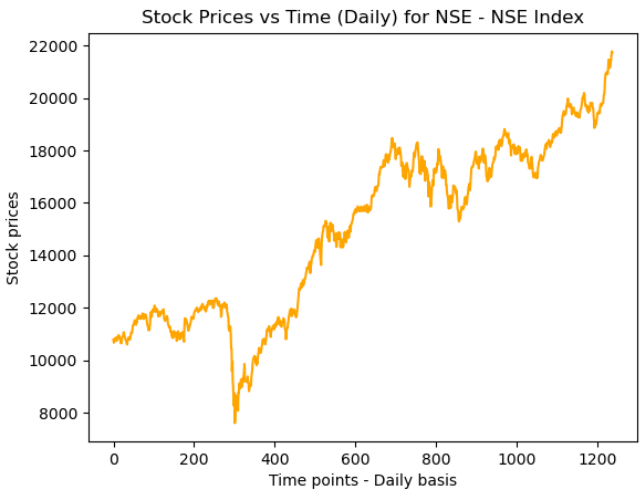
MA374 – Financial Engineering Laboratory

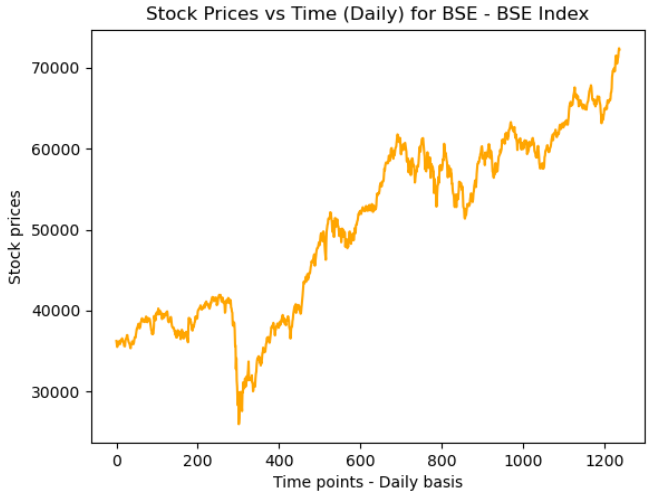
Lab – 06

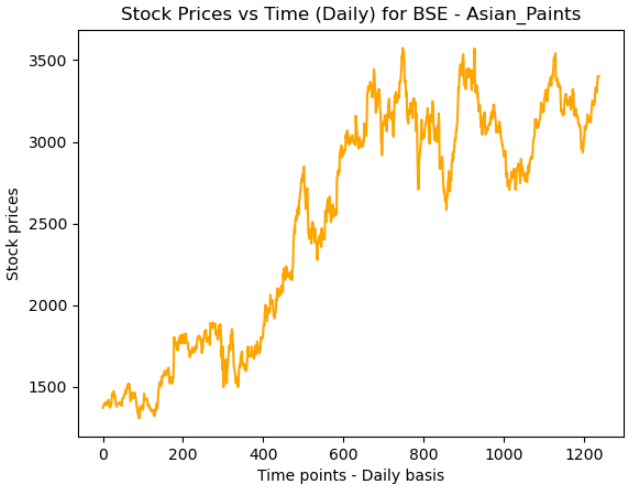
Dipanshu Goyal 210123083

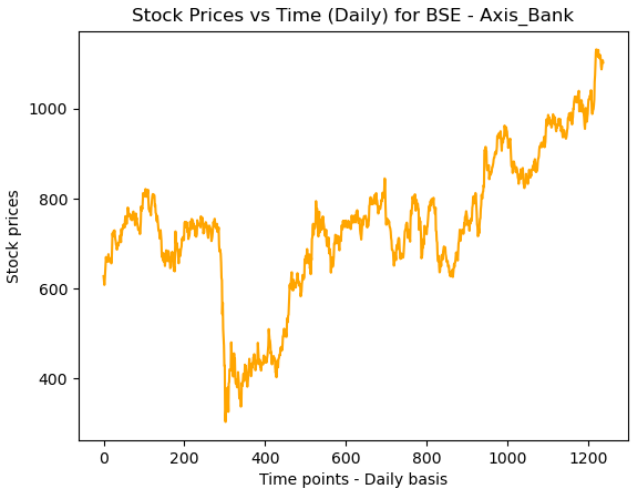
- Instead of putting each and every plot in the report, I'm putting plots for the BSE Index, NSE Index, 4 stocks from BSE and 4 stocks from NSE. Other plots follow similar behaviour and can be found in the Plots folder for every question for each category (daily, weekly, monthly).

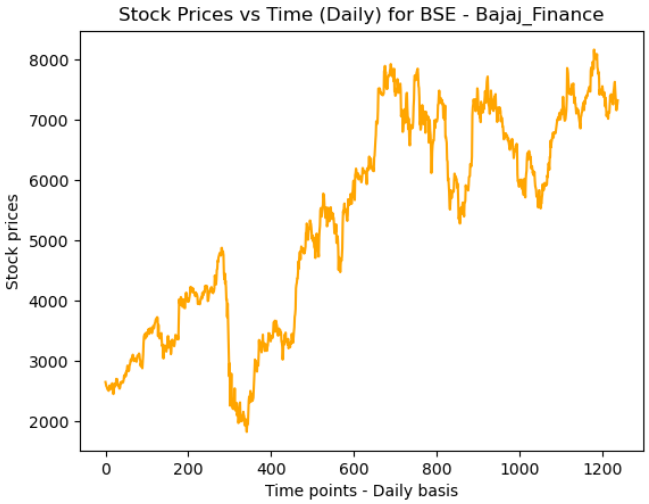
Ques – 1

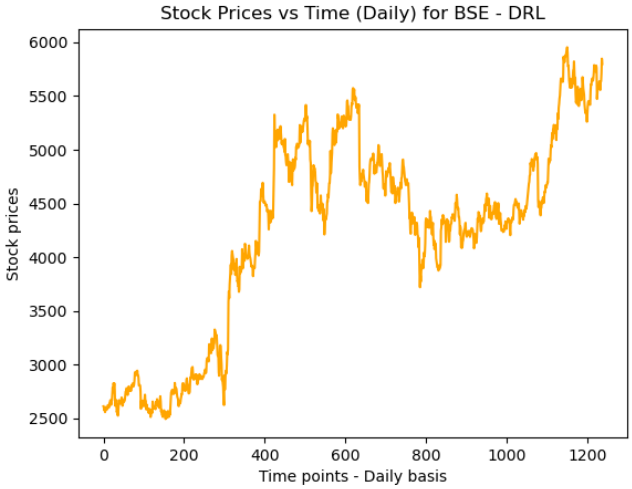


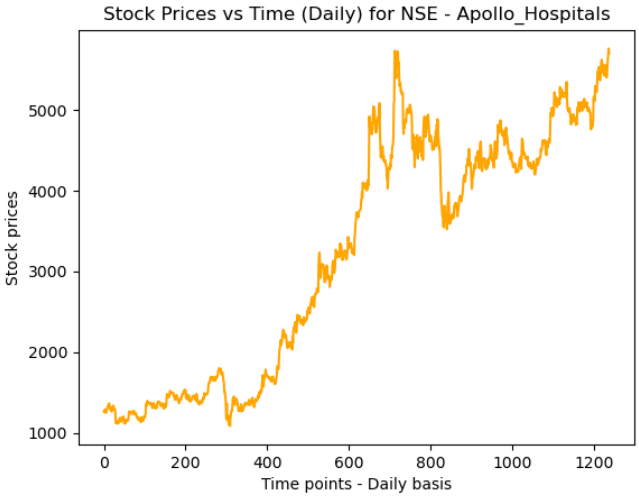


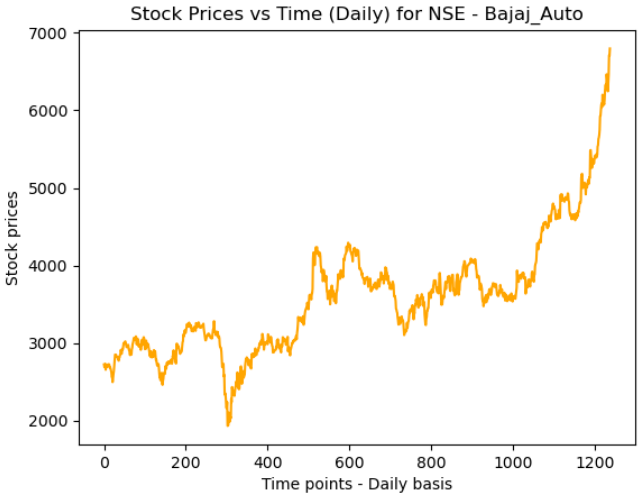


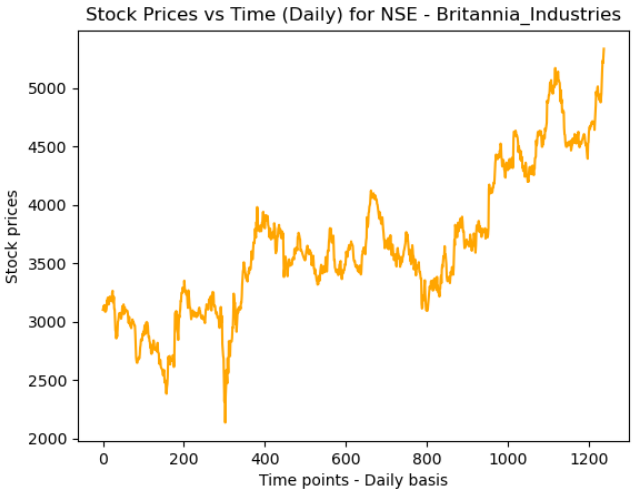


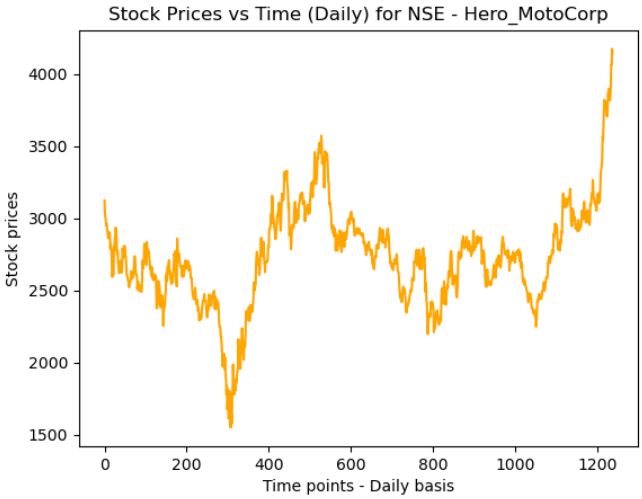

Stock Prices vs Time (Daily) for BSE - Bajaj_Finance
Stock prices
Time points - Daily basis

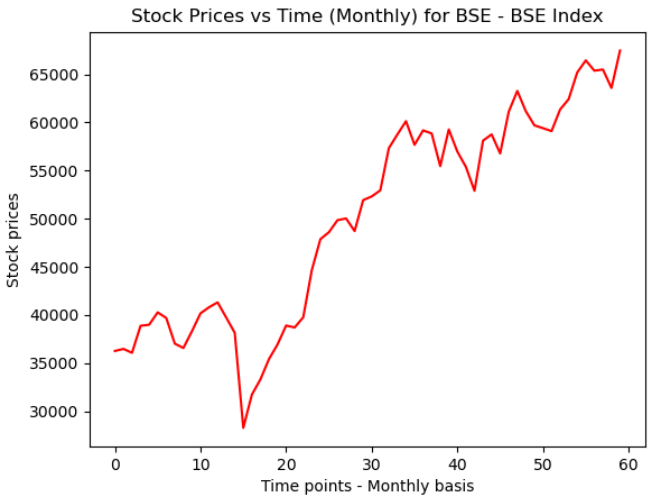

Stock Prices vs Time (Daily) for BSE - DRL
Stock prices
Time points - Daily basis

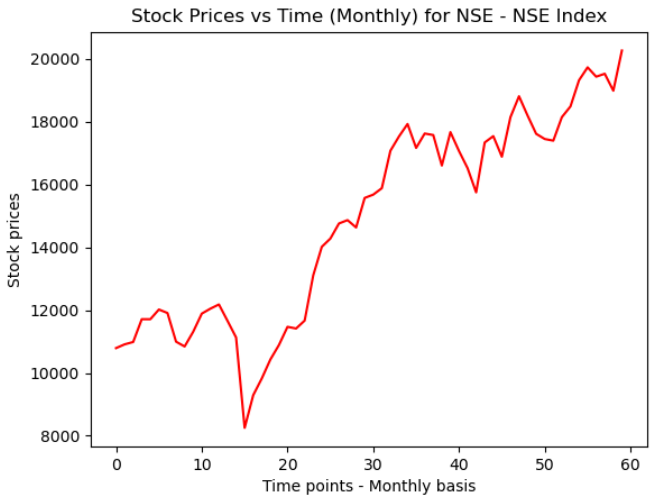

Stock Prices vs Time (Daily) for NSE - Apollo_Hospitals
Stock prices
Time points - Daily basis


Stock Prices vs Time (Daily) for NSE - Bajaj_Auto
Stock prices
Time points - Daily basis


Stock Prices vs Time (Daily) for NSE - Britannia_Industries
Stock prices
Time points - Daily basis


Stock Prices vs Time (Daily) for NSE - Hero_MotoCorp
Stock prices
Time points - Daily basis


Stock Prices vs Time (Monthly) for BSE - BSE Index
Stock prices
Time points - Monthly basis


Stock Prices vs Time (Monthly) for NSE - NSE Index
Stock prices
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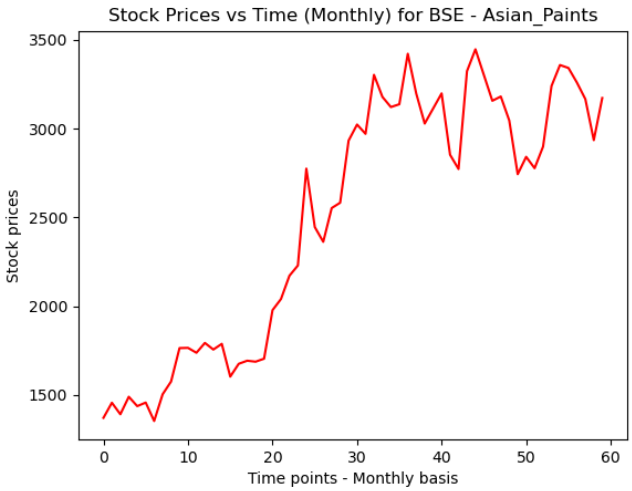
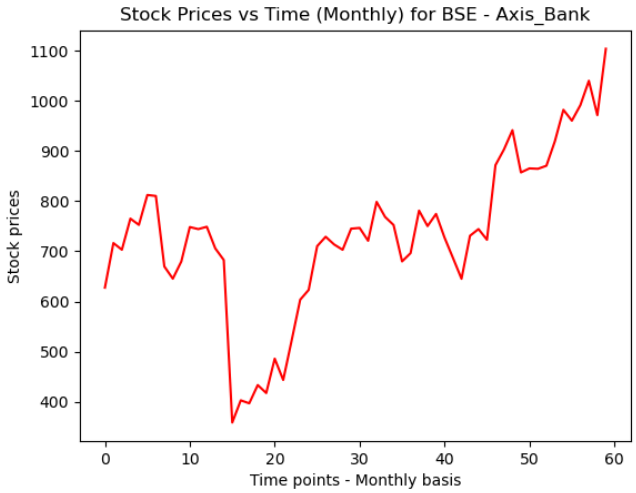
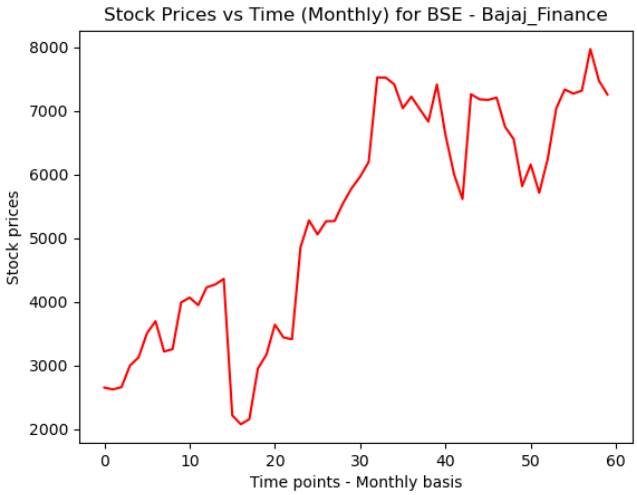
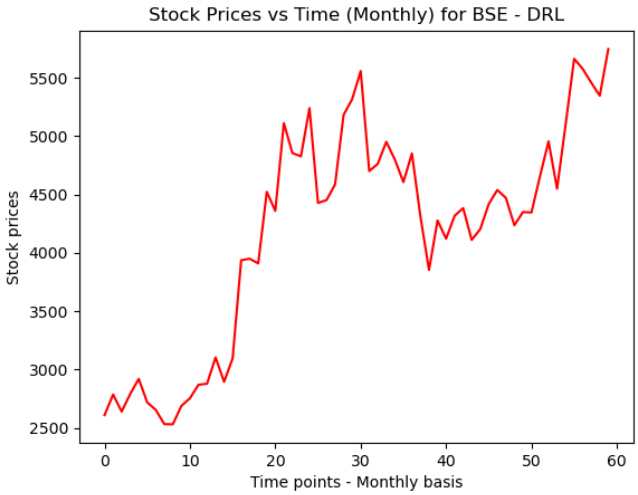
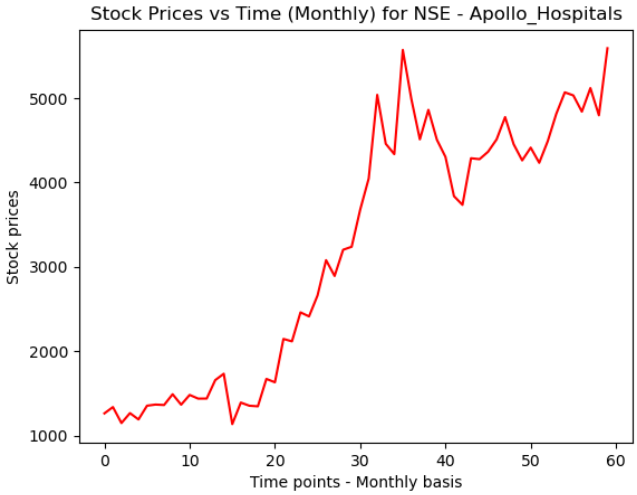
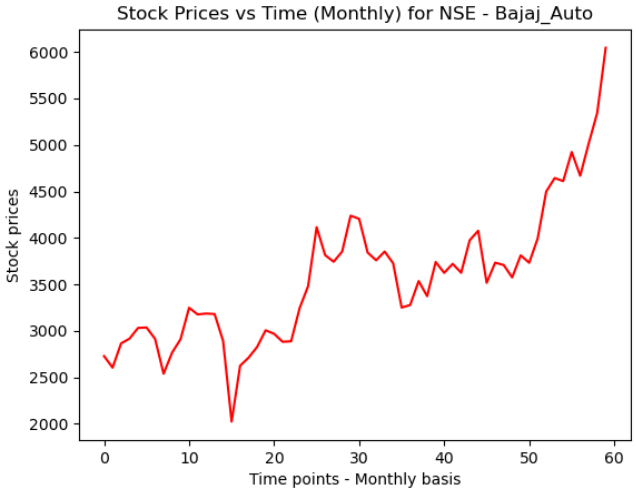

