Ma374-LAB 06

Name: Harsh Yadav **Roll. No.**: 180123015 **Dept.**: Mathematics and Computing

Submission Date: 25-02-2021

QUESTION 1:

Similar to the previous assignment, **company stock prices (10 from Sensex-BSE and 10 from Nifty-NSE)** ranging from **Jan 1, 2014 to Dec 31, 2018** was collected. (daily, weekly and monthly closing prices). Also, Nifty index values and Sensex index values (for the same range) was collected (from Yahoo Finance). Then, the **Stock Price vs Time** was plotted out.

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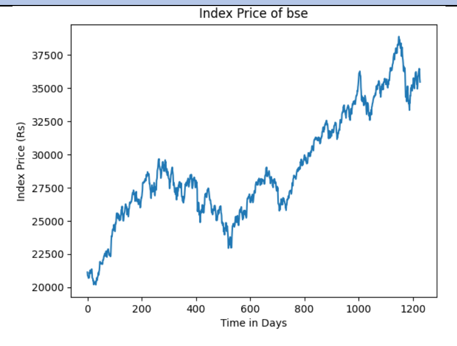
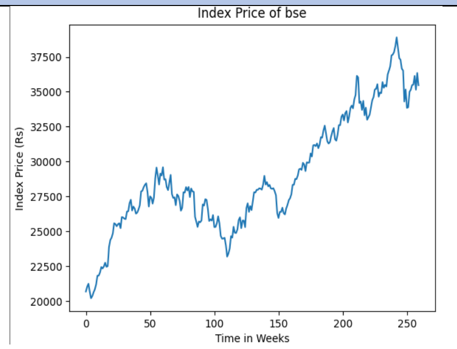
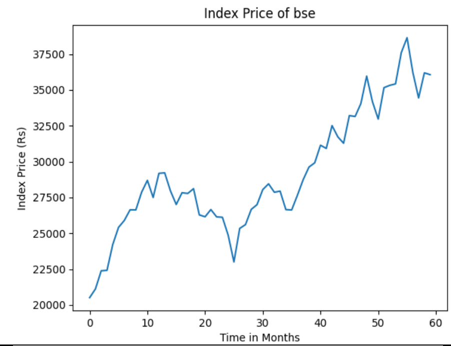
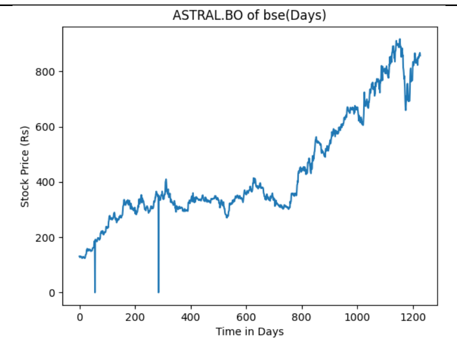
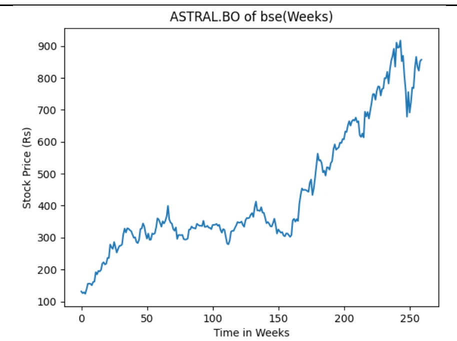
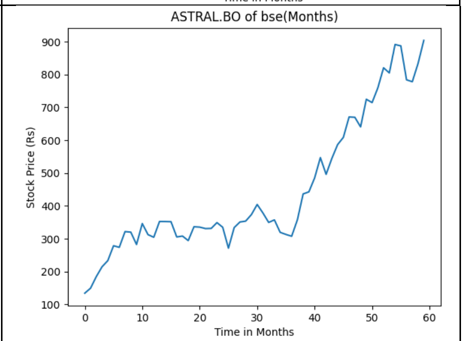
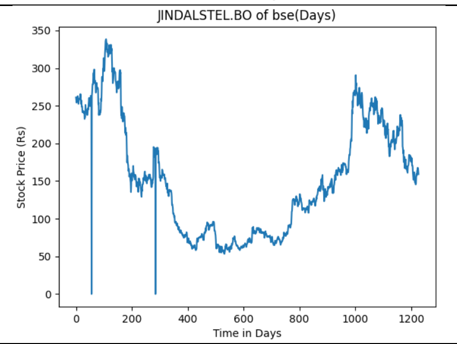
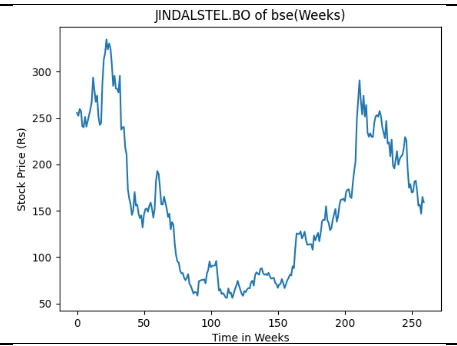
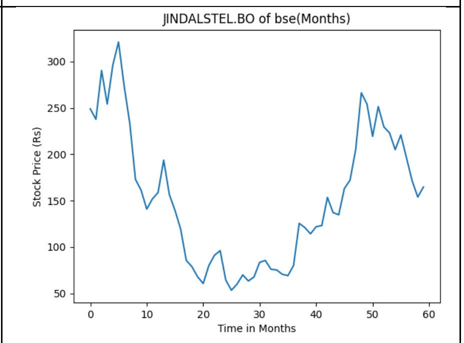
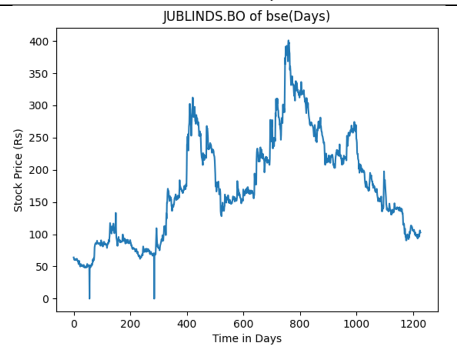
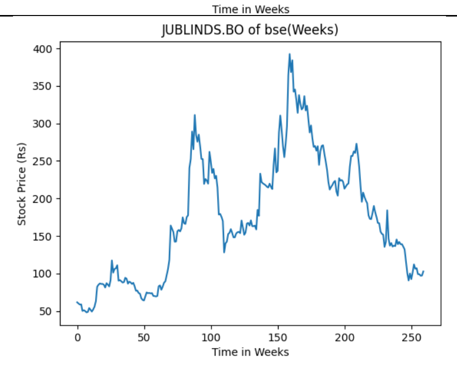
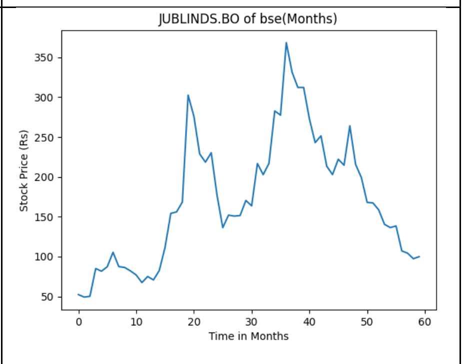
BSE INDEX			
ASTRAL			
Jindal Steel			
JubLinds			

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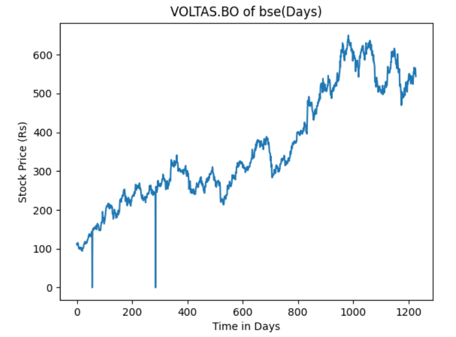

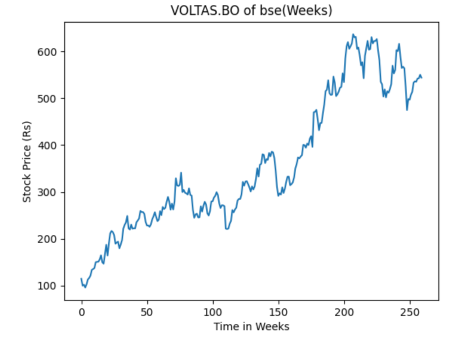

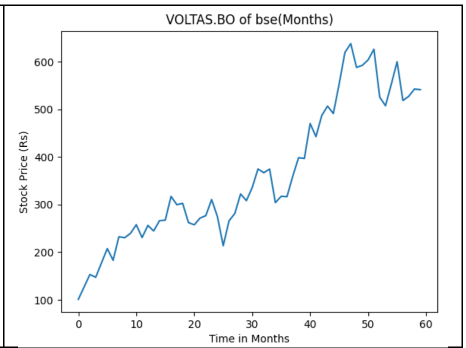

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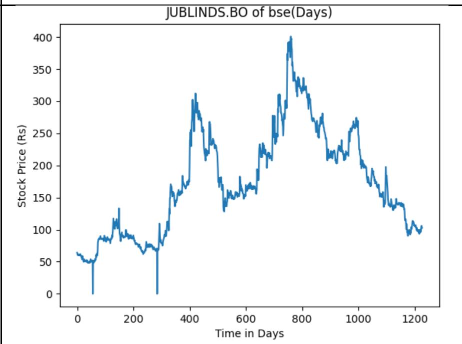

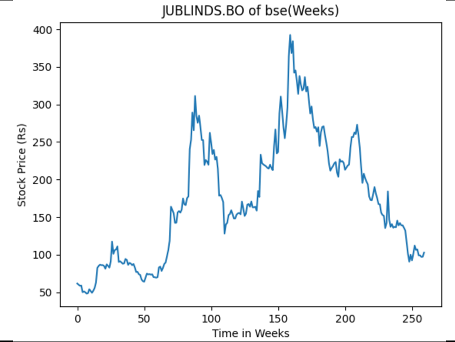

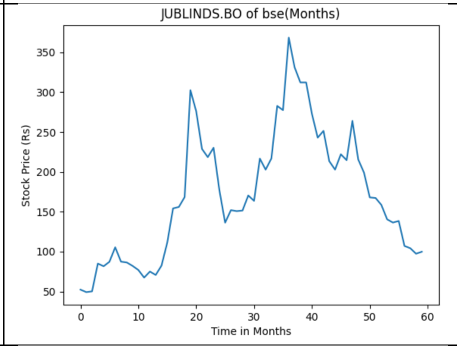

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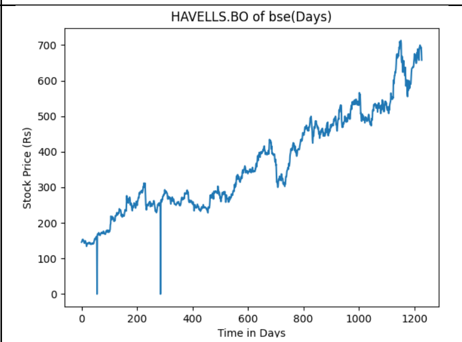

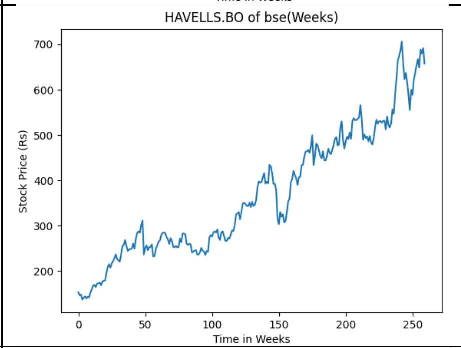

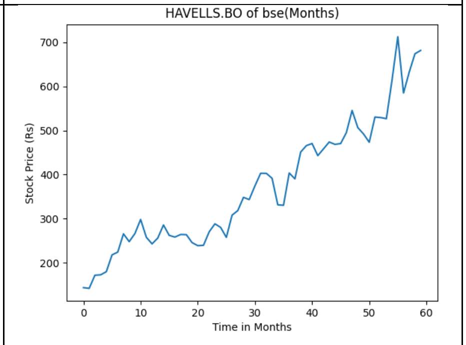

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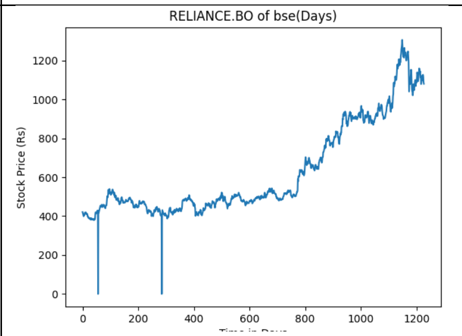

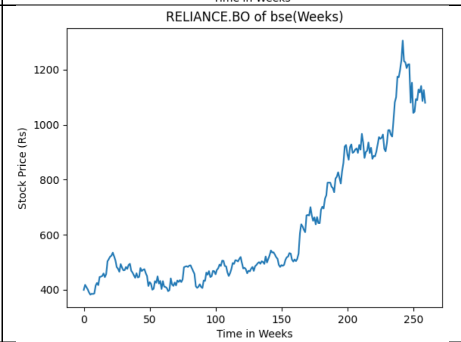

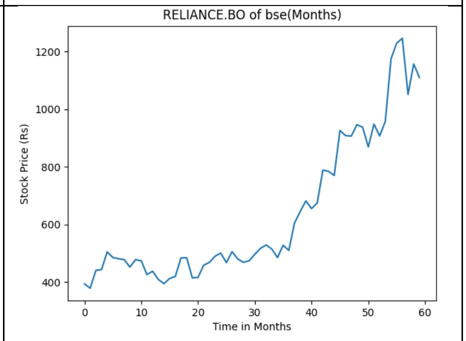

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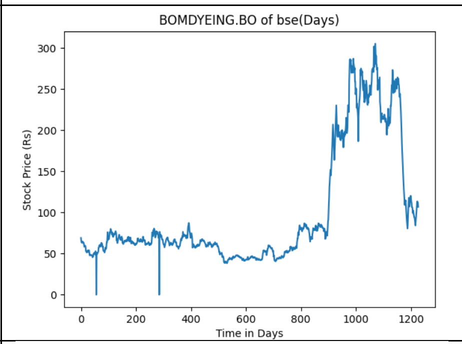

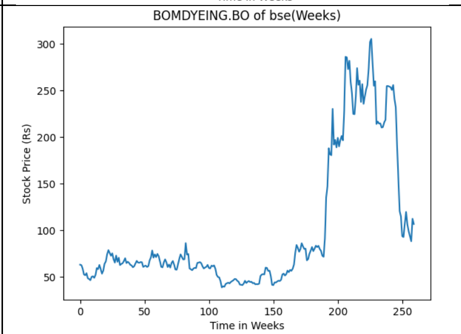

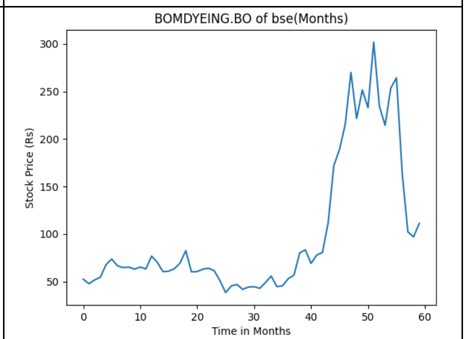

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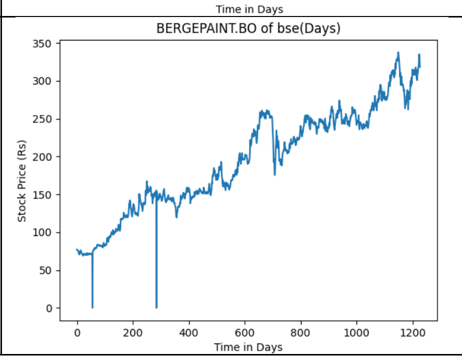
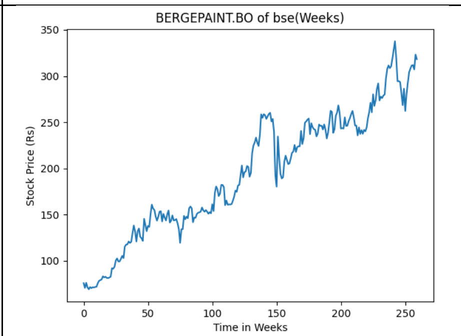
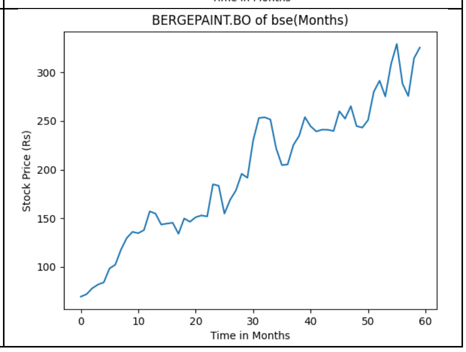
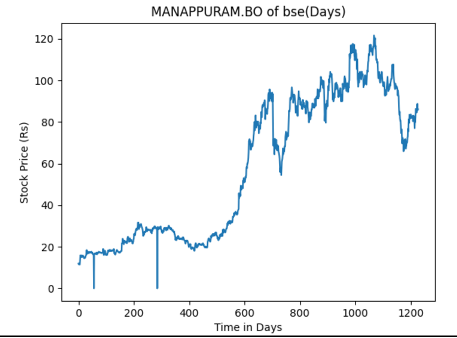
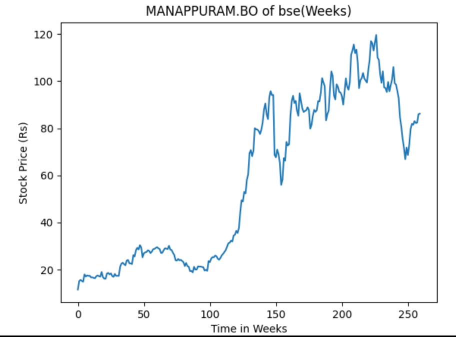
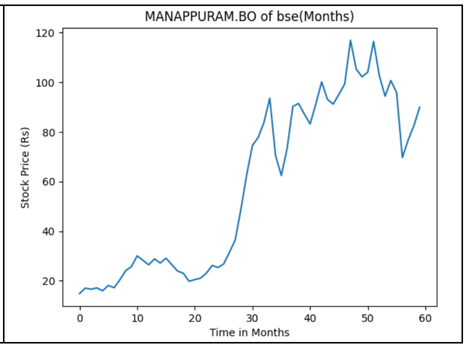






