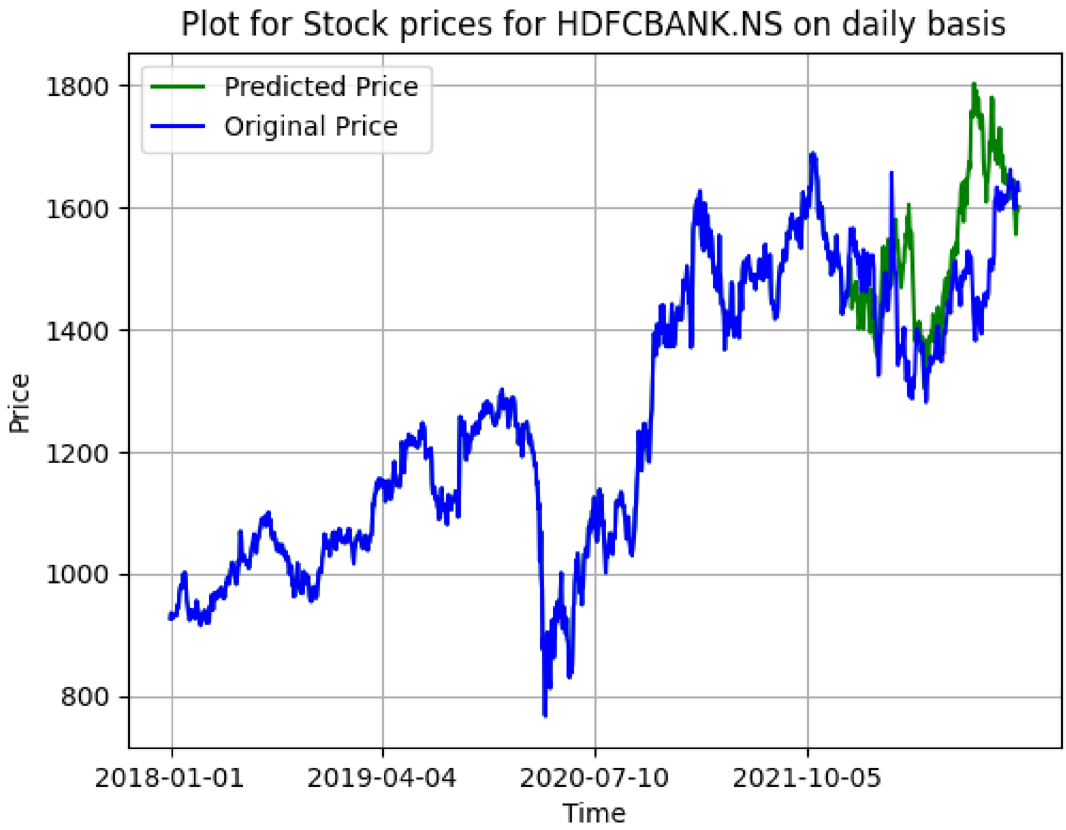
Z1, Z2, ..., Zn are independent N(0, 1) variables, ui is the log return of day i, and si and si-1 are adjacent closing stock prices of day i - 1 and day i respectively