Stock Prices vs Time (Monthly) for BSE - Asian_Paints
Stock prices
Time points - Monthly basis

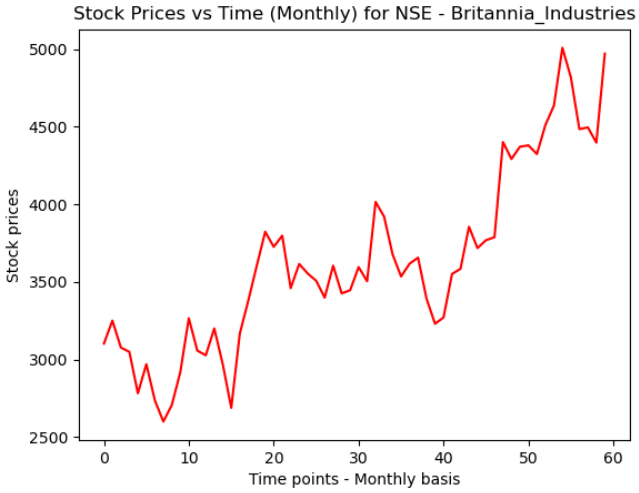

Stock Prices vs Time (Monthly) for BSE - Axis_Bank
Stock prices
Time points - Monthly basis

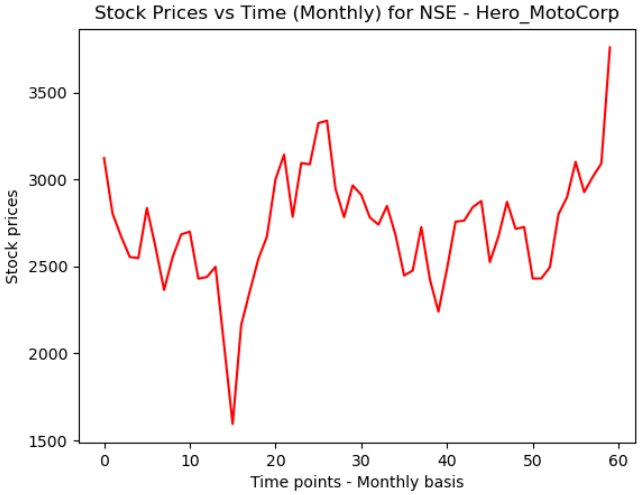

Stock Prices vs Time (Monthly) for BSE - Bajaj_Finance
Stock prices
Time points - Monthly basis

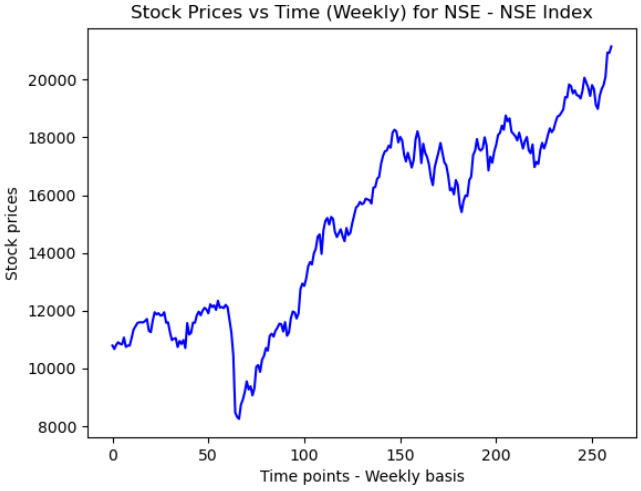

Stock Prices vs Time (Monthly) for BSE - DRL
Stock prices
Time points - Monthly basis

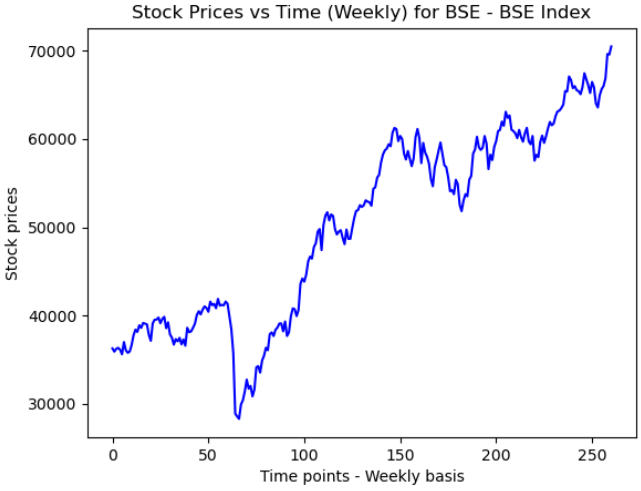

Stock Prices vs Time (Monthly) for NSE - Apollo_Hospitals
Stock prices
Time points - Monthly basis

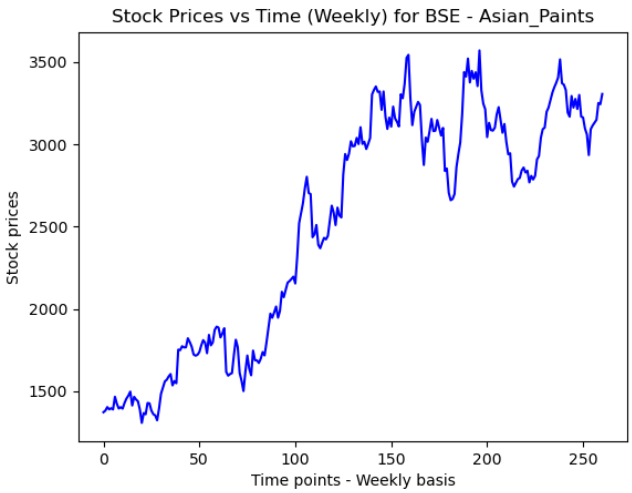

Stock Prices vs Time (Monthly) for NSE - Bajaj_Auto
Stock prices
Time points - Monthly basis

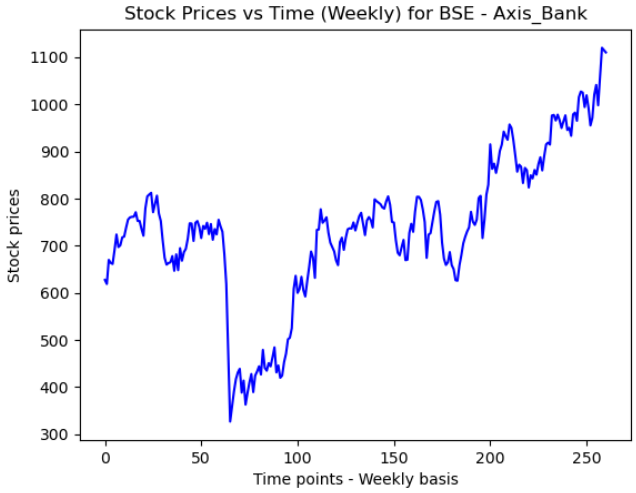

Stock Prices vs Time (Monthly) for NSE - Britannia_Industries
Stock prices
Time points - Monthly basis

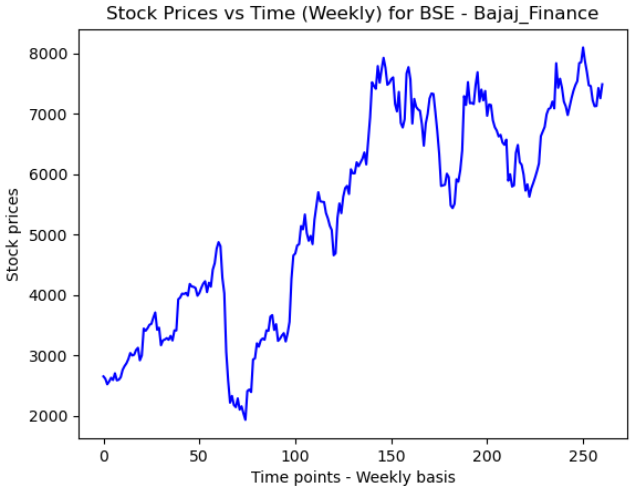

Stock Prices vs Time (Monthly) for NSE - Hero_MotoCorp
Stock prices
Time points - Monthly basis

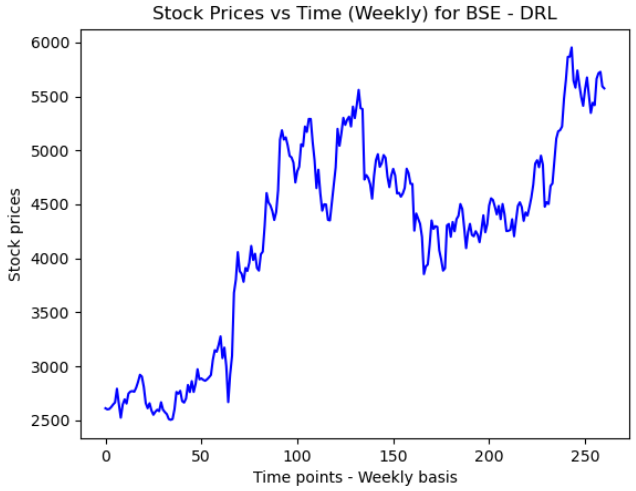

Stock Prices vs Time (Weekly) for NSE - NSE Index
Stock prices
Time points - Weekly basis

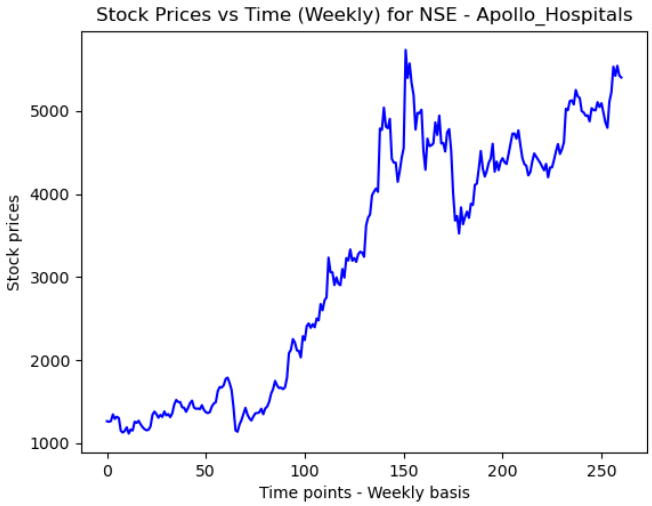

Stock Prices vs Time (Weekly) for BSE - BSE Index
Stock prices
Time points - Weekly basis

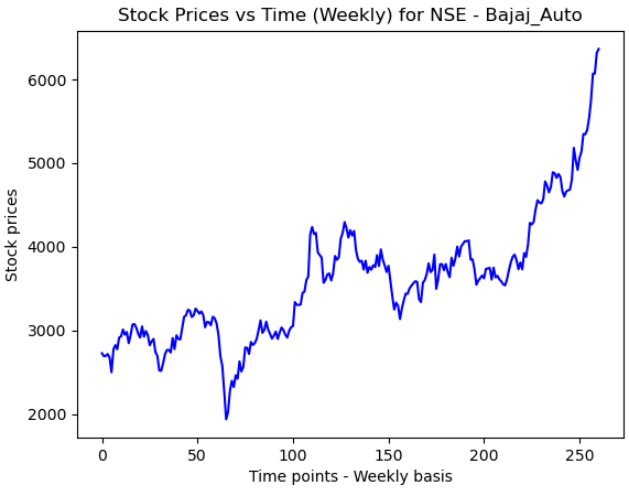

Stock Prices vs Time (Weekly) for BSE - Asian_Paints
Stock prices
Time points - Weekly basis

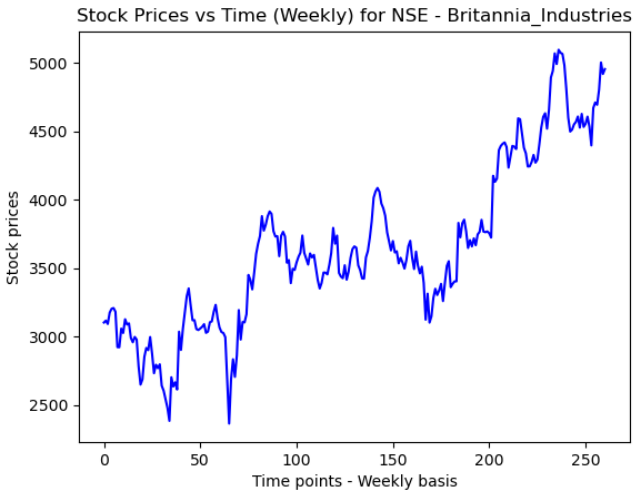

Stock Prices vs Time (Weekly) for BSE - Axis_Bank
Stock prices
Time points - Weekly basis

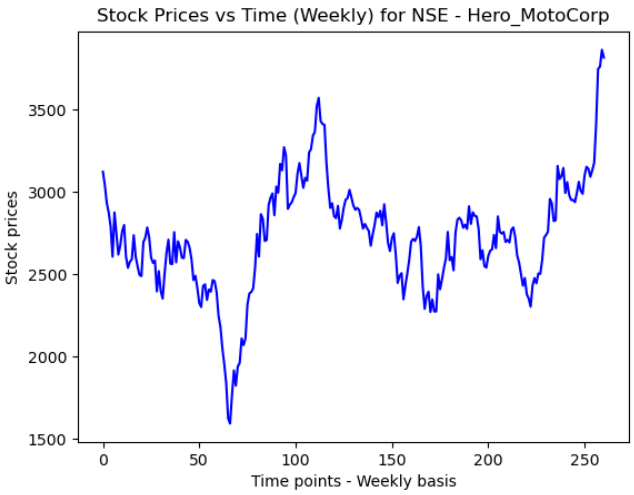

Stock Prices vs Time (Weekly) for BSE - Bajaj_Finance
Stock prices
Time points - Weekly basis


Stock Prices vs Time (Weekly) for BSE - DRL
Stock prices
Time points - Weekly basis


Stock Prices vs Time (Weekly) for NSE - Apollo_Hospitals
Stock prices
Time points - Weekly basis


Stock Prices vs Time (Weekly) for NSE - Bajaj_Auto
Stock prices
Time points - Weekly basis