Mannapuram			

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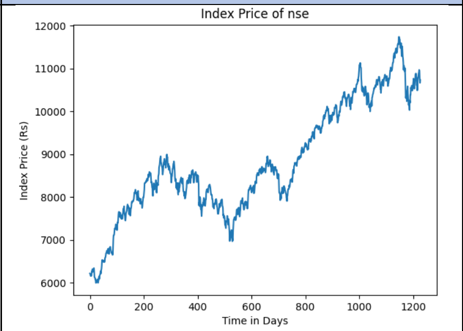
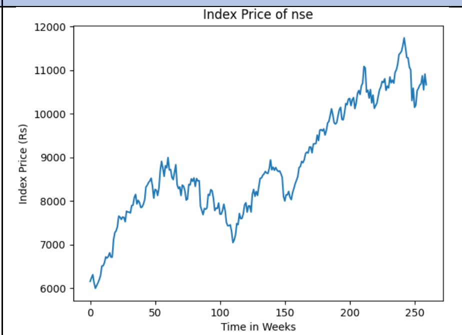
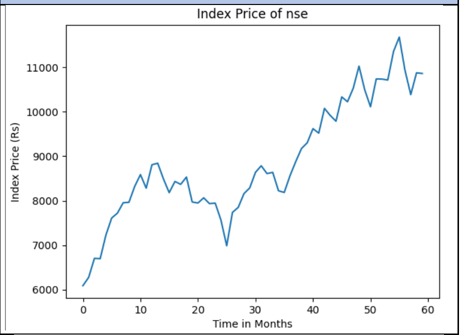
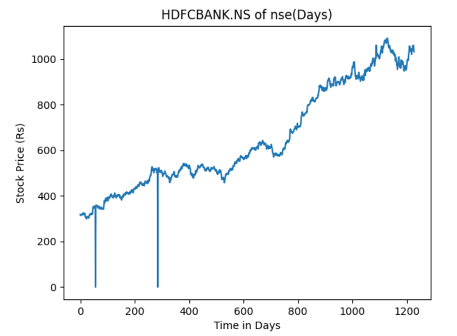
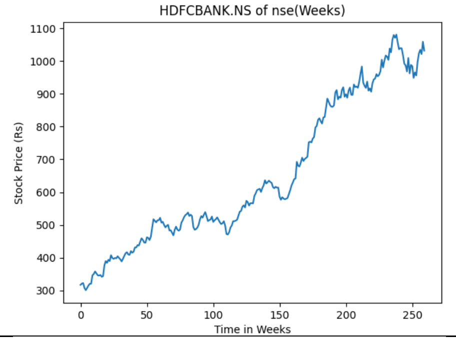
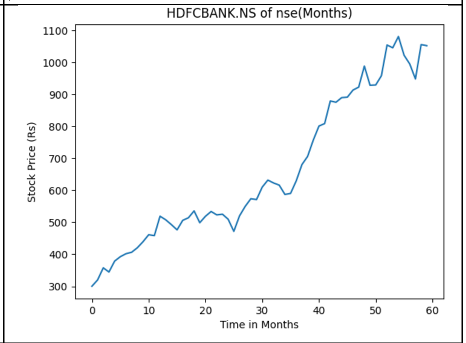
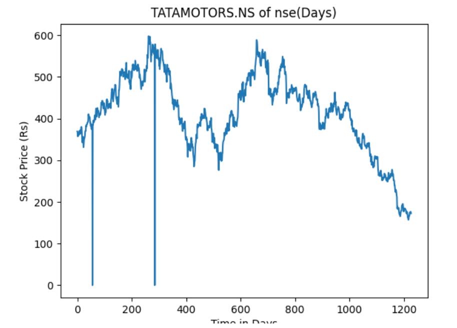
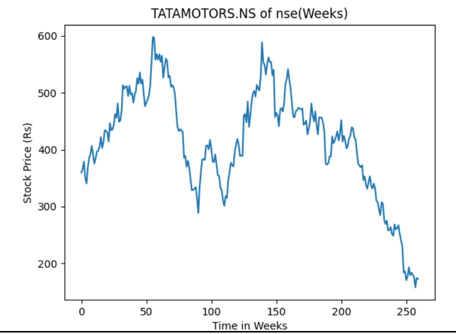
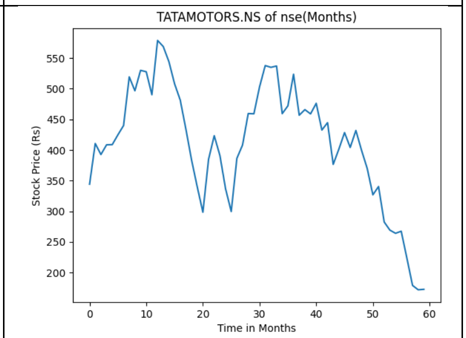
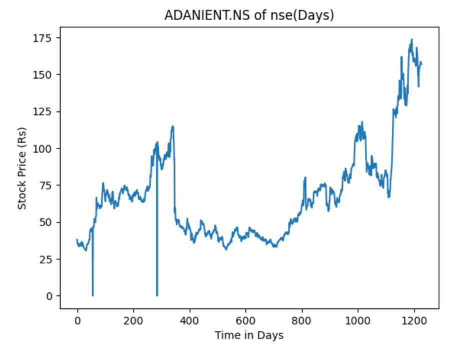
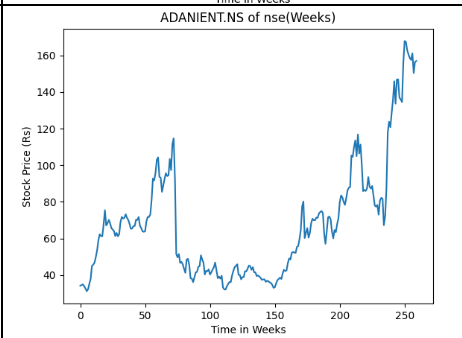
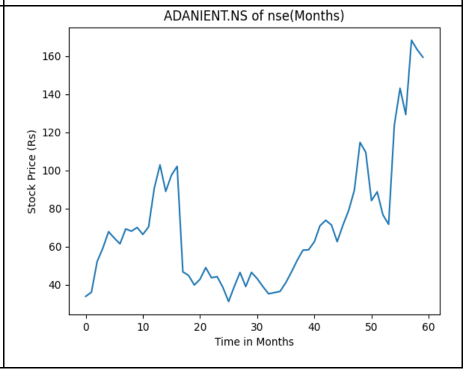
NSE Index			
HDFC Bank			
TATA Motors			
Adanient			

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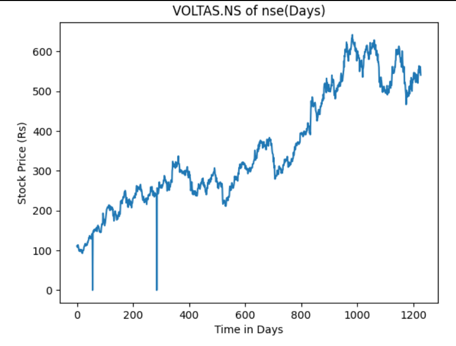

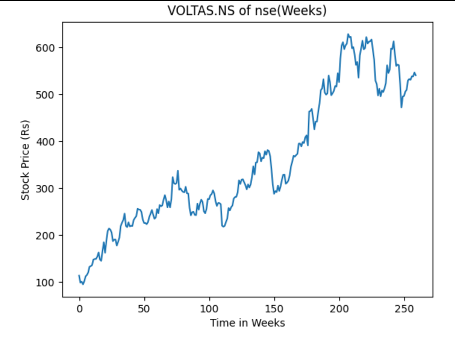

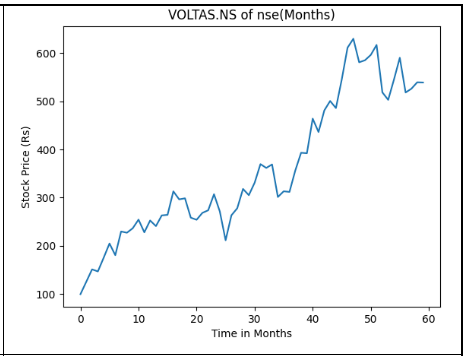

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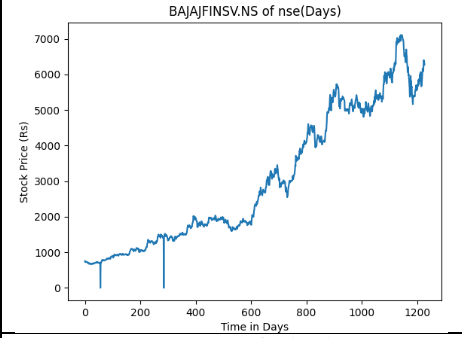

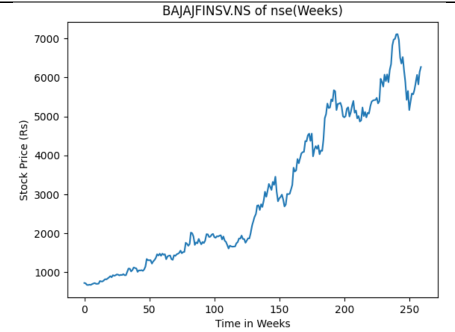

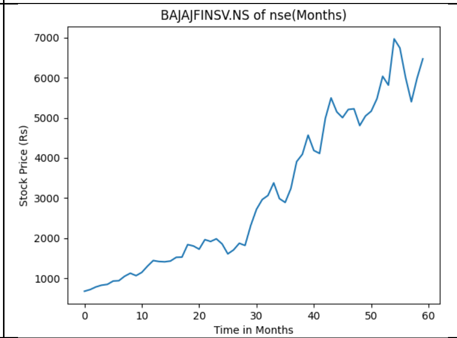

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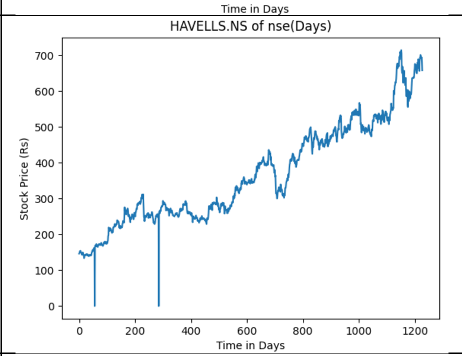

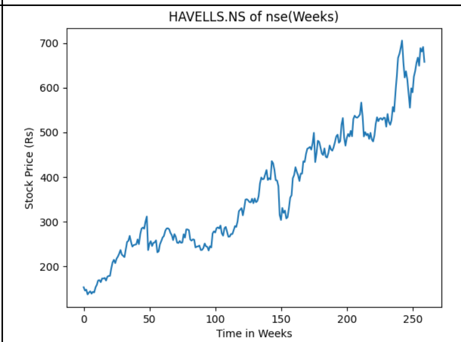

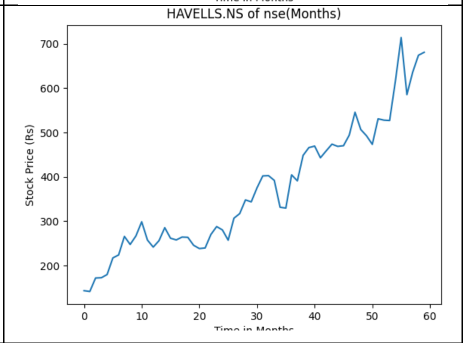

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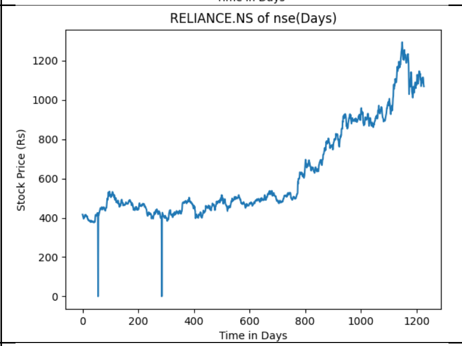

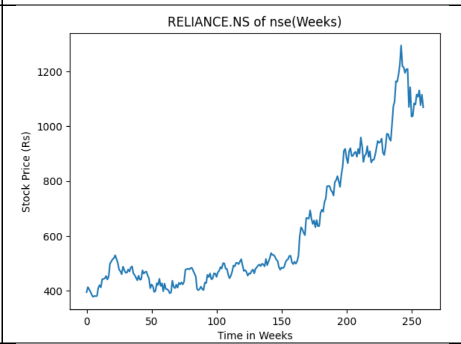

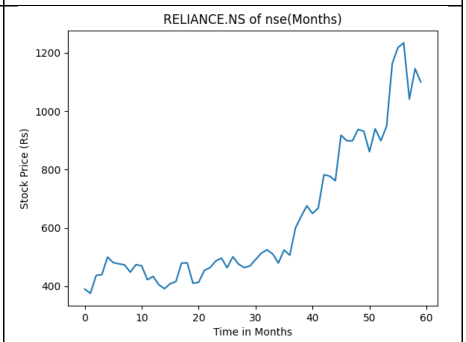

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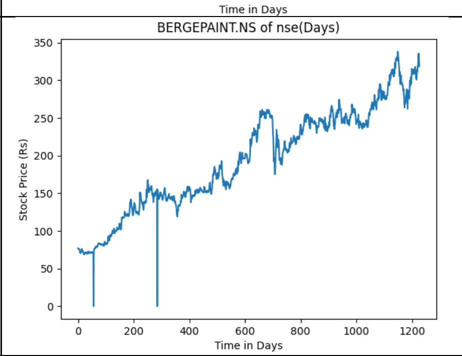

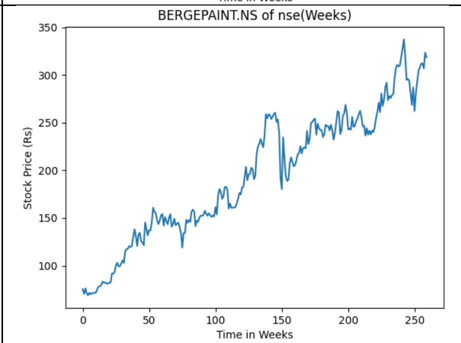

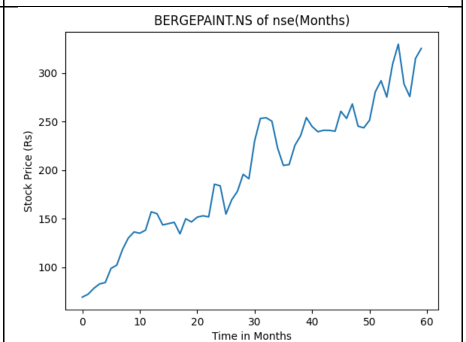

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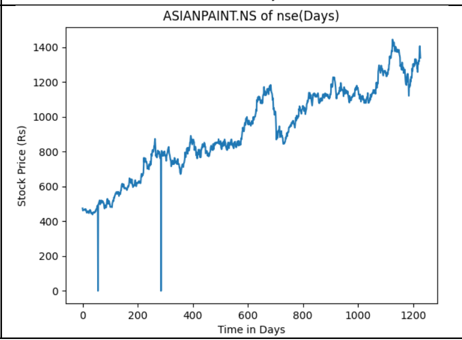
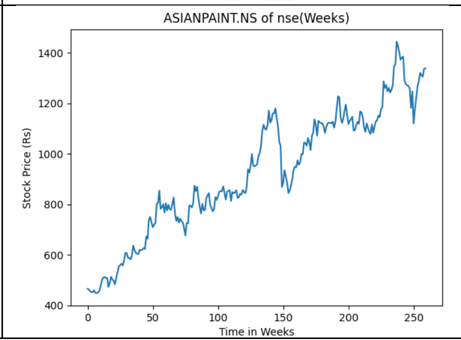
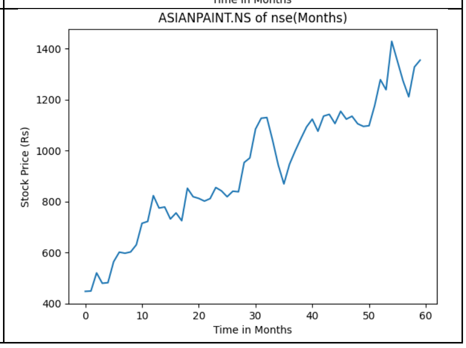
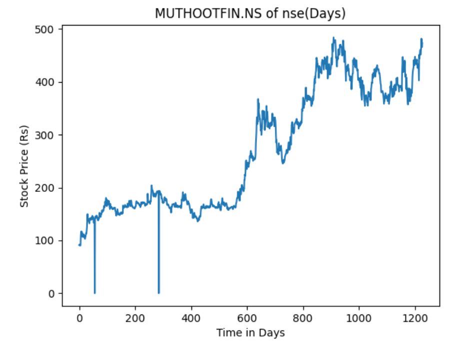
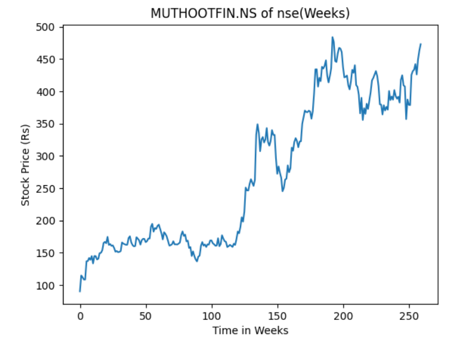
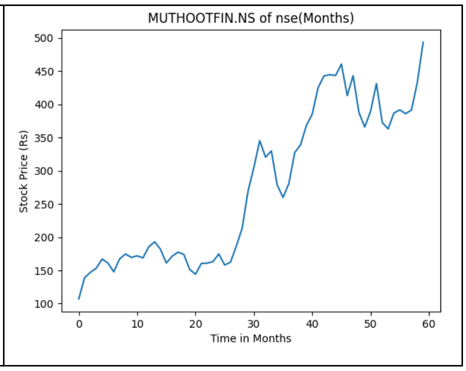


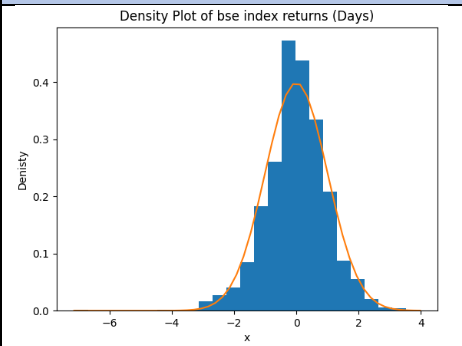
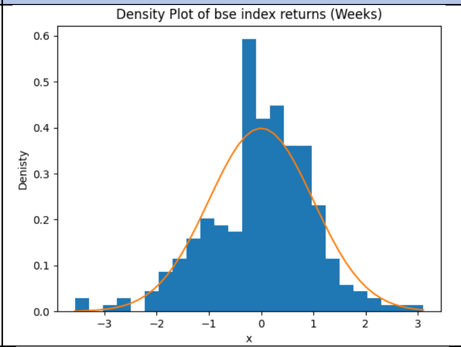
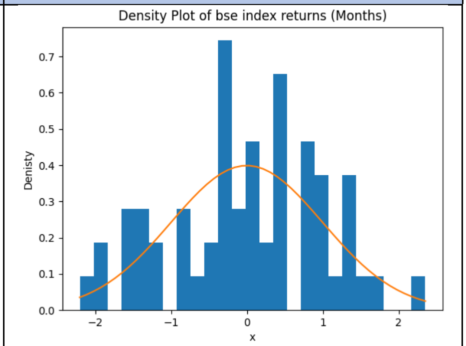
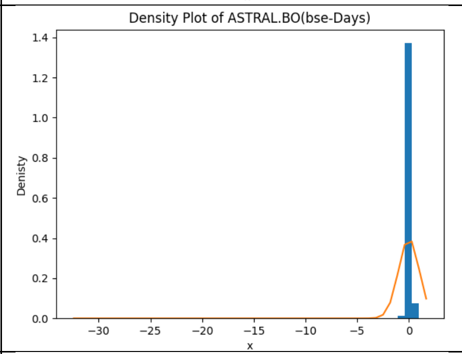
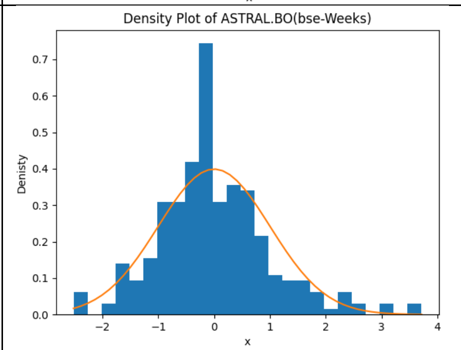
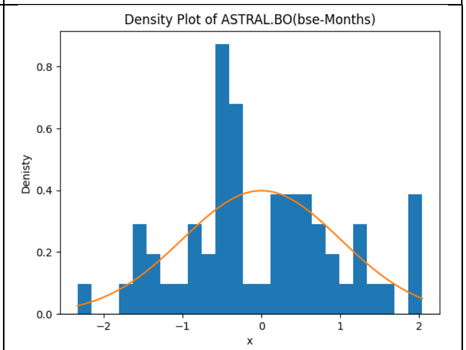
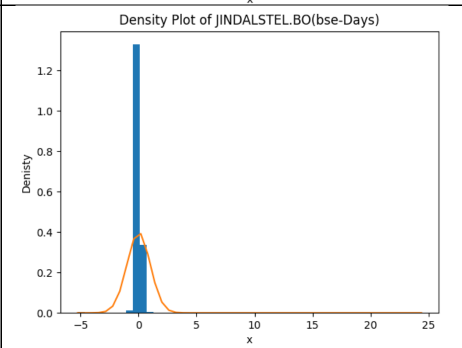
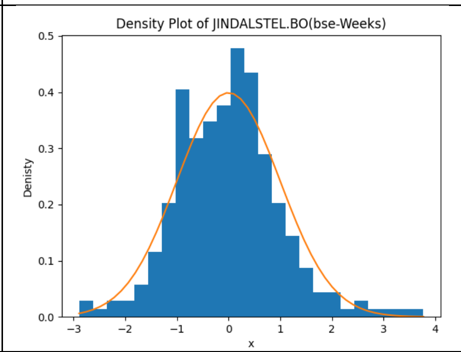
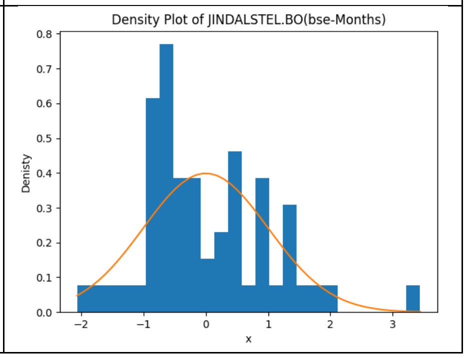




