

Project Number: DZT 2120

Stock Market Simulation

An Interactive Qualifying Project Report: Submitted to the Faculty

of WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

By

Calvin Rambacher

Submitted:

December 12, 2022

Approved by Professor Dalin Tang, Project Advisor

This report represents the work of one or more WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on the web without editorial or peer review.

Abstract

The goal of this project was to conduct a simulation of the stock market to figure out which trading strategy would be most effective. A neural network program was designed to analyze stock market patterns for the prediction of trends. A six-week simulation was completed using three different trading techniques: day trading, position trading, and trading guided by neural network. The returns of the three methods were strategies are as follows: 64.38% for Neural Network, 61.69% for position trading, and 48.64% for day trading. In comparison, S&P 500 only gained 5.65% for the same period of time. This project gave the student insight into how the stock market works so that he could make informed trading decisions in the future.

Table of Contents:

Abstract	2
Table of Contents	3
Table of Figures	6
Table of Tables	10
1. Introduction	12
1.1 Goals, Scope, and General Plan	12
1.2 Background Information	12
1.2.1 History of the Stock Market	12
1.2.2 Stock Market Terminology	14
2. Strategies	16
2.1 Day Trading	16
2.2 End-Of-Day Trading	16
2.3 News/Trend Trading	16
2.4 Position Trading	16
2.5 Breakout Trading	17
2.6 Reversal Trading	17
2.7 My Trading Plan	17
3. Implementation	18
3.1 Strategies	18
3.2 The Neural Network	18
3.3 The Simulation Guidelines	19
3.4 Weeks 4-6	19
4. Weekly Market News and Condition	20

4.1 Week 1	20
4.2 Week 2	21
4.3 Week 3	22
4.4 Week 4	24
4.5 Week 5	28
4.6 Week 6	32
5. Simulation 1: Day Trading	37
5.1 Week 1	37
5.2 Week 2	37
5.3 Week 3	37
5.4 Week 4	38
5.5 Week 5	39
5.6 Week 6	41
6. Simulation 2: Position Trading	43
6.1 Week 1	43
6.2 Week 2	43
6.3 Week 3	43
6.4 Week 4	43
6.5 Week 5	44
6.6 Week 6	44
7. Simulation 3: Neural Network Trading	45
7.1 Week 1	45
7.2 Week 2	46
7.3 Week 3	48

7.4 Week 4	49
7.5 Week 5	54
7.6 Week 6	59
8. Conclusion	63
8.1 Day Trading Conclusions	63
8.2 Position Trading Conclusions	63
8.3 Neural Network Trading Conclusions	64
8.4 Overall Conclusions	64
8.4 Final Thoughts	66
References	67
Appendix	68
Basic Neural Network Model	68
Final Neural Network Model	68

iii. Table of Figures:

Figure 4.1.1: TSLA Stock June 13-17	20
Figure 4.2.1: TSLA Stock June 17-24	22
Figure 4.3.1: TSLA Stock June 27 – July 1	23
Figure 4.4.1: TSLA Stock July 2-8	24
Figure 4.4.2: NFLX Stock July 2-8	25
Figure 4.4.3: LOW Stock July 2-8	25
Figure 4.4.4: SYY Stock July 2-8	26
Figure 4.5.1: TSLA Stock July 11-15	29
Figure 4.5.2: NFLX Stock July 11-15	29
Figure 4.5.3: LOW Stock July 11-15	30
Figure 4.5.4: SYY Stock July 11-15	30
Figure 4.6.1: TSLA Stock July 18-22	33
Figure 4.6.2: NFLX Stock July 18-22	33
Figure 4.6.3: LOW Stock July 18-22	34
Figure 4.6.4: SYY Stock July 18-22	34
Figure 7.1.1: Week 1 Monday Night Prediction for Tuesday	45
Figure 7.1.2: Week 1 Tuesday Night Prediction for Wednesday	45
Figure 7.1.3: Week 1 Wednesday Night Prediction for Thursday	45
Figure 7.1.4: Week 1 Thursday Night Prediction for Friday	45
Figure 7.2.1: Week 1 Friday Night Prediction for Week 2 Tuesday	46
Figure 7.2.2: Week 2 Tuesday Night Prediction for Wednesday	47
Figure 7.2.3: Week 2 Wednesday Night Prediction for Thursday	47
Figure 7.2.4: Week 2 Thursday Night Prediction for Friday	47

Figure 7.2.5: Week 2 Friday Night Prediction for Week 3 Monday	47
Figure 7.3.1: Week 3 Monday Night Prediction for Tuesday	48
Figure 7.3.2: Week 3 Tuesday Night Prediction for Wednesday	48
Figure 7.3.3: Week 3 Wednesday Night Prediction for Thursday	49
Figure 7.3.4: Week 3 Thursday Night Prediction for Friday	49
Figure 7.3.5: Week 3 Friday Night Prediction for Week 4 Tuesday	49
Figure 7.4.1: TSLA Week 4 Tuesday Night Prediction for Wednesday	50
Figure 7.4.2: TSLA Week 4 Wednesday Night Prediction for Thursday	50
Figure 7.4.3: TSLA Week 4 Thursday Night Prediction for Friday	50
Figure 7.4.4: TSLA Week 4 Friday Night Prediction for Week 5 Monday	50
Figure 7.4.5: NFLX Week 4 Tuesday Night Prediction for Wednesday	51
Figure 7.4.6: NFLX Week 4 Wednesday Night Prediction for Thursday	51
Figure 7.4.7: NFLX Week 4 Thursday Night Prediction for Friday	51
Figure 7.4.8: NFLX Week 4 Friday Night Prediction for Week 5 Monday	51
Figure 7.4.9: LOW Week 4 Tuesday Night Prediction for Wednesday	52
Figure 7.4.10: LOW Week 4 Wednesday Night Prediction for Thursday	52
Figure 7.4.11: LOW Week 4 Thursday Night Prediction for Friday	52
Figure 7.4.12: LOW Week 4 Friday Night Prediction for Week 5 Monday	52
Figure 7.4.13: SYX Week 4 Tuesday Night Prediction for Wednesday	53
Figure 7.4.14: SYX Week 4 Wednesday Night Prediction for Thursday	53
Figure 7.4.15: SYX Week 4 Thursday Night Prediction for Friday	53
Figure 7.4.16: SYX Week 4 Friday Night Prediction for Week 5 Monday	53
Figure 7.5.1: TSLA Week 5 Monday Night Prediction for Tuesday	54
Figure 7.5.2: TSLA Week 5 Tuesday Night Prediction for Wednesday	54

Figure 7.5.3: TSLA Week 5 Wednesday Night Prediction for Thursday	54
Figure 7.5.4: TSLA Week 5 Thursday Night Prediction for Friday	55
Figure 7.5.5: TSLA Week 5 Friday Night Prediction for Week 5 Monday	55
Figure 7.5.6: NFLX Week 5 Monday Night Prediction for Tuesday	55
Figure 7.5.7: NFLX Week 5 Tuesday Night Prediction for Wednesday	56
Figure 7.5.8: NFLX Week 5 Wednesday Night Prediction for Thursday	56
Figure 7.5.9: NFLX Week 5 Thursday Night Prediction for Friday	56
Figure 7.5.10: NFLX Week 5 Friday Night Prediction for Week 5 Monday	56
Figure 7.5.11: LOW Week 5 Monday Night Prediction for Tuesday	57
Figure 7.5.12: LOW Week 5 Tuesday Night Prediction for Wednesday	57
Figure 7.5.13: LOW Week 5 Wednesday Night Prediction for Thursday	57
Figure 7.5.14: LOW Week 5 Thursday Night Prediction for Friday	57
Figure 7.5.15: LOW Week 5 Friday Night Prediction for Week 6 Monday	57
Figure 7.5.16: SYX Week 5 Monday Night Prediction for Tuesday	58
Figure 7.5.17: SYX Week 5 Tuesday Night Prediction for Wednesday	58
Figure 7.5.18: SYX Week 5 Wednesday Night Prediction for Thursday	58
Figure 7.5.19: SYX Week 5 Thursday Night Prediction for Friday	58
Figure 7.5.20: SYX Week 5 Friday Night Prediction for Week 5 Monday	58
Figure 7.6.1: TSLA Week 6 Monday Night Prediction for Tuesday	59
Figure 7.6.2: TSLA Week 6 Tuesday Night Prediction for Wednesday	59
Figure 7.6.3: TSLA Week 6 Wednesday Night Prediction for Thursday	59
Figure 7.6.4: TSLA Week 6 Thursday Night Prediction for Friday	59
Figure 7.6.5: NFLX Week 6 Monday Night Prediction for Tuesday	60
Figure 7.6.6: NFLX Week 6 Tuesday Night Prediction for Wednesday	60

Figure 7.6.7: NFLX Week 6 Wednesday Night Prediction for Thursday	60
Figure 7.6.8: NFLX Week 6 Thursday Night Prediction for Friday	60
Figure 7.6.9: LOW Week 6 Monday Night Prediction for Tuesday	61
Figure 7.6.10: LOW Week 6 Tuesday Night Prediction for Wednesday	61
Figure 7.6.11: LOW Week 6 Wednesday Night Prediction for Thursday	61
Figure 7.6.12: LOW Week 6 Thursday Night Prediction for Friday	61
Figure 7.6.13: SYX Week 6 Monday Night Prediction for Tuesday	62
Figure 7.6.14: SYX Week 6 Tuesday Night Prediction for Wednesday	62
Figure 7.6.15: SYX Week 6 Wednesday Night Prediction for Thursday	62
Figure 7.6.16: SYX Week 6 Thursday Night Prediction for Friday	62

iv. Table of Tables:

Table 4.1.1: Week 1 Transaction History	21
Table 4.2.1: Week 2 Transaction History	22
Table 4.3.1: Week 3 Transaction History	23
Table 4.4.1: Week 4 Transaction History	27
Table 4.5.1: Week 5 Transaction History	31
Table 4.5.1: Week 6 Transaction History	35
Table 5.1.1: Week 1 Day Trading	37
Table 5.2.1: Week 2 Day Trading	37
Table 5.3.1: Week 3 Day Trading	38
Table 5.4.1: TSLA Week 4 Day Trading	38
Table 5.4.2: NFLX Week 4 Day Trading	38
Table 5.4.3: LOW Week 4 Day Trading	39
Table 5.4.4: SYY Week 4 Day Trading	39
Table 5.5.1: TSLA Week 5 Day Trading	39
Table 5.5.2: NFLX Week 5 Day Trading	40
Table 5.5.3: LOW Week 5 Day Trading	40
Table 5.5.4: SYY Week 5 Day Trading	40
Table 5.6.1: TSLA Week 6 Day Trading	41
Table 5.6.2: NFLX Week 6 Day Trading	41
Table 5.6.3: LOW Week 6 Day Trading	42
Table 5.6.4: SYY Week 6 Day Trading	42
Table 7.1.1: Week 1 Neural Network Predictions	46
Table 7.2.1: Week 2 Neural Network Predictions	47

Table 7.3.1: Week 3 Neural Network Predictions	49
Table 7.4.1: TSLA Week 4 Neural Network Predictions	51
Table 7.4.2: NFLX Week 4 Neural Network Predictions	52
Table 7.4.3: LOW Week 4 Neural Network Predictions	53
Table 7.4.4: SYY Week 4 Neural Network Predictions	54
Table 7.5.1: TSLA Week 5 Neural Network Predictions	55
Table 7.5.2: NFLX Week 5 Neural Network Predictions	56
Table 7.5.3: LOW Week 5 Neural Network Predictions	57
Table 7.5.4: SYY Week 5 Neural Network Predictions	58
Table 7.6.1: TSLA Week 6 Neural Network Predictions	59
Table 7.6.2: NFLX Week 6 Neural Network Predictions	60
Table 7.6.3: LOW Week 6 Neural Network Predictions	61
Table 7.6.4: SYY Week 6 Neural Network Predictions	62

1. Introduction

1.1 Goals, Scope, and General Plan

The goal for this IQP is to increase my knowledge of data mapping tools and deep learning. By the end of the IQP, I hope to have a working model of some of the metrics of the stock market for predicting short-term changes. I also hope to use my model to increase my “money” throughout the IQP. The method I plan to use is to run a neural network on past stock market data and use that to produce a buying and selling strategy (find out how much to try to make off each stock and when to cut losses). I will simulate using this strategy along with two other strategies, day trading and position trading, to see how my method compares with the pre-established trading strategies.

1.2 Background Information

1.2.1 History

The idea of the stock system originated in the canals of Venice. In the fourteenth century, moneylenders would trade their debts and loans to other lenders and to individuals with better loans to pay off their debts. That transformed into the first stock exchange in the 15th and 16th centuries in Antwerp, Belgium. Though this is considered the first stock market, in fact, no stocks were traded. Here, brokers would exchange promissory notes and bonds and would work with government, business, and individual debt affairs.