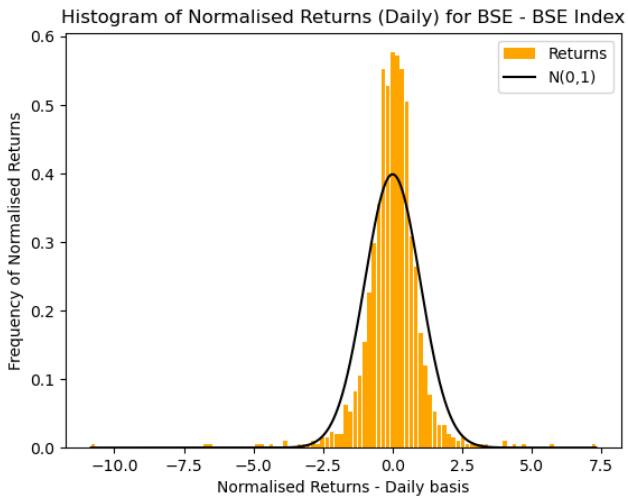


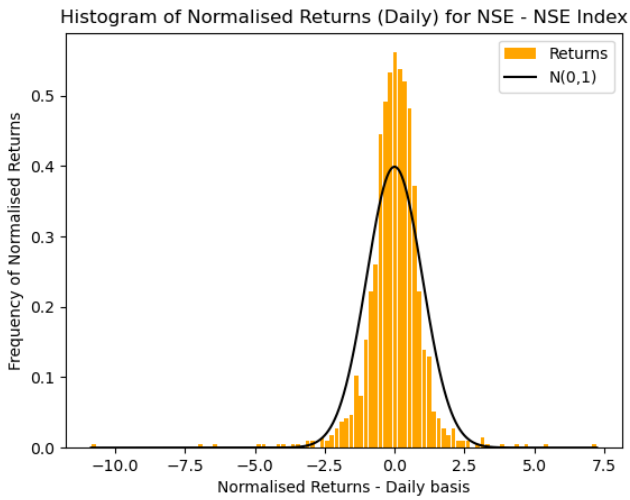
Ques – 2

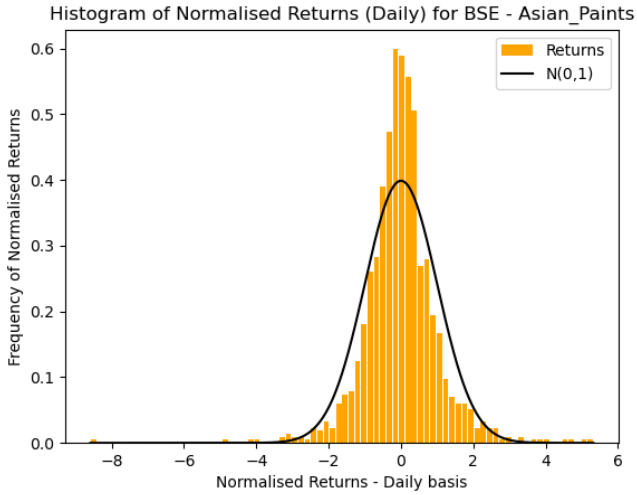
Observations:

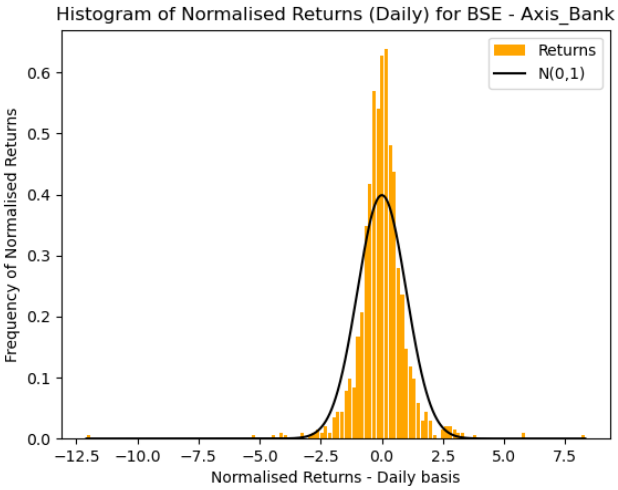
● The first and very obvious observation is the striking similarity in the graph of N (0,1) and the histogram. {This is also slightly obvious because we are observing the Central Limit Theorem, which dictates that the distribution of these normalized returns has to be N (0,1)}

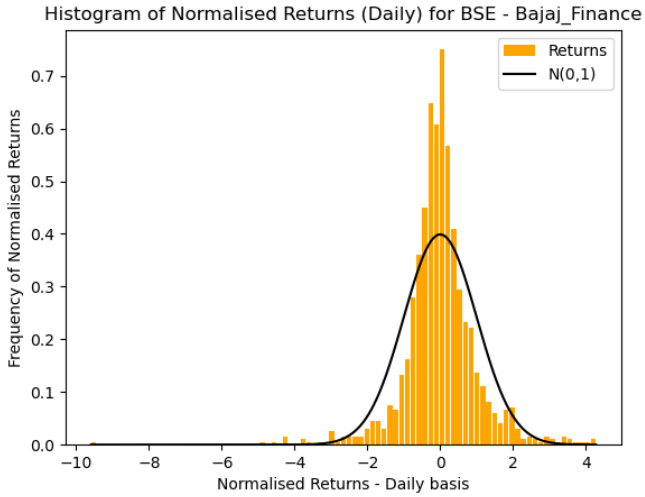
● Near the tails of these plots, the histogram deviates slightly from the N (0,1) plot. We see that while N (0,1) goes to 0 at these points, the stock does not always go because the practical market scenario is not ideal and is influenced by factors like economic fluctuations, company decisions, etc.

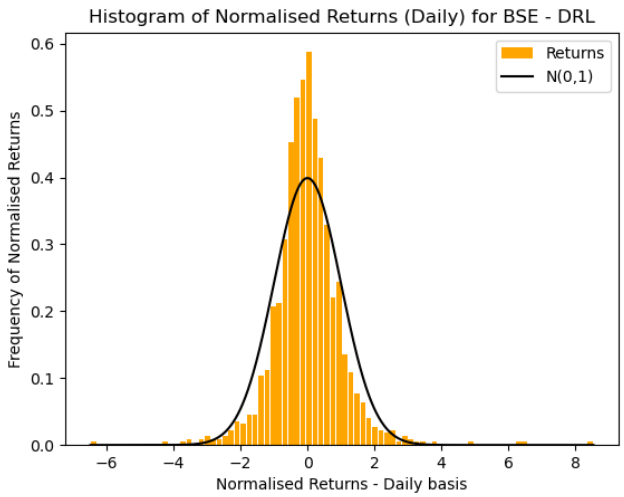


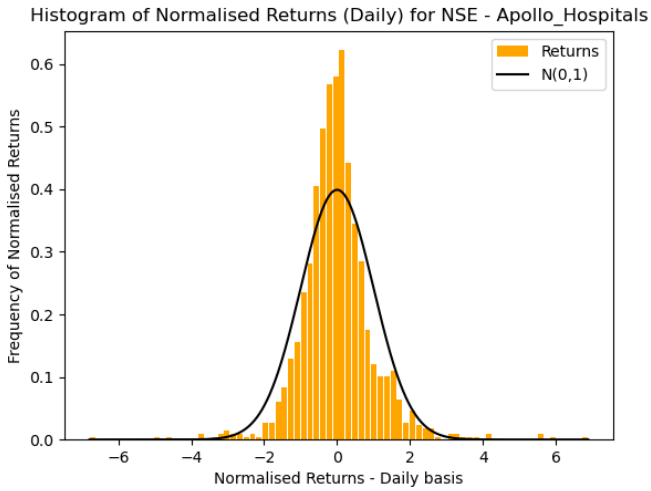



Histogram of Normalised Returns (Daily) for BSE - Asian_Paints
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Daily basis


Histogram of Normalised Returns (Daily) for BSE - Axis_Bank
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Daily basis


Histogram of Normalised Returns (Daily) for BSE - Bajaj_Finance
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Daily basis


Histogram of Normalised Returns (Daily) for BSE - DRL
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Daily basis


Histogram of Normalised Returns (Daily) for NSE - Apollo_Hospitals
Returns
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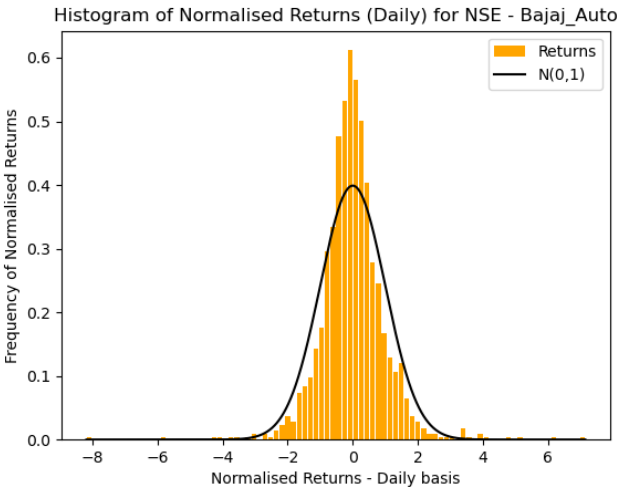
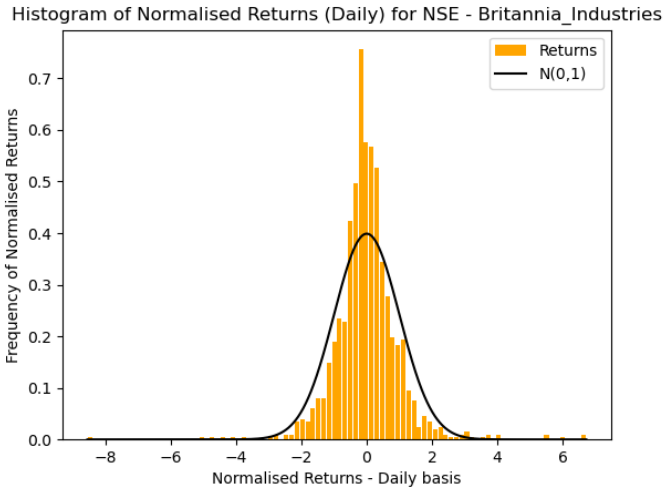
Frequency of Normalised Returns
Normalised Returns - Daily basis


Histogram of Normalised Returns (Daily) for NSE - Bajaj_Auto
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Daily basis


Histogram of Normalised Returns (Daily) for NSE - Britannia_Industries
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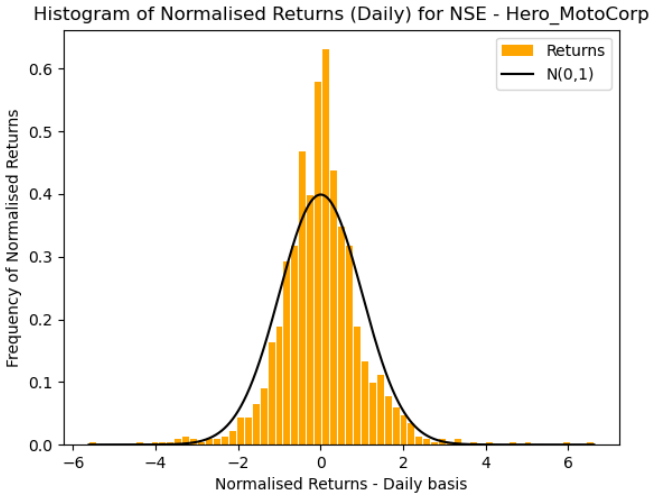
Histogram of Normalised Returns (Daily) for NSE - Hero_MotoCorp
Returns
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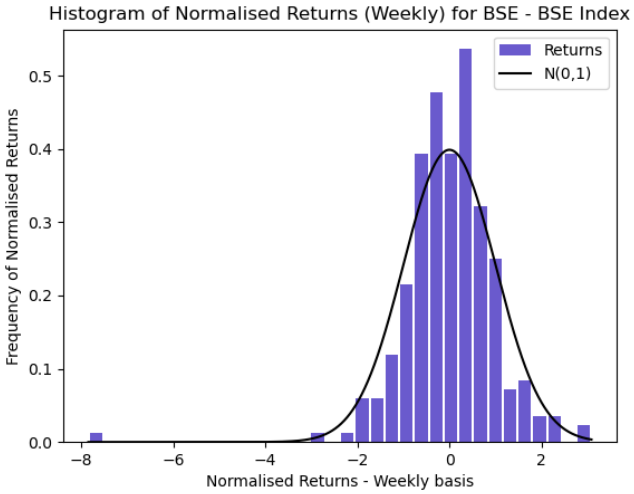
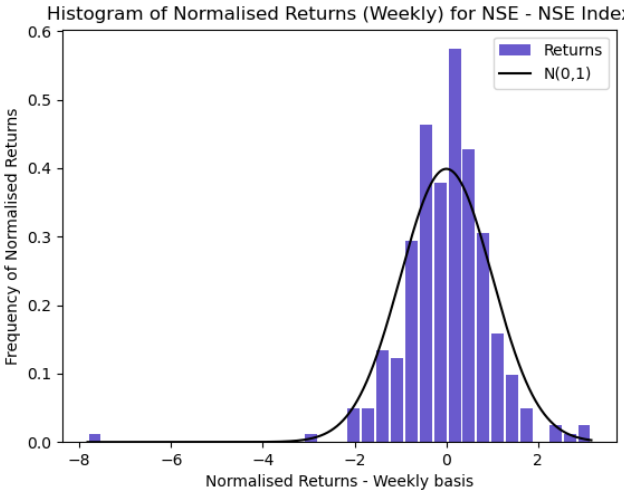
Frequency of Normalised Returns
Normalised Returns - Daily basis


Histogram of Normalised Returns (Weekly) for BSE - BSE Index
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Weekly basis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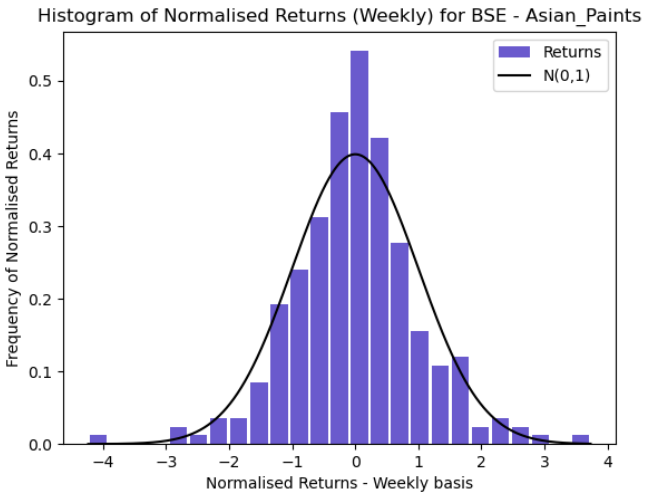
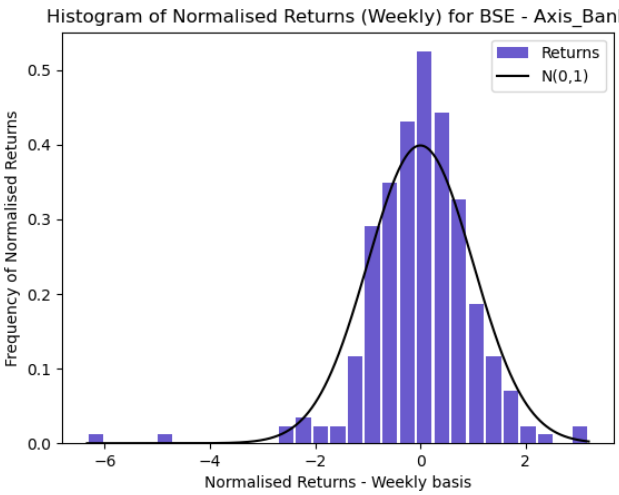

Histogram of Normalised Returns (Weekly) for BSE - Asian_Paints
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Weekly basis