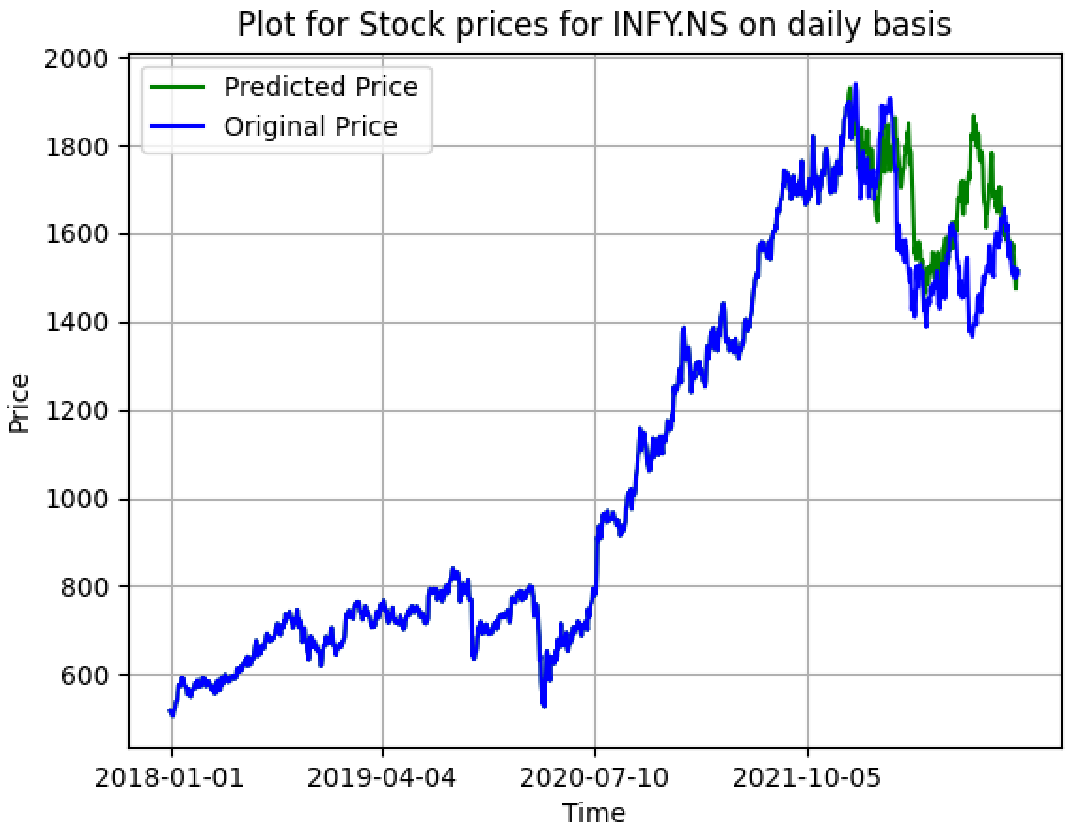
For daily stock data:

The generated stock prices path along with the actual path for stocks in bsedata1 are:

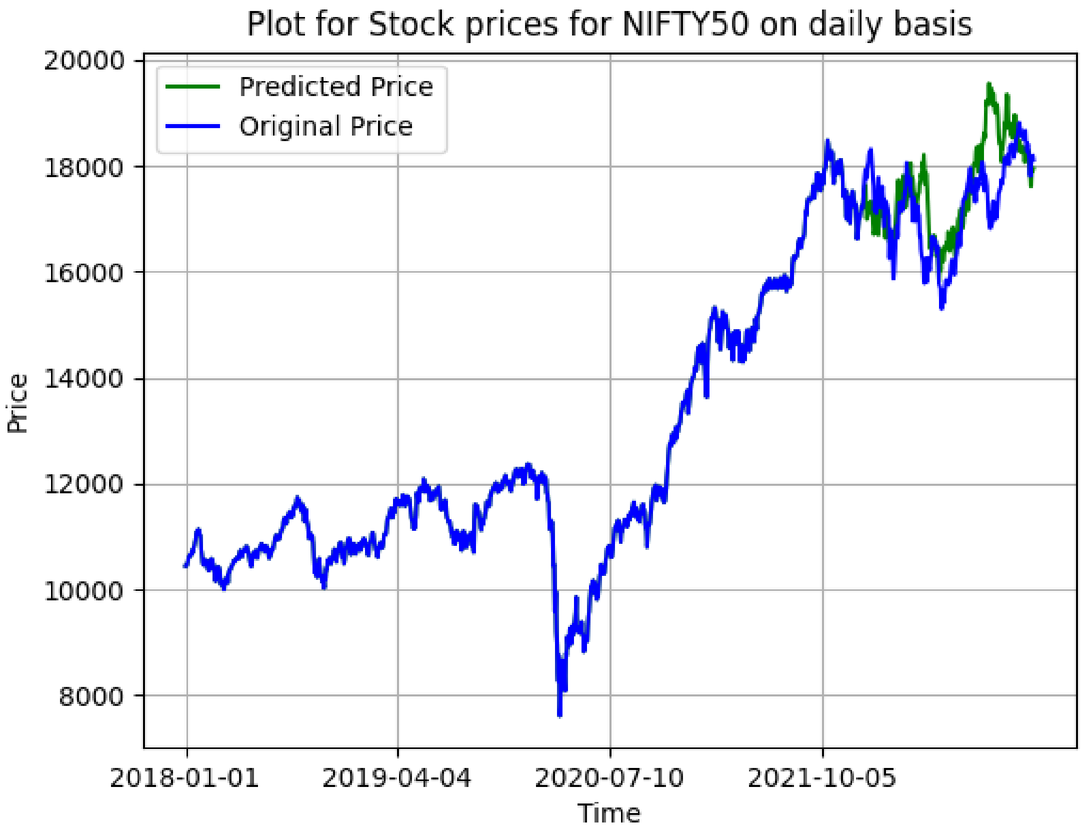

Plot for Stock prices for Sensex on daily basis
Predicted Price
Original Price
65000
60000
55000
50000
45000
40000
35000
30000
25000
Price
2018-01-01
2019-04-04
2020-07-10
2021-10-05
Time