The first company to be publicly traded was the East India Company in 1602. The reasoning behind this company’s decision to go public was simple: risk. It was immensely costly and risky to send ships from Europe all the way around Africa to Asia at the time, spending months on the journey with money having been spent and not yet returned. On top of that, these ships had to contend with the rough seas of the Atlantic, Southern, and Indian oceans as well as hordes of Barbary pirates and harsh weather. Because of this huge risk, the East India Company

decided to offer stock options to investors that would pay dividends on all profits the company made. This method was much safer and more profitable than the previous method: putting investments into one ship with a chance of either massive or no profits.

Within the next few years, many other trading companies followed suit, also offering up stock options to investors. The physical stock options were made of paper, and, without a stock exchange where investors would buy and sell, investors would have to track down the person they were hoping to buy or sell their shares with. This problem led many in London to congregate in coffee shops, where stocks written on paper would be traded between brokers. Another problem in England was the lack of regulation of who could make stock options and what they were worth. People started popping up businesses very quickly, making a stock, selling the stock to unsuspecting buyers with no tangible return at that time. This phenomenon was so profitable that companies like the South Sea Company were able to get luxurious offices before any of their ships even left the dock. When buyers realized that they were not getting any return on their investments, the whole stock system collapsed, creating a large crash and a new law that barred stock trading until it was repealed in 1825.

In 1817, the New York Stock Exchange (NYSE) was formed. Despite coming after the Philadelphia Stock Exchange, the NYSE quickly gained huge popularity due to its geographical position in the United States and the lack of competition from alike stock exchanges. Eventually more and more stock exchanges opened, and today almost every country has their own stock exchange.

The newest innovation in stock trading happened in 1971 with the creation of the National Association of Securities Dealers Automated Quotations (NASDAQ). NASDAQ was novel, as it eliminated the in-person element of stock trading. This form of online-only stock

trading was also better than traditional stock exchanges, as it reduced the bid-ask spread, giving buyers and sellers fairer prices.

1.2.2 Terminology

Bull Market: A bull market is when the stock market is expected to rise.

Bear Market: A bear market is when the stock market is expected to fall.

Stock: A stock is a portion of a company's residual assets, able to be bought by and sold to other investors.

Window Dressing: A window dressing is a strategy used by companies near the end of a quarter to improve the appearance of their company to drive up the stock price. This is usually accomplished by postponing payments and/or booking their revenue sooner than the end of the quarter. Window dressing is also used by mutual fund managers to sell stocks with losses and pick different stocks that are projected to rise before shareholder meetings. These strategies are very short-term, as the stock will usually fall more afterwards than it had risen during the window dressing [1].

Consumer Price Index (CPI): A metric for determining average change over time of prices paid by consumers in a certain market basket. Consumer price index is calculated for a specific year by the equation:

$$\{\text{Cost of a market basket in that year}\} / (\{\text{Cost of a market basket in a base year}\} * 100).$$

Consumer Price Index is used to measure inflation and deflation as well as adjustments to cost-of-living [2].

Bid-Ask Spread: The difference between the price the buyer is willing to buy the share at and the price the seller is asking for the share.

Short-Term Trading Strategy: A short-term trading strategy is a strategy traders use over a brief period, anywhere from days to fractions of a second. This strategy works off the principle

that a stock option is traded so quickly that it only gains a small percentage more value, but done many times in a brief period, it can be an effective strategy to gain money.

Long-Term Trading Strategy: A long-term trading strategy is a strategy traders use over a long time, usually months or years. This strategy works off the principle that the stock(s) invested in will appreciate over time at a rate faster than inflation.

Market Basket: A market basket is a collection of tangible items that share a common theme of consumerism. Examples of market baskets are food and beverages, housing, medical care, transportation, clothing, and recreation [2].

2. Strategies

2.1 Day Trading:

Day trading, as defined by this IQP, is a form of trading where a user buys a stock in the morning near open and sells the stock by the day's end. The idea of this strategy is to make a small amount of profit from the day and between close and the next day's opening the market will drop down and settle, waiting for the user to buy in the morning for another rise.

2.2 End-Of-Day Trading:

End-of-day trading is a trading strategy where a user makes trading decisions near to or after the closing bell. The advantage of this strategy is it is much easier for casual stock traders to get into stocks, as they do not have to worry about what the market is doing during the day and can trade after they get home from work and are relaxing.

2.3 News/Trend Trading:

News trading, or trend trading, is a strategy where a user buys and sells stocks based on news reports. This strategy is much harder to do effectively than casual strategies, as the user must be diligent and watch the market and news carefully to stay ahead of the rest of the investors in the stock market.

2.4 Position Trading:

Position trading is a long-term strategy of buying whatever stock a user wants and then waiting on it for a period of time. This strategy works on the assumption that gradually a stock will increase in value as both the underlying company and the stock market as a whole increase in value.

2.5 Breakout Trading:

Breakout trading is a strategy where a user waits for stock to “break out” of a generalized streak of small increases and decreases and skyrockets to a new height. At this point, the user would sell before the market catches up to this stock and the price drops.

2.6 Reversal Trading:

Reversal trading is a strategy where a user trades stocks at the local minima and maxima of the stock price. This strategy relies on knowing when the market will have a “bullish reversal” (where the user would buy at its lowest price) or a “bearish reversal” (where the user would sell before the price goes down).

2.7 Neural Network Trading:

In this IQP, I have created a neural network that analyzes the historical data from each of the stocks and the input (the ending price from the previous trading day) and outputs a value based on whether the neural network thinks the stock will rise or fall. If the neural network thinks the stock will rise, it will output a positive number; if the neural network thinks the stock will fall, it will output a negative number. Based on this number, the trading strategy will either sell, buy, or hold on its stock, hopefully creating massive gains as it will more accurately predict the rise and fall of the stock than any traditional method.

2.8 My Trading Plan:

My plan for this IQP is to simulate Day Trading and Position Trading strategies and compare them with the buying/selling strategy from my neural network. I will run the simulation for 6 weeks, after which time I will analyze the patterns of trading and determine which method was the most profitable.

3. Implementation

3.1 Strategies:

The strategies for this IQP I am simulating are day trading, position trading, and neural network trading. The reasoning behind choosing these strategies is I wanted to simulate a short-term strategy (day trading), a long-term strategy (position trading), and a hybrid of the two with my neural network.

3.2 The Neural Network:

The neural network I designed uses TensorFlow 2 and Keras. I wrote the model in Python using Anaconda with Jupyter Notebook. I am training my model with the past year of TSLA data, training with the first 11 months, and testing with the last month (having been “vaulted” and not used for training). At that point, I will use it to input the value at the beginning of the day and find the output of where (with a confidence interval) the stock will land by the end of the day. Based on that, I will decide whether to buy or sell the stock.

The strategy I am working with is a four-part strategy:

- If the trader has stock:
 - If the market is expected to go up, keep stock and do not sell
 - If the market is expected to go down, sell stock
- If the trader has no stock:
 - If the market is expected to go up, buy stock
 - If the market is expected to go down, wait for the neural network to predict a rise

This strategy is a (hopefully smarter) version of reversal trading, where my neural network will predict the movements of the market before it happens.

3.3 The Simulation Guidelines:

I chose TSLA as the stock the strategies would be trading because it is a stock that I have a few shares of and if I can simulate the market with my neural network, I may be able to use that knowledge for my future stock trading with my actual stock.

The guidelines of the simulation are as follows:

- The simulation will run for 6 weeks, starting on 6/13/2022 and ending on 7/24/2022.
- There will be three “traders:” one using day-trading methods, one using position-trading methods, and one using the method laid out by the neural network.
- Each trader will have either one stock asset or zero stock assets. The metrics by which the strategies will be compared are the change in stock price and how much the traders gained.

3.4 Weeks 4-6

After Week 3, I realized that I needed to have more stocks traded in my simulation. I decided to add three more stocks for the second half of the simulation: NFLX, LOW, and SYY. I chose these three stocks because they, along with TSLA, represent four distinct sectors of the stock market, with Automotive, Entertainment, Hardware/Materials, and Food. Each of these stocks will be entered into each of the strategies and will be day traded, position traded, and traded with guidance of the neural network. I also decided to only start these stocks after the decision was made, as if I had tried to “posthumously” trade the stocks and pretended I did not know where the market was going in the future, that would have invalidated the integrity of the whole simulation.

4. Weekly Market News and Condition

4.1 Week 1

TSLA this week was overall negative, starting at 667.96 on Monday morning and ending at 650.28, as seen in Figure 4.1.1: TSLA Stock June 13-17. TSLA had two notable local minima this week, with 638.94 on Tuesday morning and 628.56 on Thursday afternoon. There was one notable local maximum, 700.76 right before close on Wednesday. TSLA overall had a net loss of 17.68 (2.65%). The transactions for this week can be found in Table 4.1.1: Week 1 Transaction History.

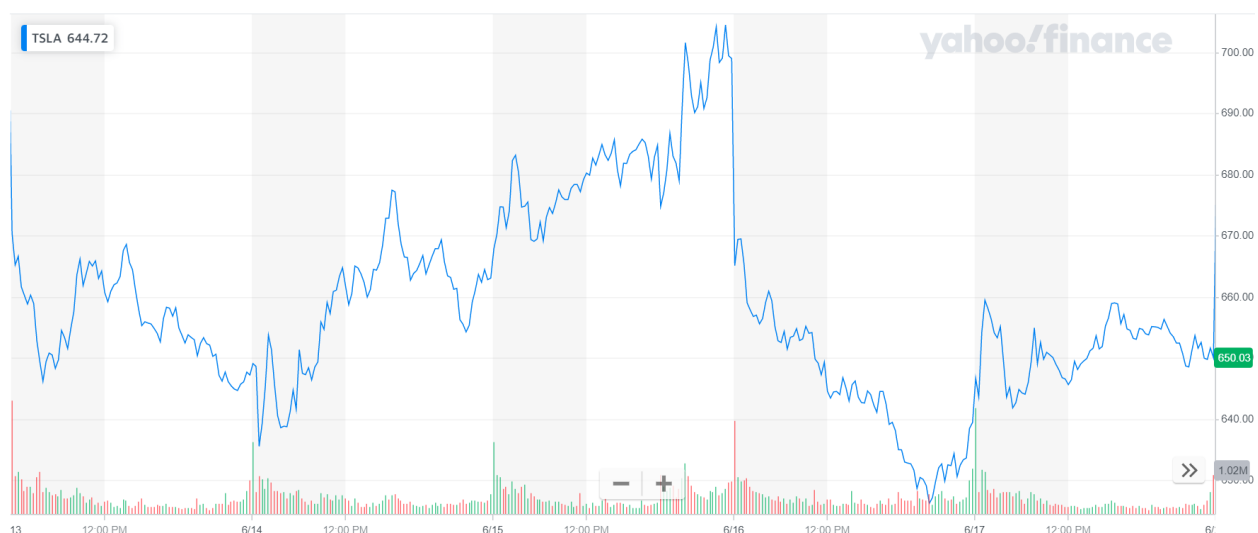


Figure 4.1.1: TSLA Stock June 13-17

Table 4.1.1: Week 1 Transaction History

Date	Symbol	Strategy	Buy/ Sell	Price	Share	Net Cost/ Proceeds	Profit/ Loss
06/13	TSLA	Day	Buy	\$667.96	1	667.96	
06/13	TSLA	Day	Sell	\$647.21	1	647.21	(20.75)
06/13	TSLA	Position-All	Buy	\$667.96	1	667.96	
06/13	TSLA	Position- Week	Buy	\$667.96	1	667.96	
06/13	TSLA	Neural Network	Buy	\$667.96	1	667.96	
06/14	TSLA	Day	Buy	\$655.04	1	655.04	
06/14	TSLA	Day	Sell	\$662.67	1	662.67	7.63
06/15	TSLA	Day	Buy	\$663.34	1	663.34	
06/15	TSLA	Day	Sell	\$699.00	1	699.00	35.66
06/15	TSLA	Neural Network	Sell	\$699.00	1	699.00	31.04
06/16	TSLA	Day	Buy	\$667.50	1	667.50	
06/16	TSLA	Day	Sell	\$639.30	1	639.30	(28.20)
06/16	TSLA	Neural Network	Buy	\$639.30	1	639.30	
06/17	TSLA	Day	Buy	\$641.49	1	641.49	
06/17	TSLA	Day	Sell	\$650.28	1	650.28	8.79
06/17	TSLA	Position- Week	Sell	\$650.28	1	650.28	(17.68)
06/17	TSLA	Neural Network	Sell	\$650.28	1	650.28	10.98
						Accumulative Profit:	27.47

4.2 Week 2

TSLA was fluctuating a lot this week after a jump on Tuesday (as seen by Figure 4.2.1: TSLA Stock June 17-24), where each day would have a dip and come back up to around the same price. The most notable days were Tuesday when the stock jumped up over 30 points over the weekend to start the short week, and Friday, when TSLA started to stabilize at a higher price bracket, jumping up over 20 points. The transactions for this week can be found in Table 4.2.1: Week 2 Transaction History.