Muthoot Finance			

Question 2:

Using the above collected data, the **returns R_i** have been calculated. And, also, corresponding values of μ and σ have ben also calculated. Normalized value of returns was then calculated. The superimposed graphs of **N** (0,1) and density histograms obtained are as follows:

Name	DAILY	WEEKLY	MONTHLY
BSE INDEX			
ASTRAL			
Jindal Steel			

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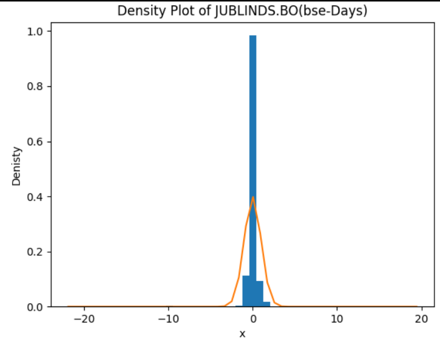
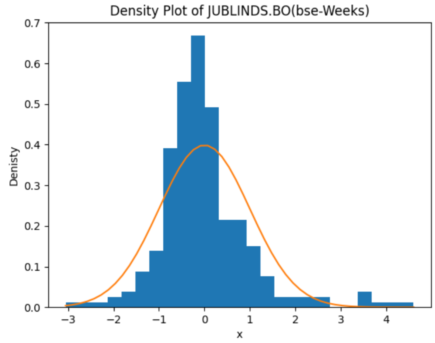
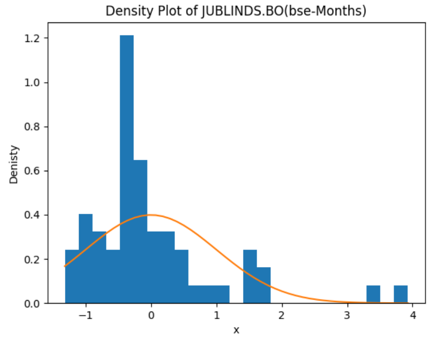
<tr><td>JubLinds</td><td>
</td><td>
</td><td>
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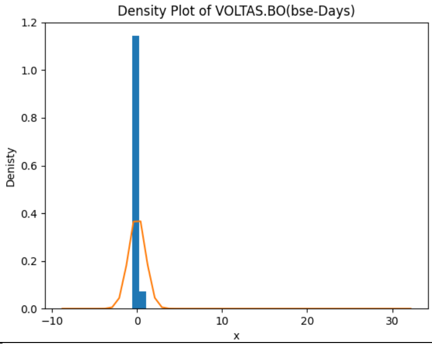
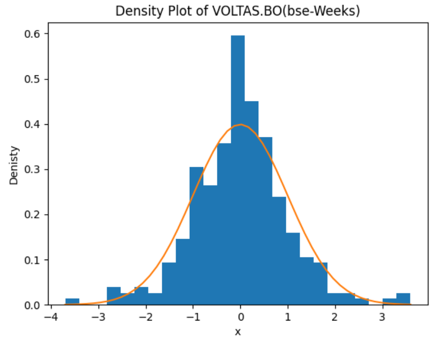
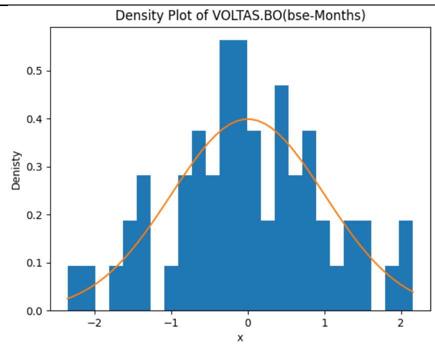
<tr><td>Voltas</td><td>
</td><td>
</td><td>
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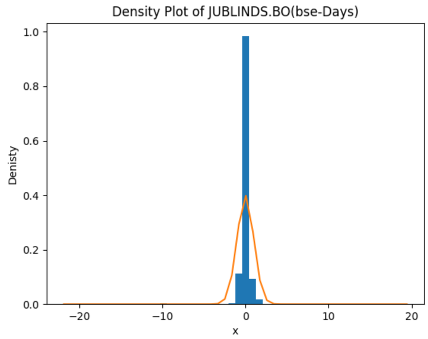
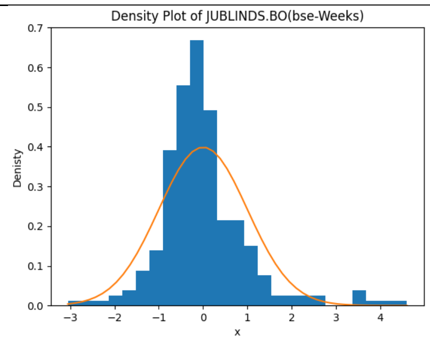
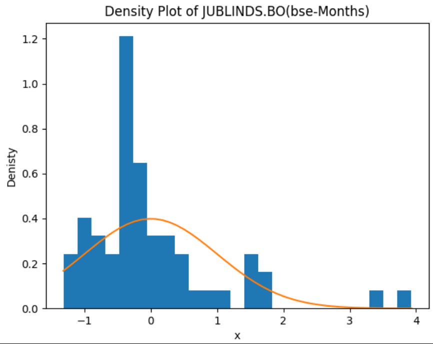
<tr><td>JubiLinds</td><td>
</td><td>
</td><td>
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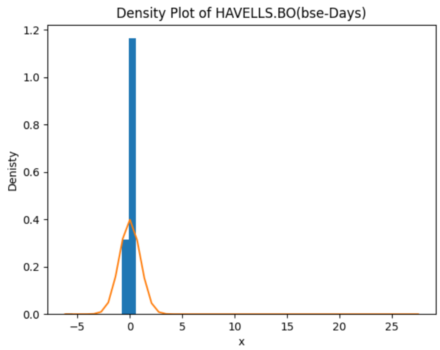
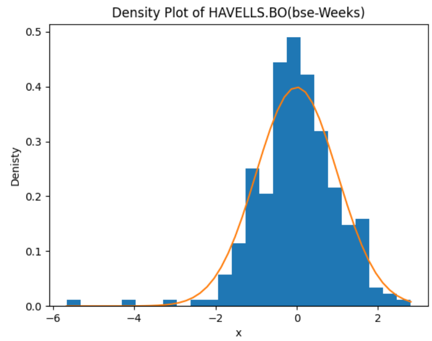
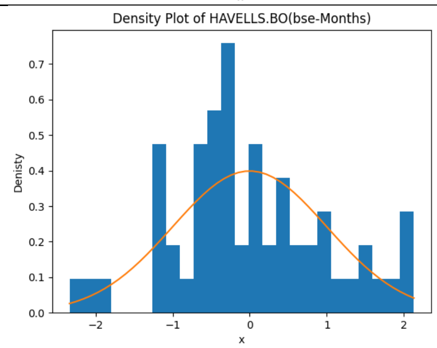
<tr><td>Havells</td><td>
</td><td>
</td><td>
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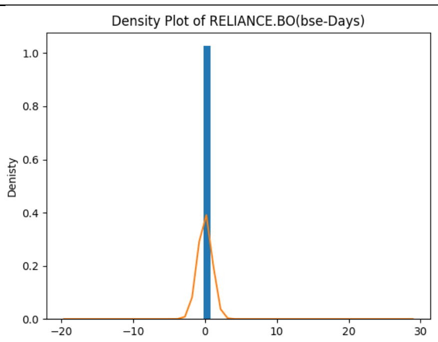
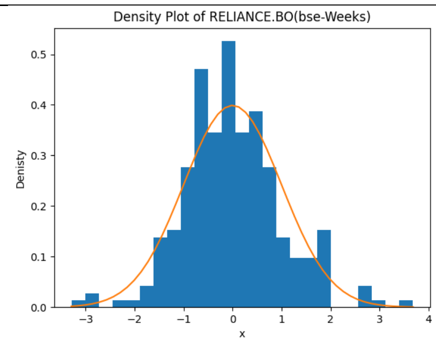
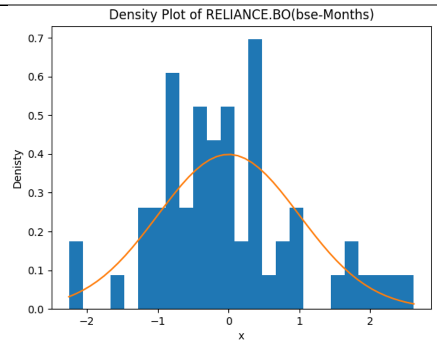
<tr><td>Reliance</td><td>
</td><td>
</td><td>
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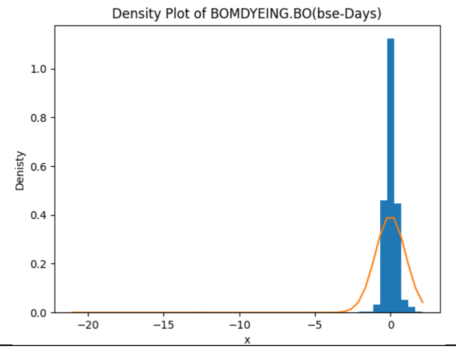
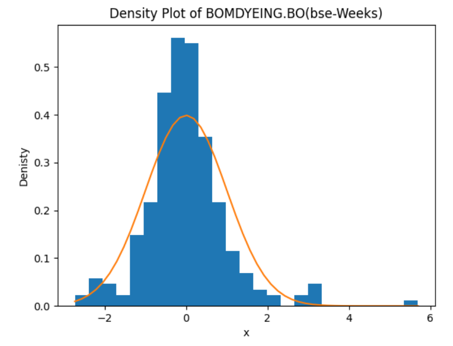
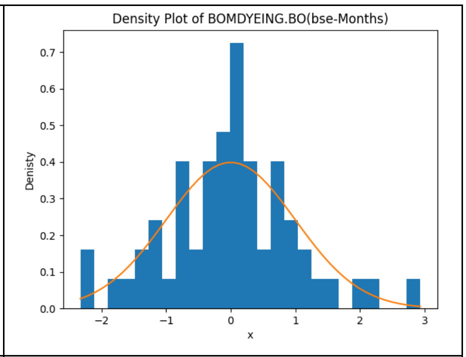
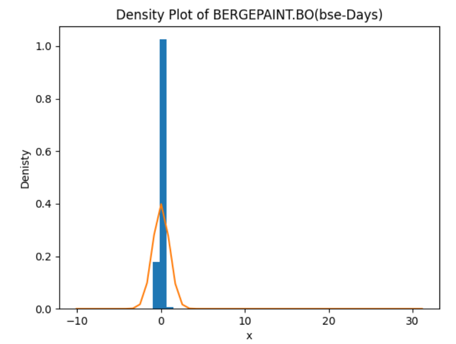
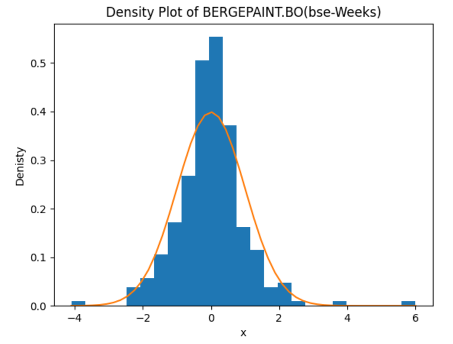
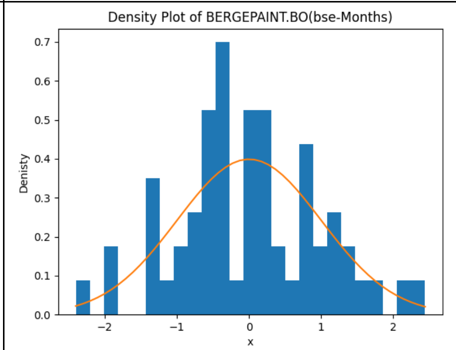
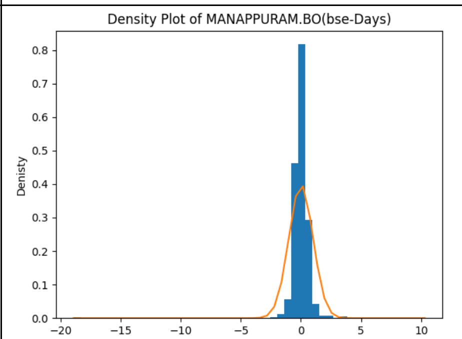
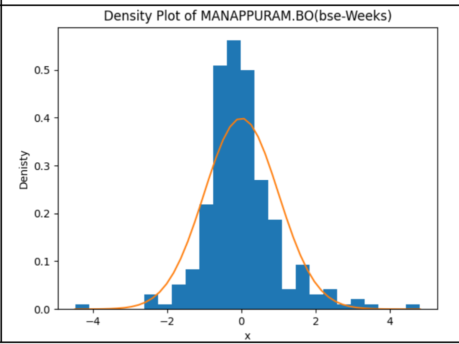
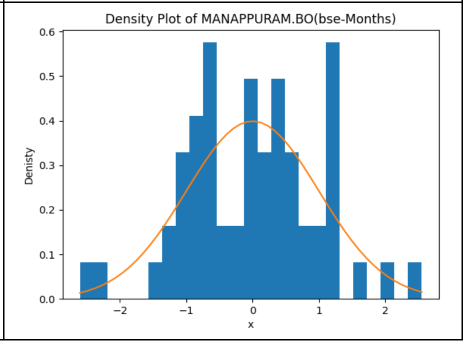
Bombay Dyeing			
Berger Paint			
Mannapuram			