Histogram of Normalised Returns (Weekly) for BSE - Axis_Bank
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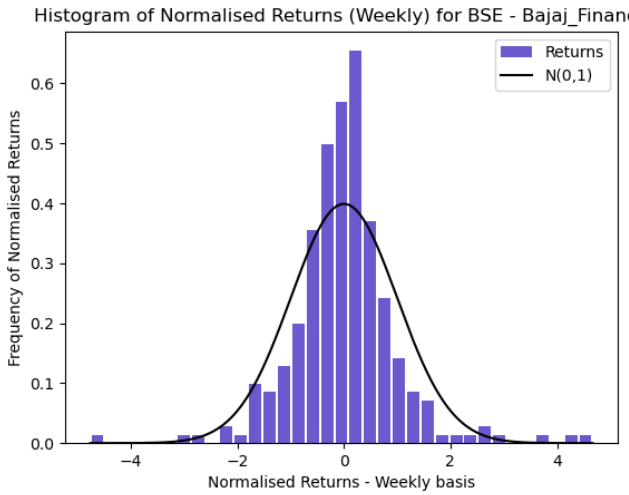
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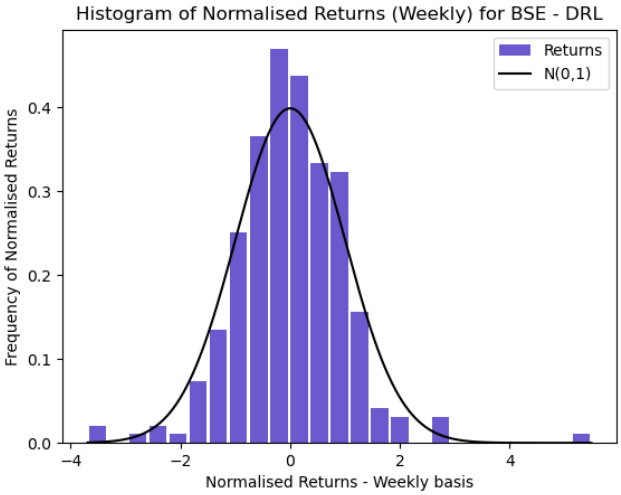
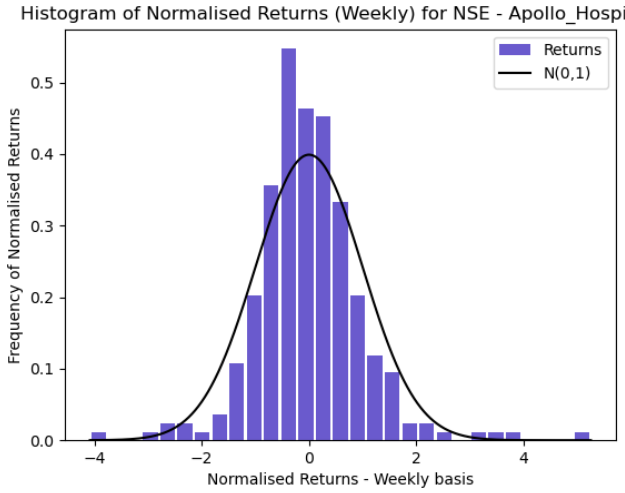
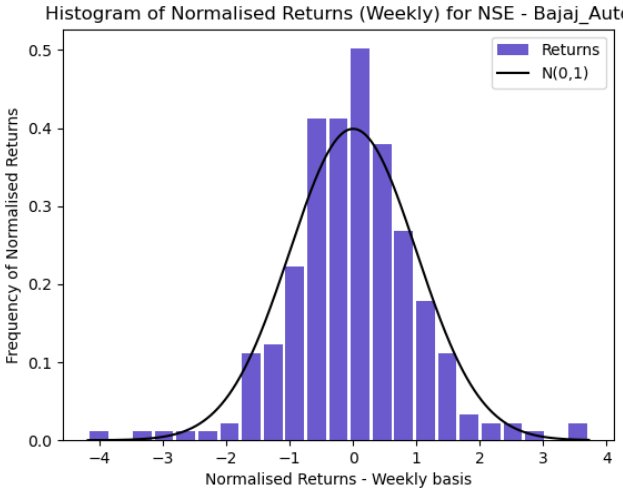
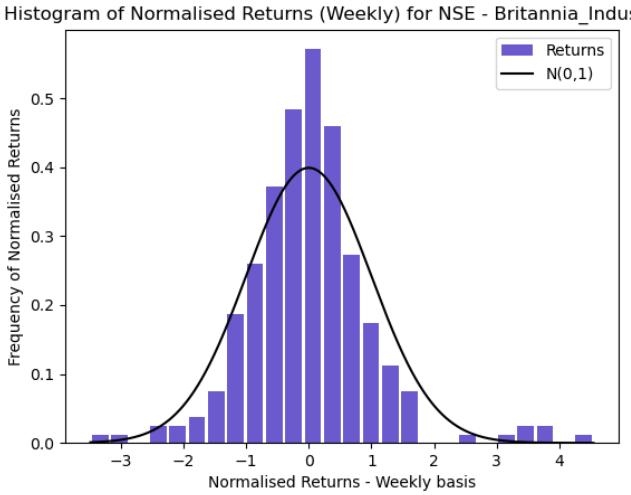
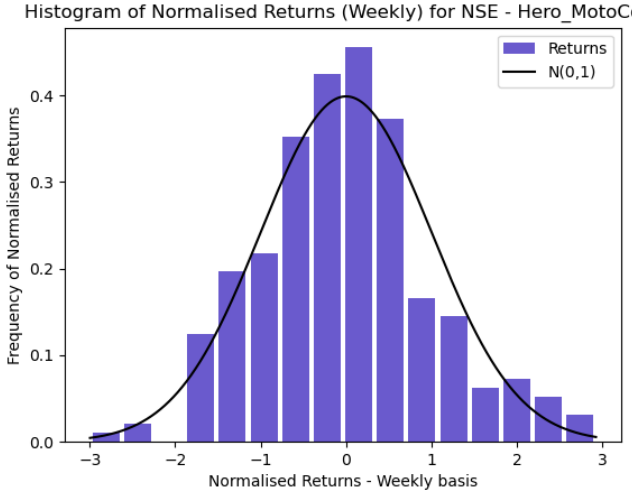
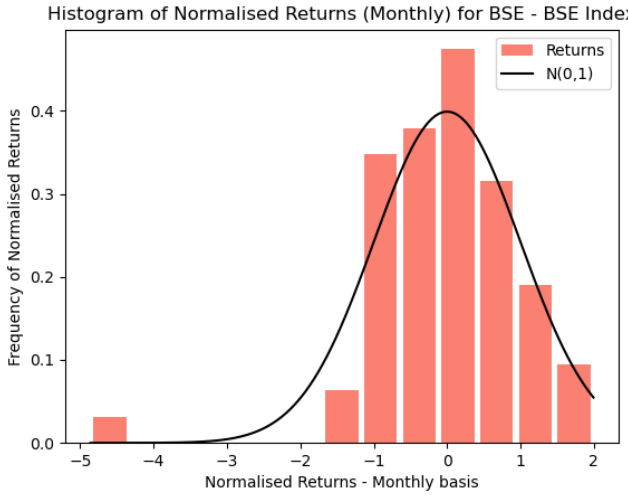

Histogram of Normalised Returns (Weekly) for BSE - DRL
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Weekly basis

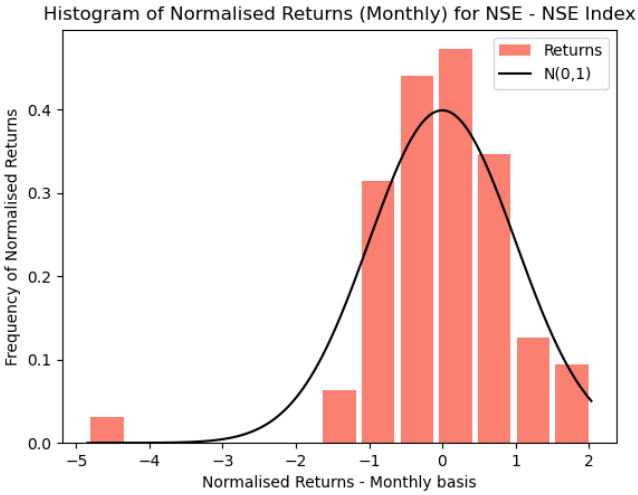

Histogram of Normalised Returns (Weekly) for NSE - Apollo_Hospitals
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Weekly basis

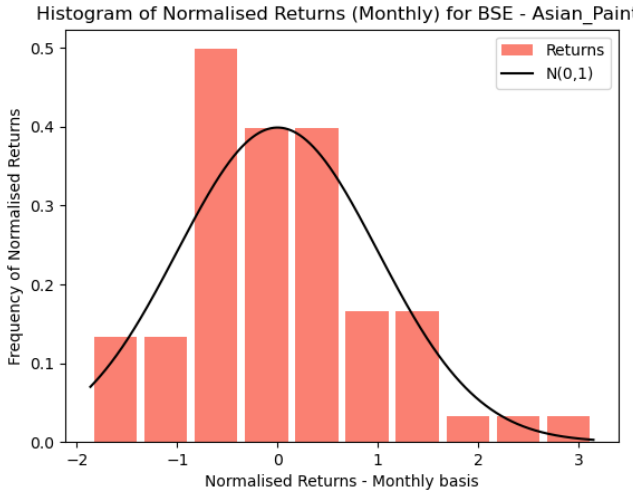

Histogram of Normalised Returns (Weekly) for NSE - Bajaj_Auto
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Weekly basis

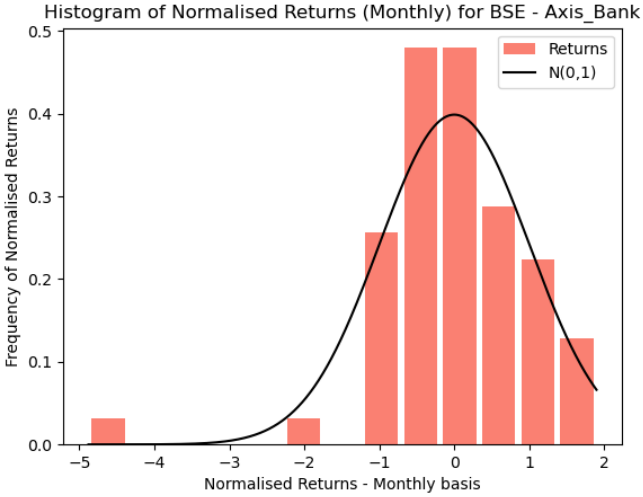

Histogram of Normalised Returns (Weekly) for NSE - Britannia_Industries
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Weekly basis

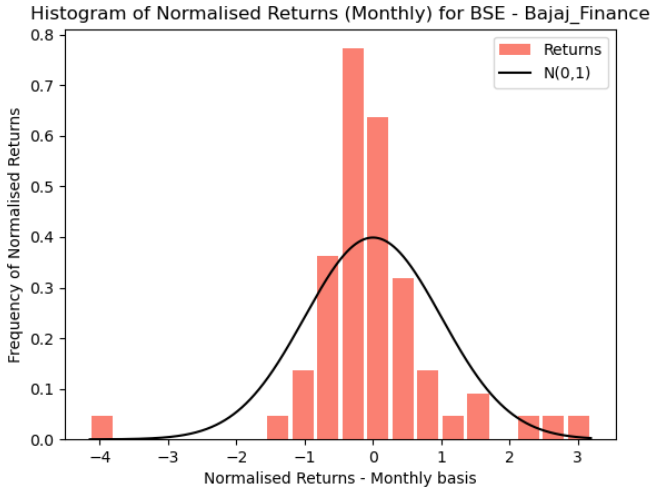

Histogram of Normalised Returns (Weekly) for NSE - Hero_MotoCorp
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Weekly basis

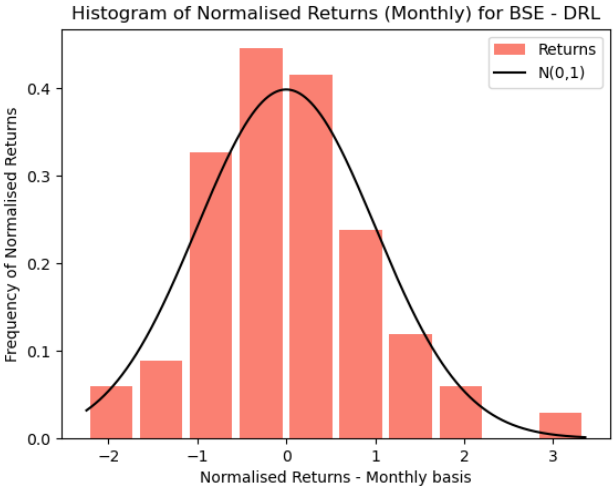

Histogram of Normalised Returns (Monthly) for BSE - BSE Index
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Monthly basis

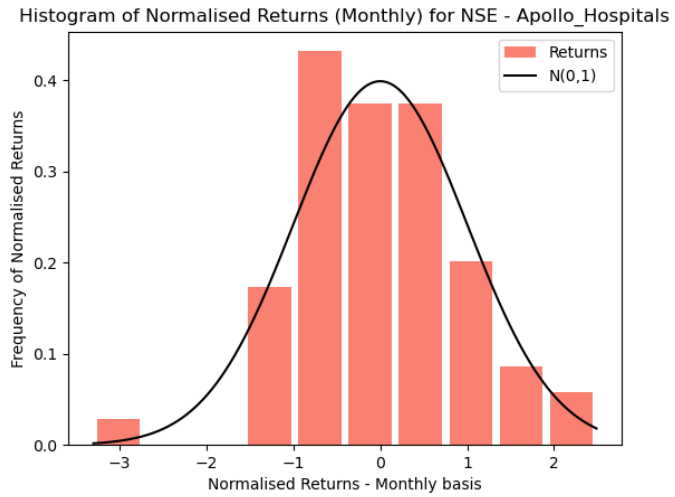

Histogram of Normalised Returns (Monthly) for NSE - NSE Index
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Monthly basis

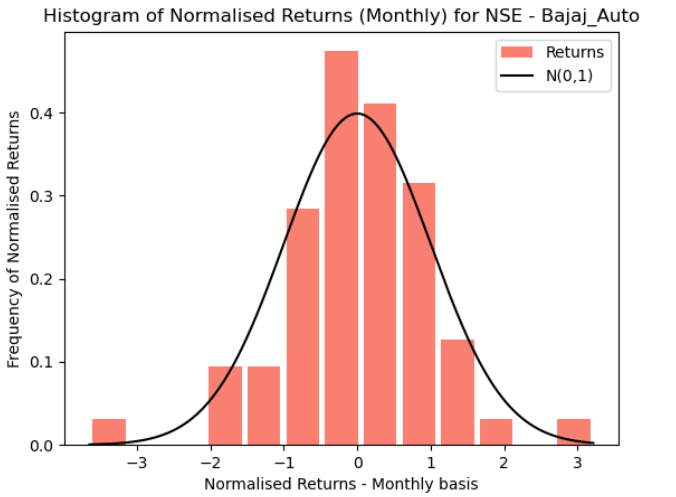

Histogram of Normalised Returns (Monthly) for BSE - Asian_Paints
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Monthly basis

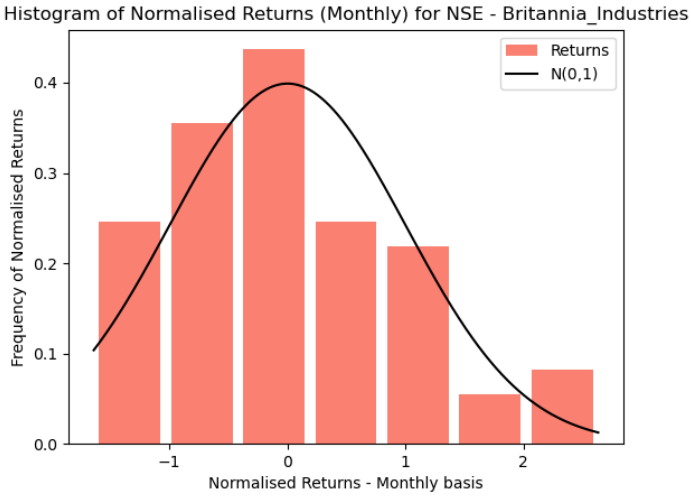

Histogram of Normalised Returns (Monthly) for BSE - Axis_Bank
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Monthly basis

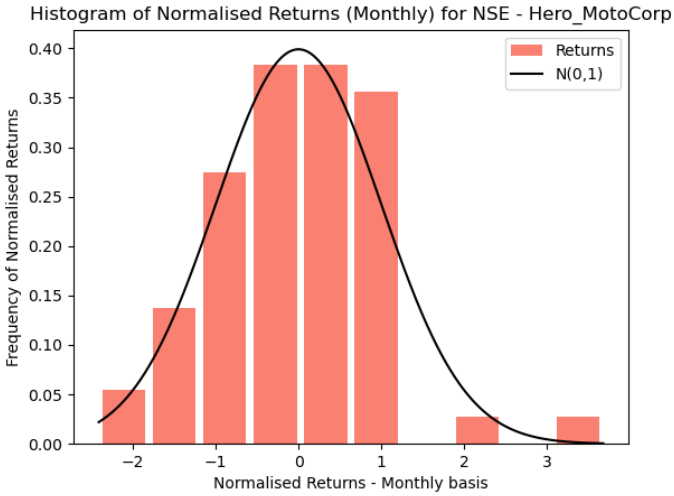

Histogram of Normalised Returns (Monthly) for BSE - Bajaj_Finance
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Monthly basis


Histogram of Normalised Returns (Monthly) for BSE - DRL
Returns
N(0,1)
Frequency of Normalised Returns
Normalised Returns - Monthly basis