Figure 4.2.1: TSLA Stock June 17-24

Table 4.2.1: Week 2 Transaction History

Date	Symbol	Strategy	Buy/ Sell	Price	Shares	Net Cost/ Proceeds	Profit/Loss
06/21	TSLA	Day	Buy	674.16	1	674.16	
06/21	TSLA	Day	Sell	710.99	1	710.99	36.83
06/21	TSLA	Position- Week	Buy	674.16	1	674.16	
06/22	TSLA	Day	Buy	703.13	1	703.13	
06/22	TSLA	Day	Sell	708.26	1	708.26	5.13
06/23	TSLA	Day	Buy	713.87	1	713.87	
06/23	TSLA	Day	Sell	705.21	1	705.21	(8.66)
06/24	TSLA	Day	Buy	712.65	1	712.65	
06/24	TSLA	Day	Sell	737.12	1	737.12	24.47
06/24	TSLA	Position- Week	Sell	737.12	1	737.12	62.96
06/24	TSLA	Neural Network	Buy	737.12	1	737.12	
						Accumulative Profit:	120.73

4.3 Week 3

This week was rough for TSLA in the market as seen by Figure 4.3.1: TSLA June 27- July 1. The “breakout” seen at the end of last week was short lived, as the market only stayed at the higher price point for one day and dropped down to the lower price point starting on

Tuesday. The rest of the week stayed relatively constant, with a dip on Thursday (which then went back up an hour later). The transactions for this week can be found in Table 4.3.1: Week 3 Transaction History.



Figure 4.3.1: TSLA June 27-July 1

Table 4.3.1: Week 3 Transaction History

Date	Symbol	Strategy	Buy/Sell	Price	Shares	Net Cost/Proceeds	Profit/Loss
06/27	TSLA	Day	Buy	\$748.08	1	748.08	
06/27	TSLA	Day	Sold	\$734.76	1	734.76	(13.32)
06/27	TSLA	Position-Week	Buy	\$748.08	1	748.08	
06/28	TSLA	Day	Buy	\$733.83	1	733.83	
06/28	TSLA	Day	Sold	\$697.99	1	697.99	(35.84)
06/28	TSLA	Neural Network	Sold	\$697.99	1	697.99	(39.13)
06/29	TSLA	Day	Buy	\$691.50	1	691.50	
06/29	TSLA	Day	Sold	\$685.47	1	685.47	(6.03)
06/30	TSLA	Day	Buy	\$673.56	1	673.56	
06/30	TSLA	Day	Sold	\$673.42	1	673.42	(0.14)
06/30	TSLA	Neural Network	Buy	\$673.42	1	673.42	
07/01	TSLA	Day	Buy	\$680.69	1	680.69	
07/01	TSLA	Day	Sold	\$681.79	1	681.79	1.10
07/01	TSLA	Position-Week	Sold	\$681.79	1	681.79	(66.29)
						Accumulative	(159.65)

						Profit:	
--	--	--	--	--	--	---------	--

4.4 Week 4

Week 4 was great for the entire market. All four of the stocks I am simulating rose significantly: TSLA rose 83.95 (11.2%) as seen by Figure 4.4.1, NFLX rose 10.84 (5.8%) as seen by Figure 4.4.2, LOW rose 6.5 (3.6%) as seen by Figure 4.4.3, and SYM rose 0.86 (1%) as seen by Figure 4.4.4. Though there were some fluctuations in the market over the short week (because of Independence Day on Monday), overall, it was a gradual rise for all four stocks I simulated. The full transaction history for Week 4 can be seen in Table 4.4.1: Week 4 Transaction History.



Figure 4.4.1: TSLA Stock July 5-8



Figure 4.4.2: NFLX Stock July 5-8



Figure 4.4.3: LOW Stock July 5-8

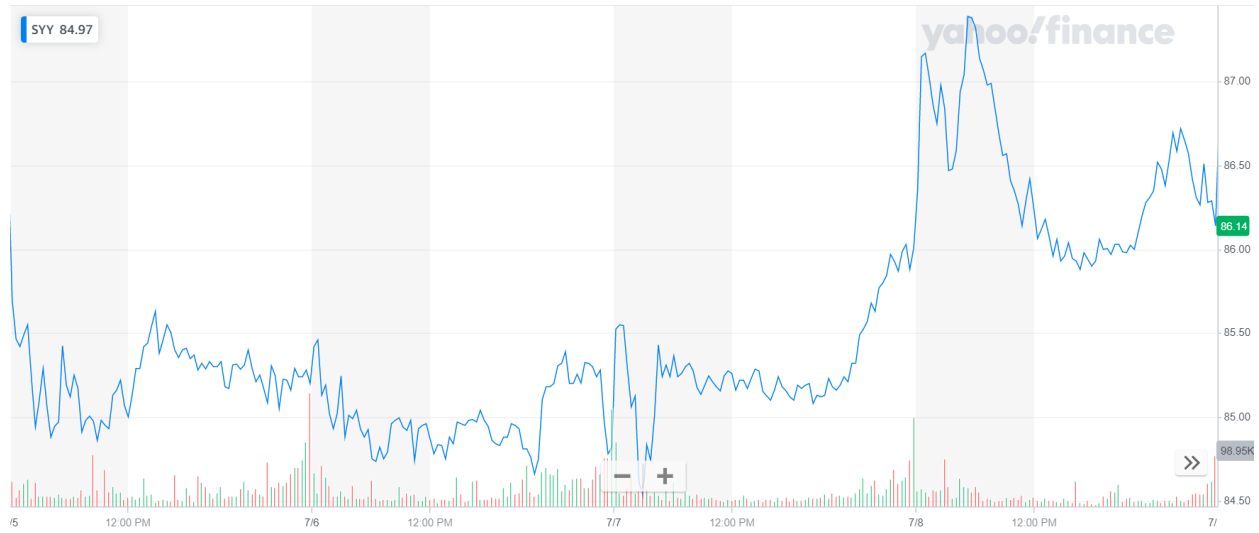


Figure 4.4.4: SYY Stock July 5-8

Table 4.4.1: Week 4 Transaction History

Date	Symbol	Strategy	Buy/Sell	Price	Shares	Net Cost/Proceeds	Profit/Loss
07/05	TSLA	Day	Buy	668.34	1	668.34	
07/05	TSLA	Day	Sell	699.20	1	699.20	30.86
07/05	NFLX	Day	Buy	176.14	1	176.14	
07/05	NFLX	Day	Sell	185.89	1	185.89	9.75
07/05	LOW	Day	Buy	175.05	1	175.05	
07/05	LOW	Day	Sell	179.87	1	179.87	4.82
07/05	SY Y	Day	Buy	85.29	1	85.29	
07/05	SY Y	Day	Sell	85.20	1	85.20	(0.09)
07/05	TSLA	Position-Week	Buy	668.34	1	668.34	
07/05	NFLX	Position-Week	Buy	176.14	1	176.14	
07/05	LOW	Position-Week	Buy	175.05	1	175.05	
07/05	SY Y	Position-Week	Buy	85.29	1	85.29	
07/05	TSLA	Position-All	Buy	668.34	1	668.34	
07/05	NFLX	Position-All	Buy	176.14	1	176.14	
07/05	LOW	Position-All	Buy	175.05	1	175.05	
07/05	SY Y	Position-All	Buy	85.29	1	85.29	
07/05	NFLX	Neural Network	Buy	176.14	1	176.14	
07/05	LOW	Neural Network	Buy	175.05	1	175.05	
07/05	SY Y	Neural Network	Buy	85.29	1	85.29	
07/05	NFLX	Neural Network	Sell	185.89	1	185.89	9.75
07/06	TSLA	Day	Buy	692.27	1	692.27	
07/06	TSLA	Day	Sell	695.20	1	695.20	2.93
07/06	NFLX	Day	Buy	185.20	1	185.20	
07/06	NFLX	Day	Sell	184.06	1	184.06	(1.14)
07/06	LOW	Day	Buy	180.78	1	180.78	
07/06	LOW	Day	Sell	179.00	1	179.00	(1.78)
07/06	SY Y	Day	Buy	85.10	1	85.10	
07/06	SY Y	Day	Sell	84.82	1	84.82	(0.28)
07/06	NFLX	Neural Network	Buy	184.06	1	184.06	
07/07	TSLA	Day	Buy	701.38	1	701.38	
07/07	TSLA	Day	Sell	733.63	1	733.63	32.25
07/07	NFLX	Day	Buy	184.40	1	184.40	
07/07	NFLX	Day	Sell	189.27	1	189.27	4.87
07/07	LOW	Day	Buy	179.87	1	179.87	
07/07	LOW	Day	Sell	181.52	1	181.52	1.65

07/07	SY Y	Day	Buy	85.26	1	85.26	
07/07	SY Y	Day	Sell	86.01	1	86.01	0.75
07/07	SY Y	Neural Network	Sell	86.01	1	86.01	0.72
07/08	TSLA	Day	Buy	726.90	1	726.90	
07/08	TSLA	Day	Sell	752.29	1	752.29	25.39
07/08	NFLX	Day	Buy	186.09	1	186.09	
07/08	NFLX	Day	Sell	186.98	1	186.98	0.89
07/08	LOW	Day	Buy	180.90	1	180.90	
07/08	LOW	Day	Sell	181.55	1	181.55	0.65
07/08	SY Y	Day	Buy	86.11	1	86.11	
07/08	SY Y	Day	Sell	86.15	1	86.15	0.04
07/08	TSLA	Position-Week	Sell	752.29	1	752.29	83.95
07/08	NFLX	Position-Week	Sell	186.98	1	186.98	10.84
07/08	LOW	Position-Week	Sell	181.55	1	181.55	6.50
07/08	SY Y	Position-Week	Sell	86.15	1	86.15	0.86
07/08	TSLA	Neural Network	Sell	752.29	1	752.29	78.87
07/08	NFLX	Neural Network	Sell	186.98	1	186.98	2.92
07/08	SY Y	Neural Network	Buy	86.15	1	86.15	
						Accumulative Profit:	305.97

4.5 Week 5

Week 5 was hectic across the board for the market. The general trend was a large rise or fall during the aftermarket each day with a moderately flat plateau during the day. This plateau may be tilted to rise or fall, but, generally, the slope was not that high. All four of the stocks saw a rise on Thursday night/Friday, possibly breaking out and into a new price bracket.

TSLA had a relatively flat week compared to the other stocks in the simulation, with the absolute maximum at 756.11 on Monday morning and the absolute minimum at 676.74 on Wednesday morning as seen by Figure 4.5.1.



Figure 4.5.1: TSLA Stock July 11-15

NFLX had an interesting week, with the stock plummeting from 184.73 on Monday morning to 170.98 Wednesday morning before rising slowly Wednesday to Friday morning and jumping up to 189.11 Friday during the day as seen by Figure 4.5.2.



Figure 4.5.2: NFLX Stock July 11-15

LOW started in the middle range on Monday morning, starting at 181.22. The stock jumped up every morning and fell during the day each day this week, apart from Thursday, where the stock rose from 179.41 to 182.61 over the course of the day and rose significantly in

the aftermarket Thursday night to 185.71 Friday morning. These changes can be seen in Figure 4.5.3.



Figure 4.5.3: LOW Stock July 11-15

SYX followed the trend of the market with relatively flat plateaus during the trading hours and large increases in the first and last hours of trading and the aftermarket as seen by Figure 4.5.4. SYX also rose significantly on Thursday night to a new height for Friday.