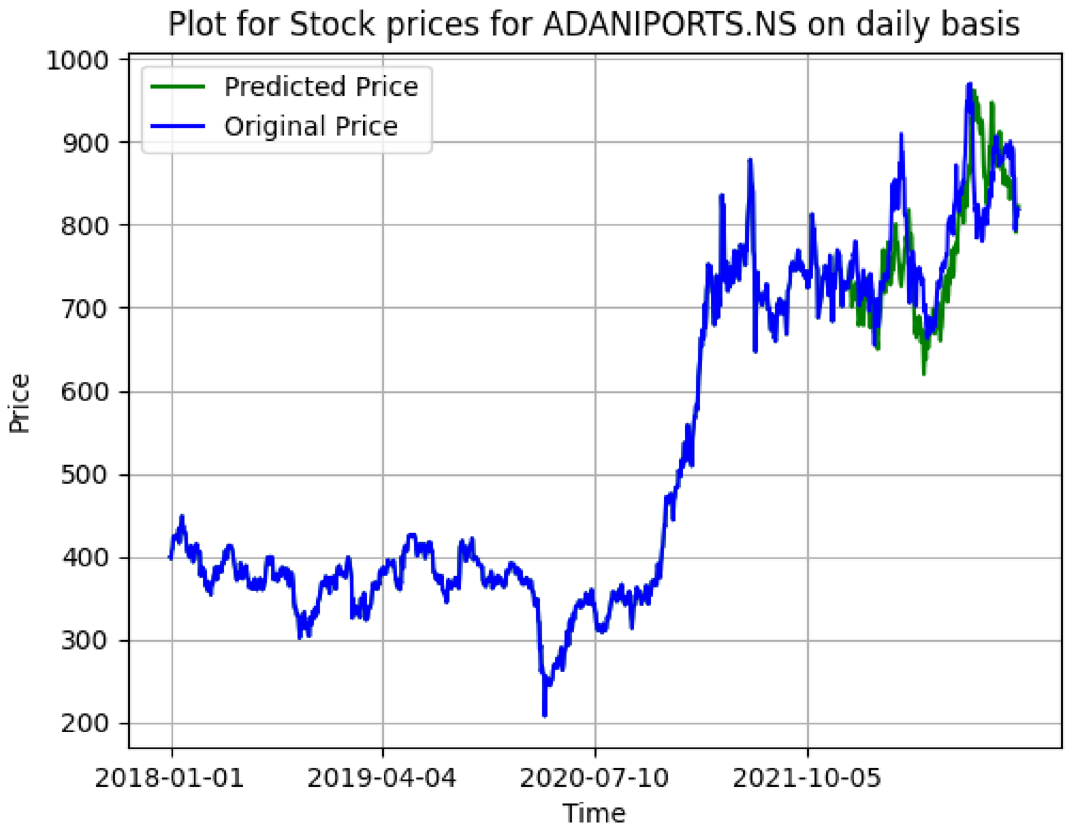

Plot for Stock prices for TATASTEEL.NS on daily basis
Predicted Price
Original Price
140
120
100
80
60
40
20
Price
2018-01-01
2019-04-04
2020-07-10
2021-10-05
Time

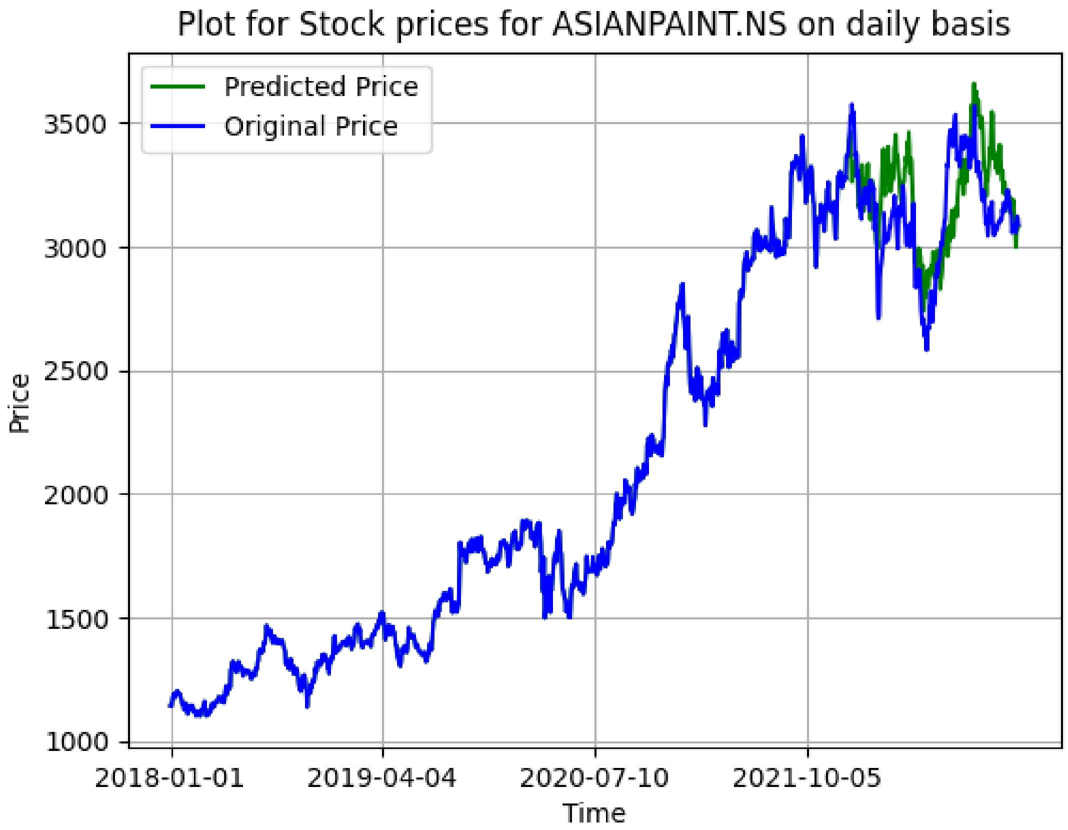

Plot for Stock prices for HDFCBANK.NS on daily basis
Predicted Price
Original Price
Price
Time
1800
1600
1400
1200
1000
800
2018-01-01
2019-04-04
2020-07-10
2021-10-05