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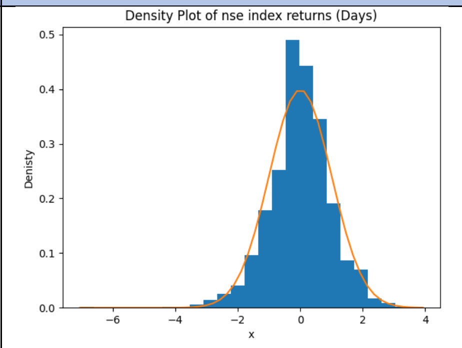
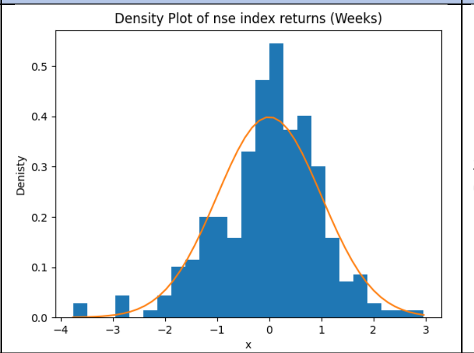
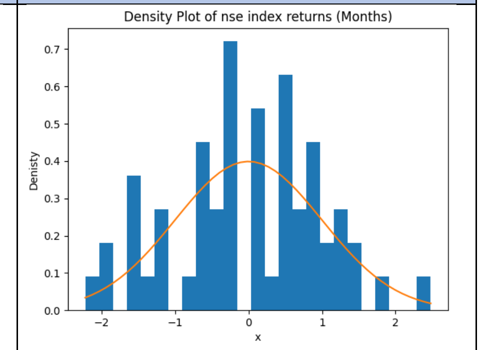
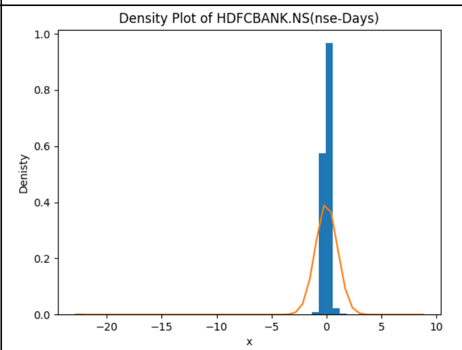
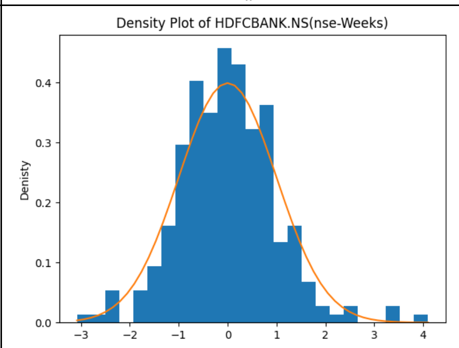
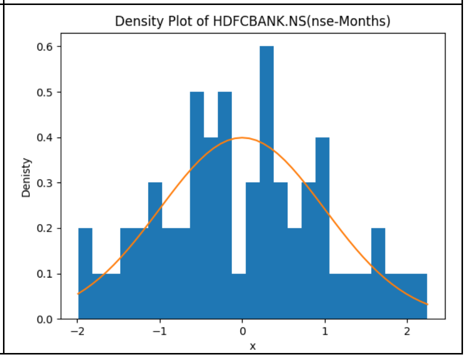
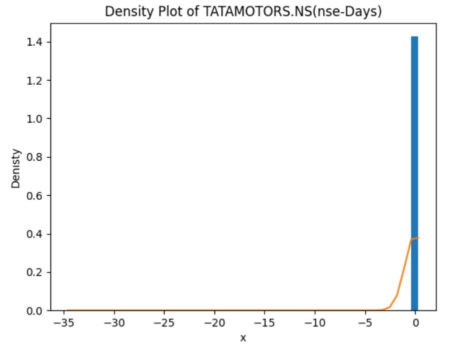
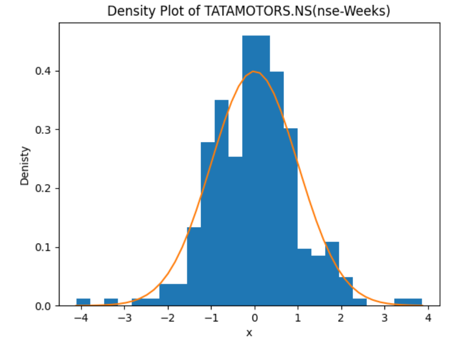
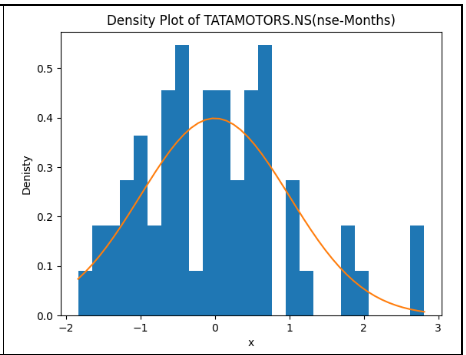
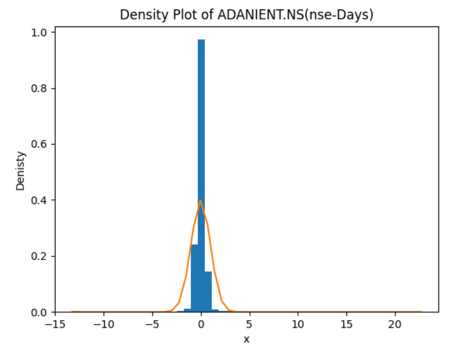
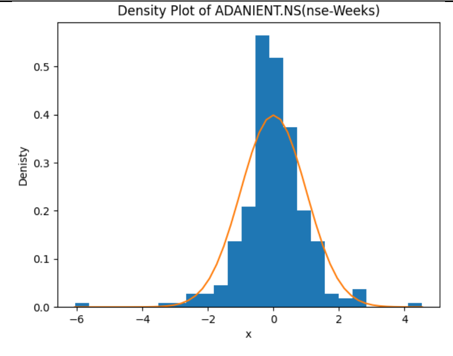
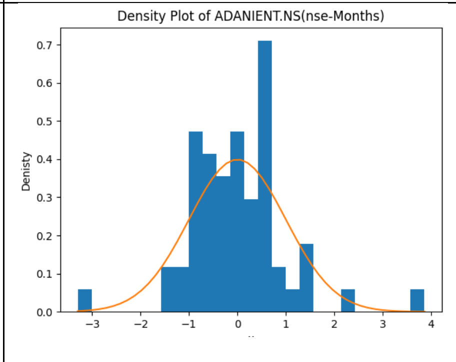
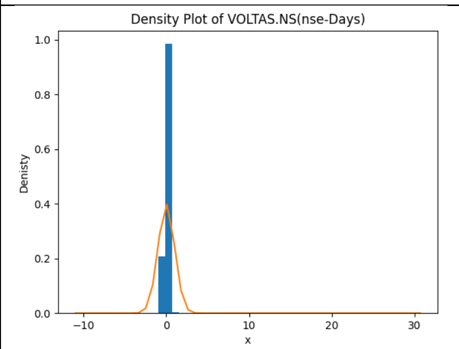
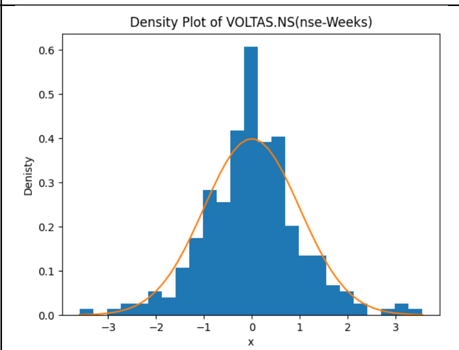
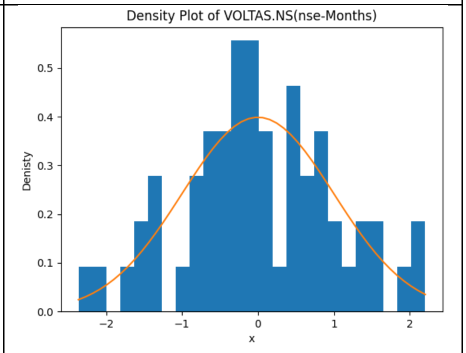
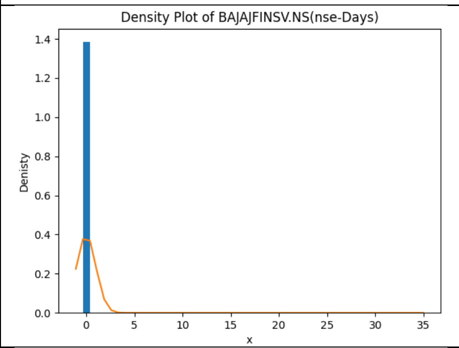
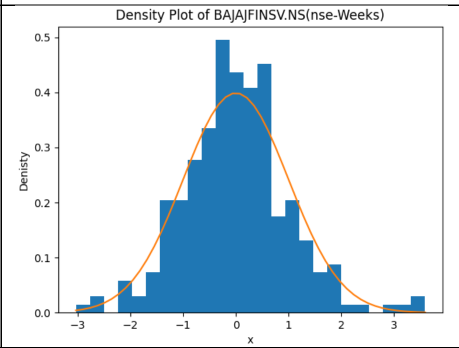
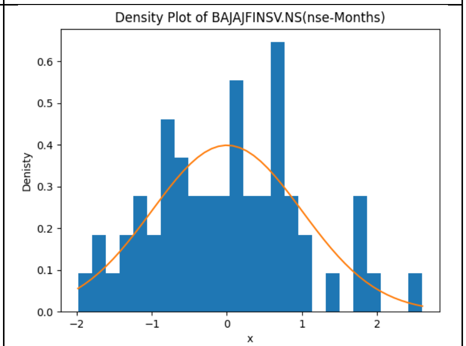
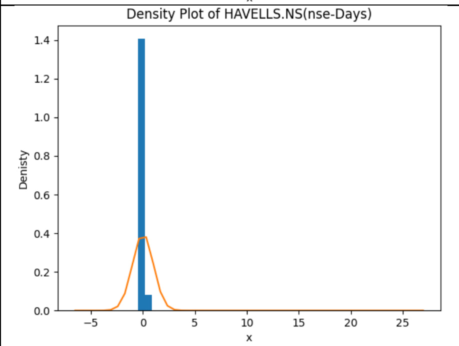
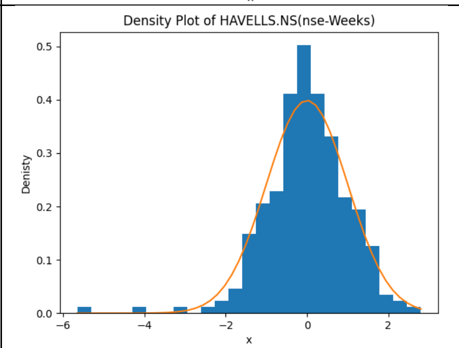
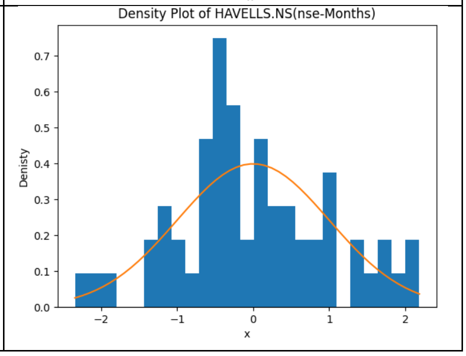
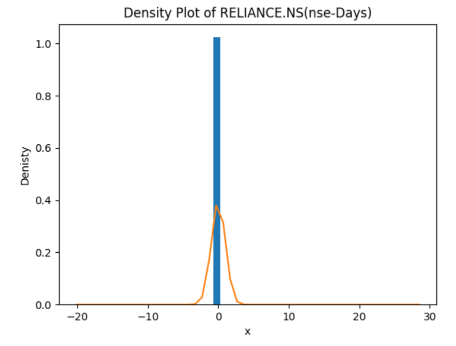
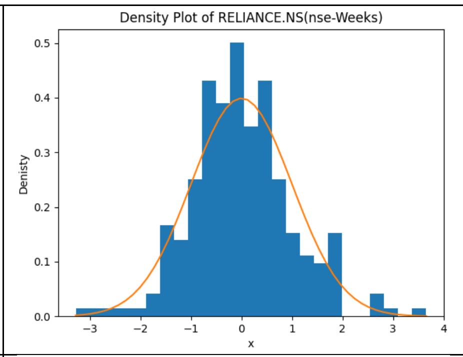
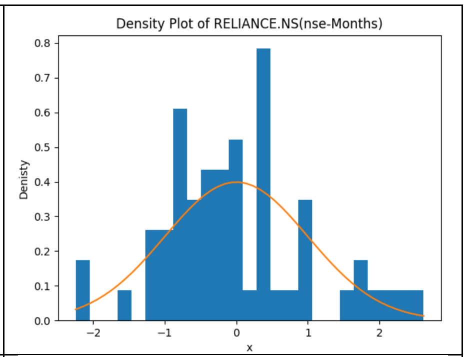
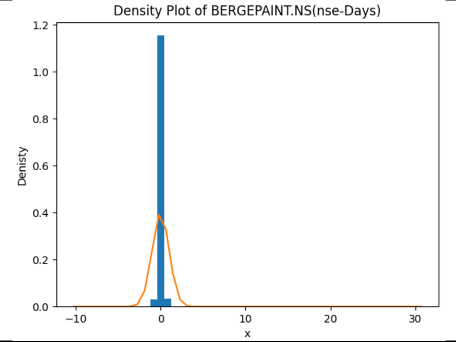
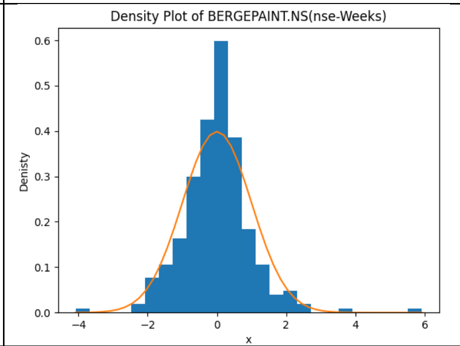
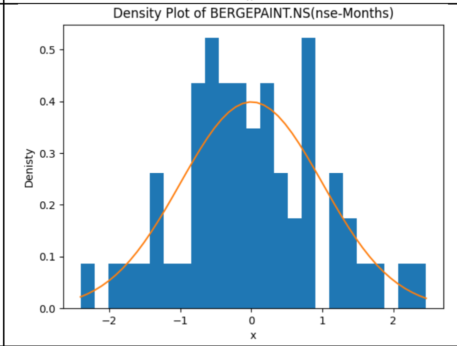
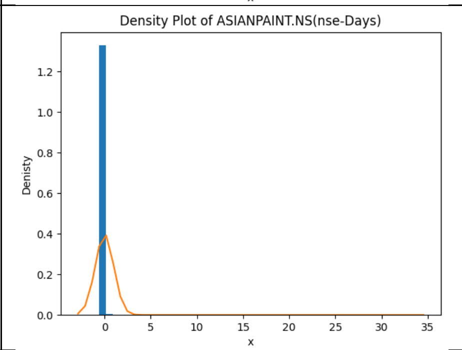
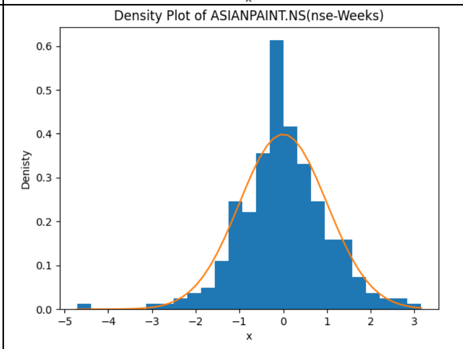
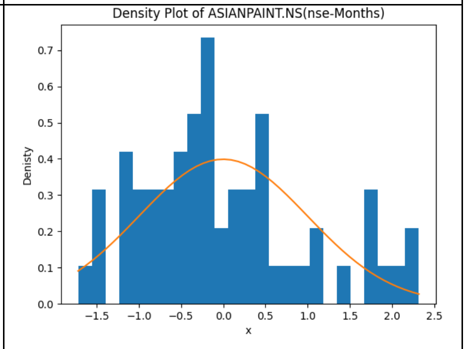
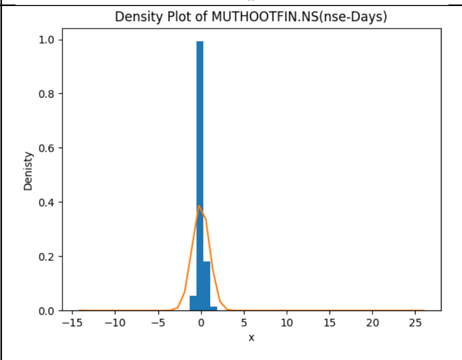
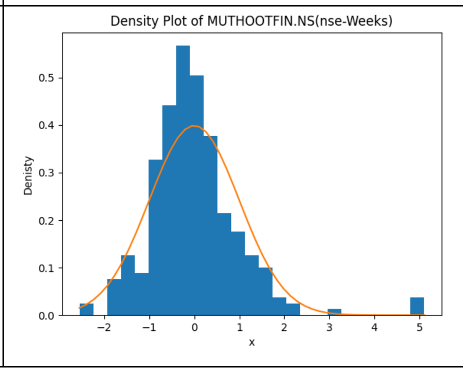
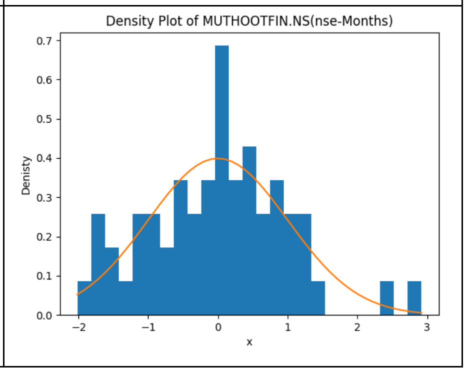
NSE Index			
HDFC Bank			

TATA Motors			
Adanient			
Voltas			
BajajFinserve			
Havells			

Reliance			
Berger Paints			
Asian Paints			
Muthoot Finance			

It can be seen that **the Normal Distribution estimates with great similarity the Density plot of the stocks, and the resemblance strengthens with increase in data points.**

If we observe at the tails, we can see that the density plot jumps above the normal plots at some instances, and the normal ploy goes to zero. In real world scenarios, the stock prices are influences by many hard to predict factors, and hence don't exactly follow the normal distribution. **Stock values might be over inflated in such scenarios, and hence can rise over the normal plots.**

Question 3:

In the logarithmic returns, we can see that the log normal returns suppress the ordinary returns. This effect amplifies when the percent return is high. Hence, we can see that tails are also somewhat suppressed. Here is a look at the log-normal returns density plots:

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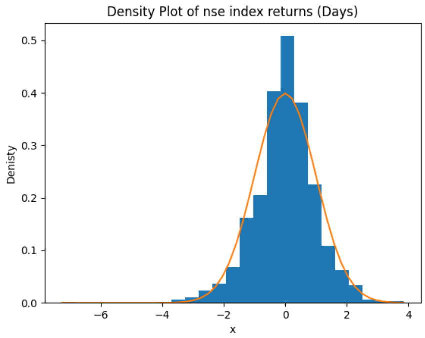
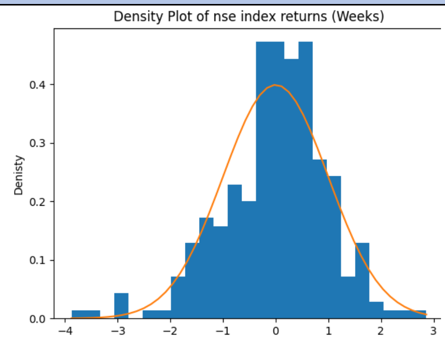
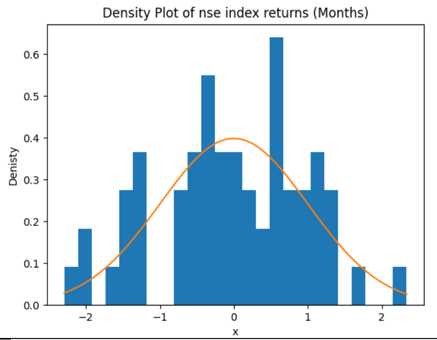
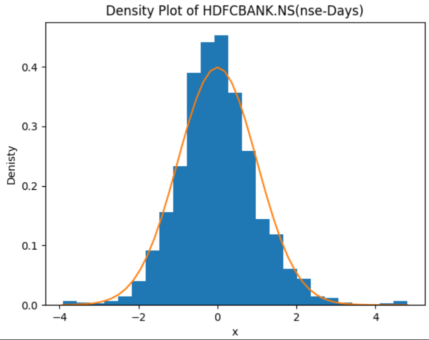
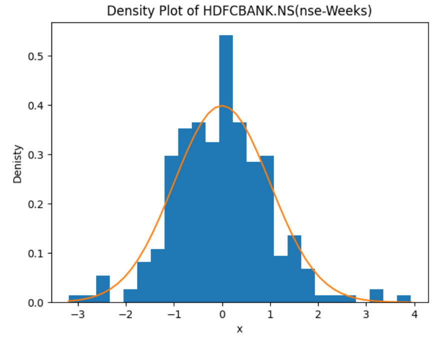
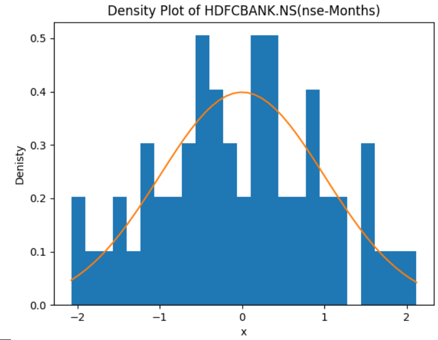
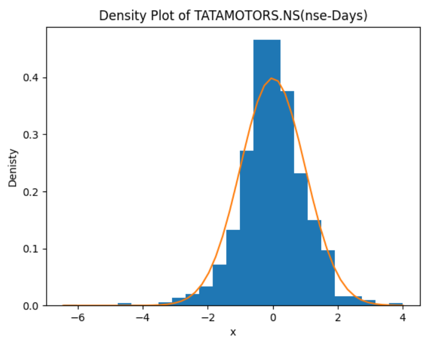
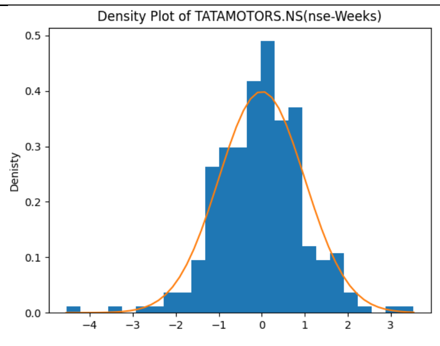
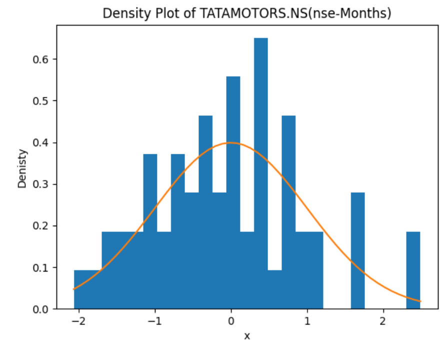
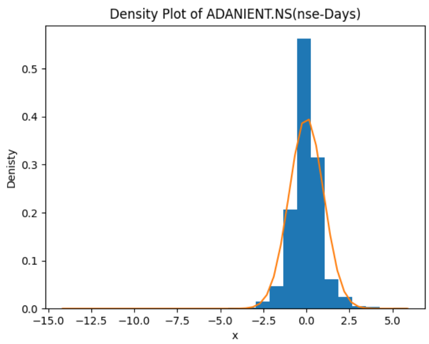
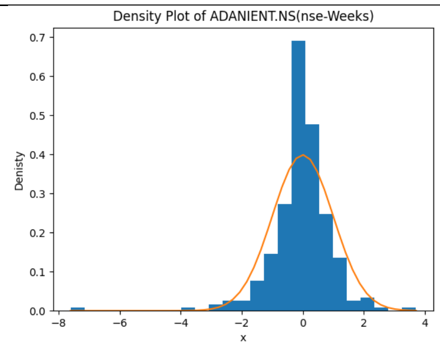
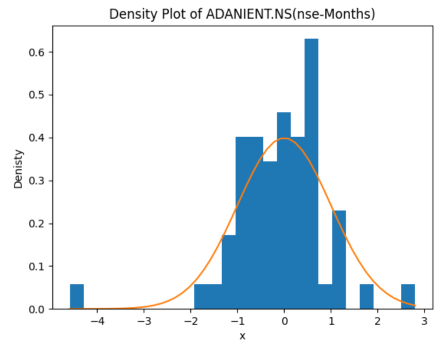
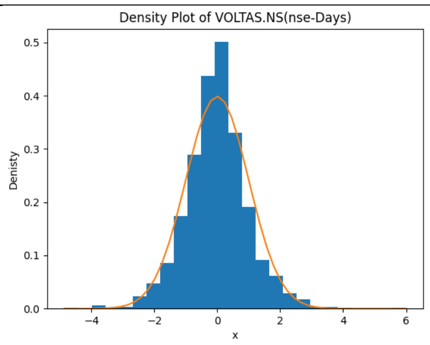
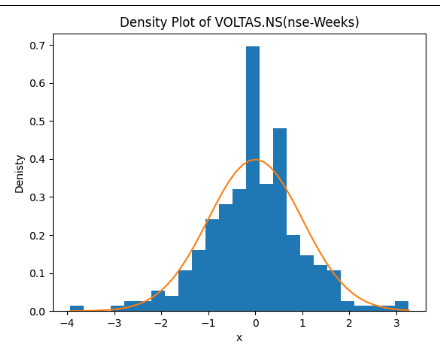
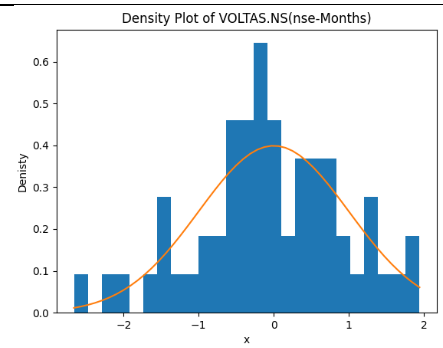
<tr><td>NSE Index</td><td></td><td></td><td></td></tr>
<tr><td>HDFC Bank</td><td></td><td></td><td></td></tr>
<tr><td>TATA Motors</td><td></td><td></td><td></td></tr>
<tr><td>Adanient</td><td></td><td></td><td></td></tr>
<tr><td>Voltas</td><td></td><td></td><td></td></tr>
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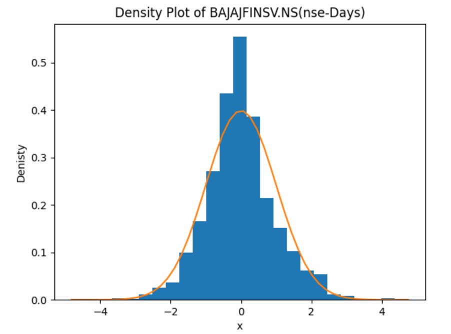
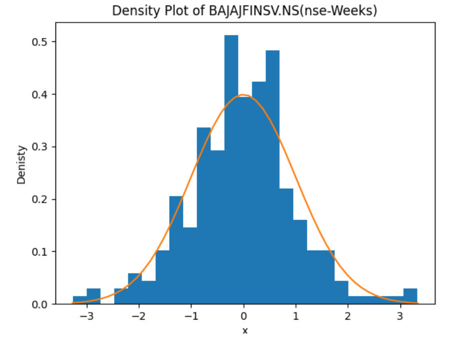
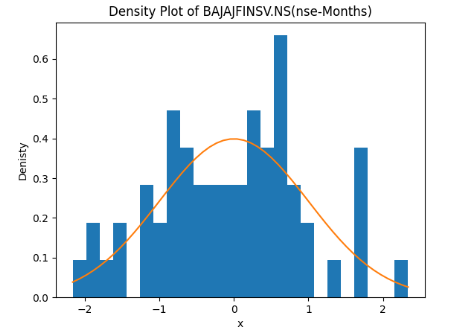
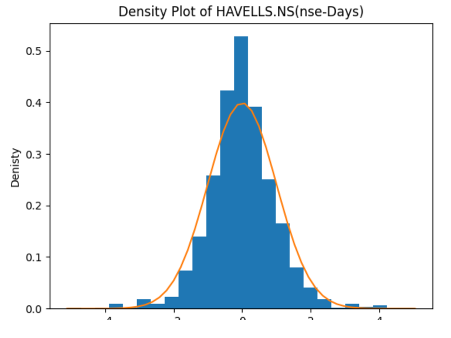
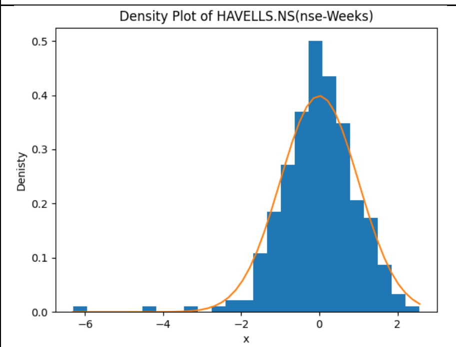
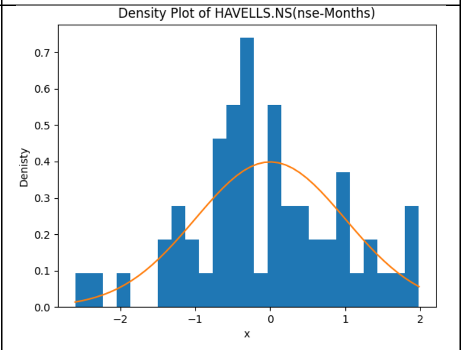
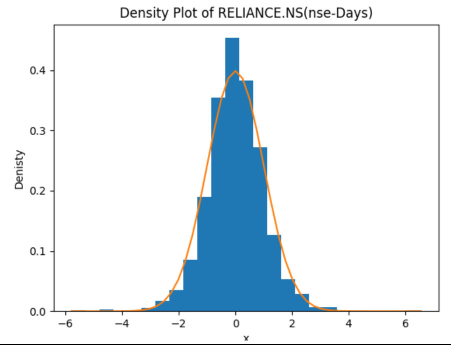
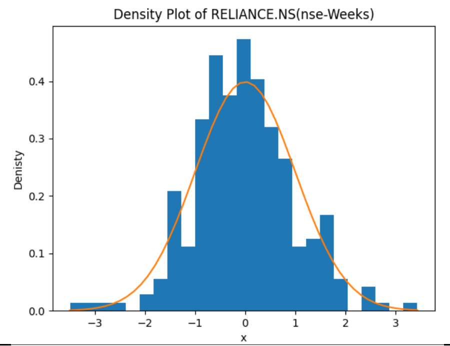
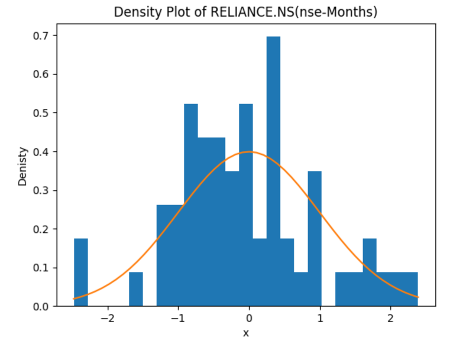
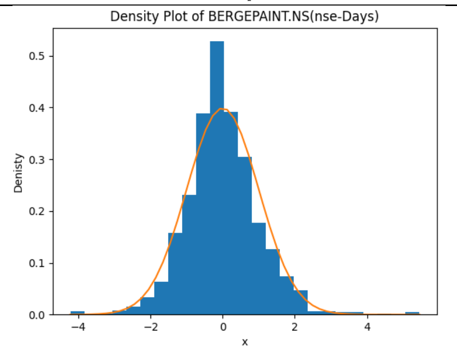
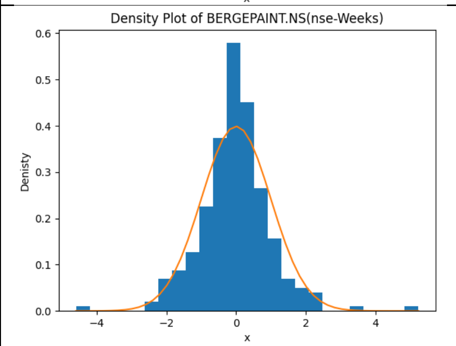
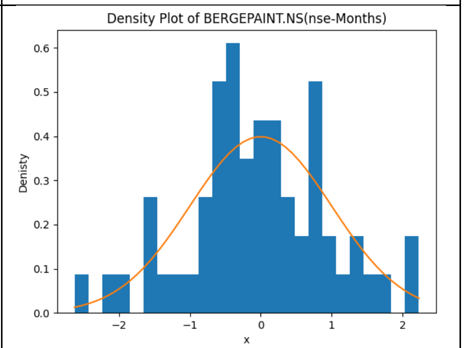
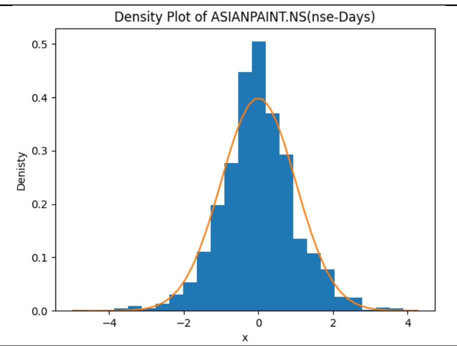
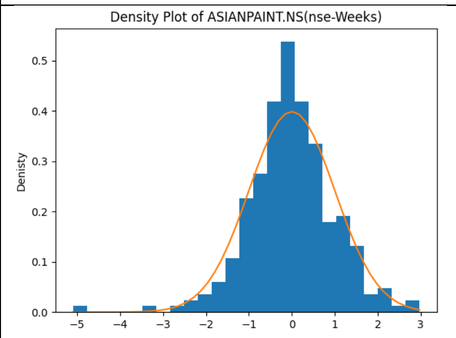
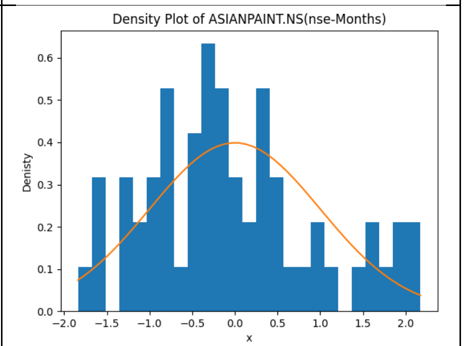
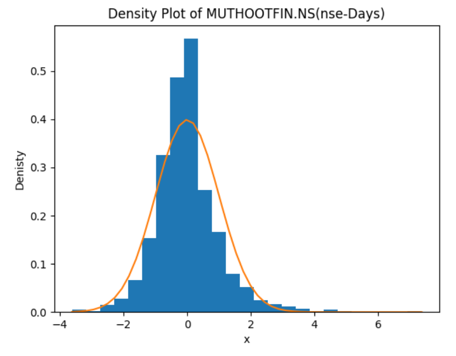
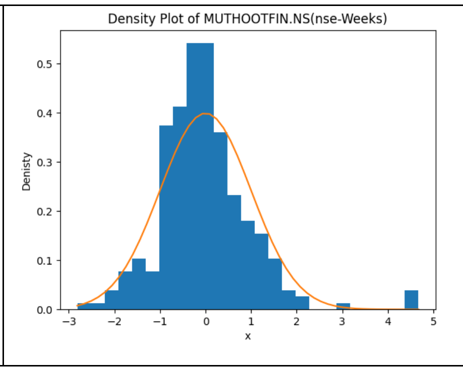
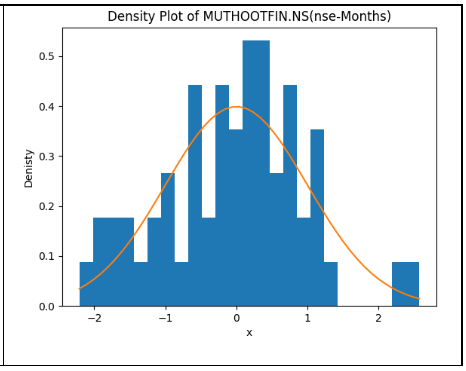
BajajFinserve			
Havells			
Reliance			
Berger Paints			
Asian Paints			

Muthoot Finance			

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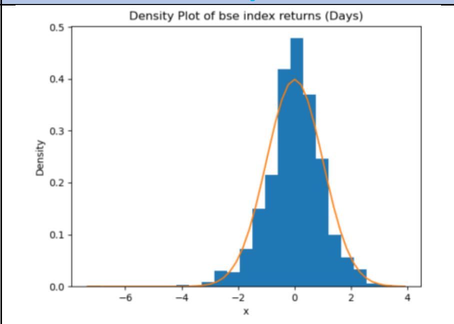
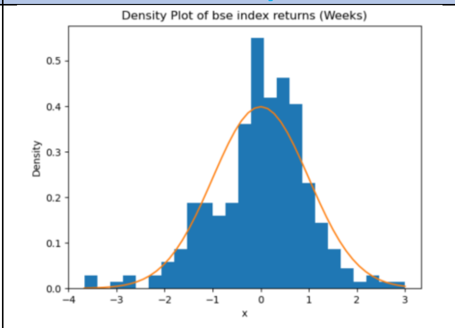
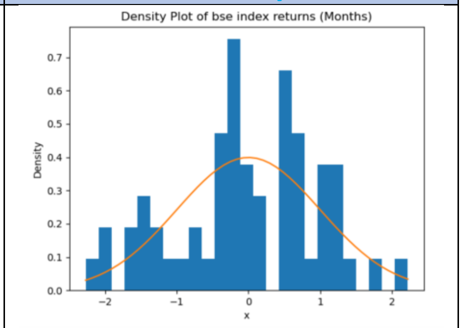
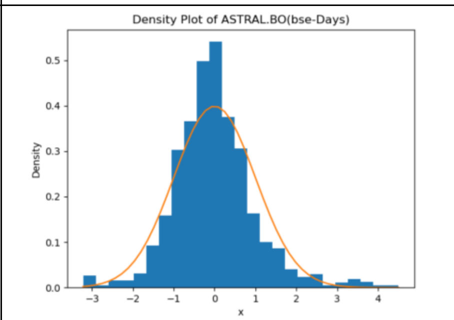
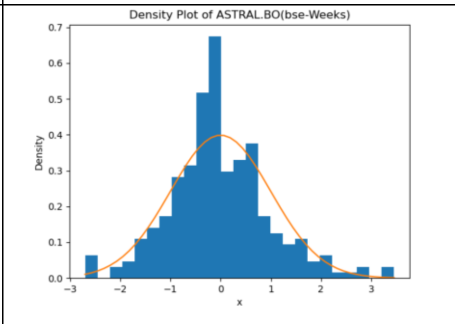
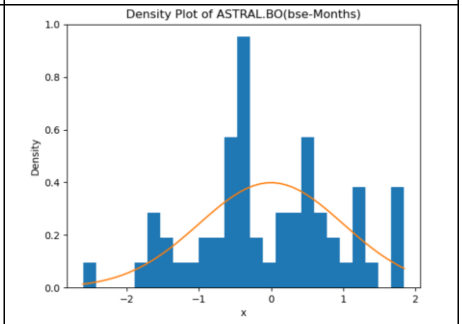
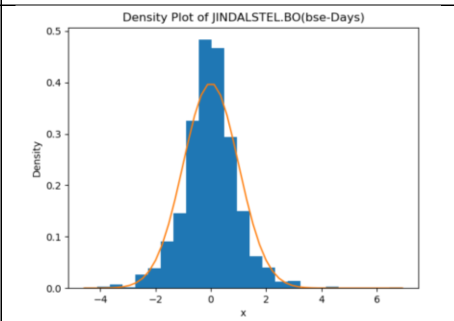
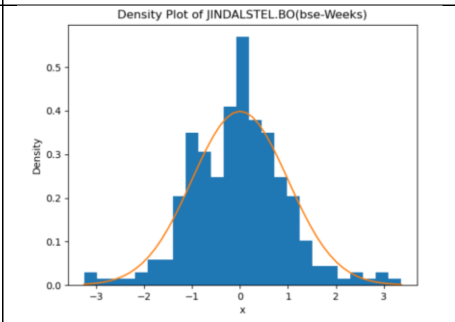
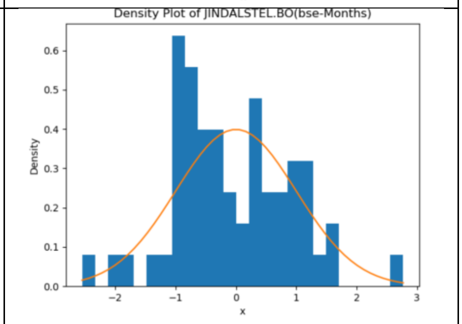
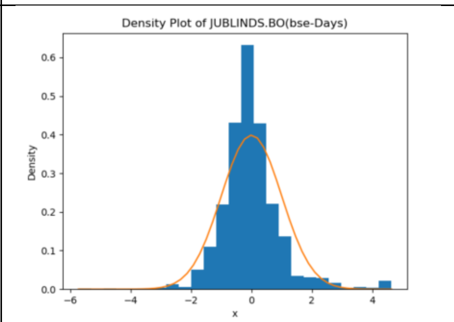
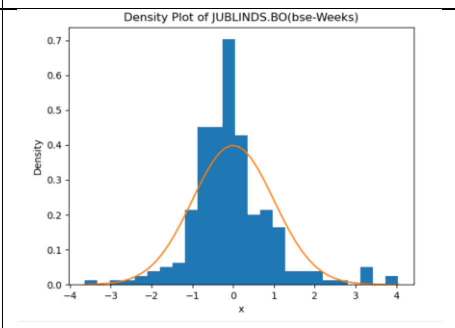
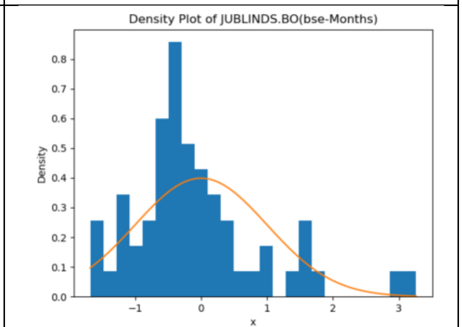
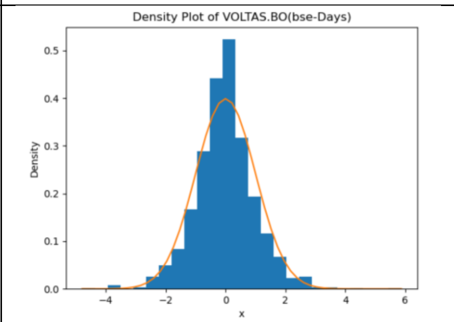
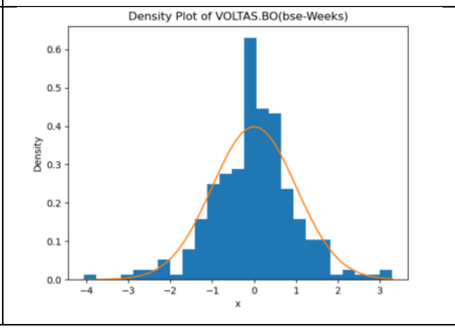
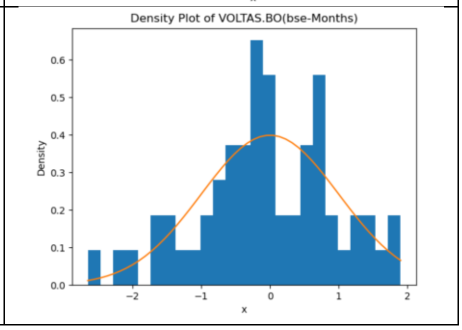
BSE index			
Astral			
Jindal			
Jubilinds			
Voltas			