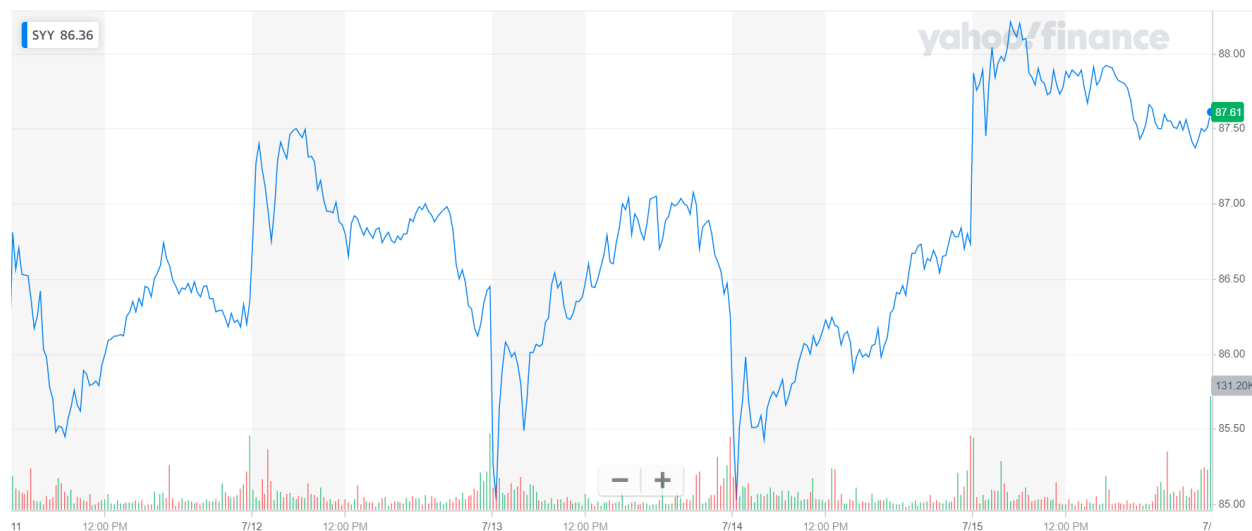


Figure 4.5.4: SYX Stock July 11-15

Table 4.5.1: Week 5 Transaction History

Date	Symbol	Strategy	Buy/ Sell	Price	Shares	Net Cost/ Proceeds	Profit/Loss
07/11	TSLA	Position-Week	Buy	756.11	1	756.11	
07/11	NFLX	Position-Week	Buy	184.73	1	184.73	
07/11	LOW	Position-Week	Buy	181.22	1	181.22	
07/11	SYU	Position-Week	Buy	85.84	1	85.84	
07/11	TSLA	Day	Buy	756.11	1	756.11	
07/11	TSLA	Day	Sell	703.03	1	703.03	(53.08)
07/11	NFLX	Day	Buy	184.73	1	184.73	
07/11	NFLX	Day	Sell	177.34	1	177.34	(7.39)
07/11	LOW	Day	Buy	181.22	1	181.22	
07/11	LOW	Day	Sell	180.10	1	180.10	(1.12)
07/11	SYU	Day	Buy	85.84	1	85.84	
07/11	SYU	Day	Sell	86.35	1	86.35	0.51
07/11	SYU	Neural Network	Sell	86.35	1	86.35	0.20
07/12	TSLA	Day	Buy	699.21	1	699.21	
07/12	TSLA	Day	Sell	710.29	1	710.29	(11.08)
07/12	NFLX	Day	Buy	177.34	1	177.34	
07/12	NFLX	Day	Sell	174.45	1	174.45	(2.89)
07/12	LOW	Day	Buy	181.99	1	181.99	
07/12	LOW	Day	Sell	181.12	1	181.12	(0.87)
07/12	SYU	Day	Buy	86.32	1	86.32	
07/12	SYU	Day	Sell	86.45	1	86.45	0.13
07/12	TSLA	Neural Network	Buy	710.29	1	710.29	
07/12	NFLX	Neural Network	Buy	174.75	1	174.75	
07/13	TSLA	Day	Buy	676.74	1	676.74	
07/13	TSLA	Day	Sell	711.12	1	711.12	34.38
07/13	NFLX	Day	Buy	170.98	1	170.98	
07/13	NFLX	Day	Sell	176.56	1	176.56	5.58
07/13	LOW	Day	Buy	178.24	1	178.24	
07/13	LOW	Day	Sell	182.33	1	182.33	4.09
07/13	SYU	Day	Buy	85.49	1	85.49	
07/13	SYU	Day	Sell	86.27	1	86.27	0.78
07/13	NFLX	Neural Network	Sell	176.56	1	176.56	2.11
07/13	LOW	Neural Network	Sell	182.33	1	182.33	7.28
07/14	TSLA	Day	Buy	704.59	1	704.59	
07/14	TSLA	Day	Sell	714.93	1	714.93	10.34

07/14	NFLX	Day	Buy	175.56	1	175.56	
07/14	NFLX	Day	Sell	174.78	1	174.78	(0.78)
07/14	LOW	Day	Buy	179.41	1	179.41	
07/14	LOW	Day	Sell	182.61	1	182.61	3.20
07/14	SYU	Day	Buy	85.09	1	85.09	
07/14	SYU	Day	Sell	86.73	1	86.73	1.64
07/15	TSLA	Day	Buy	721.21	1	721.21	
07/15	TSLA	Day	Sell	720.20	1	720.20	(1.01)
07/15	NFLX	Day	Buy	175.68	1	175.68	
07/15	NFLX	Day	Sell	189.11	1	189.11	13.43
07/15	LOW	Day	Buy	185.79	1	185.79	
07/15	LOW	Day	Sell	185.00	1	185.00	(0.79)
07/15	SYU	Day	Buy	88.03	1	88.03	
07/15	SYU	Day	Sell	87.62	1	87.62	(0.41)
07/15	TSLA	Position-Week	Sell	720.20	1	720.20	(35.91)
07/15	NFLX	Position-Week	Sell	189.11	1	189.11	4.38
07/15	LOW	Position-Week	Sell	185.00	1	185.00	3.78
07/15	SYU	Position-Week	Sell	87.62	1	87.62	1.78
07/15	TSLA	Neural Network	Sell	720.20	1	720.20	20.99
07/15	LOW	Neural Network	Buy	185.00	1	185.00	
						Accumulative Profit:	(0.73)

4.6 Week 6

The market was erratic this week. TSLA jumped to new heights this week, breaking out from the 725-750 range into the 775+ range on Wednesday night, where it continued to climb until the end of the week, as seen in Figure 4.6.1: TSLA Stock July 18-22.



Figure 4.6.1: TSLA Stock July 18-22

NFLX also had a jump this week, this time on Tuesday night from 190-200 to 210+. Shortly after, NFLX took a dip down to 203, but bounced back and kept climbing the rest of the week, as shown in Figure 4.6.2: NFLX Stock July 18-22



Figure 4.6.2: NFLX Stock July 18-22

LOW had a more gradual increase this week, going from 185 on Monday night to 193 at close on Thursday, until Thursday night where it shot up to new heights, as seen by Figure 4.6.3: LOW Stock July 18-22.



Figure 4.6.3: LOW Stock July 18-22

SY Y had a crazy week this week, fluctuating rapidly and with many local maxima and minima. SY Y ended off the week at 86.87 after all of that, as seen by Figure 4.6.4: SY Y Stock July 18-22.

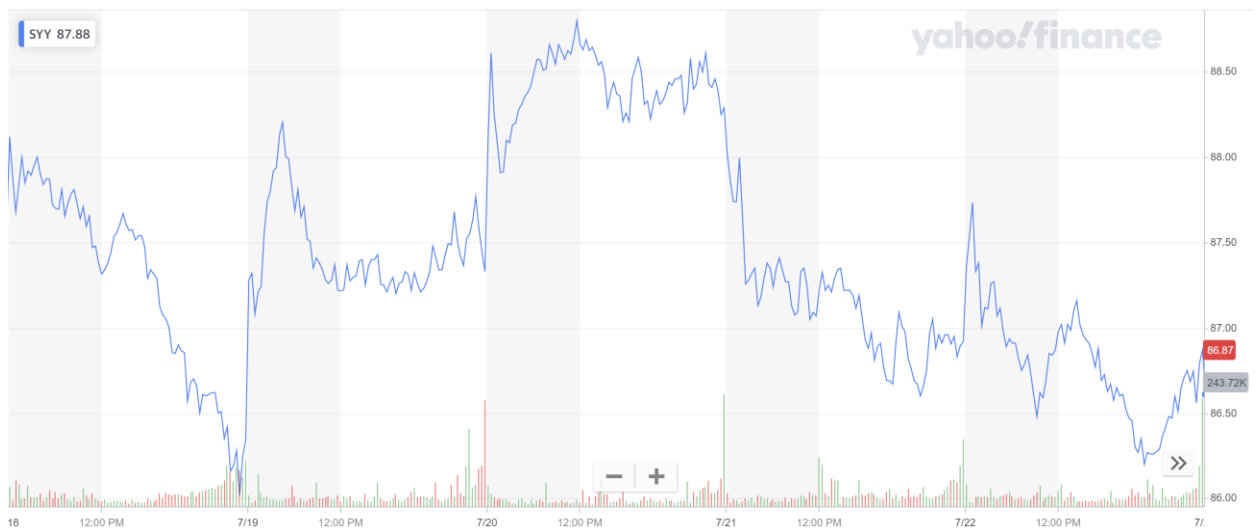


Figure 4.6.4: SY Y Stock July 18-22

Table 4.6.1: Week 6 Transaction History

Date	Symbol	Strategy	Buy/Sell	Price	Shares	Net Cost/Proceeds	Profit/Loss
7/18	TSLA	Day	Buy	734.15	1	734.15	
7/18	TSLA	Day	Sell	721.64	1	721.64	(12.51)
7/18	NFLX	Day	Buy	192.72	1	192.72	
7/18	NFLX	Day	Sell	190.92	1	190.92	(1.8)
7/18	LOW	Day	Buy	186.61	1	186.61	
7/18	LOW	Day	Sell	185.73	1	185.73	(0.88)
7/18	SY Y	Day	Buy	88.18	1	88.18	
7/18	SY Y	Day	Sell	86.34	1	86.34	(1.84)
7/18	TSLA	Position-Week	Buy	734.15	1	734.15	
7/18	NFLX	Position-Week	Buy	192.72	1	192.72	
7/18	LOW	Position-Week	Buy	186.61	1	186.61	
7/18	SY Y	Position-Week	Buy	88.18	1	88.18	
7/18	TSLA	Neural Network	Buy	721.64	1	721.64	
7/18	NFLX	Neural Network	Buy	190.92	1	190.92	
7/18	SY Y	Neural Network	Buy	86.34	1	86.34	
7/19	TSLA	Day	Buy	735	1	735	
7/19	TSLA	Day	Sell	736.59	1	736.59	1.59
7/19	NFLX	Day	Buy	193.02	1	193.02	
7/19	NFLX	Day	Sell	201.63	1	201.63	8.61
7/19	LOW	Day	Buy	187.25	1	187.25	
7/19	LOW	Day	Sell	188.7	1	188.7	1.45
7/19	SY Y	Day	Buy	87.3	1	87.3	
7/19	SY Y	Day	Sell	87.36	1	87.36	0.06
7/19	LOW	Neural Network	Sell	188.7	1	188.7	3.7
7/20	TSLA	Day	Buy	740.2	1	740.2	
7/20	TSLA	Day	Sell	742.5	1	742.5	2.3
7/20	NFLX	Day	Buy	208.07	1	208.07	
7/20	NFLX	Day	Sell	216.44	1	216.44	8.37
7/20	LOW	Day	Buy	188.39	1	188.39	
7/20	LOW	Day	Sell	190.99	1	190.99	2.6
7/20	SY Y	Day	Buy	87.73	1	87.73	
7/20	SY Y	Day	Sell	88.23	1	88.23	0.5
7/20	LOW	Neural Network	Buy	190.99	1	190.99	
7/20	SY Y	Neural	Sell	88.23	1	88.23	1.89

		Network					
7/21	TSLA	Day	Buy	765	1	765	
7/21	TSLA	Day	Sell	815.12	1	815.12	50.12
7/21	NFLX	Day	Buy	214.09	1	214.09	
7/21	NFLX	Day	Sell	223.38	1	223.38	9.29
7/21	LOW	Day	Buy	191.24	1	191.24	
7/21	LOW	Day	Sell	193.59	1	193.59	2.35
7/21	SY Y	Day	Buy	87.84	1	87.84	
7/21	SY Y	Day	Sell	86.92	1	86.92	(0.92)
7/21	NFLX	Neural Network	Sell	223.38	1	223.38	32.46
7/21	SY Y	Neural Network	Buy	86.92	1	86.92	
7/22	TSLA	Day	Buy	829	1	829	
7/22	TSLA	Day	Sell	816.73	1	816.73	(12.27)
7/22	NFLX	Day	Buy	222.38	1	222.38	
7/22	NFLX	Day	Sell	220.44	1	220.44	(1.94)
7/22	LOW	Day	Buy	194.82	1	194.82	
7/22	LOW	Day	Sell	195.67	1	195.67	0.85
7/22	SY Y	Day	Buy	87.08	1	87.08	
7/22	SY Y	Day	Sell	86.86	1	86.86	(0.22)
7/22	TSLA	Position-Week	Sell	816.73	1	816.73	82.58
7/22	NFLX	Position-Week	Sell	220.44	1	220.44	27.72
7/22	LOW	Position-Week	Sell	195.67	1	195.67	9.06
7/22	SY Y	Position-Week	Sell	86.86	1	86.86	(1.32)
7/22	TSLA	Position-All	Sell	816.73	1	816.73	148.77
7/22	NFLX	Position-All	Sell	220.44	1	220.44	44.3
7/22	LOW	Position-All	Sell	195.67	1	195.67	20.62
7/22	SY Y	Position-All	Sell	86.86	1	86.86	1.57
7/22	TSLA	Neural Network	Sell	816.73	1	816.73	95.09
7/22	LOW	Neural Network	Sell	195.67	1	195.67	4.68
7/22	SY Y	Neural Network	Sell	86.86	1	86.86	(0.06)
						Accumulative Profit:	526.77

5. Simulation 1: Day Trading

5.1 Week 1

Day Trading was marginally profitable this week, with a gain of \$3.13 overall. Day trading has the highest volatility, as seen in Table 5.1.1: Week 1 Day Trading with changes of both +35.66 and -28.20.