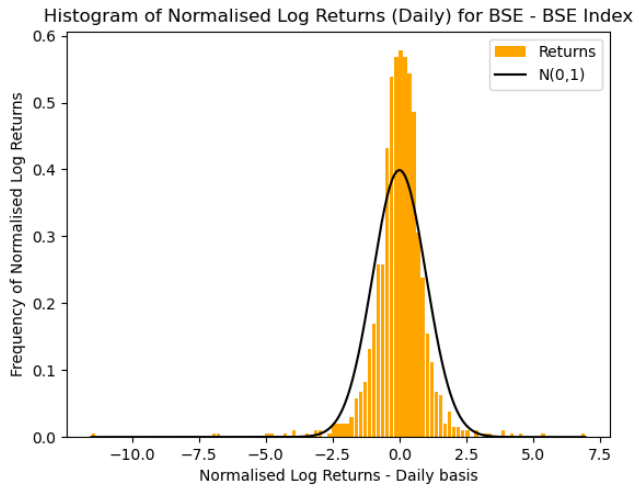


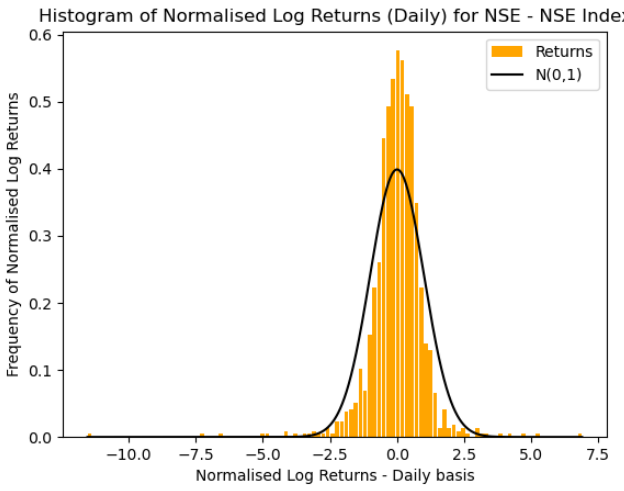


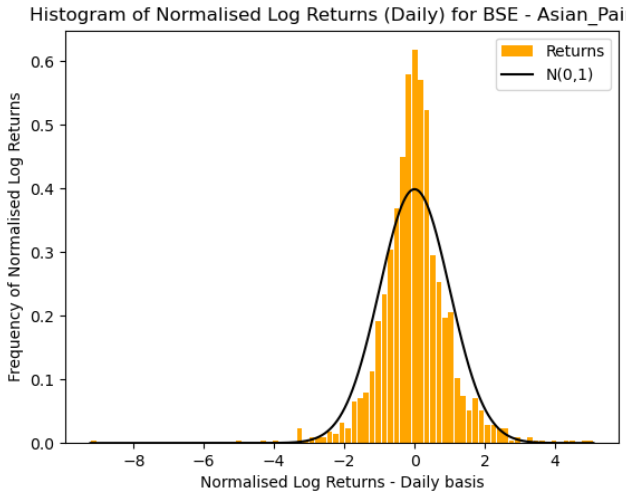
Ques – 3

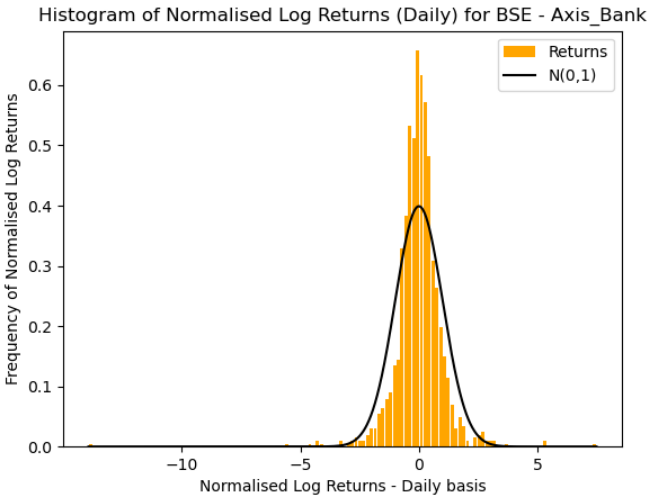
Observations:

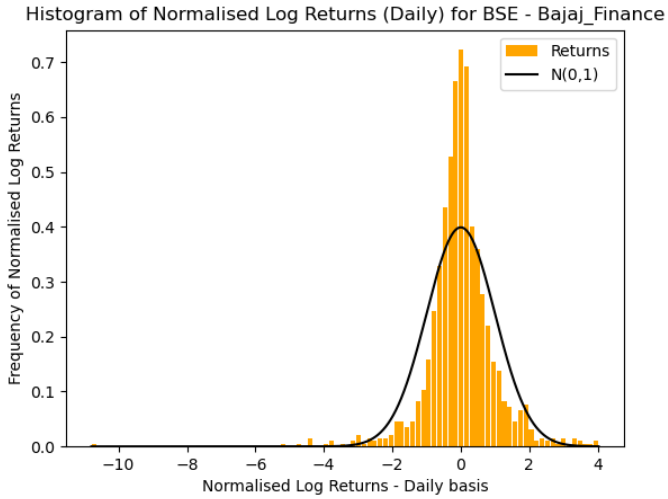
● The observations are exactly similar to question 2, but in this case, we see less deviation between the N (0,1) curve and the histograms.

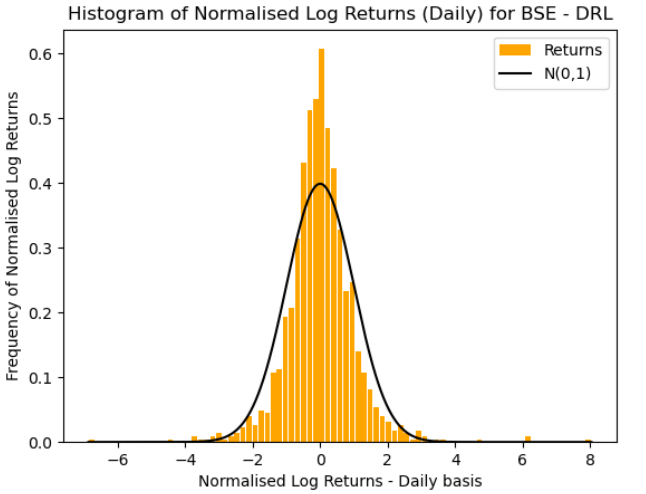


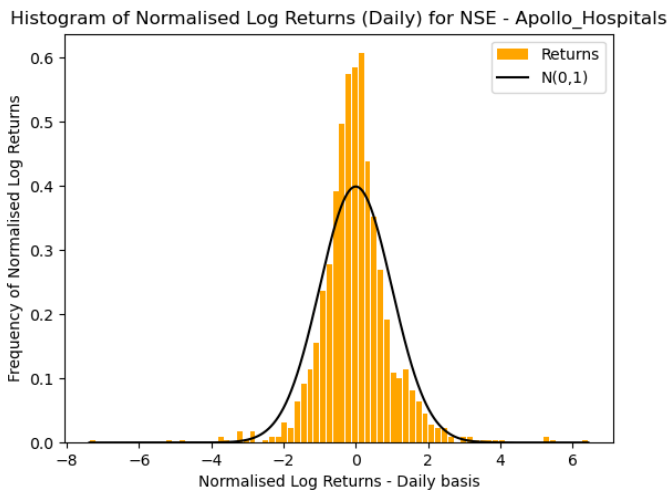


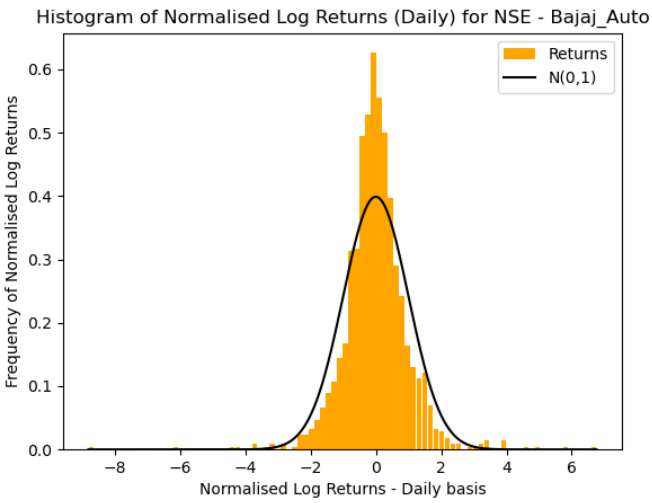

Histogram of Normalised Log Returns (Daily) for BSE - Asian_Paints
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Daily basis

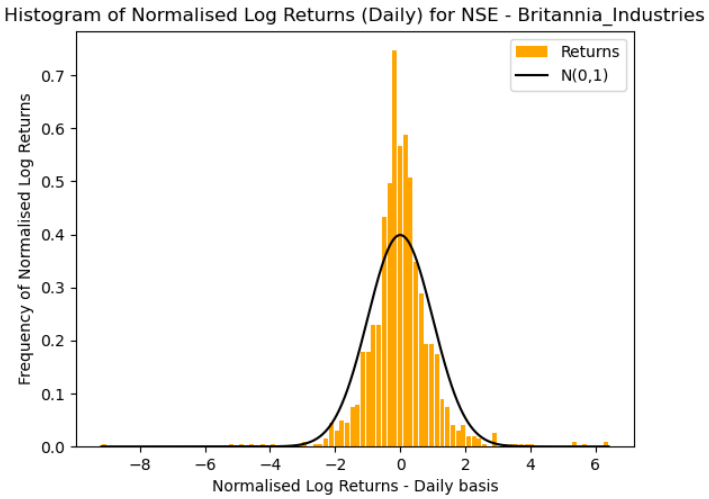

Histogram of Normalised Log Returns (Daily) for BSE - Axis_Bank
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Daily basis

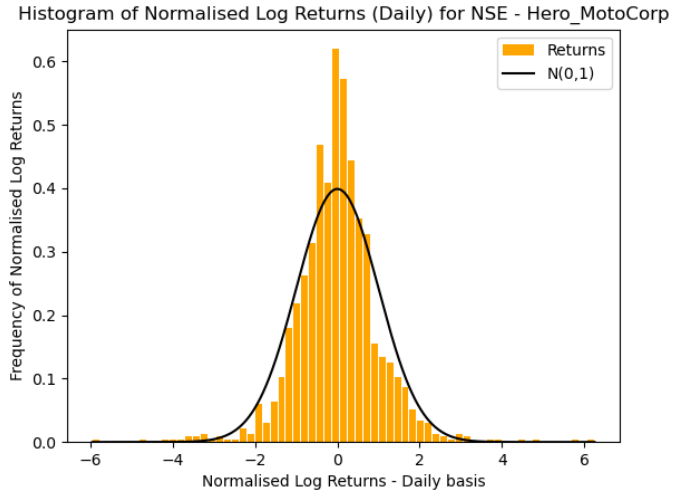

Histogram of Normalised Log Returns (Daily) for BSE - Bajaj_Finance
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Daily basis

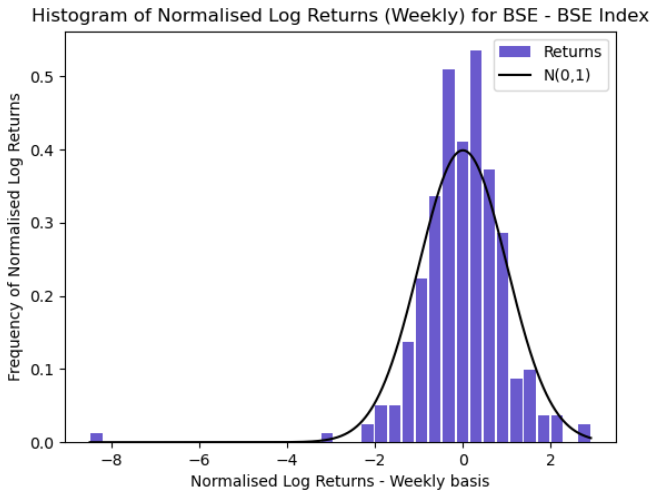

Histogram of Normalised Log Returns (Daily) for BSE - DRL
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Daily basis

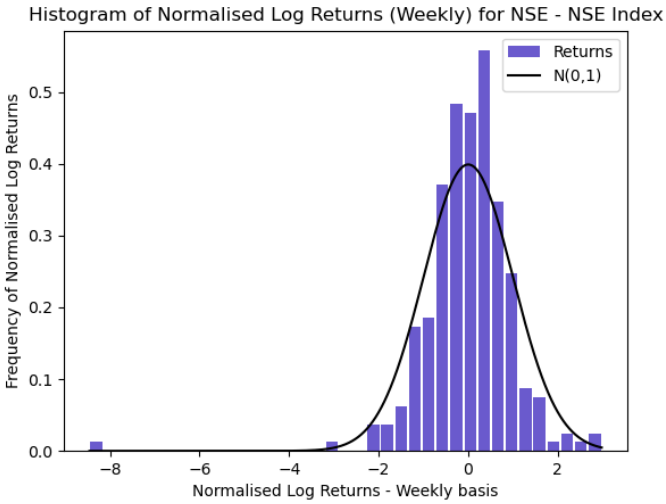

Histogram of Normalised Log Returns (Daily) for NSE - Apollo_Hospitals
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Daily basis

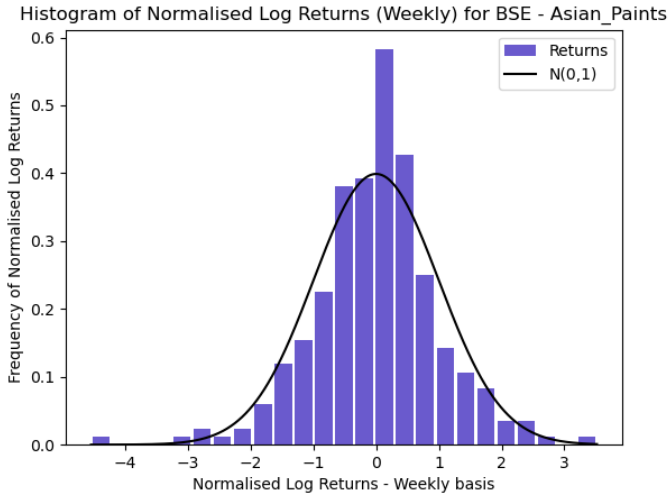

Histogram of Normalised Log Returns (Daily) for NSE - Bajaj_Auto
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Daily basis

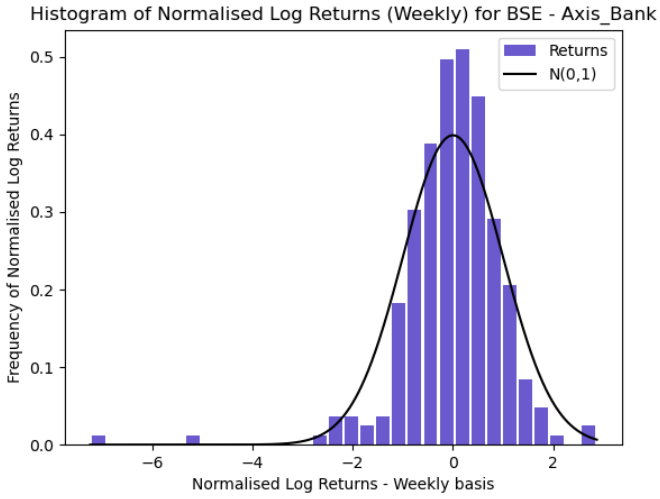

Histogram of Normalised Log Returns (Daily) for NSE - Britannia_Industries
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Daily basis

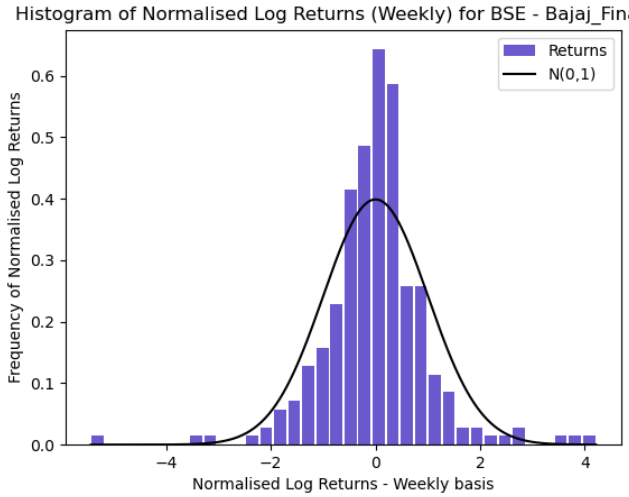

Histogram of Normalised Log Returns (Daily) for NSE - Hero_MotoCorp
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Daily basis

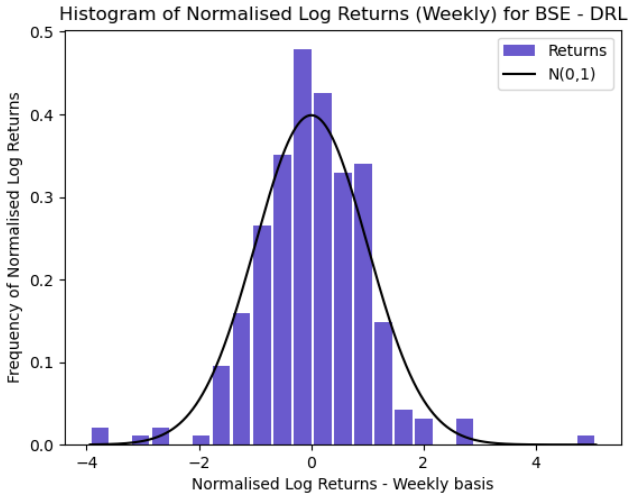

Histogram of Normalised Log Returns (Weekly) for BSE - BSE Index
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

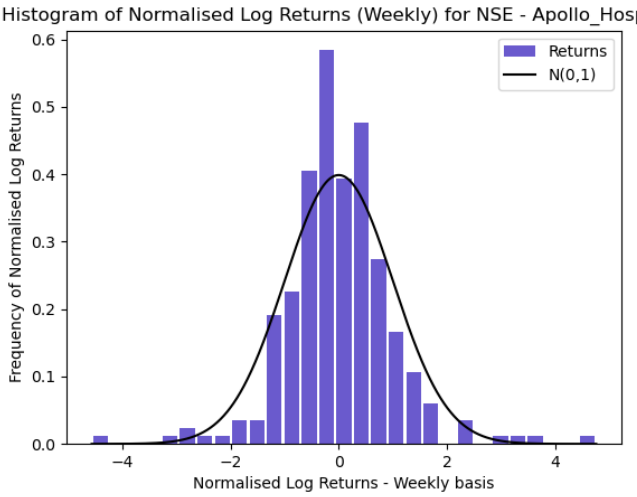

Histogram of Normalised Log Returns (Weekly) for NSE - NSE Index
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