Plot for Stock prices for INFY.NS on daily basis
Predicted Price
Original Price
Price
Time
2000
1800
1600
1400
1200
1000
800
600
2018-01-01
2019-04-04
2020-07-10
2021-10-05

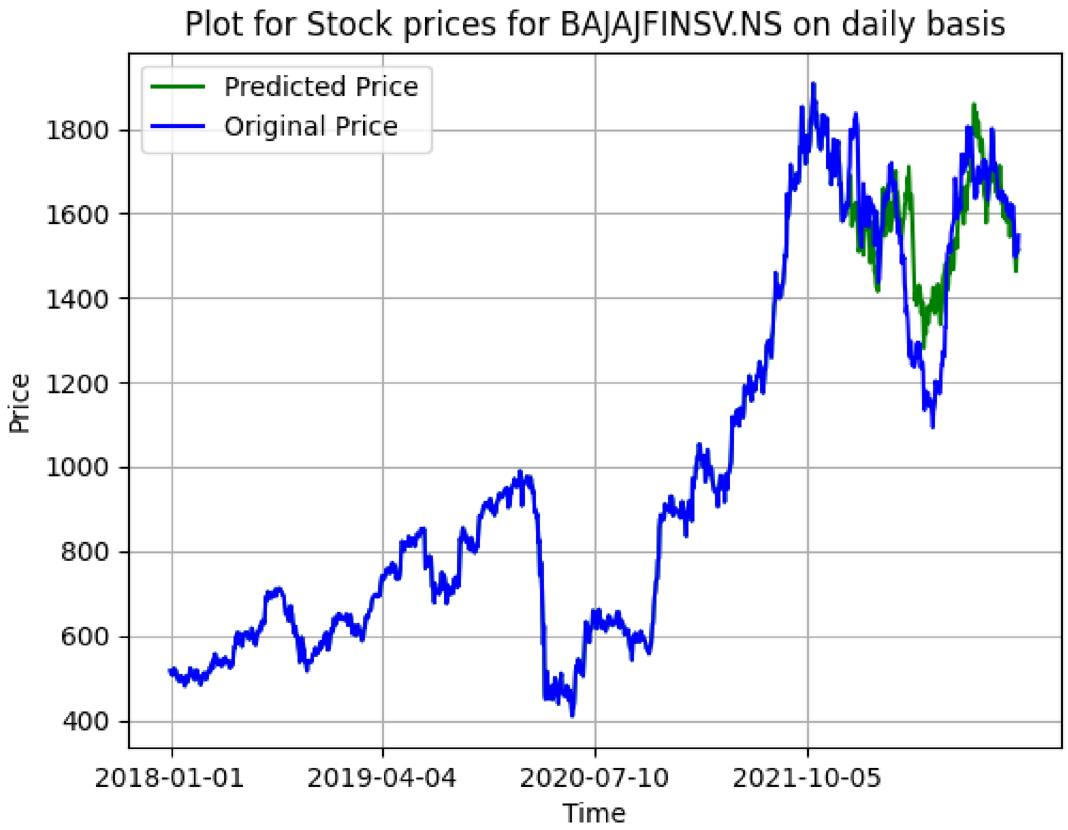
The generated stock prices path along with the actual path for stocks in nsedata1 are:


Plot for Stock prices for NIFTY50 on daily basis
Predicted Price
Original Price
20000
18000
16000
14000
12000
10000
8000
Price
2018-01-01
2019-04-04
2020-07-10
2021-10-05
Time


Plot for Stock prices for ADANIPORTS.NS on daily basis
Predicted Price
Original Price
1000
900
800
700
600
500
400
300
200
Price
2018-01-01
2019-04-04
2020-07-10
2021-10-05
Time