Table 5.1.1: Week 1 Day Trading

	Price Start	Price End	Day Start	Day End	Change
6/13	667.96	647.21	667.96	647.21	-20.75
6/14	655.04	662.67	655.04	662.67	7.63
6/15	663.34	699.00	663.34	699.00	35.66
6/16	667.50	639.30	667.50	639.30	-28.20
6/17	641.49	650.28	641.49	650.28	8.79

5.2 Week 2

Day trading had both big gains and losses this week, but ultimately the gains outweighed the losses, with a total gain this week of 57.77, for an overall total of 60.90 for the entire simulation so far as seen by Table 5.2.1: Week 2 Day Trading.

Table 5.2.1: Week 2 Day Trading

	Price Start	Price End	Day Start	Day End	Change
6/21	674.16	710.99	674.16	710.99	36.83
6/22	703.13	708.26	703.13	708.26	5.13
6/23	713.87	705.21	713.87	705.21	-8.66
6/24	712.65	737.12	712.65	737.12	24.47

5.3 Week 3

Week 3 was rough for the day trading strategy as seen by Table 5.3.1: Week 3 Day Trading. Of the five days the market was open, only one day had a positive return. All other days were losses anywhere from -0.14 to -35.84. Overall, this week netted the day trading strategy a huge loss of -54.23, which drops the total profit from the entire simulation down to +6.67.

Table 5.3.1: Week 3 Day Trading

	Price Start	Price End	Day Start	Day End	Change
6/27	748.08	734.76	748.08	734.76	-13.32
6/28	733.83	697.99	733.83	697.99	-35.84
6/29	691.5	685.47	691.5	685.47	-6.03
6/30	673.56	673.42	673.56	673.42	-0.14
7/1	680.69	681.79	680.69	681.79	1.10

5.4 Week 4

TSLA was very profitable this week, growing 91.43 and bringing up the total for the simulation of TSLA stock up to 98.10 as seen by Table 5.4.1: TSLA Week 4 Day Trading.

Table 5.4.1: TSLA Week 4 Day Trading

	Price Start	Price End	Day Start	Day End	Change
07/05	668.34	699.2	668.34	699.2	30.86
07/06	692.27	695.2	692.27	695.2	2.93
07/07	701.38	733.63	701.38	733.63	32.25
07/08	726.9	752.29	726.9	752.29	25.39

NFLX also had a good week, gaining 14.37 (7.7%) as seen by Table 5.4.2: NFLX Week 4 Day Trading. As this was the first week NFLX was simulated, the total for NFLX for the simulation is 14.37.

Table 5.4.2: NFLX Week 4 Day Trading

	Price Start	Price End	Day Start	Day End	Change
07/05	176.14	185.89	176.14	185.89	9.75
07/06	185.2	184.06	185.2	184.06	-1.14
07/07	184.4	189.27	184.4	189.27	4.87
07/08	186.09	186.98	186.09	186.98	0.89

LOW had a good week this week to start out its simulation, gaining 5.34 (3%) as seen by Table 5.4.3: LOW Week 4 Day Trading, also the total for this simulation so far.

Table 5.4.3: LOW Week 4 Day Trading

	Price Start	Price End	Day Start	Day End	Change
07/05	175.05	179.87	175.05	179.87	4.82
07/06	180.78	179	180.78	179	-1.78
07/07	179.87	181.52	179.87	181.52	1.65
07/08	180.9	181.55	180.9	181.55	0.65

SYY had a great week to round out the stocks. It gained 0.42 (0.5%), despite a negative start to the week with two negative days as seen by Table 5.4.4: SYY Week 4 Day Trading.

Table 5.4.4: SYY Week 4 Day Trading

	Price Start	Price End	Day Start	Day End	Change
07/05	85.29	85.2	85.29	85.2	-0.09
07/06	85.1	84.82	85.1	84.82	-0.28
07/07	85.26	86.01	85.26	86.01	0.75
07/08	86.11	86.15	86.11	86.15	0.04

5.5 Week 5

TSLA was all over the board this week, with increases of up to 34.38 and decreases up to -53.08 as seen by Table 5.5.1: TSLA Week 5 Day Trading. Overall, the strategy lost 20.45 (-2.8%), bringing the overall profit of the strategy for the entire simulation to 77.65.

Table 5.5.1: TSLA Week 5 Day Trading

	Price Start	Price End	Day Start	Day End	Change
07/11	756.11	703.03	756.11	703.03	-53.08
07/12	710.29	699.21	710.29	699.21	-11.08
07/13	676.74	711.12	676.74	711.12	34.38
07/14	704.59	714.93	704.59	714.93	10.34
07/15	721.21	720.2	721.21	720.2	-1.01

NFLX was even more hectic than TSLA, with changes of both 13.43 and -7.39 as seen by Table 5.5.2: NFLX Week 5 Day Trading. Overall, the strategy gained 7.95 (+4.2%), for a total profit of 22.32 for the entire simulation.

Table 5.5.2: NFLX Week 5 Day Trading

	Price Start	Price End	Day Start	Day End	Change
07/11	184.73	177.34	184.73	177.34	-7.39
07/12	177.34	174.45	177.34	174.45	-2.89
07/13	170.98	176.56	170.98	176.56	5.58
07/14	175.56	174.78	175.56	174.78	-0.78
07/15	175.68	189.11	175.68	189.11	13.43

LOW had big gains and small losses this week, ending out at a gain of 4.51 (+2.4%) for the week and 9.85 for the entire simulation as seen by Table 5.5.3: LOW Week 5 Day Trading.

Table 5.5.3: LOW Week 5 Day Trading

	Price Start	Price End	Day Start	Day End	Change
07/11	181.22	180.1	181.22	180.1	-1.12
07/12	181.99	181.12	181.99	181.12	-0.87
07/13	178.24	182.33	178.24	182.33	4.09
07/14	179.41	182.61	179.41	182.61	3.2
07/15	185.79	185	185.79	185	-0.79

SYX had four out of five days profiting, with little increments for each day, as seen by Table 5.5.4: SYX Week 5 Day Trading. The strategy for this stock ended the week with a gain of 2.65 (+3.0) for the week and 3.07 for the entire simulation.

Table 5.5.4: SYX Week 5 Day Trading

	Price Start	Price End	Day Start	Day End	Change
07/11	85.84	86.35	85.84	86.35	0.51

07/12	86.32	86.45	86.32	86.45	0.13
07/13	85.49	86.27	85.49	86.27	0.78
07/14	85.09	86.73	85.09	86.73	1.64
07/15	88.03	87.62	88.03	87.62	-0.41

5.6 Week 6

Week 6 was volatile for TSLA, with days that lost 12.51 and 12.27 and a day that gained 50.12, as seen by Table 5.6.1: TSLA Week 6 Day Trading. Overall, the day trading strategy for TSLA had a net profit of 29.23.

Table 5.6.1: TSLA Week 6 Day Trading

	Price Start	Price End	Day Start	Day End	Change
7/18	734.15	721.64	734.15	721.64	-12.51
7/19	735	736.59	735	736.59	1.59
7/20	740.2	742.5	740.2	742.5	2.3
7/21	765	815.12	765	815.12	50.12
7/22	829	816.73	829	816.73	-12.27

NFLX had a good week this week, with minimal losses and three days of big gains as seen by Table 5.6.2: NFLX Week 6 Day Trading, ending out the week with a net profit of 22.53.

Table 5.6.2: NFLX Week 6 Day Trading

	Price Start	Price End	Day Start	Day End	Change
7/18	192.72	190.92	192.72	190.92	-1.8
7/19	193.02	201.63	193.02	201.63	8.61
7/20	208.07	216.44	208.07	216.44	8.37
7/21	214.09	223.38	214.09	223.38	9.29
7/22	222.38	220.44	222.38	220.44	-1.94

LOW had a good week, with four out of five days giving positive returns as seen by Table 5.6.3: LOW Week 6 Day Trading. This week ended out with a net profit of 6.37.

Table 5.6.3: LOW Week 6 Day Trading

	Price Start	Price End	Day Start	Day End	Change
7/18	186.61	185.73	186.61	185.73	-0.88
7/19	187.25	188.7	187.25	188.7	1.45
7/20	188.39	190.99	188.39	190.99	2.6
7/21	191.24	193.59	191.24	193.59	2.35
7/22	194.82	195.67	194.82	195.67	0.85

SYY was the worst of the four stocks this week for the day trading strategy, with only two profitable days and three net loss days, as seen by Table 5.6.4: SYY Week 6 Day Trading. This gave the strategy a net loss of -2.42 this week.

Table 5.6.4: SYY Week 6 Day Trading

	Price Start	Price End	Day Start	Day End	Change
7/18	88.18	86.34	88.18	86.34	-1.84
7/19	87.3	87.36	87.3	87.36	0.06
7/20	87.73	88.23	87.73	88.23	0.5
7/21	87.84	86.92	87.84	86.92	-0.92
7/22	87.08	86.86	87.08	86.86	-0.22

6. Simulation 2: Position Trading

6.1 Week 1

The overall position trading strategy bought the stock at 667.96 and will hold it until the end of the simulation.

The week-long position trading strategy was the least profitable of the three strategies this week, with a loss of 17.68.

6.2 Week 2

The week-long position trading strategy was immensely profitable this week, as the market rose out of its previous bracket to settle in a higher one by the end of the week. This rise resulted in a gain of 62.96, from 674.16 to 737.12. The overall profit from this method is now 45.28.

6.3 Week 3

The week-long position trading strategy took an extremely hard hit this week. With the market falling to the position that it was at the beginning of Week 2, the week-long position trading strategy lost all its profits from the previous week, a loss of -66.29. The overall profit for this method over the entire simulation so far is -21.01

6.4 Week 4

This week was the start of the long-term position trading strategy for NFLX, LOW, and SYX. Each stock was bought at 176.14, 175.05, and 85.29, respectively. The week-long trading strategy for TSLA was profitable, making 83.95 and bringing the total to 62.94 for the whole simulation. NFLX made 10.84 in its first week, a gain of 5.8 percent. LOW made 6.50 in its first week, a gain of 3.6 percent. SYX had the lowest gain this week with 0.86 (1.0 percent).

6.5 Week 5

Week 5 continued the trading strategies of week-long and simulation-long trading for each stock. TSLA bought at 756.11 and sold at 720.20, a net loss of 35.91 (-5.0%). This loss brought the total profit of TSLA for this trading strategy down to 27.03 for the entire simulation. NFLX bought at 184.73 and sold for a small profit at 189.11 of 4.38 (+2.3%) for a simulation total profit of 15.22. LOW also made a small profit this week, buying at 181.22 and selling at 185.00. This netted LOW a profit of 3.78 (+2.0%), bringing the total for LOW in this strategy for the entire simulation to +10.28. SYY made a profit this week, buying at 85.84 and selling at 87.26 for a gain of 1.78 (+2.0%). This profit brings the total for this stock for this strategy for the entire simulation to +2.64.

6.6 Week 6

Week 6 was profitable for TSLA, as the stock rose and stayed up at the end of the week. The strategy this week bought at 734.15 and sold at 816.73, a net profit of 82.58 (11.7%). NFLX had its best week yet, buying at 192.72 and selling at 220.44, a net profit of 27.72 (12.5%). LOW also had an amazing week, buying at 186.61 and selling at 195.67, a net profit of 9.06 (4.6%). SYY had the worst week of the simulation, buying at 88.18 and selling at 86.86, a net loss of 1.32 (-1.5%).