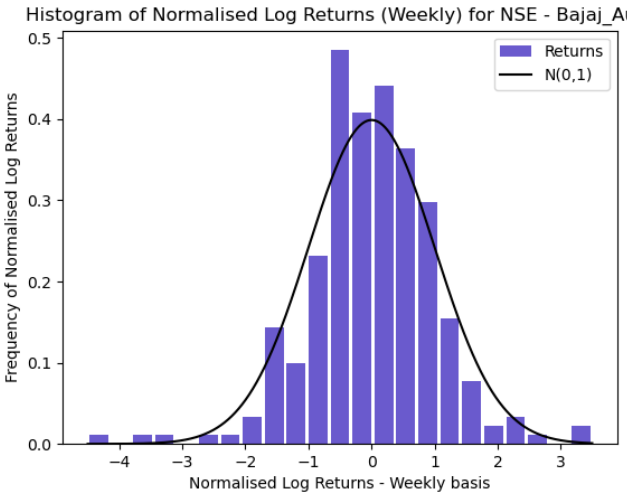

Histogram of Normalised Log Returns (Weekly) for BSE - Asian_Paints
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

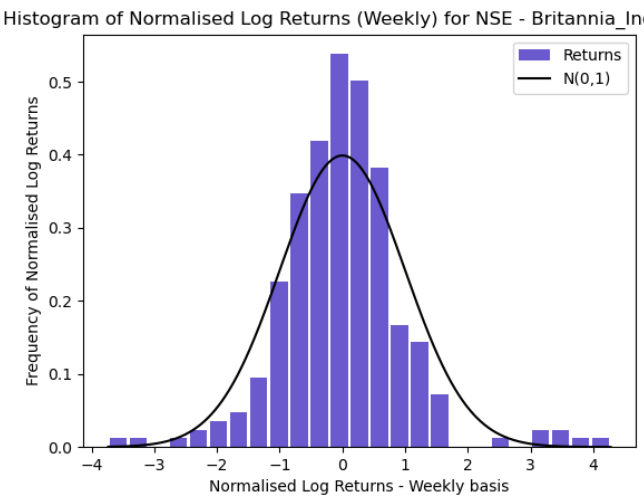

Histogram of Normalised Log Returns (Weekly) for BSE - Axis_Bank
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

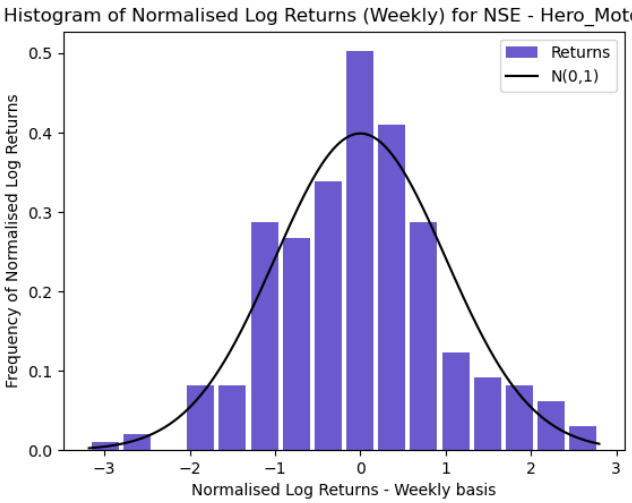

Histogram of Normalised Log Returns (Weekly) for BSE - Bajaj_Finance
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

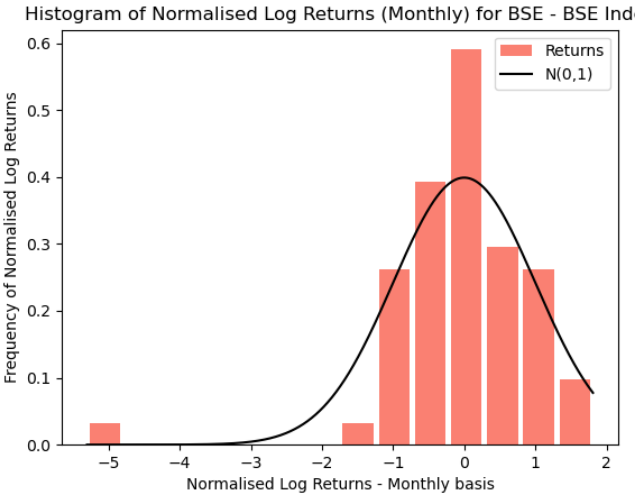

Histogram of Normalised Log Returns (Weekly) for BSE - DRL
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

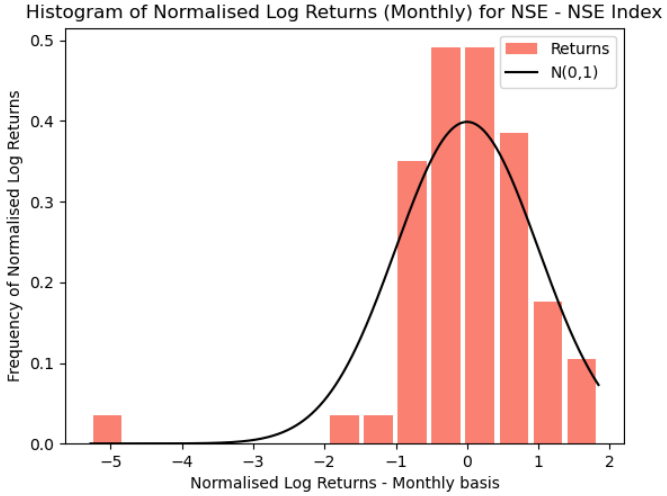

Histogram of Normalised Log Returns (Weekly) for NSE - Apollo_Hospitals
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

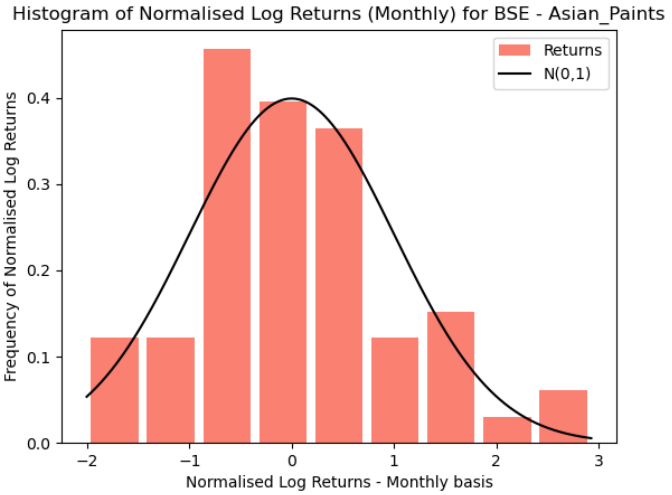

Histogram of Normalised Log Returns (Weekly) for NSE - Bajaj_Auto
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

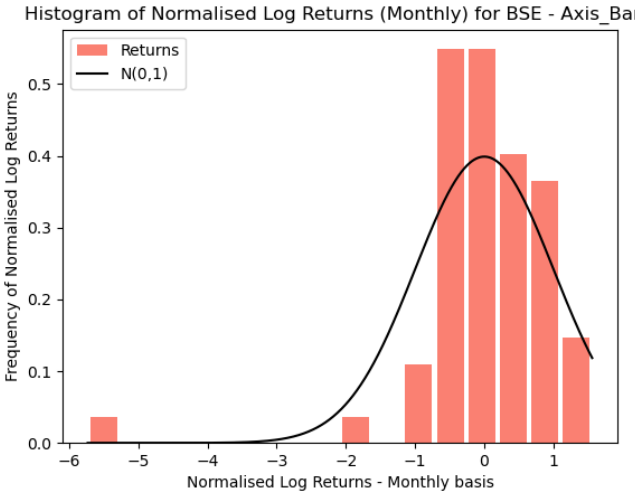

Histogram of Normalised Log Returns (Weekly) for NSE - Britannia_Industrie
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

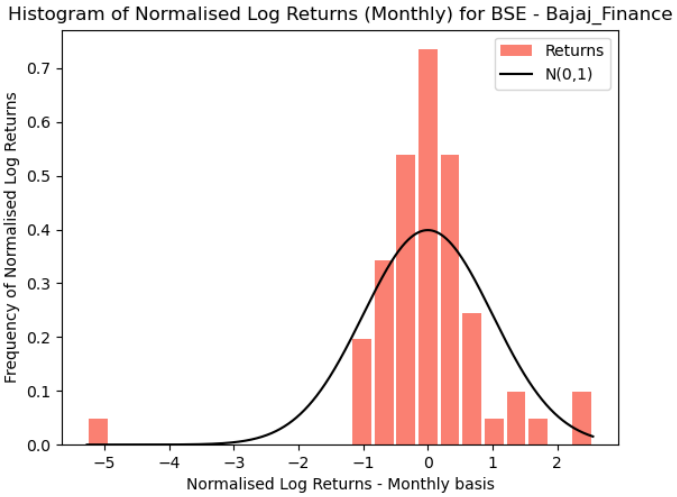

Histogram of Normalised Log Returns (Weekly) for NSE - Hero_MotoCorp
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Weekly basis

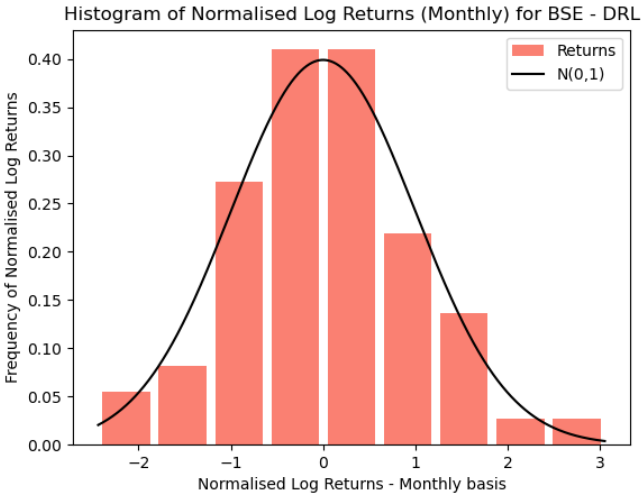

Histogram of Normalised Log Returns (Monthly) for BSE - BSE Index
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Monthly basis

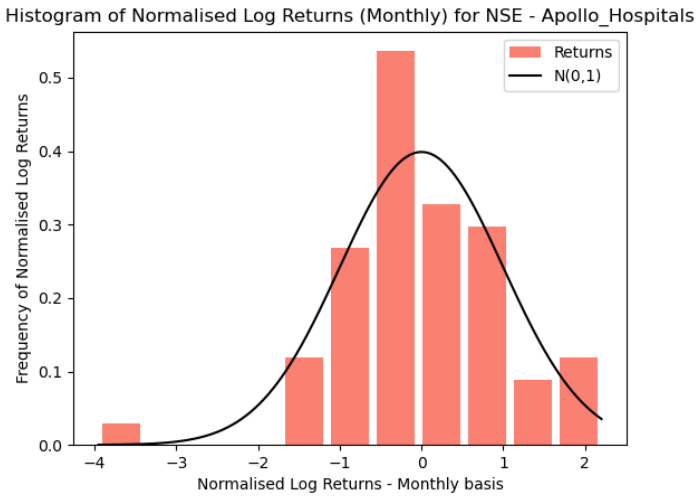

Histogram of Normalised Log Returns (Monthly) for NSE - NSE Index
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Monthly basis

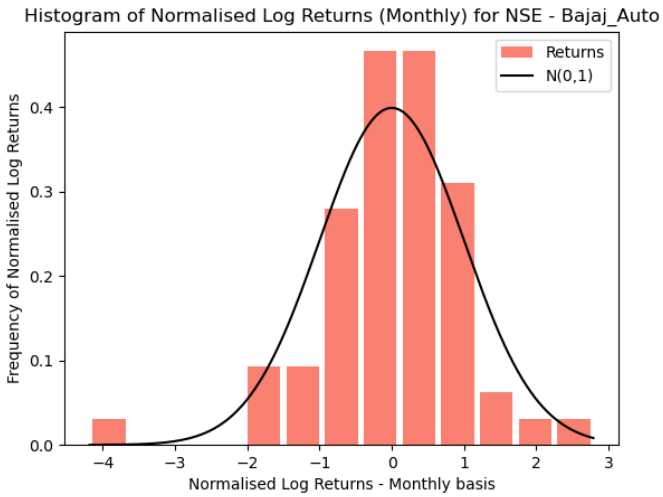

Histogram of Normalised Log Returns (Monthly) for BSE - Asian_Paints
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Monthly basis

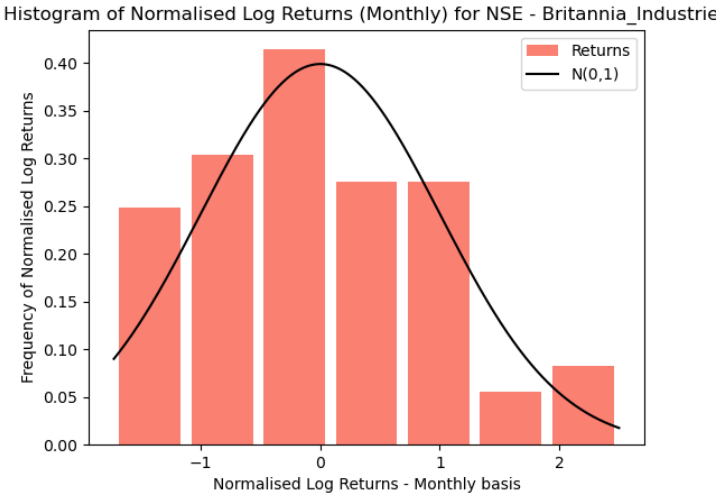

Histogram of Normalised Log Returns (Monthly) for BSE - Axis_Bank
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Monthly basis

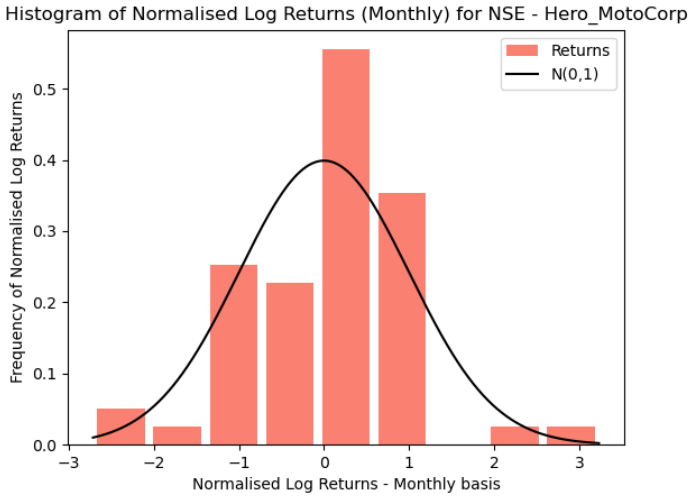

Histogram of Normalised Log Returns (Monthly) for BSE - Bajaj_Finance
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Monthly basis


Histogram of Normalised Log Returns (Monthly) for BSE - DRL
Returns
N(0,1)
Frequency of Normalised Log Returns
Normalised Log Returns - Monthly basis









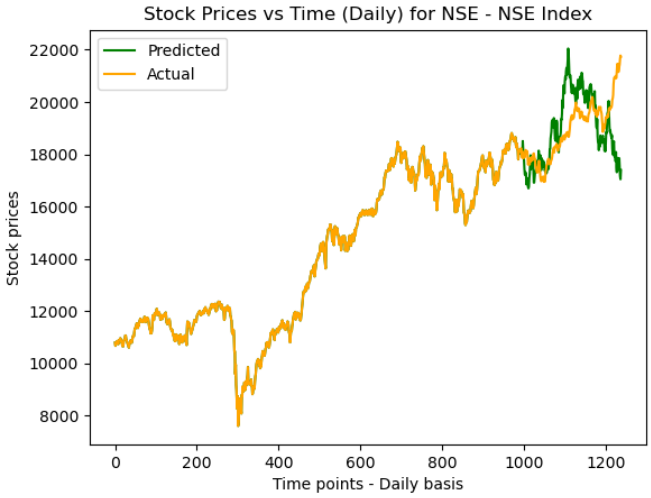
Ques – 4

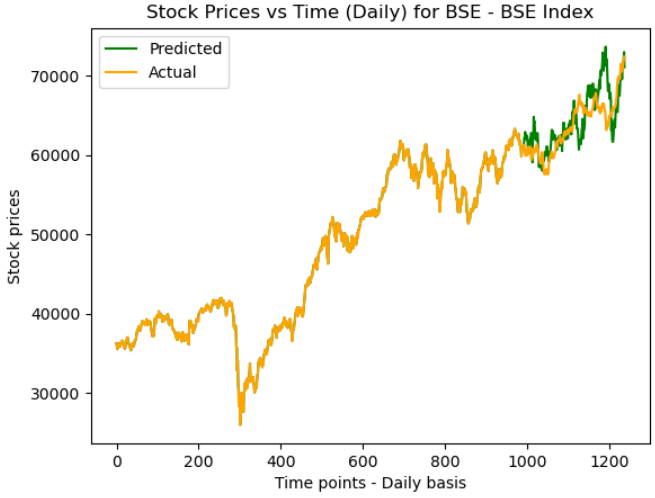
For this question, the jump-diffusion model was used to predict the stock prices for the year 2023 in a daily fashion by calculating μ and σ from the data till 31 Dec 2022.