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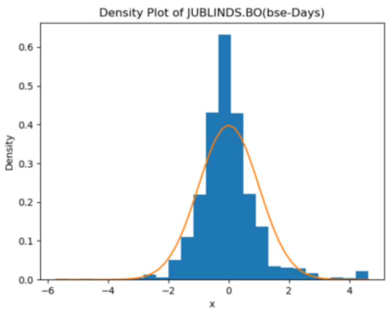
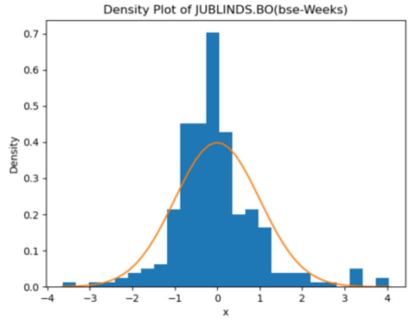
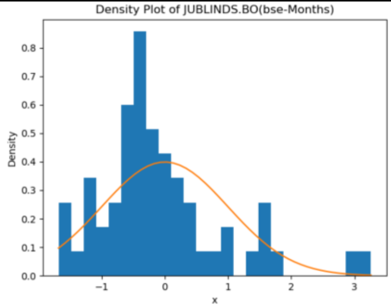
<tr><td>Jubilinds</td><td>
</td><td>
</td><td>
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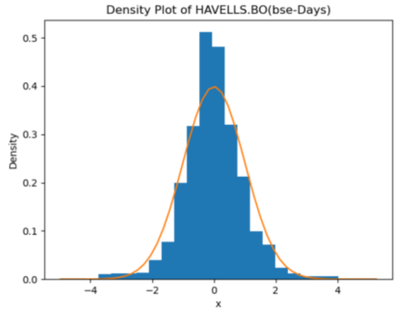
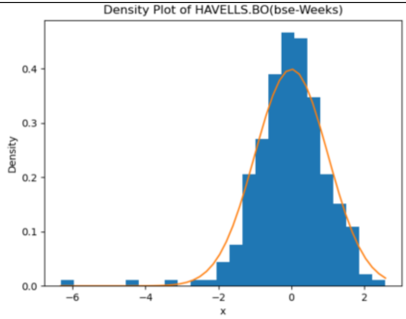
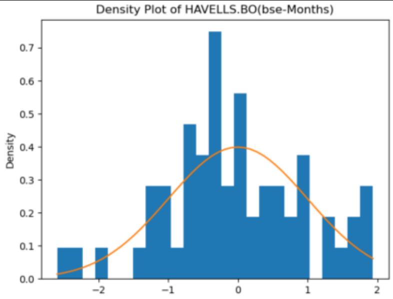
<tr><td>Havells</td><td>
</td><td>
</td><td>
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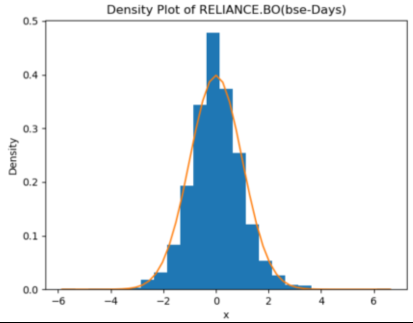
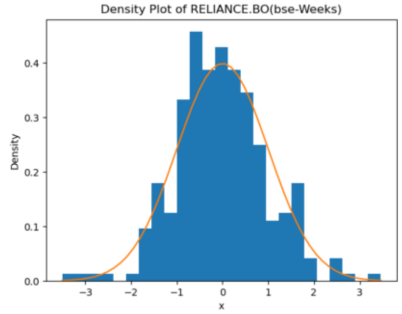
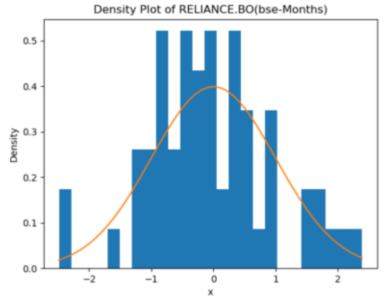
<tr><td>Reliance</td><td>
</td><td>
</td><td>
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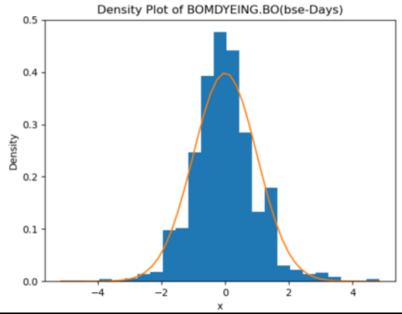
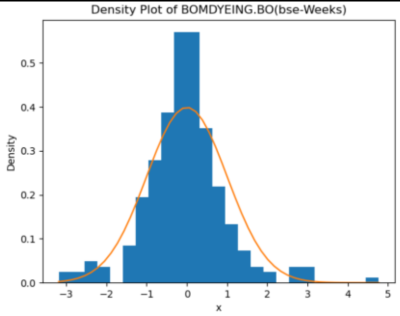
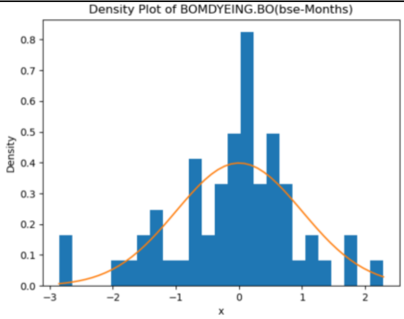
<tr><td>Bombay dyeing</td><td>
</td><td>
</td><td>
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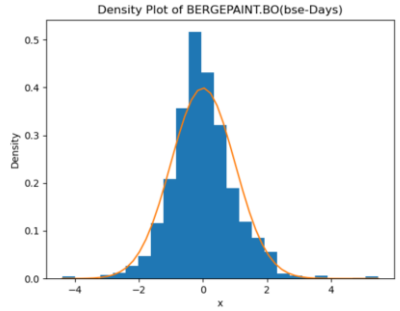
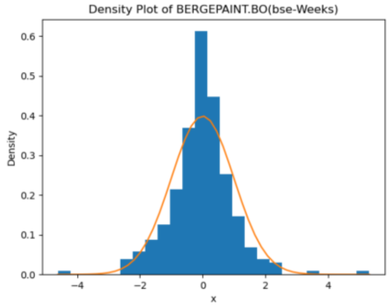
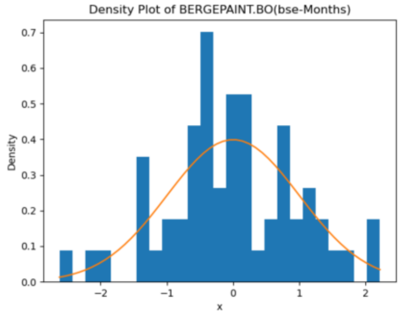
<tr><td>Berger Paints</td><td>
</td><td>
</td><td>
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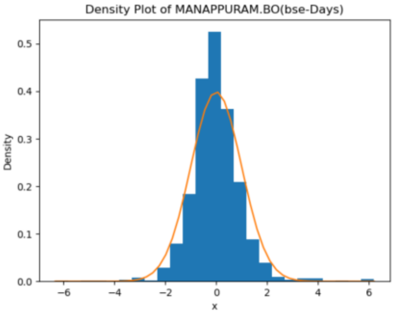
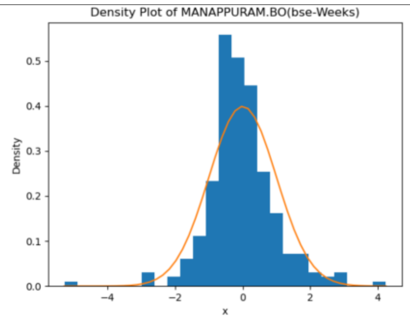
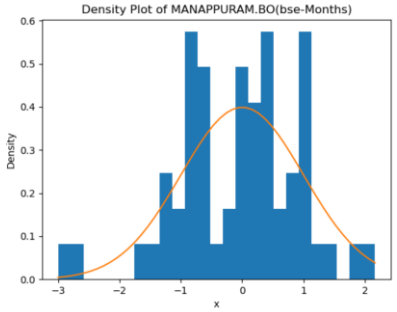
<tr><td>Mannapurram</td><td>
</td><td>
</td><td>
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Question 4 & 5:

For simulating the stock prices for the period of January 1, 2018 to December 31, 2018 by using the daily(monthly and weekly) data for the period January 1, 2014 to December 31, 2017, I have used jump diffusion model assuming that the ratio of asset price after and before a jump should follow the log-normal distribution LN(μ , σ^2), by using the first approach i.e. **Simulating the dates** to generate the path of stock prices .

- NSE Stocks:

1. Estimated mu for HDFCBANK.NS Stock calculated from monthly data: 0.02413189832704609
   Estimated sigma for HDFCBANK.NS Stock calculated from monthly data: 0.04687479519397373
   Estimated mu for HDFCBANK.NS Stock calculated from weekly data : 0.005295433656878217
   Estimated sigma for HDFCBANK.NS Stock calculated from weekly data : 0.02145981523503995
   Estimated mu for HDFCBANK.NS Stock calculated from daily data : 0.0011430961617151846
   Estimated sigma for HDFCBANK.NS Stock calculated from daily data : 0.010680315234023713

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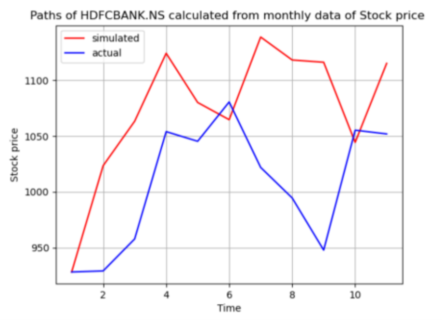
<td>
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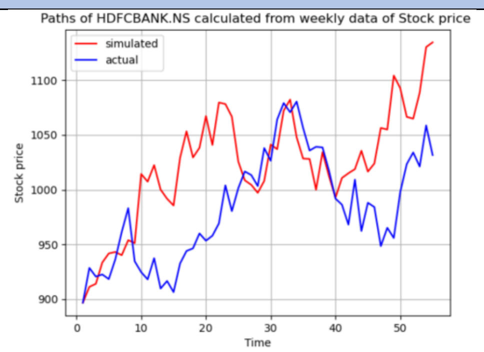
<td>
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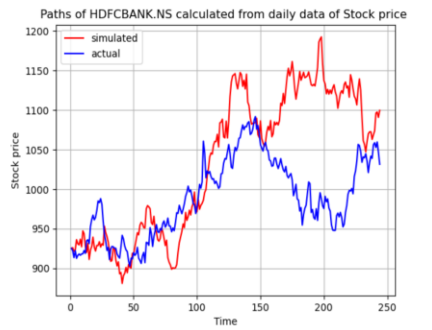
<td>
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2. Estimated mu for TATAMOTORS.NS Stock calculated from monthly data: 0.006720902750023057
   Estimated sigma for TATAMOTORS.NS Stock calculated from monthly data: 0.102499365552607
   Estimated mu for TATAMOTORS.NS Stock calculated from weekly data : 0.0016429392736979503
   Estimated sigma for TATAMOTORS.NS Stock calculated from weekly data : 0.04560606169320774
   Estimated mu for TATAMOTORS.NS Stock calculated from daily data : 0.00036144694408122197
   Estimated sigma for TATAMOTORS.NS Stock calculated from daily data : 0.021630796610193587

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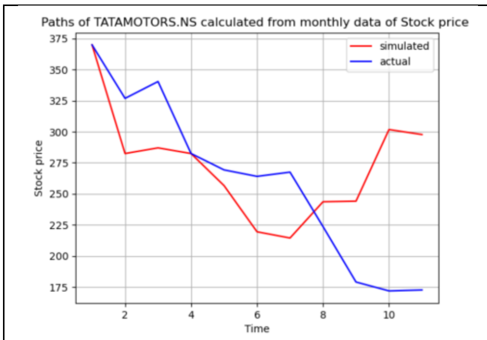
<td>
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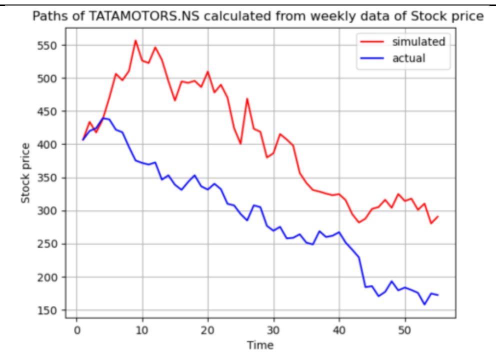
<td>
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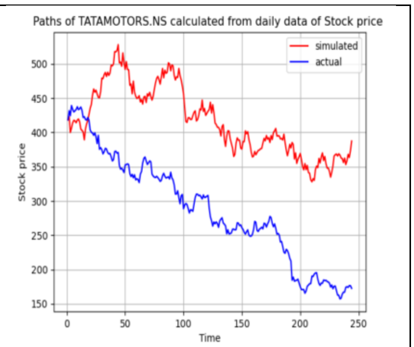
<td>
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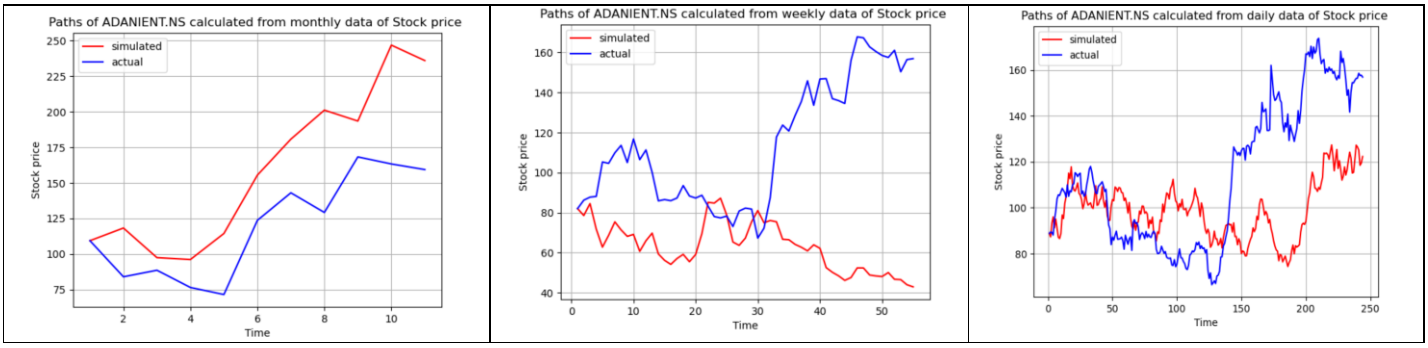
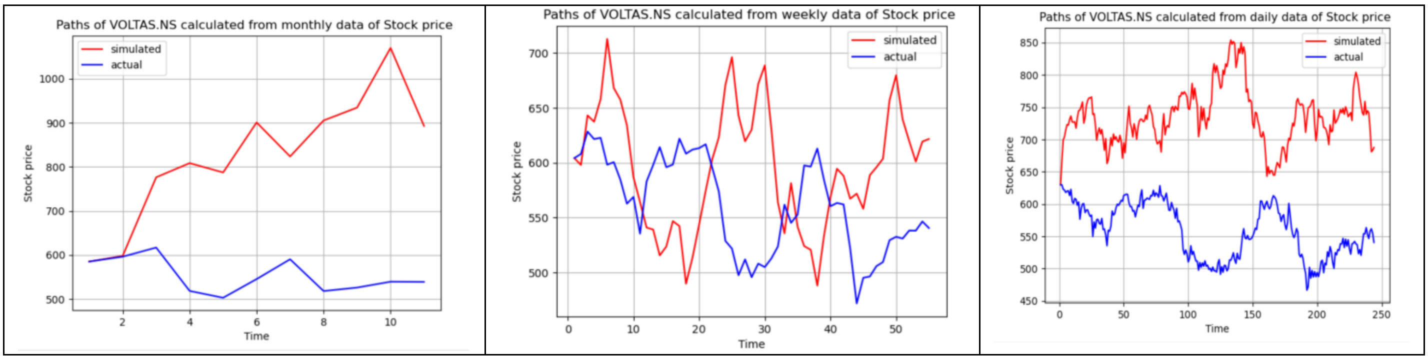
3. Estimated mu for ADANIENT.NS Stock calculated from monthly data : 0.03842577057486449
   Estimated sigma for ADANIENT.NS Stock calculated from monthly data : 0.16998902427031154
   Estimated mu for ADANIENT.NS Stock calculated from weekly data : 0.007153688119860335
   Estimated sigma for ADANIENT.NS Stock calculated from weekly data : 0.07605623755454467

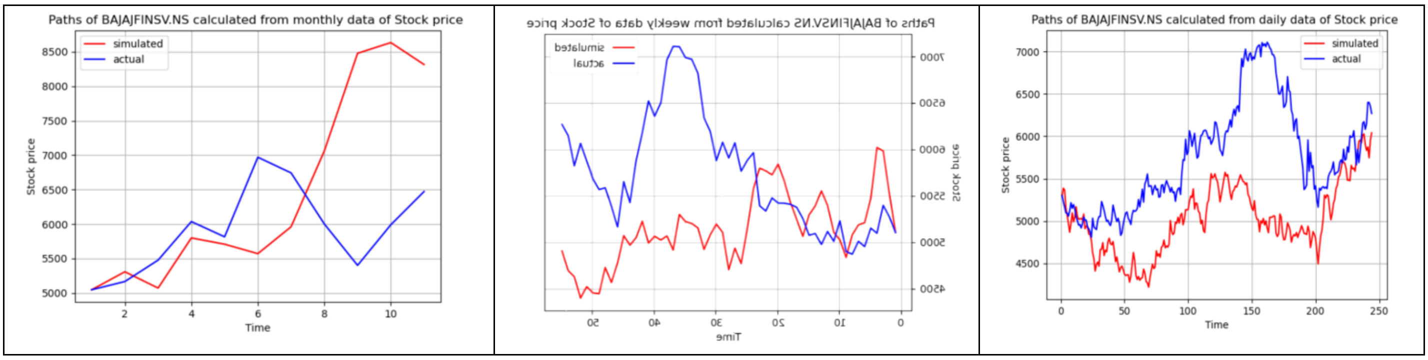
Estimated mu for ADANIENT.NS Stock calculated from daily data : 0.0014561109281105381
Estimated sigma for ADANIENT.NS Stock calculated from daily data : 0.03446180589456988



4. Estimated mu for VOLTAS.NS Stock calculated from monthly data : 0.04215609727819506
   Estimated sigma for VOLTAS.NS Stock calculated from monthly data : 0.10978152022646319
   Estimated mu for VOLTAS.NS Stock calculated from weekly data : 0.009534091700472348
   Estimated sigma for VOLTAS.NS Stock calculated from weekly data : 0.052419969359866245
   Estimated mu for VOLTAS.NS Stock calculated from daily data : 0.002066185469692937
   Estimated sigma for VOLTAS.NS Stock calculated from daily data : 0.024457172458322442