7. Simulation 3: Neural Network Trading

7.1 Week 1

The neural network strategy bought stock to start the simulation and at the end of trading on Monday held its stock and did not sell as it was predicted to rise Tuesday. This prediction was accurate, as the stock went from 647.21 to 662.67.

```
1/1 [=====] - 0s 32ms/step
X=[647.21], Predicted=[0.00380366]
```

Figure 7.1.1: Week 1 Monday Night Prediction for Tuesday

The neural network held its stock on Tuesday as it predicted another rise into Wednesday. This was accurate, shown by the rise from 662.67 to 699.00.

```
1/1 [=====] - 0s 32ms/step
X=[662.67], Predicted=[0.00726301]
```

Figure 7.1.2: Week 1 Tuesday Night Prediction for Wednesday

The neural network predicted a fall in price on Thursday, and thus sold its stock on Wednesday night. This prediction was accurate, as TSLA stock fell from 699.00 to 639.30.

```
1/1 [=====] - 0s 36ms/step
X=[699], Predicted=[-0.01301405]
```

Figure 7.1.3: Week 1 Wednesday Night Prediction for Thursday

The neural network predicted a rise in price for Friday, so it bought stock on Thursday night. This was accurate as TSLA rose from 639.30 to 650.28.

```
1/1 [=====] - 0s 34ms/step
X=[639.3], Predicted=[0.0170857]
```

Figure 7.1.4: Week 1 Thursday Night Prediction for Friday

Overall, the neural network predicted 4/4 correct, giving a 100% accuracy for the week and a 100% accuracy so far for the entire simulation. With all the correct predictions, the neural network strategy has made +42.02, the best of the strategies this week.

Table 7.1.1: Week 1 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
06/13	667.96	647.21	667.96	667.96	0.00	0.0038	Y	N	Y
06/14	655.04	662.67	667.96	667.96	0.00	0.0073	-	N	Y
06/15	663.34	699	667.96	699	31.04	-0.0130	-	Y	Y
06/16	667.5	639.3	639.30	639.30	0.00	0.0171	Y	-	Y
06/17	641.49	650.28	639.30	650.28	10.98	-0.0139	-	Y	N

7.2 Week 2

Week 2 was rough for the neural network. Of the four predictions made (including Week 1 Friday's prediction for Tuesday), only two were correct. The neural network kept predicting a drop in the market, and the market only dropped Tuesday, Wednesday, and Thursday and rose to new highs following that for the rest of the week. Because the neural network kept predicting a drop, I never bought stock (and had sold on Week 1 Friday), resulting in no change to the profits of this strategy and holding strong at 42.02.

The neural network predicted a fall in price between Friday and Tuesday (Monday was Juneteenth; the stock market was closed for the holiday), shown in Figure 7.2.1: Week 1 Friday Night Prediction for Week 2 Tuesday. This prediction was incorrect, as the market rose from 650.28 at the close on Friday to 674.16 at the opening on Tuesday.

```
1/1 [=====] - 0s 41ms/step
X=[650.28], Predicted=[-0.01393335]
```

Figure 7.2.1: Week 1 Friday Night Prediction for Week 2 Tuesday

One of only two correct predictions this week, the neural network predicted a fall from 710.99 to 708.26, as shown in Figure 7.2.2: Week 2 Tuesday Night Prediction for Wednesday.

```
1/1 [=====] - 0s 62ms/step
X=[710.99], Predicted=[-0.0314189]
```

Figure 7.2.2: Week 2 Tuesday Night Prediction for Wednesday

Thursday was the second correct prediction of the week (see Figure 7.2.3: Week 2 Wednesday Night Prediction for Thursday), where the market dropped very slightly from 708.26 to 705.21.

```
1/1 [=====] - 0s 31ms/step
X=[708.26], Predicted=[-0.01564187]
```

Figure 7.2.3: Week 2 Wednesday Night Prediction for Thursday

The market jumped up on Friday against the prediction of the neural network (see Figure 7.2.4: Week 2 Thursday Night Prediction for Friday). It rose from 705.21 to 737.12, a jump of almost 32 dollars!

```
1/1 [=====] - 0s 36ms/step
X=[705.21], Predicted=[-0.00350056]
```

Figure 7.2.4: Week 2 Thursday Night Prediction for Friday

The neural network predicts a rise over the weekend, as shown by Figure 7.2.5: Week 2 Friday Night Prediction for Week 3 Monday. This prediction means I will buy stock and see where it lands on Monday after the weekend!

```
1/1 [=====] - 0s 61ms/step
X=[737.12], Predicted=[0.01366799]
```

Figure 7.2.5: Week 2 Friday Night Prediction for Week 3 Monday

Table 7.2.1: Week 2 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
06/21	674.16	710.99	710.99	710.99	0.00	-0.1393	N	-	Y
06/22	703.13	708.26	710.99	710.99	0.00	-0.0156	N	-	Y
06/23	713.87	705.21	710.99	710.99	0.00	-0.0035	N	-	N
06/24	712.65	737.12	737.12	737.12	0.00	0.0137	Y	-	

7.3 Week 3

Week 3, despite the market struggling, was not as hard on the neural network strategy as it was on the other two strategies. Overall, the neural network correctly predicted three out of the five days (including Friday of Week 2). This resulted in two buys and one sell, which netted the strategy a loss of -39.13.

The week started out with the two incorrect predictions, as Friday-Monday and Monday-Tuesday both predicted a rise in the stock market when the stock market fell.

```
1/1 [=====] - 0s 63ms/step
X=[734.76], Predicted=[0.02610206]
```

Figure 7.3.1: Week 3 Monday Night Prediction for Tuesday

Tuesday's prediction for Wednesday was the first correct prediction of the week, as the market fell lower. This triggered the strategy to sell its stock at a loss of -39.13, the only change this week.

```
1/1 [=====] - 0s 59ms/step
X=[697.99], Predicted=[-0.00506252]
```

Figure 7.3.2: Week 3 Tuesday Night Prediction for Wednesday

The neural network correctly predicted another fall on Thursday, and thus did not buy any stock until Friday as seen by Figure 7.3.3: Week 3 Wednesday Night Prediction for Thursday.


```
1/1 [=====] - 0s 59ms/step
X=[685.47], Predicted=[-0.00811736]
```

Figure 7.3.3: Week 3 Wednesday Night Prediction for Thursday

The neural network correctly predicted a bullish market on Thursday night for Friday as seen by Figure 7.3.4: Week 3 Thursday Night Prediction for Friday. Because of this, the strategy bought a stock, which then rose from 673.42 to 681.79.

```
1/1 [=====] - 0s 61ms/step
X=[673.42], Predicted=[0.01298437]
```

Figure 7.3.4: Week 3 Thursday Night Prediction for Friday

The neural network is predicting a rise from 681.79 over the holiday weekend (shown in Figure 7.3.5: Week 3 Friday Night Prediction for Week 4 Tuesday), and thus did not sell the stock on Friday. This means that any gains made from the correct prediction will not be seen until the strategy is told to sell.

```
1/1 [=====] - 0s 63ms/step
X=[681.79], Predicted=[0.00555514]
```

Figure 7.3.5: Week 3 Friday Night Prediction for Week 4 Tuesday

Table 7.3.1: Week 3 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
06/27	748.08	734.76	737.12	737.12	0.00	0.0261	-	N	N
06/28	733.83	697.99	737.12	697.99	-39.13	-0.0051	-	Y	Y
06/29	691.5	685.47	697.99	697.99	0.00	-0.0081	N	-	Y
06/30	673.56	673.42	673.42	673.42	0.00	0.0130	Y	-	Y
07/01	680.69	681.79	673.42	673.42	0.00	0.0056	-	N	

7.4 Week 4

Week 4 was great for TSLA, as three out of four predictions were correct. The neural network predicted a fall over the weekend (shown by Figure 7.3.5 Week 3 Friday Night Prediction for Week 4 Tuesday), which had the strategy sell for a huge profit of 78.87. Tuesday

night's prediction for Wednesday (shown by Figure 7.4.1) was the only incorrect prediction this week, with the network predicting a rise and TSLA dropping from 699.2 to 695.2.

```
1/1 [=====] - 0s 100ms/step
X=[699.2], Predicted=[0.00066848]
```

Figure 7.4.1: TSLA Week 4 Tuesday Night Prediction for Wednesday

Wednesday night's prediction was the first correct prediction this week, as the market rose from 695.20 to 733.63, shown by Figure 7.4.2: TSLA Week 4 Wednesday Night Prediction for Thursday.

```
1/1 [=====] - 0s 23ms/step
X=[695.2], Predicted=[0.01362382]
```

Figure 7.4.2: TSLA Week 4 Wednesday Night Prediction for Thursday

Thursday night's prediction was also correct, as shown by Figure 7.4.3: TSLA Week 4 Thursday Night Prediction for Friday, as TSLA rose from 733.63 to 752.29.

```
1/1 [=====] - 0s 24ms/step
X=[733.63], Predicted=[0.0007014]
```

Figure 7.4.3: TSLA Week 4 Thursday Night Prediction for Friday

```
1/1 [=====] - 0s 19ms/step
X=[752.29], Predicted=[-0.00988134]
```

Figure 7.4.4: TSLA Week 4 Friday Night Prediction for Week 5 Monday

Table 7.4.1: TSLA Week 4 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/05	668	699.2	673.42	673.42	0.00	0.0007	-	N	N
07/06	692	695.2	673.42	673.42	0.00	0.0136	-	N	Y
07/07	701	733.63	673.42	673.42	0.00	0.0007	-	N	Y
07/08	727	752.29	673.42	752.29	78.87	-0.0099	-	Y	

NFLX also had a good week, with 2 out of 3 correct predictions, as seen by Figure 7.4.5: NFLX Week 4 Tuesday Night Prediction for Wednesday, Figure 7.4.6: NFLX Week 4 Wednesday Night Prediction for Thursday, and Figure 7.4.7: NFLX Week 4 Thursday Night Prediction for Friday as well as Table 7.4.2: NFLX Week 4 Neural Network Predictions. NFLX bought and sold stock twice over the course of the week, ending out with a total gain of 12.67.

```
1/1 [=====] - 0s 65ms/step
X=[113.5], Predicted=[-0.00786481]
```

Figure 7.4.5: NFLX Week 4 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 101ms/step
X=[114.33], Predicted=[0.00056645]
```

Figure 7.4.6: NFLX Week 4 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 25ms/step
X=[116.3], Predicted=[0.00590954]
```

Figure 7.4.7: NFLX Week 4 Thursday Night Prediction for Friday

```
1/1 [=====] - 0s 18ms/step
X=[115.54], Predicted=[-0.00800617]
```

Figure 7.4.8: NFLX Week 4 Friday Night Prediction for Week 5 Monday

Table 7.4.2: NFLX Week 4 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/05	176	185.89	176.14	185.89	9.75	-0.0079	Y	Y	Y
07/06	185	184.06	184.06	184.06	0	0.0006	Y	-	Y
07/07	184	189.27	184.06	184.06	0	0.00591	-	N	N
07/08	186	186.98	184.06	186.98	2.92	-0.008	-	Y	

LOW also did well this week, with two out of three predictions being correct, as seen by Figure 7.4.9: LOW Week 4 Tuesday Night Prediction for Wednesday, Figure 7.4.10: LOW Week 4 Wednesday Night Prediction for Thursday, and Figure 7.4.11: LOW Week 4 Thursday Night Prediction for Friday as well as Table 7.4.3: LOW Week 4 Neural Network Predictions. Overall, the network had the strategy not sell after the initial buy, which means that any profits will be reflected only after the strategy sells.

```
1/1 [=====] - 0s 27ms/step
X=[179.87], Predicted=[0.00083262]
```

Figure 7.4.9: LOW Week 4 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 83ms/step
X=[179], Predicted=[0.00458014]
```

Figure 7.4.10: LOW Week 4 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 33ms/step
X=[181.52], Predicted=[0.00239436]
```

Figure 7.4.11: LOW Week 4 Thursday Night Prediction for Friday

```
1/1 [=====] - 0s 24ms/step
X=[181.55], Predicted=[0.0008404]
```

Figure 7.4.12: LOW Week 4 Friday Night Prediction for Week 5 Monday

Table 7.4.3: LOW Week 4 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/05	175.05	179.87	175.05	175.05	0	0.0008	Y	N	N
07/06	180.78	179	175.05	175.05	0	0.0046	-	N	Y
07/07	179.87	181.52	175.05	175.05	0	0.0024	-	N	Y
07/08	180.9	181.55	175.05	175.05	0	0.0008	-	N	

This week was not as good for SYY and the neural network, as only one out of three predictions was correct as seen by Figure 7.4.13: SYY Week 4 Tuesday Night Prediction for Wednesday, Figure 7.4.14: SYY Week 4 Wednesday Night Prediction for Thursday, and Figure 7.4.15: SYY Week 4 Thursday Night Prediction for Friday as well as Table 7.4.4: SYY Week 4 Neural Network Predictions. The neural network told the strategy to sell once and buy once after the initial buy, which netted the strategy a profit of 0.72.

```
1/1 [=====] - 0s 31ms/step
X=[85.29], Predicted=[6.380625e-05]
```