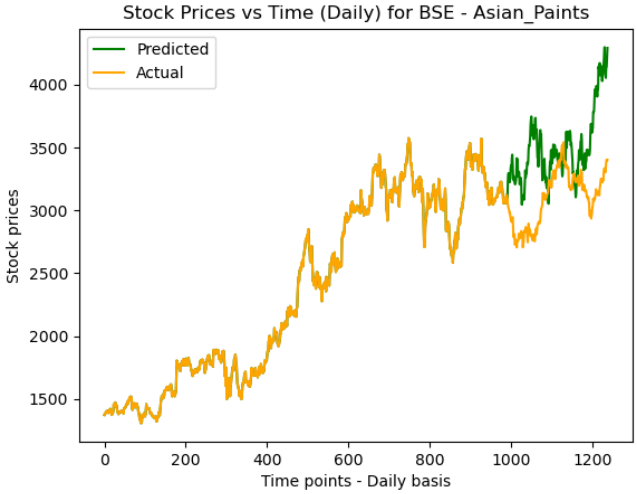
The basic algorithm has been explained below: -

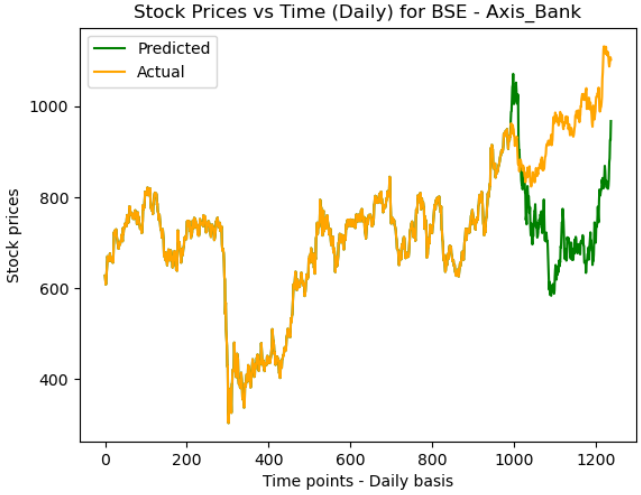
1. Generate $Z \sim N(0,1)$
2. Generate $N \sim \text{Poisson}(\lambda(t_{i+1} - t_i))$
   If $N = 0$, set $M = 0$ and go to step 4
3. Generate $\log Y_1, \log Y_2, \ldots \log Y_N$ from their common distribution and set $M = \log Y_1 + \log Y_2 + \cdots + \log Y_N$
4. Set $X(t_{i+1}) = X(t_i) + \left(\mu - \frac{1}{2}\sigma^2\right)(t_{i+1} - t_i) + \sigma\sqrt{t_{i+1} - t_i}\, Z_i + M$

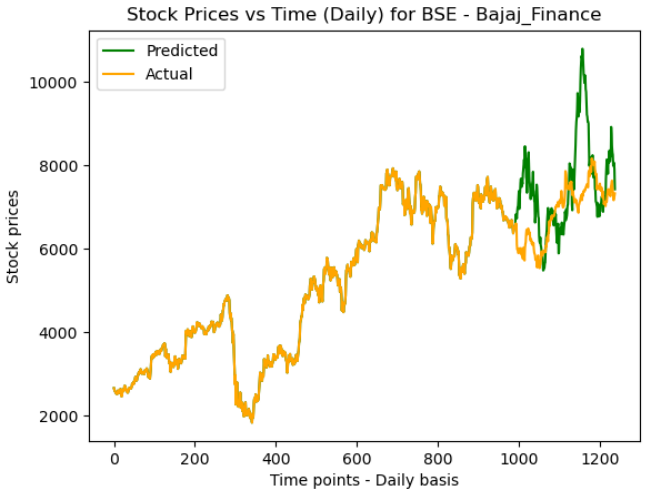
Thereafter, S (t_{i+1}) is obtained using S (t_{i+1}) = exp {X (t_{i+1})}.

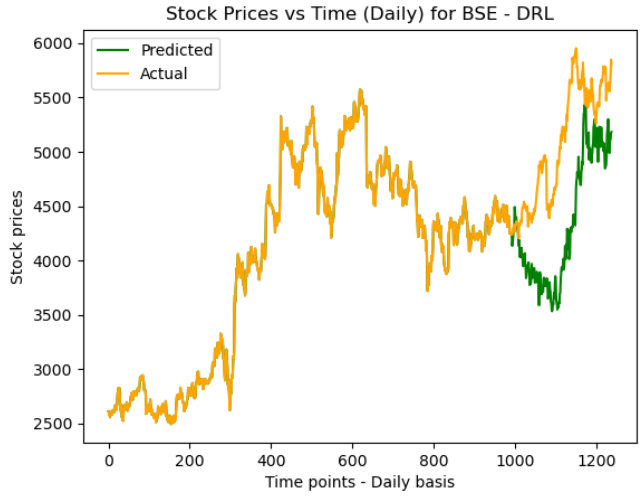

Stock Prices vs Time (Daily) for NSE - NSE Index
Predicted
Actual
Stock prices
Time points - Daily basis

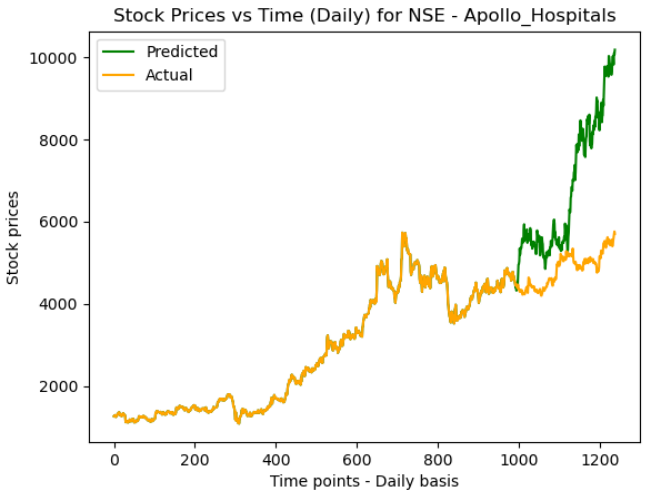

Stock Prices vs Time (Daily) for BSE - BSE Index
Predicted
Actual
Stock prices
Time points - Daily basis

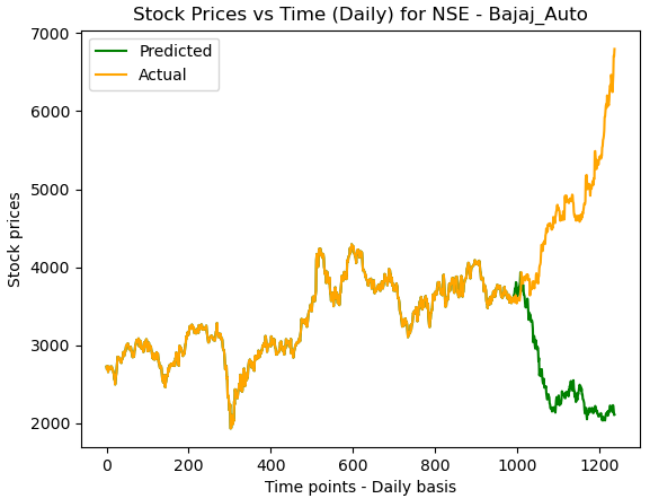

Stock Prices vs Time (Daily) for BSE - Asian_Paints
Predicted
Actual
Stock prices
Time points - Daily basis

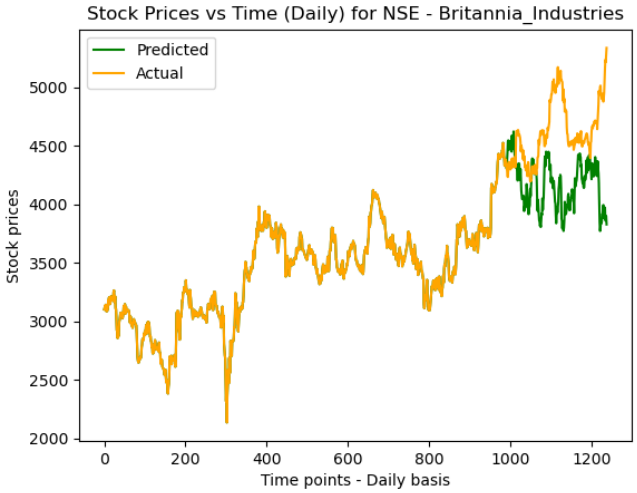

Stock Prices vs Time (Daily) for BSE - Axis_Bank
Predicted
Actual
Stock prices
Time points - Daily basis

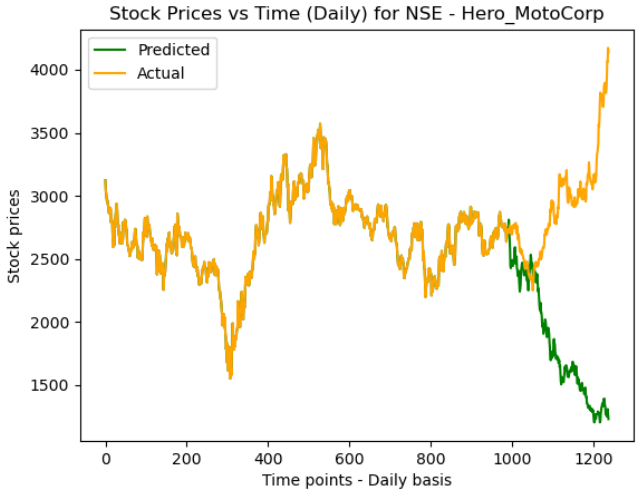

Stock Prices vs Time (Daily) for BSE - Bajaj_Finance
Predicted
Actual
Stock prices
Time points - Daily basis


Stock Prices vs Time (Daily) for BSE - DRL
Predicted
Actual
Stock prices
Time points - Daily basis

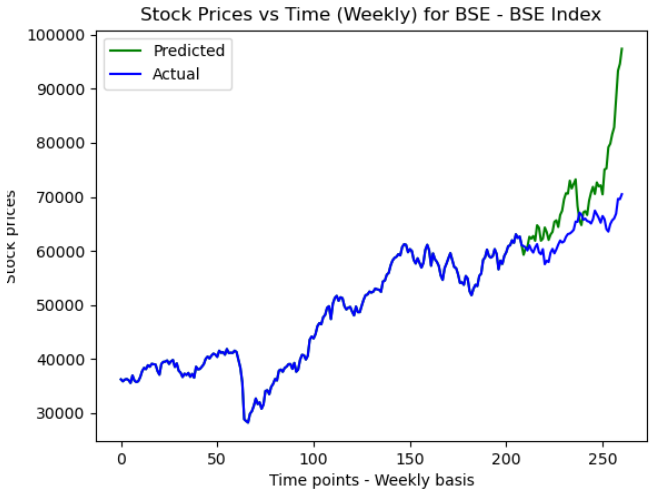

Stock Prices vs Time (Daily) for NSE - Apollo_Hospitals
Predicted
Actual
Stock prices
Time points - Daily basis

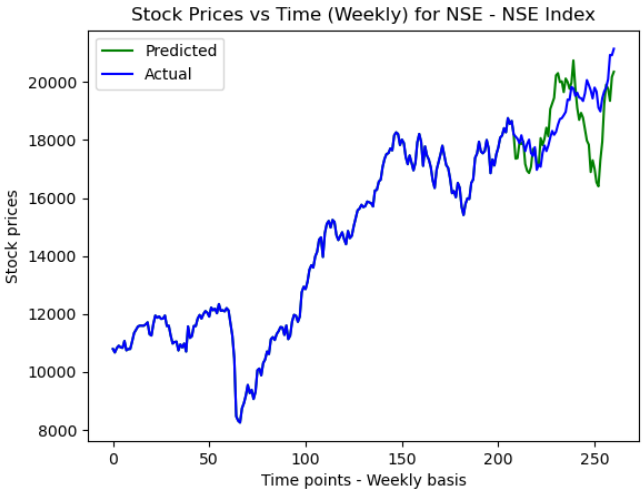

Stock Prices vs Time (Daily) for NSE - Bajaj_Auto
Predicted
Actual
Stock prices
Time points - Daily basis

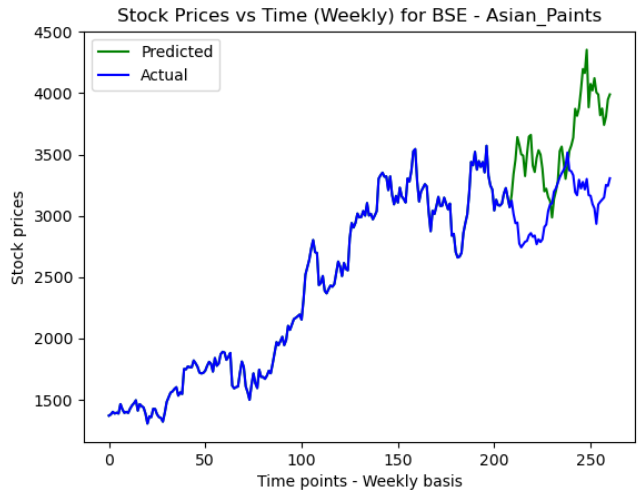

Stock Prices vs Time (Daily) for NSE - Britannia_Industries
Predicted
Actual
Stock prices
Time points - Daily basis

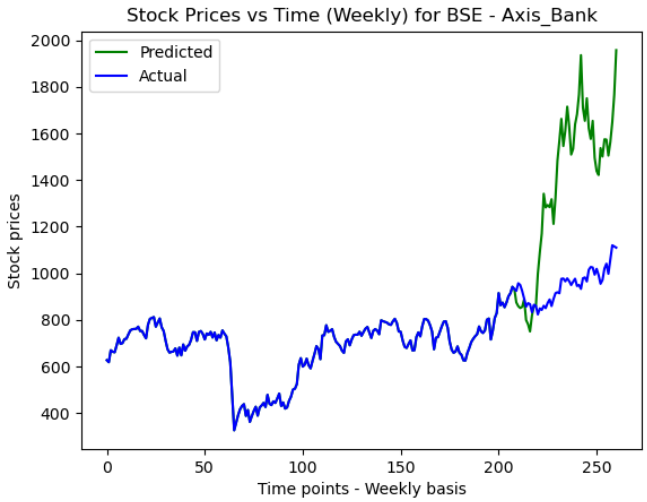

Stock Prices vs Time (Daily) for NSE - Hero_MotoCorp
Predicted
Actual
Stock prices
Time points - Daily basis

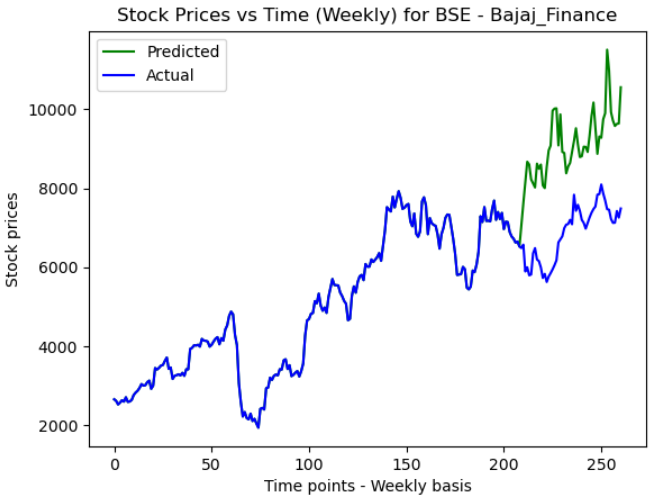
Ques – 5

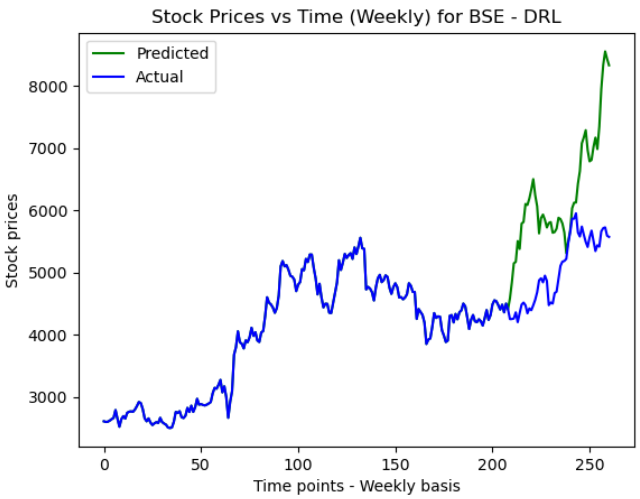

Stock Prices vs Time (Weekly) for BSE - BSE Index
Predicted
Actual
Stock prices
Time points - Weekly basis