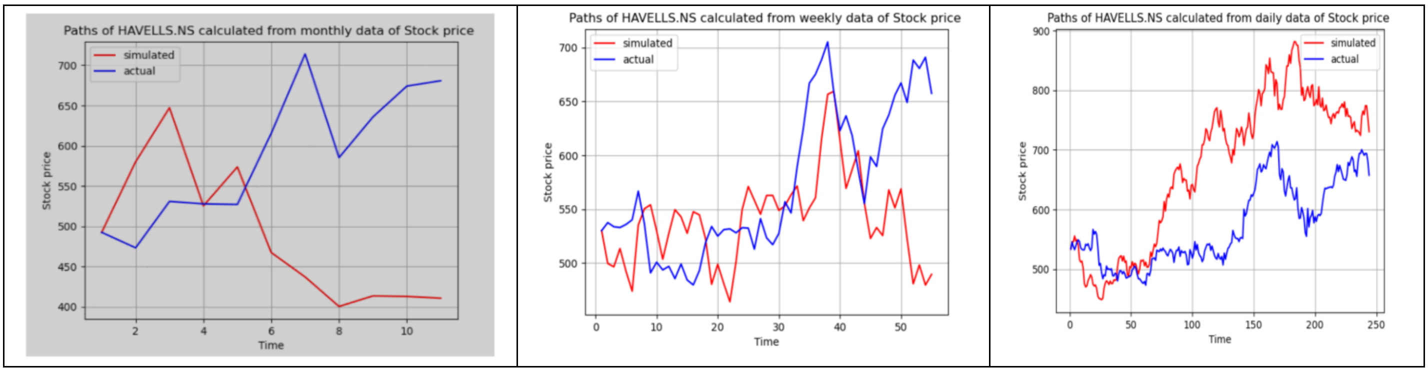


5. Estimated mu for BAJAJFINSV.NS Stock calculated from monthly data : 0.044586023538499234
   Estimated sigma for BAJAJFINSV.NS Stock calculated from monthly data : 0.08457587071691366
   Estimated mu for BAJAJFINSV.NS Stock calculated from weekly data : 0.01056988068767866
   Estimated sigma for BAJAJFINSV.NS Stock calculated from weekly data : 0.04612955909277094
   Estimated mu for BAJAJFINSV.NS Stock calculated from daily data : 0.0021628538901428455
   Estimated sigma for BAJAJFINSV.NS Stock calculated from daily data : 0.01917260398753345

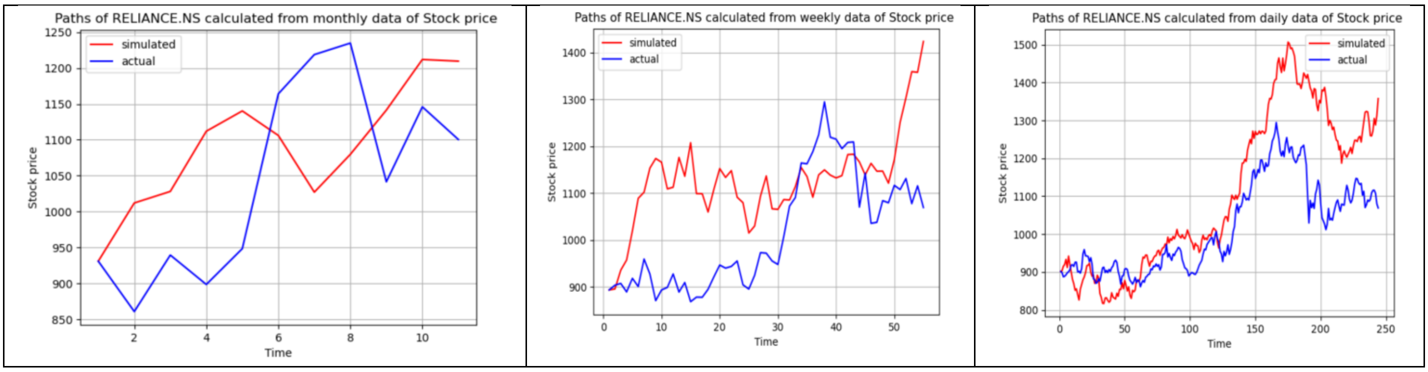


6. Estimated mu for HAVELLS.NS Stock calculated from monthly data : 0.028804149163669763
   Estimated sigma for HAVELLS.NS Stock calculated from monthly data : 0.0853654269461794
   Estimated mu for HAVELLS.NS Stock calculated from weekly data : 0.0071176168014109075
   Estimated sigma for HAVELLS.NS Stock calculated from weekly data : 0.04638309227955468
   Estimated mu for HAVELLS.NS Stock calculated from daily data : 0.0015198513618546725

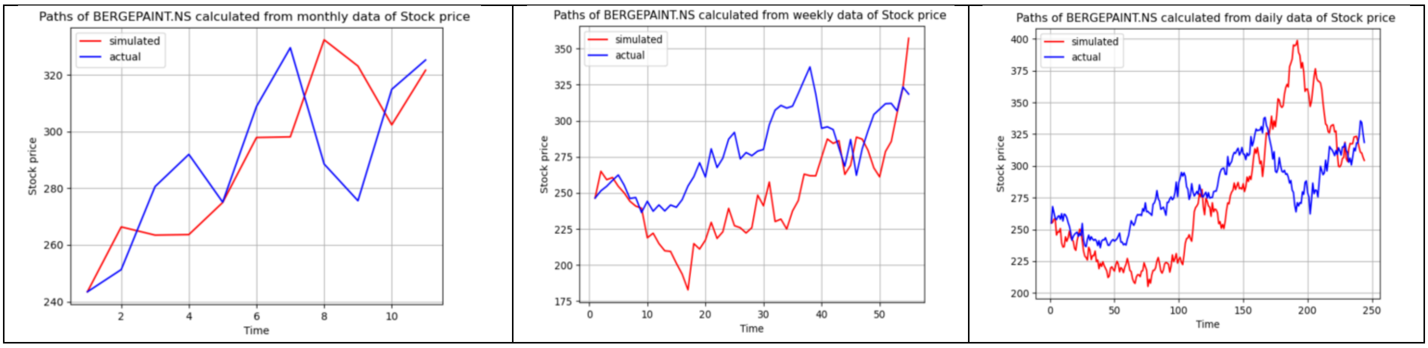
Estimated sigma for HAVELLS.NS Stock calculated from daily data : 0.020162965390377437



7. Estimated mu for RELIANCE.NS Stock calculated from monthly data : 0.020293856118848014
   Estimated sigma for RELIANCE.NS Stock calculated from monthly data : 0.07130742133654072
   Estimated mu for RELIANCE.NS Stock calculated from weekly data : 0.004597393776417752
   Estimated sigma for RELIANCE.NS Stock calculated from weekly data : 0.035254046231850696
   Estimated mu for RELIANCE.NS Stock calculated from daily data : 0.0009021062544099472
   Estimated sigma for RELIANCE.NS Stock calculated from daily data : 0.015435626323187181

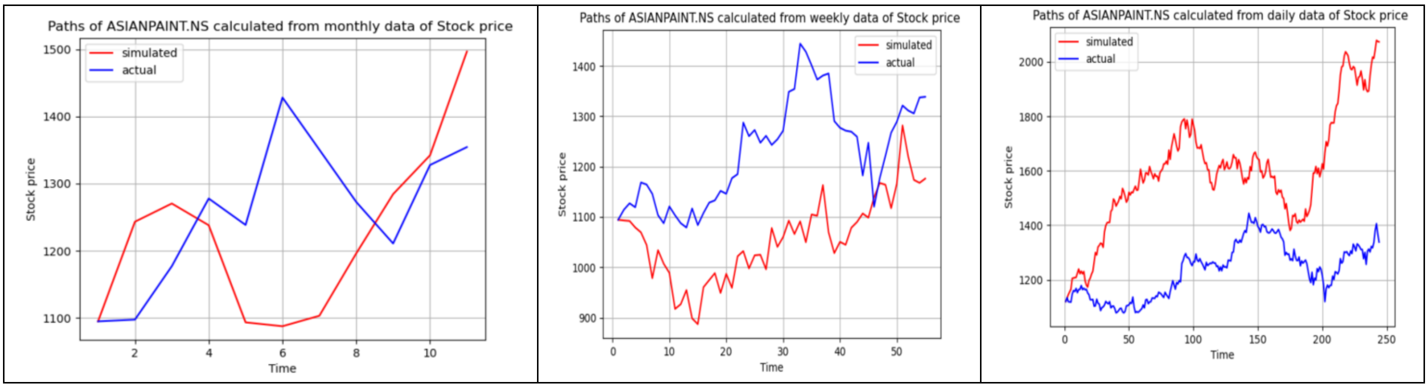


8. Estimated mu for BERGEPAINT.NS Stock calculated from monthly data : 0.02854031308909805
   Estimated sigma for BERGEPAINT.NS Stock calculated from monthly data : 0.07560783606025016
   Estimated mu for BERGEPAINT.NS Stock calculated from weekly data : 0.007106898558266252
   Estimated sigma for BERGEPAINT.NS Stock calculated from weekly data : 0.0516859577104628
   Estimated mu for BERGEPAINT.NS Stock calculated from daily data : 0.0014358867856170375
   Estimated sigma for BERGEPAINT.NS Stock calculated from daily data : 0.02092111567584855

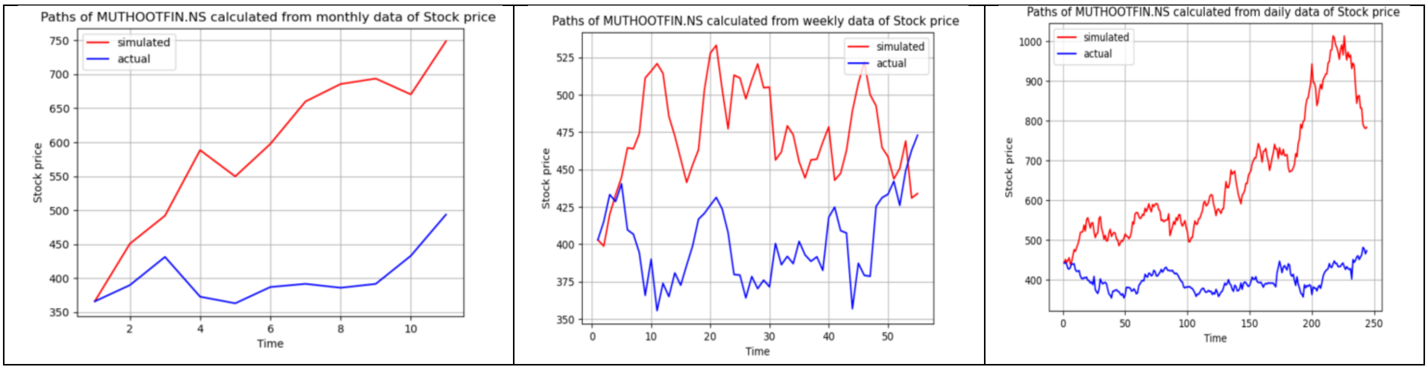


9. Estimated mu for ASIANPAINT.NS Stock calculated from monthly data : 0.020278272305123985
   Estimated sigma for ASIANPAINT.NS Stock calculated from monthly data : 0.0639788890623011
   Estimated mu for ASIANPAINT.NS Stock calculated from weekly data : 0.004783887276780889
   Estimated sigma for ASIANPAINT.NS Stock calculated from weekly data : 0.03500814742880526
   Estimated mu for ASIANPAINT.NS Stock calculated from daily data : 0.0010002583246603123

Estimated sigma for ASIANPAINT.NS Stock calculated from daily data : 0.015946225726382546

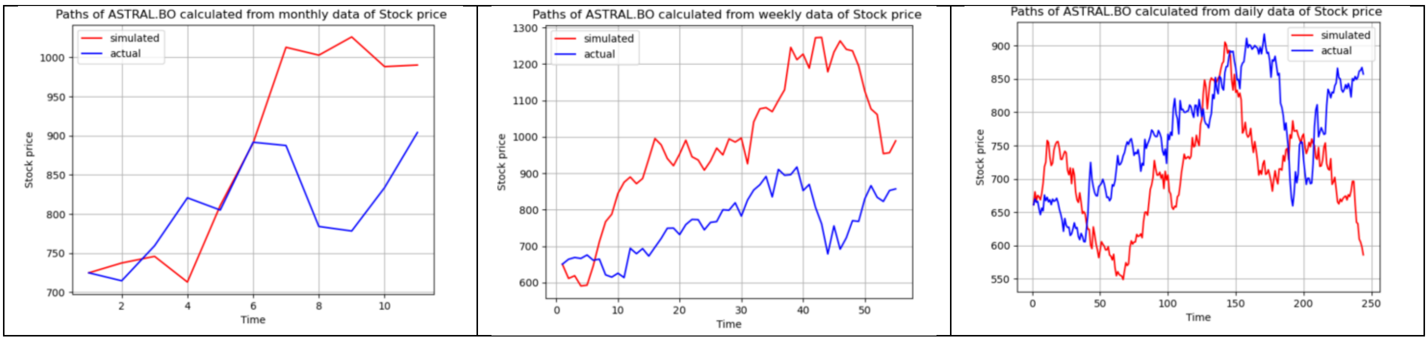


10. Estimated mu for MUTHOOTFIN.NS Stock calculated from monthly data : 0.02939929930213017
    Estimated sigma for MUTHOOTFIN.NS Stock calculated from monthly data : 0.09272359747443211
    Estimated mu for MUTHOOTFIN.NS Stock calculated from weekly data : 0.00858482391391399
    Estimated sigma for MUTHOOTFIN.NS Stock calculated from weekly data : 0.050823327440264285
    Estimated mu for MUTHOOTFIN.NS Stock calculated from daily data : 0.0019088505228944382
    Estimated sigma for MUTHOOTFIN.NS Stock calculated from daily data : 0.024677987170363853

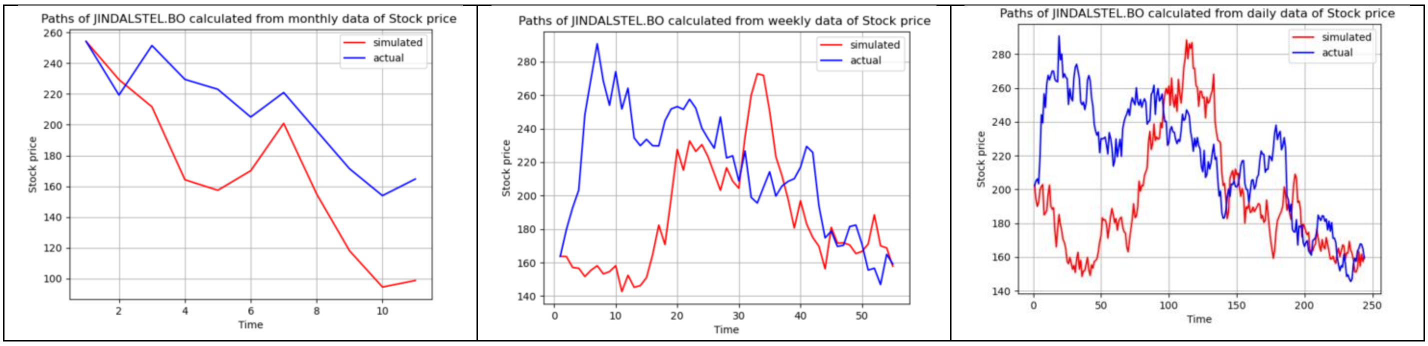


- BSE Stocks:

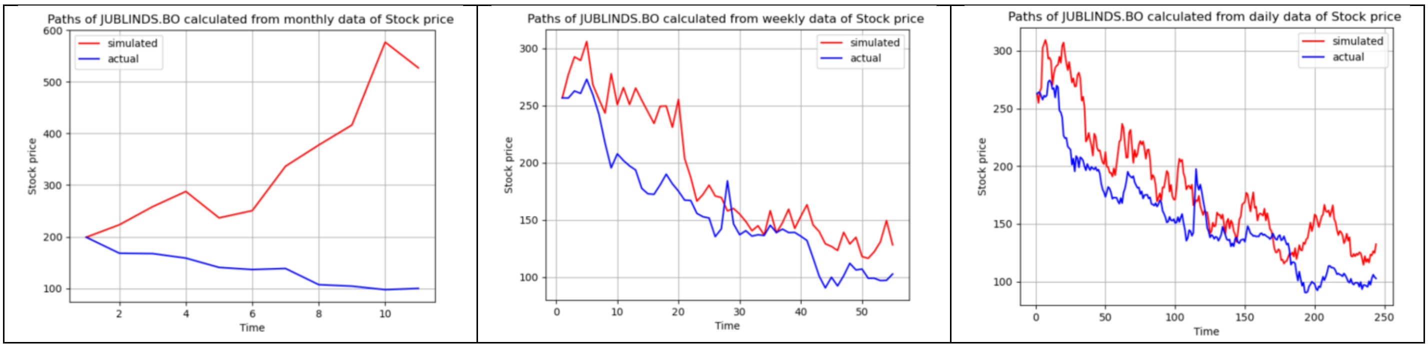
1. Estimated mu for ASTRAL.BO Stock calculated from monthly data : 0.03940432247427337
   Estimated sigma for ASTRAL.BO Stock calculated from monthly data : 0.10011072123401066
   Estimated mu for ASTRAL.BO Stock calculated from weekly data : 0.008859510841879763
   Estimated sigma for ASTRAL.BO Stock calculated from weekly data : 0.04585924973772943
   Estimated mu for ASTRAL.BO Stock calculated from daily data : 0.0018406289971613665
   Estimated sigma for ASTRAL.BO Stock calculated from daily data : 0.019779518860872838



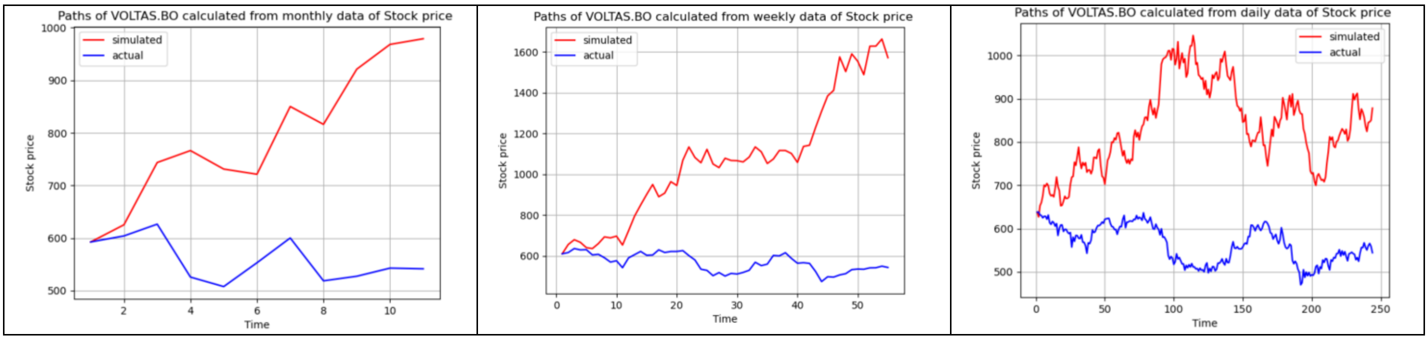
2. Estimated mu for JINDALSTEL.BO Stock calculated from monthly data : 0.014783254253848303
   Estimated sigma for JINDALSTEL.BO Stock calculated from monthly data : 0.1694805185106117
   Estimated mu for JINDALSTEL.BO Stock calculated from weekly data : 0.0003162388453244623
   Estimated sigma for JINDALSTEL.BO Stock calculated from weekly data : 0.07055084773574148
   Estimated mu for JINDALSTEL.BO Stock calculated from daily data : 0.00027978544277640187
   Estimated sigma for JINDALSTEL.BO Stock calculated from daily data : 0.03285602452115922