Figure 7.4.13: SYY Week 4 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 33ms/step
X=[84.82], Predicted=[0.00077351]
```

Figure 7.4.14: SYY Week 4 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 20ms/step
X=[86.01], Predicted=[-0.00053247]
```

Figure 7.4.15: SYY Week 4 Thursday Night Prediction for Friday

```
1/1 [=====] - 0s 27ms/step
X=[86.15], Predicted=[0.00078564]
```

Figure 7.4.16: SYY Week 4 Friday Night Prediction for Week 5 Monday

Table 7.4.4: SYY Week 4 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/05	85	85.2	85.29	85.29	0	0.00006	Y	N	N
07/06	85	84.82	85.29	85.29	0	0.0007	-	N	Y
07/07	85	86.01	85.29	86.01	0.72	-0.0005	-	Y	N
07/08	86	86.15	86.15	86.15	0	0.0007	Y		

7.5 Week 5

TSLA had a perfect run this week, getting all 5 predictions correct, as shown by Figure 7.4.4: TSLA Week 4 Friday Night Prediction for Week 5 Monday, Figure 7.5.1: TSLA Week 5 Monday Night Prediction for Tuesday, Figure 7.5.2: TSLA Week 5 Tuesday Night Prediction for Wednesday, Figure 7.5.3: TSLA Week 5 Wednesday Night Prediction for Thursday, and Figure 7.5.4: TSLA Week 5 Thursday Night Prediction for Friday as well as Table 7.5.1: TSLA Week 5 Neural Network Predictions. Overall, the strategy bought once and sold once on Tuesday and Friday, respectively. This netted the strategy a gain of 20.99 (+2.9%). This sale brings the total profit for TSLA over the entire simulation up to 102.75. The neural network also predicted a fall between Friday night and Monday of Week 6, as shown by Figure 7.5.5: TSLA Week 5 Friday Night Prediction for Week 6 Monday.

```
1/1 [=====] - 0s 64ms/step
X=[703.03], Predicted=[-0.00218103]
```

Figure 7.5.1: TSLA Week 5 Monday Night Prediction for Tuesday

```
1/1 [=====] - 0s 11ms/step
X=[699.21], Predicted=[0.01963444]
```

Figure 7.5.2: TSLA Week 5 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 18ms/step
X=[711.12], Predicted=[0.00678263]
```

Figure 7.5.3: TSLA Week 5 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 125ms/step
X=[714.93], Predicted=[0.00681897]
```

Figure 7.5.4: TSLA Week 5 Thursday Night Prediction for Friday

```
1/1 [=====] - 0s 98ms/step
X=[720.2], Predicted=[-0.01253125]
```

Figure 7.5.5: TSLA Week 5 Friday Night Prediction for Week 6 Monday

Table 7.5.1: TSLA Week 5 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/11	756.11	703.03	752.29	752.29	0.00	-0.0022	N	-	Y
07/12	710.29	699.21	699.21	699.21	0.00	0.0196	Y	-	Y
07/13	676.74	711.12	699.21	699.21	0.00	0.0068	-	N	Y
07/14	704.59	714.93	699.21	699.21	0.00	0.0068	-	N	Y
07/15	721.21	720.2	699.21	720.2	20.99	-0.0125	-	Y	

NFLX also did well this week, with correct prediction on Week 4 Friday, Monday, Tuesday, and Wednesday, as seen by Figure 7.4.8: NFLX Week 4 Friday Night Prediction for Week 5 Monday, 7.5.6: NFLX Week 5 Monday Night Prediction for Tuesday, Figure 7.5.7: NFLX Week 5 Tuesday Night Prediction for Wednesday, and Figure 7.5.8: NFLX Week 5 Wednesday Night Prediction for Thursday. The neural network did predict a fall between Thursday and Friday, as shown by Figure 7.5.9: NFLX Week 5 Thursday Night Prediction for Friday, which brought this week's only incorrect prediction. Overall, the strategy this week bought once and sold once for a total gain of 2.12 (+1.2%), bringing the total for the entire simulation to 14.78.

```
1/1 [=====] - 0s 54ms/step
X=[177.34], Predicted=[-0.00555376]
```

Figure 7.5.6: NFLX Week 5 Monday Night Prediction for Tuesday

```
1/1 [=====] - 0s 17ms/step
X=[174.45], Predicted=[0.00162068]
```

Figure 7.5.7: NFLX Week 5 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 20ms/step
X=[114.33], Predicted=[-0.00358047]
```

Figure 7.5.8: NFLX Week 5 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 97ms/step
X=[174.78], Predicted=[-0.00214064]
```

Figure 7.5.9: NFLX Week 5 Thursday Night Prediction for Friday

```
1/1 [=====] - 0s 67ms/step
X=[189.11], Predicted=[-0.00083079]
```

Figure 7.5.10: NFLX Week 5 Friday Night Prediction for Week 6 Monday

Table 7.5.2: NFLX Week 5 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/11	184.73	177.34	186.98	186.98	0	-0.0056	N	-	Y
07/12	177.34	174.45	174.45	174.45	0	0.0016	Y	-	Y
07/13	170.98	176.56	174.45	176.56	2.11	-0.0036	-	Y	Y
07/14	175.56	174.78	176.56	176.56	0	-0.0021	N	-	N
07/15	175.68	189.11	176.56	176.56	0	-0.0008	N	-	

LOW had a tough week, with only two out of five correct predictions on Monday and Tuesday, shown by Figure 7.4.12: LOW Week 4 Friday Night Prediction for Week 5 Monday, Figure 7.5.11: LOW Week 5 Monday Night Prediction for Tuesday, 7.5.12: LOW Week 5 Tuesday Night Prediction for Wednesday, 7.5.13: LOW Week 5 Wednesday Night Prediction for Thursday, and 7.5.14: LOW Week 5 Thursday Night Prediction for Friday. Despite this, the strategy made a profit this week, selling once and buying once as shown by Table 7.5.3: LOW Week 5 Neural Network Predictions. Going into Week 6, the strategy is holding onto a share of LOW, so any gains or losses from that will be reflected next week. This week did still bring the strategy a gain of 7.24 (+3.9%), with the total for the entire simulation also being 7.24.

1/1 [=====] - 0s 112ms/step
 X=[180.1], Predicted=[0.00097706]

Figure 7.5.11: LOW Week 5 Monday Night Prediction for Tuesday

1/1 [=====] - 0s 83ms/step
 X=[181.12], Predicted=[0.00259381]

Figure 7.5.12: LOW Week 5 Tuesday Night Prediction for Wednesday

1/1 [=====] - 0s 19ms/step
 X=[182.33], Predicted=[-0.01301246]

Figure 7.5.13: LOW Week 5 Wednesday Night Prediction for Thursday

1/1 [=====] - 0s 119ms/step
 X=[182.61], Predicted=[-0.00688045]

Figure 7.5.14: LOW Week 5 Thursday Night Prediction for Friday

1/1 [=====] - 0s 89ms/step
 X=[185], Predicted=[0.00264938]

Figure 7.5.15: LOW Week 5 Friday Night Prediction for Week 6 Monday

Table 7.5.3: LOW Week 5 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/11	181.22	180.1	175.05	175.05	0	0.0010	-	N	Y
07/12	181.99	181.12	175.05	175.05	0	0.0026	-	N	Y
07/13	178.24	182.33	175.05	182.33	7.28	-0.0130	-	Y	N
07/14	179.41	182.61	182.33	182.33	0	-0.0069	N	-	N
07/15	185.79	185	185	185	0	0.0026	Y	-	

SYX also had a rough week of predictions, only predicting two out of five days correctly as shown by Figure 7.4.16: SYX Week 4 Friday Night Prediction for Week 5 Monday, Figure 7.5.16: SYX Week 5 Monday Night Prediction for Tuesday, Figure 7.5.17: SYX Week 5 Tuesday Night Prediction for Wednesday, Figure 7.5.18: SYX Week 5 Wednesday Night Prediction for Thursday, and Figure 7.5.19: SYX Week 5 Thursday Night Prediction for Friday,

as well as Table 7.5.4: SY Y Neural Network Predictions. Nevertheless, the strategy sold once for a meager profit of 0.20 (+0.2%), bringing the total for the entire simulation to +0.92.

```
1/1 [=====] - 0s 59ms/step
X=[86.35], Predicted=[-0.00163328]
```

Figure 7.5.16: SY Y Week 5 Monday Night Prediction for Tuesday

```
1/1 [=====] - 0s 26ms/step
X=[86.45], Predicted=[-0.0005352]
```

Figure 7.5.17: SY Y Week 5 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 20ms/step
X=[86.27], Predicted=[-0.01106679]
```

Figure 7.5.18: SY Y Week 5 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 44ms/step
X=[86.73], Predicted=[-0.00182014]
```

Figure 7.5.19: SY Y Week 5 Thursday Night Prediction for Friday

```
1/1 [=====] - 0s 28ms/step
X=[87.62], Predicted=[-0.00237406]
```

Figure 7.5.20: SY Y Week 5 Friday Night Prediction for Week 6 Monday

Table 7.5.4: SY Y Week 5 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/11	85.84	86.35	86.15	86.35	0.2	-0.0016	-	Y	N
07/12	86.32	86.45	86.35	86.35	0	-0.0005	N	-	Y
07/13	85.49	86.27	86.35	86.35	0	-0.0111	N	-	N
07/14	85.09	86.73	86.35	86.35	0	-0.0018	N	-	N
07/15	88.03	87.62	86.35	86.35	0	-0.0024	N	-	

7.6 Week 6

TSLA had a perfect week this week, with 4 out of 4 correct predictions from the neural network, as shown by Figure 7.6.1: TSLA Week 6 Monday Night Prediction for Tuesday, Figure 7.6.2: TSLA Week 6 Tuesday Night Prediction for Wednesday, Figure 7.6.3: TSLA Week 6 Wednesday Night Prediction for Thursday, and Figure 7.6.4: TSLA Week 6 Thursday Night Prediction for Friday. TSLA stock only rose this week, from 721.64 to 816.73 to round out the week.

```
1/1 [=====] - 0s 85ms/step
X=[721.64], Predicted=[0.00154814]
```

Figure 7.6.1: TSLA Week 6 Monday Night Prediction for Tuesday

```
1/1 [=====] - 0s 23ms/step
X=[736.59], Predicted=[0.00481134]
```

Figure 7.6.2: TSLA Week 6 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 19ms/step
X=[742.5], Predicted=[0.0015929]
```

Figure 7.6.3: TSLA Week 6 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 34ms/step
X=[815.12], Predicted=[0.01264297]
```

Figure 7.6.4: TSLA Week 6 Thursday Night Prediction for Friday

Table 7.6.1: TSLA Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/18	734.15	721.64	721.64	721.64	0.00	0.0015	Y	-	Y
07/19	735	736.59	721.64	721.64	0.00	0.0048	-	N	Y
07/20	740.2	742.5	721.64	721.64	0.00	0.0016	-	N	Y
07/21	765	815.12	721.64	721.64	0.00	0.0126	-	N	Y
07/22	829	816.73	721.64	816.73	95.09	-	-	Y	-

NFLX also had an amazing week, with all its predictions turning true. The neural network predicted four days of rising, and the stock did just that, as shown by Figure 7.6.5: NFLX Week 6 Monday Night Prediction for Tuesday, Figure 7.6.6: NFLX Week 6 Tuesday Night Prediction for Wednesday, Figure 7.6.7: NFLX Week 6 Wednesday Night Prediction for Thursday, and Figure 7.6.8: NFLX Week 6 Thursday Night Prediction for Friday.

```
1/1 [=====] - 0s 37ms/step
X=[190.92], Predicted=[7.249694e-05]
```

Figure 7.6.5: NFLX Week 6 Monday Night Prediction for Tuesday

```
1/1 [=====] - 0s 33ms/step
X=[201.63], Predicted=[0.00133807]
```

Figure 7.6.6: NFLX Week 6 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 25ms/step
X=[216.44], Predicted=[0.00143635]
```

Figure 7.6.7: NFLX Week 6 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 27ms/step
X=[223.38], Predicted=[-0.00024014]
```

Figure 7.6.8: NFLX Week 6 Thursday Night Prediction for Friday

Table 7.6.2: NFLX Week 6 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
07/18	192.72	190.92	190.92	190.92	0	0.0007	Y	-	Y
07/19	193.02	201.63	190.92	190.92	0	0.0013	-	N	Y
07/20	208.07	216.44	190.92	190.92	0	0.0014	-	N	Y
07/21	214.09	223.38	190.92	223.38	32.46	-0.0002	-	Y	Y
07/22	222.38	220.44	223.38	223.38	0	-	N	-	-