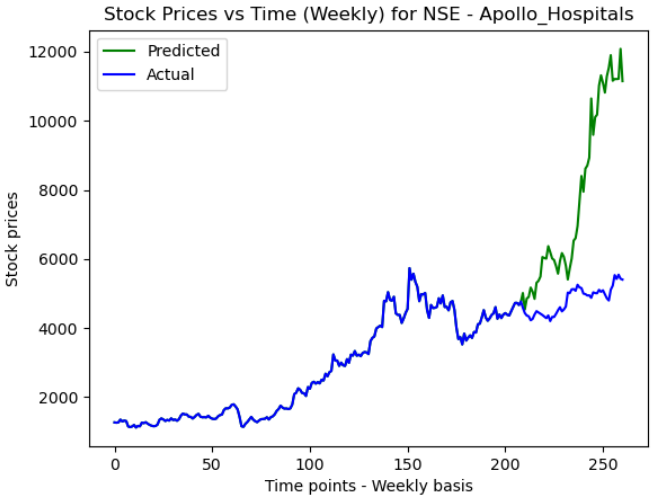

Stock Prices vs Time (Weekly) for NSE - NSE Index
Predicted
Actual
Stock prices
Time points - Weekly basis

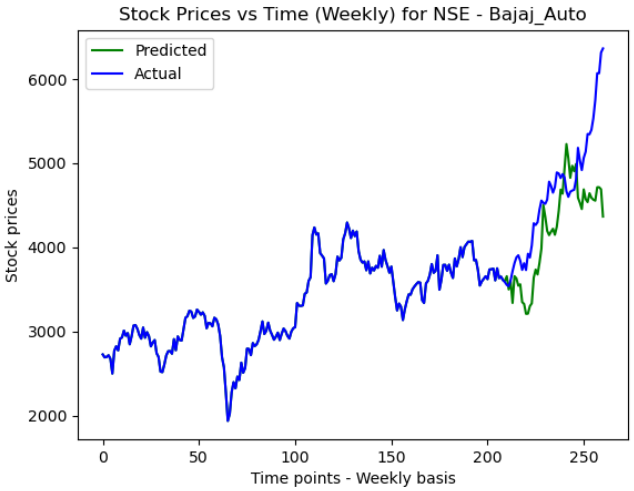

Stock Prices vs Time (Weekly) for BSE - Asian_Paints
Predicted
Actual
Stock prices
Time points - Weekly basis

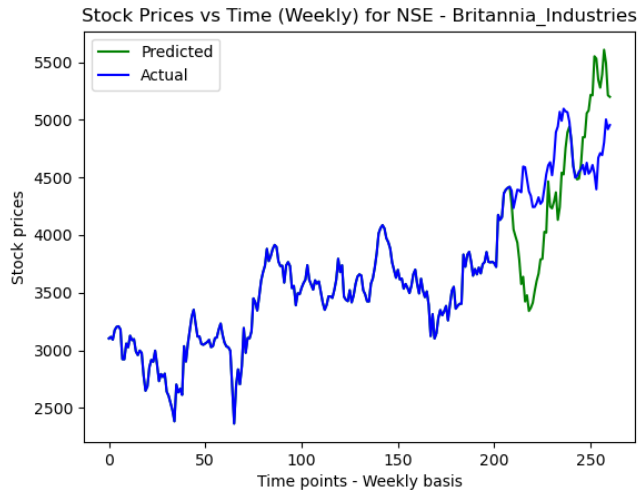

Stock Prices vs Time (Weekly) for BSE - Axis_Bank
Predicted
Actual
Stock prices
Time points - Weekly basis

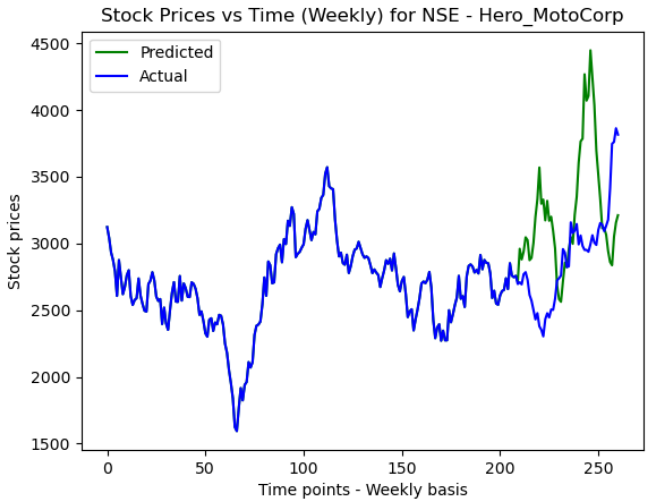

Stock Prices vs Time (Weekly) for BSE - Bajaj_Finance
Predicted
Actual
Stock prices
Time points - Weekly basis

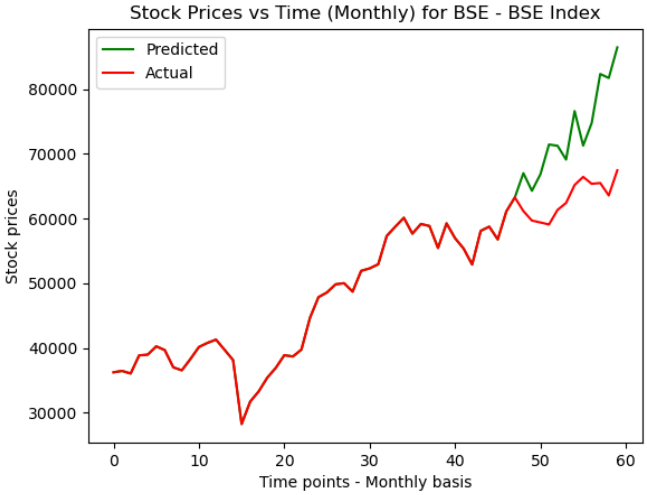

Stock Prices vs Time (Weekly) for BSE - DRL
Predicted
Actual
Stock prices
Time points - Weekly basis

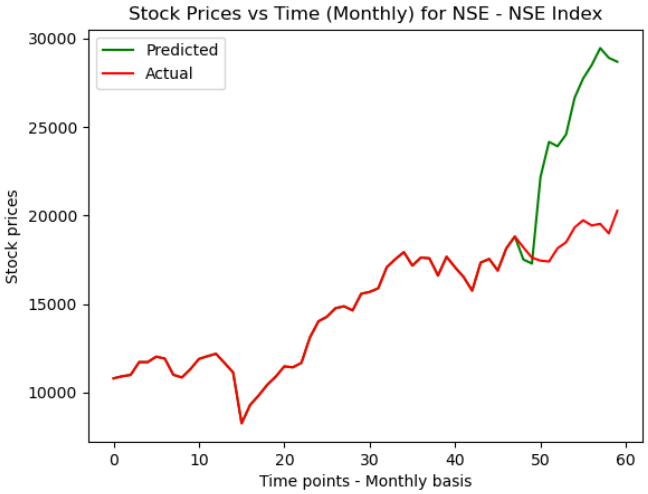

Stock Prices vs Time (Weekly) for NSE - Apollo_Hospitals
Predicted
Actual
Stock prices
Time points - Weekly basis

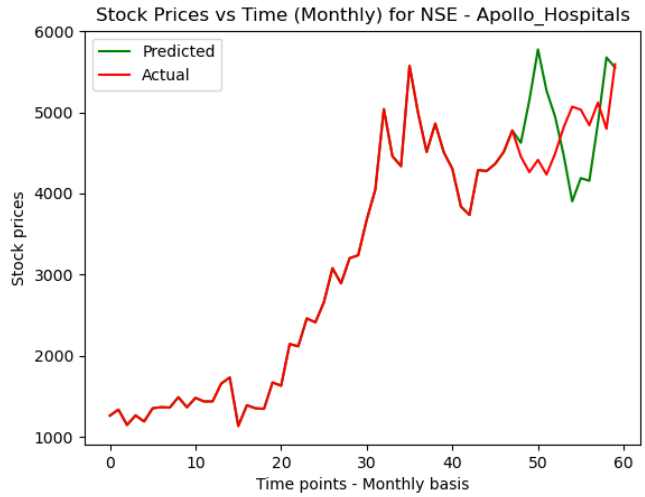

Stock Prices vs Time (Weekly) for NSE - Bajaj_Auto
Predicted
Actual
Stock prices
Time points - Weekly basis

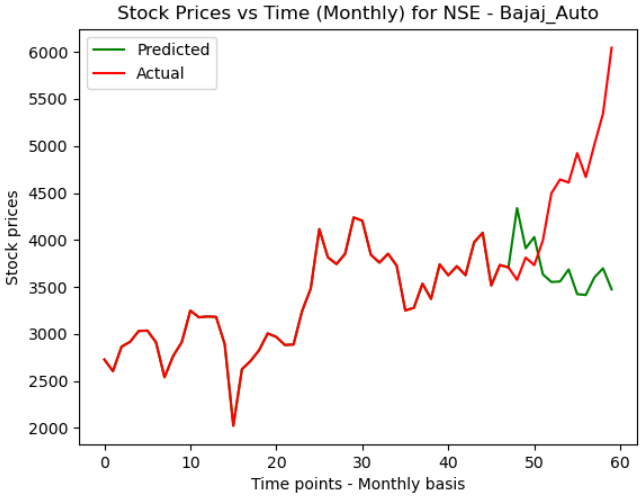

Stock Prices vs Time (Weekly) for NSE - Britannia_Industries
Predicted
Actual
Stock prices
Time points - Weekly basis

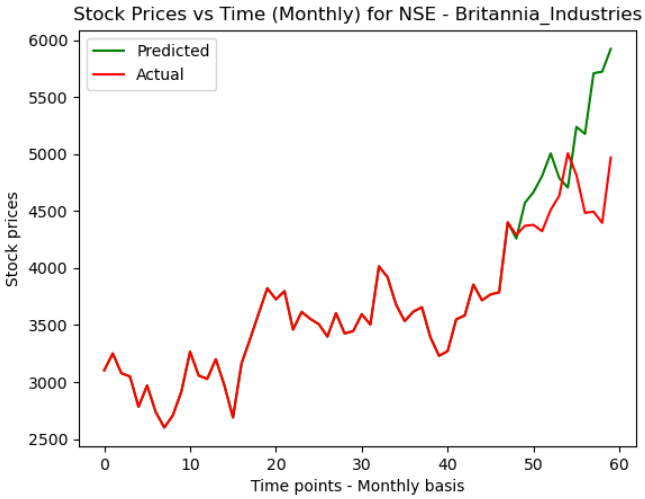

Stock Prices vs Time (Weekly) for NSE - Hero_MotoCorp
Predicted
Actual
Stock prices
Time points - Weekly basis

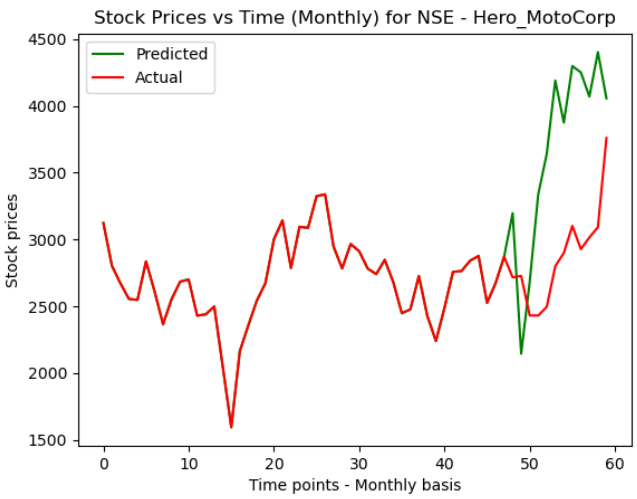

Stock Prices vs Time (Monthly) for BSE - BSE Index
Predicted
Actual
Stock prices
Time points - Monthly basis

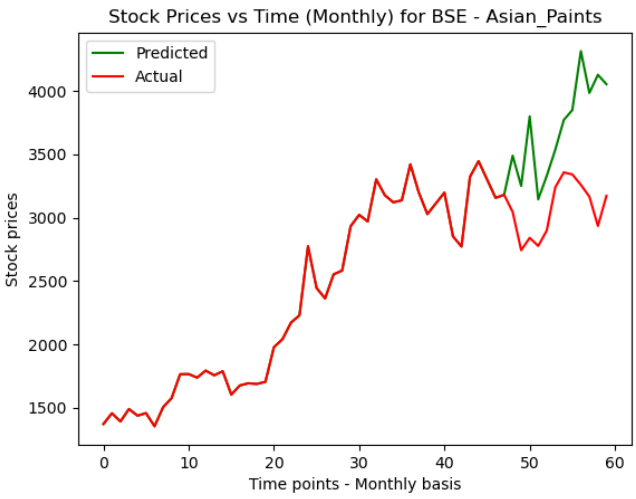

Stock Prices vs Time (Monthly) for NSE - NSE Index
Predicted
Actual
Stock prices
Time points - Monthly basis

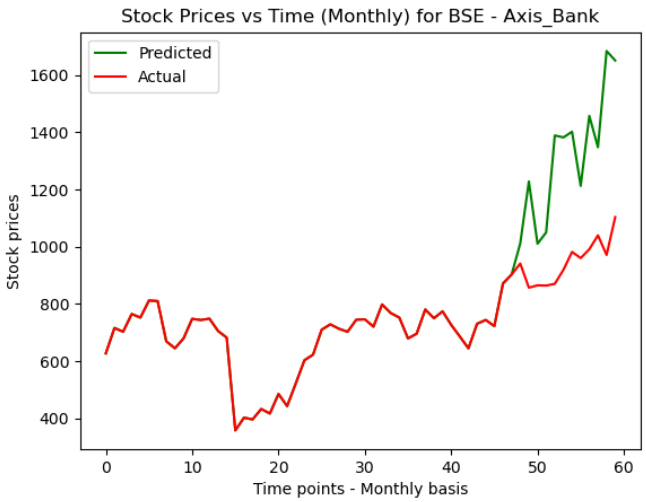

Stock Prices vs Time (Monthly) for NSE - Apollo_Hospitals
Predicted
Actual
Stock prices
Time points - Monthly basis

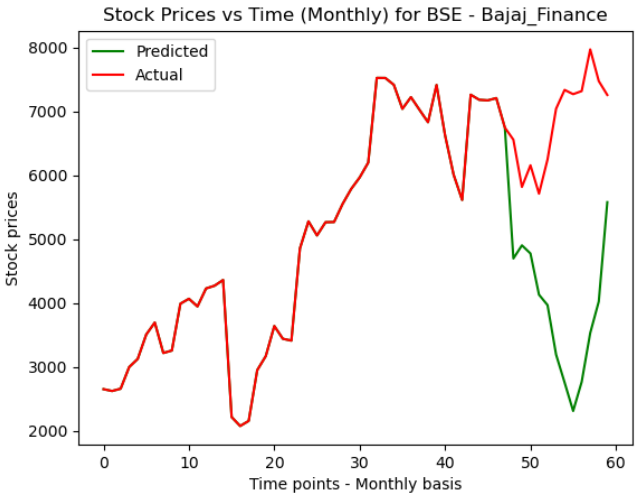

Stock Prices vs Time (Monthly) for NSE - Bajaj_Auto
Predicted
Actual
Stock prices
Time points - Monthly basis


Stock Prices vs Time (Monthly) for NSE - Britannia_Industries
Predicted
Actual
Stock prices
Time points - Monthly basis


Stock Prices vs Time (Monthly) for NSE - Hero_MotoCorp
Predicted
Actual
Stock prices
Time points - Monthly basis


Stock Prices vs Time (Monthly) for BSE - Asian_Paints
Predicted
Actual
Stock prices
Time points - Monthly basis


Stock Prices vs Time (Monthly) for BSE - Axis_Bank
Predicted
Actual
Stock prices
Time points - Monthly basis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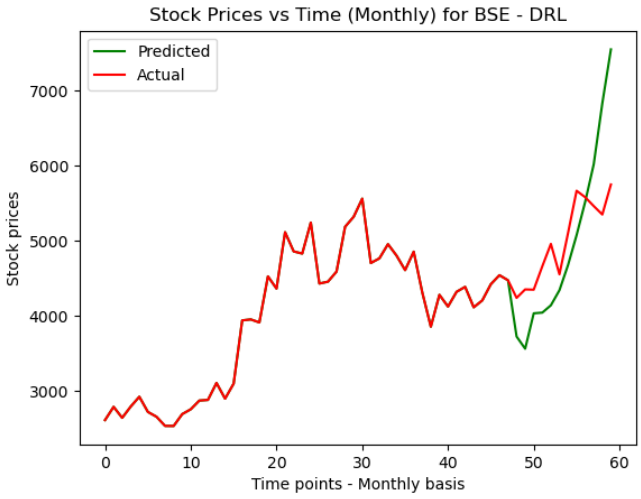
Actual
Stock prices
Time points - Monthly basis


Stock Prices vs Time (Monthly) for BSE - DRL
Predicted
Actual
Stock prices
Time points - Monthly basis