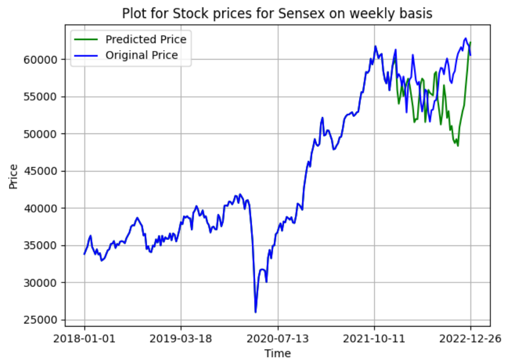
Plot for Stock prices for ASIANPAINT.NS on daily basis
Predicted Price
Original Price
3500
3000
2500
2000
1500
1000
Price
2018-01-01
2019-04-04
2020-07-10
2021-10-05
Time

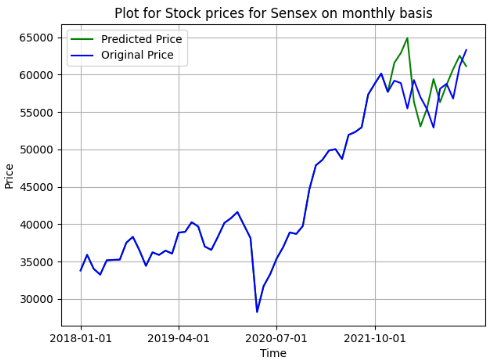


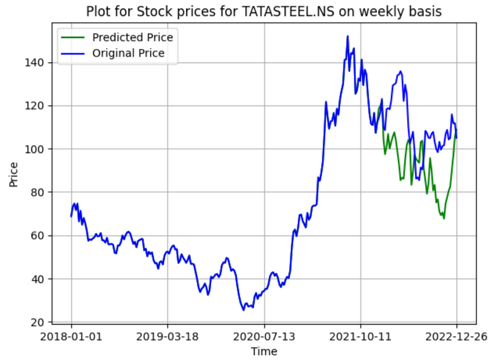
Plot for Stock prices for BAJAJFINSV.NS on daily basis
Predicted Price
Original Price
1800
1600
1400
1200
1000
800
600
400
Price
2018-01-01
2019-04-04
2020-07-10
2021-10-05
Time

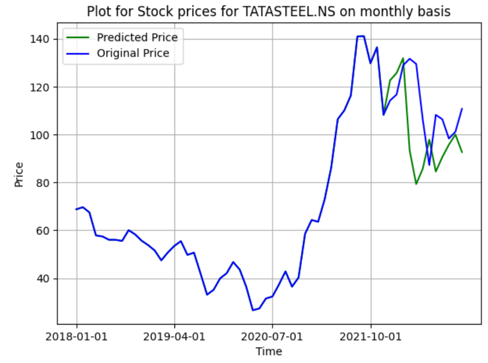
Now for Weekly and Monthly Returns the similar plots are :

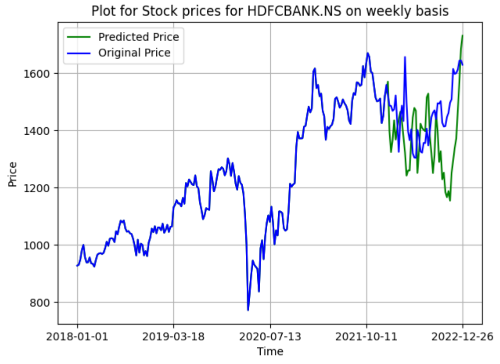
For bsedata1:

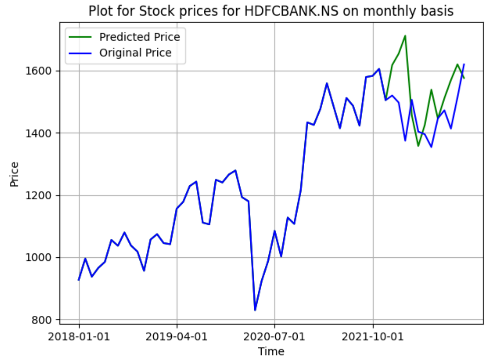


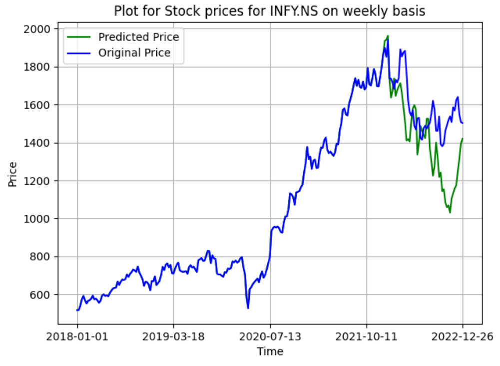


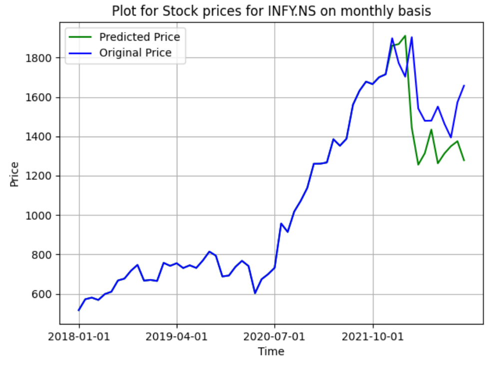




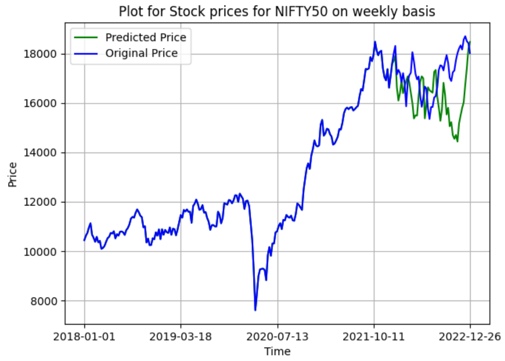


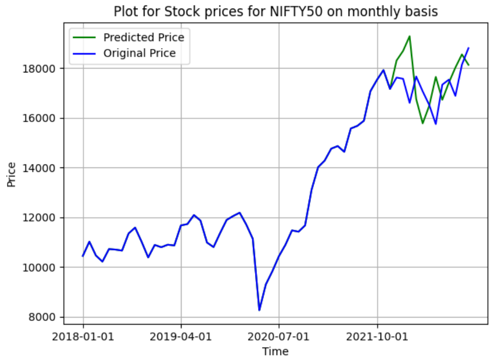


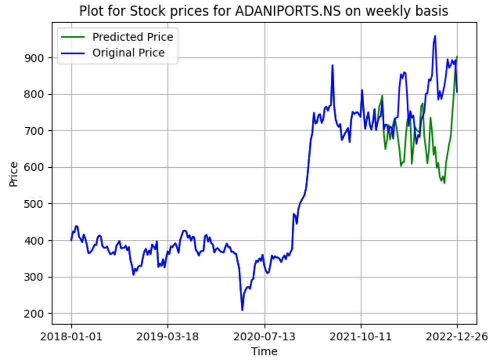


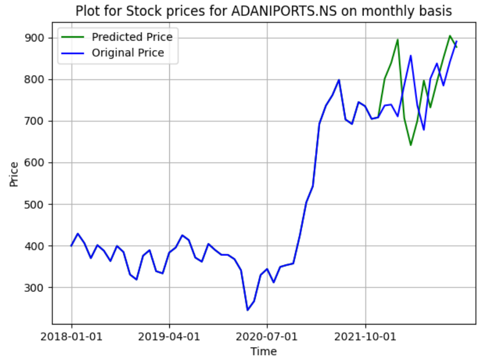


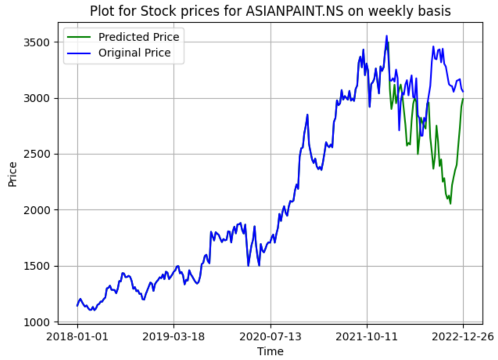
For nsedata1:

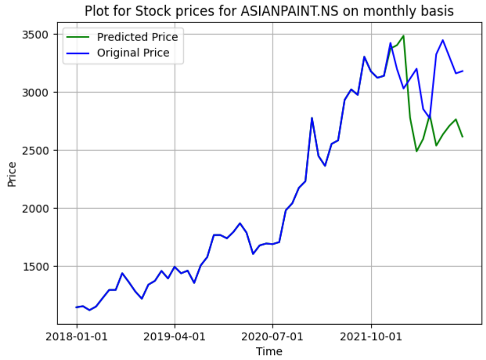

Plot for Stock prices for NIFTY50 on weekly basis
Predicted Price
Original Price
Price
Time
2018-01-01
2019-03-18
2020-07-13
2021-10-11
2022-12-26

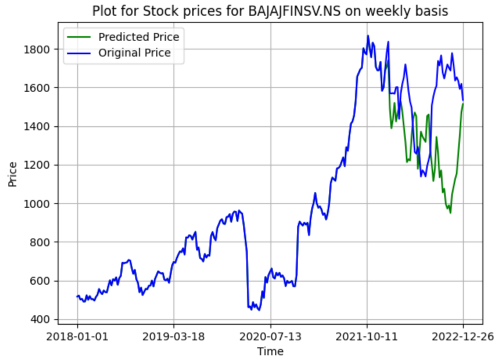

Plot for Stock prices for NIFTY50 on monthly basis
Predicted Price
Original Price
Price
Time
2018-01-01
2019-04-01
2020-07-01
2021-10-01

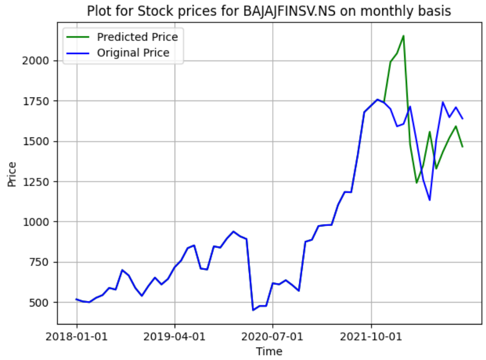

Plot for Stock prices for ADANIPORTS.NS on weekly basis
Predicted Price
Original Price
Price
Time
2018-01-01
2019-03-18
2020-07-13
2021-10-11
2022-12-26


Plot for Stock prices for ADANIPORTS.NS on monthly basis
Predicted Price
Original Price
Price
Time
2018-01-01
2019-04-01
2020-07-01
2021-10-01


Plot for Stock prices for ASIANPAINT.NS on weekly basis
Predicted Price
Original Price
Price
Time
2018-01-01
2019-03-18
2020-07-13
2021-10-11
2022-12-26


Plot for Stock prices for ASIANPAINT.NS on monthly basis
Predicted Price
Original Price
Price
Time
2018-01-01
2019-04-01
2020-07-01
2021-10-01


Plot for Stock prices for BAJAJFINSV.NS on weekly basis
Predicted Price
Original Price
Price
Time
2018-01-01
2019-03-18
2020-07-13
2021-10-11
2022-12-26


Plot for Stock prices for BAJAJFINSV.NS on monthly basis
Predicted Price
Original Price
Price
Time
2018-01-01
2019-04-01
2020-07-01
2021-10-01