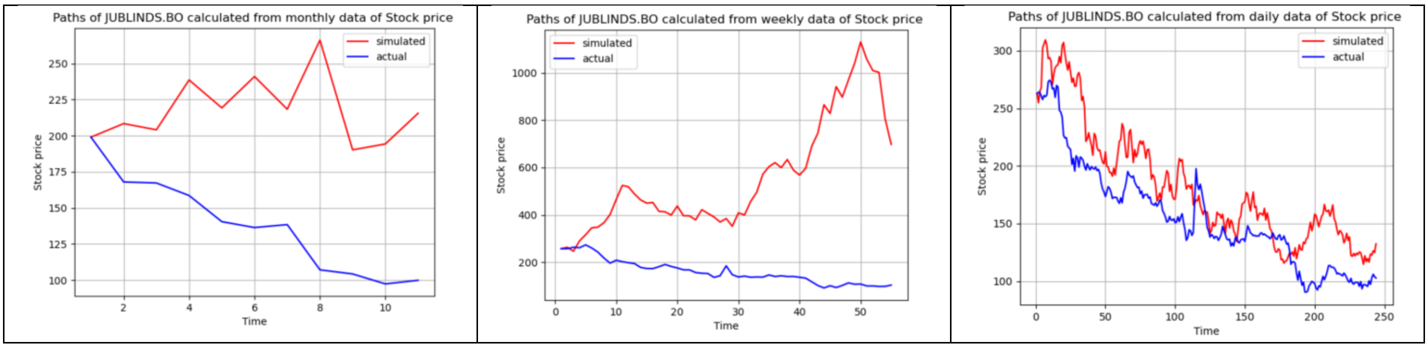
3. Estimated mu for JUBLINDS.BO Stock calculated from monthly data : 0.04352884046697169
   Estimated sigma for JUBLINDS.BO Stock calculated from monthly data : 0.18028927714238116
   Estimated mu for JUBLINDS.BO Stock calculated from weekly data : 0.010167402418748212
   Estimated sigma for JUBLINDS.BO Stock calculated from weekly data : 0.0800158033566251
   Estimated mu for JUBLINDS.BO Stock calculated from daily data : 0.00224910235715039
   Estimated sigma for JUBLINDS.BO Stock calculated from daily data : 0.040373699205604505



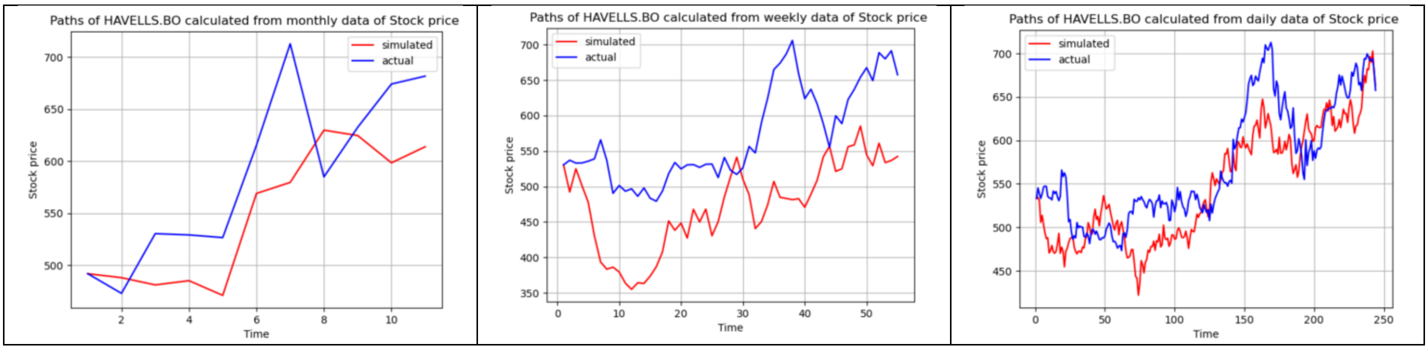
4. Estimated mu for VOLTAS.BO Stock calculated from monthly data : 0.04224447265981417
   Estimated sigma for VOLTAS.BO Stock calculated from monthly data : 0.11077315115820213
   Estimated mu for VOLTAS.BO Stock calculated from weekly data : 0.00953405413947219
   Estimated sigma for VOLTAS.BO Stock calculated from weekly data : 0.05255156024020805
   Estimated mu for VOLTAS.BO Stock calculated from daily data : 0.0020553914146443034
   Estimated sigma for VOLTAS.BO Stock calculated from daily data : 0.024035519783433275



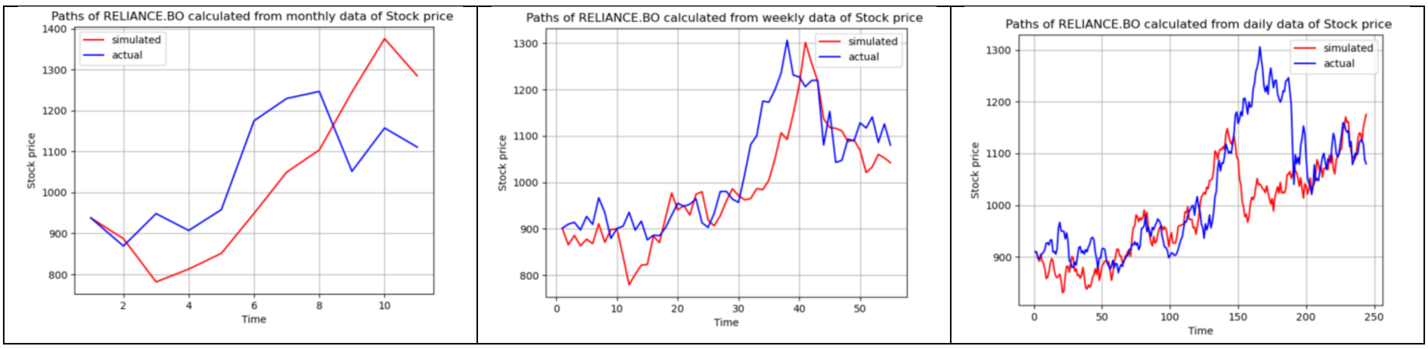
5. Estimated mu for JUBLINDS.BO Stock calculated from monthly data : 0.04352884046697169
   Estimated sigma for JUBLINDS.BO Stock calculated from monthly data : 0.18028927714238116
   Estimated mu for JUBLINDS.BO Stock calculated from weekly data : 0.010167402418748212
   Estimated sigma for JUBLINDS.BO Stock calculated from weekly data : 0.0800158033566251
   Estimated mu for JUBLINDS.BO Stock calculated from daily data : 0.00224910235715039
   Estimated sigma for JUBLINDS.BO Stock calculated from daily data : 0.040373699205604505



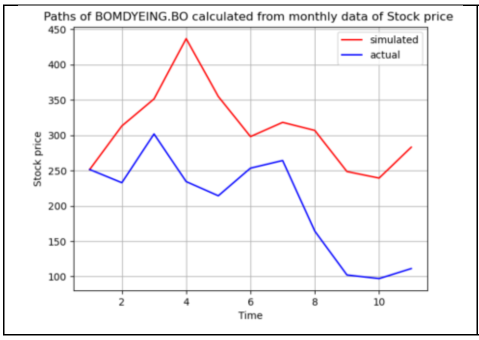
6. Estimated mu for HAVELLS.BO Stock calculated from monthly data : 0.0288215233868565
   Estimated sigma for HAVELLS.BO Stock calculated from monthly data : 0.08520131576412955
   Estimated mu for HAVELLS.BO Stock calculated from weekly data : 0.007115525926357143
   Estimated sigma for HAVELLS.BO Stock calculated from weekly data : 0.04613866382987723
   Estimated mu for HAVELLS.BO Stock calculated from daily data : 0.001515054974906492
   Estimated sigma for HAVELLS.BO Stock calculated from daily data : 0.019872738219213364

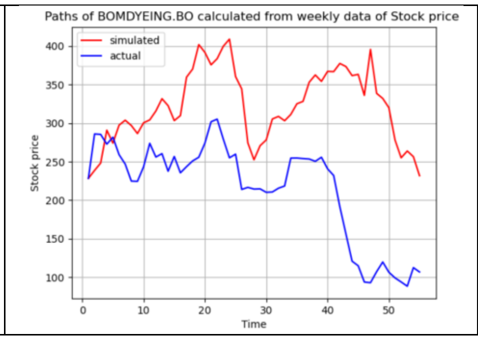


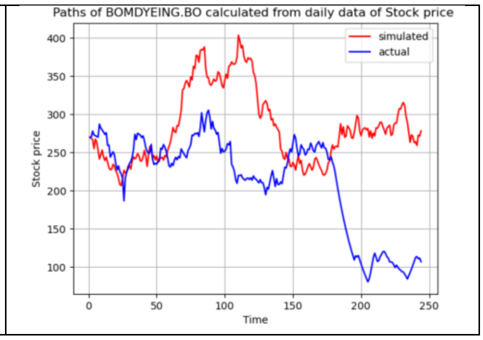
7. Estimated mu for RELIANCE.BO Stock calculated from monthly data : 0.02023057205095619
   Estimated sigma for RELIANCE.BO Stock calculated from monthly data : 0.07104364710407798
   Estimated mu for RELIANCE.BO Stock calculated from weekly data : 0.004584790653313247
   Estimated sigma for RELIANCE.BO Stock calculated from weekly data : 0.03503423046032869
   Estimated mu for RELIANCE.BO Stock calculated from daily data : 0.0008994274363467664
   Estimated sigma for RELIANCE.BO Stock calculated from daily data : 0.01526182111696882



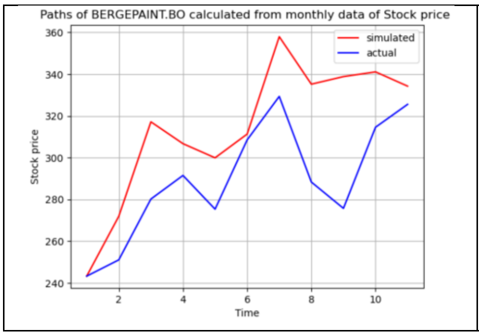
8. Estimated mu for BOMDYEING.BO Stock calculated from monthly data : 0.043636771965768206
   Estimated sigma for BOMDYEING.BO Stock calculated from monthly data : 0.1525703613138678
   Estimated mu for BOMDYEING.BO Stock calculated from weekly data : 0.009194840184443023
   Estimated sigma for BOMDYEING.BO Stock calculated from weekly data : 0.07660753659697998
   Estimated mu for BOMDYEING.BO Stock calculated from daily data : 0.0018463191291588597
   Estimated sigma for BOMDYEING.BO Stock calculated from daily data : 0.03039240379991451

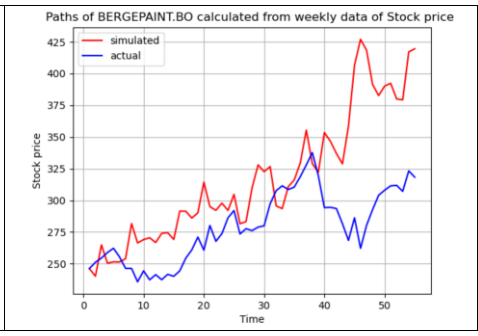


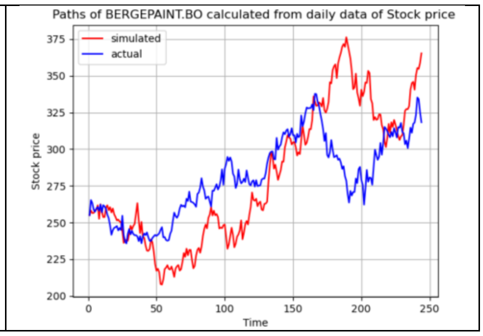




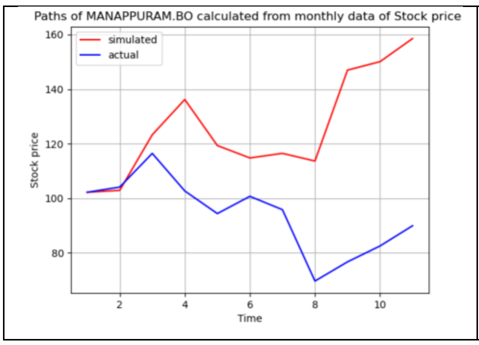
9. Estimated mu for BERGEPAINT.BO Stock calculated from monthly data : 0.02837804360235034
   Estimated sigma for BERGEPAINT.BO Stock calculated from monthly data : 0.0747294487306687
   Estimated mu for BERGEPAINT.BO Stock calculated from weekly data : 0.007053867918290025
   Estimated sigma for BERGEPAINT.BO Stock calculated from weekly data : 0.05100259816947007
   Estimated mu for BERGEPAINT.BO Stock calculated from daily data : 0.0014259198879787937
   Estimated sigma for BERGEPAINT.BO Stock calculated from daily data : 0.02054496074934908

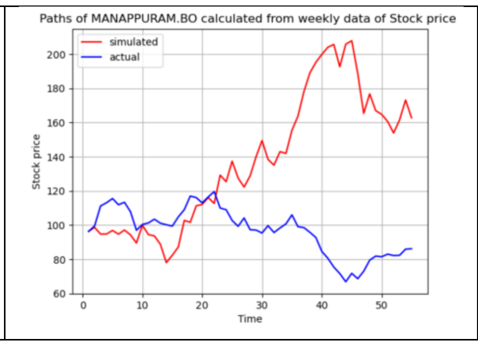


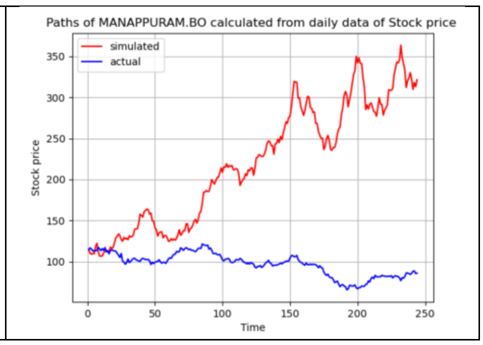




10. Estimated mu for MANAPPURAM.BO Stock calculated from monthly data : 0.045921253605150675
    Estimated sigma for MANAPPURAM.BO Stock calculated from monthly data : 0.11452875053785494
    Estimated mu for MANAPPURAM.BO Stock calculated from weekly data : 0.01244985440139506
    Estimated sigma for MANAPPURAM.BO Stock calculated from weekly data : 0.06470992076349552
    Estimated mu for MANAPPURAM.BO Stock calculated from daily data : 0.002766708469818682
    Estimated sigma for MANAPPURAM.BO Stock calculated from daily data : 0.03041746957784714







- <u>BSE Index:</u>

Estimated mu for ^BSESN Stock calculated from monthly data : 0.011140263361654301
Estimated sigma for ^BSESN Stock calculated from monthly data : 0.03791198852118281
Estimated mu for ^BSESN Stock calculated from weekly data : 0.0024792644601172374
Estimated sigma for ^BSESN Stock calculated from weekly data : 0.01838975357274523
Estimated mu for ^BSESN Stock calculated from daily data : 0.0005144429664410076
Estimated sigma for ^BSESN Stock calculated from daily data : 0.008496861030054315

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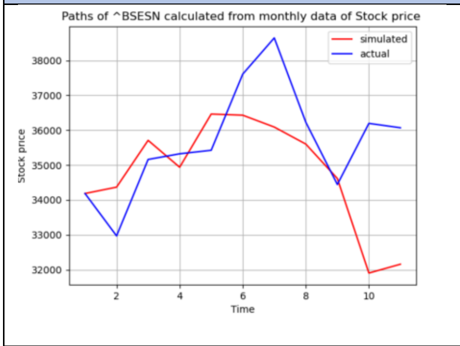
<td>
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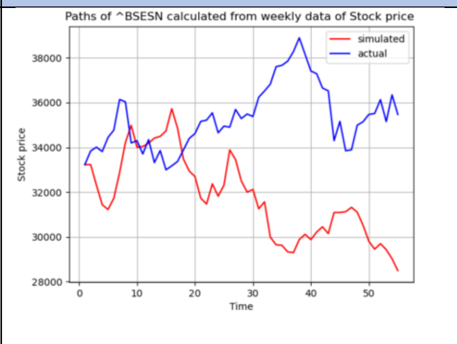
<td>
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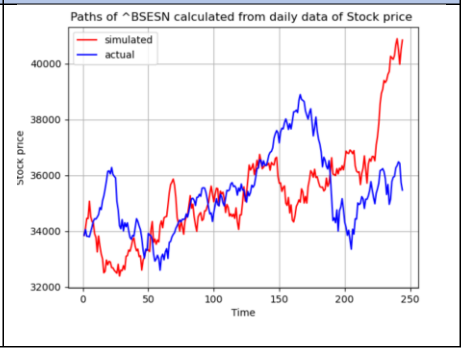
<td>
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- <u>NSE Index:</u>

Estimated mu for ^NSEI Stock calculated from monthly data : 0.011837522913951296
Estimated sigma for ^NSEI Stock calculated from monthly data : 0.038284948674235035
Estimated mu for ^NSEI Stock calculated from weekly data : 0.0026505349620828886
Estimated sigma for ^NSEI Stock calculated from weekly data : 0.018606406379968198
Estimated mu for ^NSEI Stock calculated from daily data : 0.000571444320528465
Estimated sigma for ^NSEI Stock calculated from daily data : 0.008549372761066924

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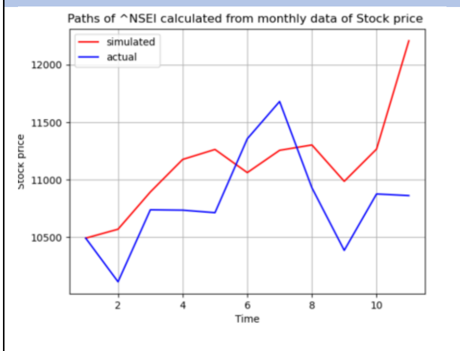
<td>
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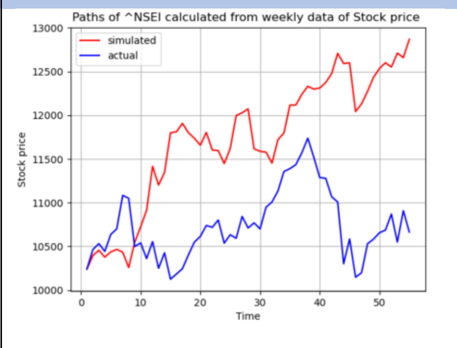
<td>
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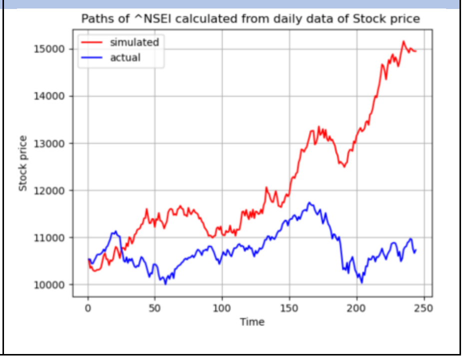
<td>
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