LOW also had a perfect week this week for predictions. The neural network predicted three days of rising, shown by 7.6.9: LOW Week 6 Monday Night Prediction for Tuesday, Figure 7.6.10: LOW Week 6 Tuesday Night Prediction for Wednesday, and Figure 7.6.11: LOW Week 6 Wednesday Night Prediction for Thursday. The neural network then correctly predicted

a fall from Thursday night into Friday, as shown by Figure 7.6.12: LOW Week 6 Thursday Night Prediction for Friday, where the stock dropped from 223.38 to 220.44. This decision ultimately was a great prediction, as the simulation then ended the next day, and the neural network strategy would have had to sell at the lower price.

```
1/1 [=====] - 0s 25ms/step
X=[185.73], Predicted=[0.00226246]
```

Figure 7.6.9: LOW Week 6 Monday Night Prediction for Tuesday

```
1/1 [=====] - 0s 30ms/step
X=[188.7], Predicted=[-0.00689594]
```

Figure 7.6.10: LOW Week 6 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 127ms/step
X=[190.99], Predicted=[0.0007424]
```

Figure 7.6.11: LOW Week 6 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 23ms/step
X=[193.59], Predicted=[0.0023582]
```

Figure 7.6.12: LOW Week 6 Thursday Night Prediction for Friday

Table 7.6.3: LOW Week 6 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
7/18	186.61	185.73	185	185	0	0.0022	-	N	Y
7/19	187.25	188.7	185	188.7	3.7	-0.0069	-	Y	N
7/20	188.39	190.99	190.99	190.99	0	0.0007	Y	-	Y
7/21	191.24	193.59	190.99	190.99	0	0.0024	-	N	Y
7/22	194.82	195.67	190.99	195.67	4.68	-	-	Y	-

SYX was the only neural network this week that did not have all predictions correct. For the first three days this week, the neural network correctly predicted the rise, rise, and fall of SYX stock, as shown by Figure 7.6.13: SYX Week 6 Monday Night Prediction for Tuesday, Figure 7.6.14: SYX Week 6 Tuesday Night Prediction for Wednesday, and Figure 7.6.15, SYX Week 6 Wednesday Night Prediction for Thursday. Sadly, Thursday night's prediction was for

SYY to rise, where the stock fell from 86.92 to 86.86, as shown by Figure 7.6.16: SYY Week 6 Thursday Night Prediction for Friday.

```
1/1 [=====] - 0s 31ms/step
X=[86.34], Predicted=[0.00118828]
```

Figure 7.6.13: SYY Week 6 Monday Night Prediction for Tuesday

```
1/1 [=====] - 0s 29ms/step
X=[87.36], Predicted=[0.00094415]
```

Figure 7.6.14: SYY Week 6 Tuesday Night Prediction for Wednesday

```
1/1 [=====] - 0s 22ms/step
X=[88.23], Predicted=[-0.00011104]
```

Figure 7.6.15: SYY Week 6 Wednesday Night Prediction for Thursday

```
1/1 [=====] - 0s 39ms/step
X=[86.92], Predicted=[0.00053731]
```

Figure 7.6.16: SYY Week 6 Thursday Night Prediction for Friday

Table 7.6.4: SYY Week 6 Neural Network Predictions

	Price Start	Price End	NN Start	NN End	Change	NN Value	Bought?	Sold?	Correct?
7/18	88.18	86.34	86.34	86.34	0	0.0012	Y	-	Y
7/19	87.3	87.36	86.34	86.34	0	0.0009	-	N	Y
7/20	87.73	88.23	86.34	88.23	1.89	-0.0001	-	Y	Y
7/21	87.84	86.92	86.92	86.92	0	0.0005	Y	-	N
7/22	87.08	86.86	86.92	86.86	-0.06	-	-	Y	-

8. Conclusion

8.1 Day Trading Conclusions

Week 1 was profitable for day trading, with a total profit of 52.08 and a total loss of 48.95, ending out at 3.13 for the week. Week 2 was even better, with a total profit of 66.43 and a total loss of 8.66, ending out at 57.77 for the week. Week 3 was rough for day trading, with a total profit of 1.10 and a total loss of 55.33, ending out at -54.23 for the week. Week 4 added three new stocks to trade using day trading, giving a profit of 114.85 and a total loss of 3.29, ending the week at 111.56. Week 5 had big gains and losses, with a profit of 74.08 and a loss of 79.42, ending out at -5.34 for the week. Week 6 had big gains and small losses for day trading, with a profit of 86.33 and a loss of 30.62, ending out at 55.71 for the week.

8.2 Position Trading Conclusions

Week 1 was not a great start for week-long position trading, with a loss of 17.68 for the week. Week 2 was profitable for week-long position trading, with a profit of 62.96 for the week. Week 3 was dismal for week-long position trading, with a loss of 66.29 for the week. Week 4, with the addition of three new stocks, was profitable for week-long position trading, with a total profit of 102.15 and no loss, ending out at 102.15 for the week. Week 5 was sub-par for week-long position trading, with a total profit of 9.94 and a total loss of 35.91, ending out at -25.97 for the week. Week 6 was profitable for week-long position trading, with a total profit of 63.92 and a total loss of 1.32, ending out at 62.60 for the week.

Weeks 1-3 was profitable for simulation-long position trading, with a total gain of 31.51. N.B., I did not sell the TSLA stock after three weeks and re-buy it at the start of Week 4. This number is purely theoretical as to split this metric into two to see before the addition of the three other stocks in Weeks 4-6 as compared to after. Weeks 4-6 added three new stocks was profitable for simulation-long position trading, with a total profit of 215.26 and no loss, ending

out at 215.26 for the last weeks of the simulation. Additionally, the numbers reported for Weeks 4-6 do not include the numbers for Weeks 1-3. The full amounts for the entire simulation will be reported on in 8.4: Overall Conclusions.

8.3 Neural Network Conclusions

Week 1 was great for neural network trading, with a profit of 42.02 and no loss, ending out at 42.02 for the week. Week 2 had all negative predictions for neural network trading, meaning no stock was sold for no profits. Week 3 was not great for neural network trading, with no profit and a loss of 39.13, ending out at -39.13 for the week. Week 4 had big gains for neural network trading, with a profit of 92.26 and no loss, ending out at 92.26 for the week. Week 5 was a wonderful week for neural network trading, with a profit of 30.58 and no loss, ending out at 30.58 for the week. Week 6 had a profitable week for neural network trading, with a profit of 137.82 and a loss of -0.06, ending out at 137.76 for the week.

The neural network predicting TSLA made 21 correct predictions and 6 incorrect predictions. The NFLX neural network made 10 correct and 3 incorrect predictions. The LOW neural network made 8 correct and 5 incorrect predictions. The SYE neural network made 7 correct and 6 incorrect predictions. Overall, the neural networks made 46 correct predictions and 20 incorrect predictions, a success rate of 70.0%, which is much better than blindly guessing whether the stock price will rise or fall.

8.4 Overall Conclusions

Overall, day trading made 168.60. Of this, TSLA was 106.88 of it, gaining 15.08% of its average value over the simulation. NFLX was another 44.85 of it, gaining 23.53% of its average value over the simulation. LOW was 16.22 of it, gaining 8.80% of its average value over the simulation. SYE was 0.65 of it, gaining 0.75% of its average value over the simulation.

Overall, weekly position trading made 173.21. Of this, TSLA was 109.61 of it, gaining 15.46% of its average value over the simulation. NFLX was another 42.94 of it, gaining 22.53% of its average value over the simulation. LOW was 19.34 of it, gaining 10.50% of its average value over the simulation. SYY was the final 1.32 of it, gaining 1.53% of its average value over the simulation.

Overall, simulation-long position trading made 246,77. Of this TSLA was 180.28 of it, gaining 25.44% of its average value over the simulation. NFLX was 44.30 of it, gaining 23.24% of its average value over the simulation. LOW was 20.62 of it, gaining 11.19% of its average value over the simulation. SYY was the last 1.57 of it, gaining 1.81% of its average value over the simulation.

Overall, neural network trading made 263.49. Of this, TSLA was 197.84 of it, gaining 27.92% of its average value over the simulation. NFLX was 47.24 of it, gaining 24.78% of its average value over the simulation. LOW was 15.66 of it, gaining 8.50% of its average value over the simulation. SYY was 2.75 of it, gaining 3.18% of its average value over the simulation.

The worst-performing trading strategy was day trading. This strategy only gained 48.64% of its value over all the stocks, averaging out to 12.04% for each stock. Next was the week-long position trading strategy. This strategy gained 50.02% of its value over all the stocks, averaging out to 12.51% for each stock. In second place was the simulation-long position trading strategy. This strategy gained 61.69% of its value over all the stocks, averaging out to 15.42% for each stock. Best of all was the neural network trading strategy, which gained 64.38% of its value over all the stocks, averaging out to 16.10% for each stock. This data proves that my neural network is more effective at predicting stock rise and fall than the other fixed strategies that I simulated. Additionally, over the simulation, S&P 500 only gained 5.65% of its value; this means that all trading strategies in the simulation beat the market.

8.5 Final Thoughts

I thoroughly enjoyed this project. I liked how I was able to incorporate Data Science topics and my field of expertise into this project with the neural network. The neural network, in itself, was a great learning experience, as it is one of the more advanced topics in Data Science and I had never made one before in any of my classes. Learning to create a neural network on my own was a wonderful experience and I feel as though I have a greater understanding of neural networks and advanced machine learning techniques because of it than I would have if I had just done it as a small group project in a class. Additionally, I enjoyed learning the Python package TensorFlow 2, which is universally used in the real world and gives me a leg up to getting a job in a Data Science field.

Having done this project, something I would change for next time is I would start with more stocks from Week 1. Having to add extra stocks halfway through the simulation has the effect, in my opinion, of creating two simulations, one of the first three weeks and one of the last three weeks when all four stocks were traded. Another thing I would change if I were to do this again is allow the stocks to buy more than one stock (up to a hard capital limit). This would allow the lower-priced stocks, such as *SY*, to see as big of theoretical gains as the higher-priced stocks, such as *TSLA*. Because I did not do this in my first simulation, I am only able to compare percentages and allowing for multiple stock options to be purchased means that the simulation gets more complex and realistic.

References

- [1]. <https://www.investopedia.com/terms/w/windowdressing.asp>
- [2]. <https://smartasset.com/investing/consumer-price-index-definition>
- [3]. <https://www.investopedia.com/articles/07/stock-exchange-history.asp>
- [4]. https://www.google.com/books/edition/The_World_s_First_Stock_Exchange/V8fbAgAAQBAJ?hl=en&gbpv=1&printsec=frontcover
- [5]. <https://www.sofi.com/learn/content/history-of-the-stock-market/#:~:text=The%20first%20modern%20stock%20trading%20was%20created%20in%20Amsterdam%20when,Amsterdam%20stock%20exchange%20was%20created.>
- [6]. <https://www.nasdaq.com/market-activity/stocks/tsla/historical>
- [7]. <https://elitedatascience.com/keras-tutorial-deep-learning-in-python>
- [8]. <https://www.quora.com/How-does-the-dropout-method-work-in-deep-learning-And-why-is-it-claimed-to-be-an-effective-trick-to-improve-your-network>
- [9]. <https://github.com/titu1994/Keras-IndRNN>
- [10]. https://github.com/Sunnydreamrain/IndRNN_Theano_Lasagne
- [11]. <https://machinelearningmastery.com/how-to-make-classification-and-regression-predictions-for-deep-learning-models-in-keras/>

Appendices

Basic Model:

```
from keras.layers import Dense, Activation
from keras.models import Sequential
import numpy as np
x = np.array([[0,0], [0,1], [1,0], [1,1]]) #sample data
y = np.array([[0], [1], [1], [0]])
model = Sequential()
model.add(Dense(2, input_shape=(2,)))
model.add(Activation('sigmoid'))
model.add(Dense(1))
model.add(Activation('sigmoid'))
model.compile(loss='mean_squared_error', optimizer='sgd', metrics=['accuracy'])
model.summary()
```

Final Working Neural Network Model:

```
from keras.layers import Dense
from numpy import loadtxt, array
from scikeras.wrappers import KerasClassifier, KerasRegressor
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import KFold
from sklearn.preprocessing import StandardScaler
from sklearn.pipeline import Pipeline
from tensorflow.keras.layers import BatchNormalization
```

```
stock_train = loadtxt("TSLA_Close_Open_Training.csv", delimiter=',')
X = stock_train[:,0:1]
Y = stock_train[:,1]
stock_test = loadtxt("TSLA_Close_Open_Testing.csv", delimiter=',')
x_test = stock_test[:,0:1]
y_test = stock_test[:,1]
print("Done with load")
l_model = Sequential()
l_model.add(Dense(50, input_dim=1, kernel_initializer='normal', activation = 'relu'))
l_model.add(Dense(27, kernel_initializer='normal', activation='relu'))
l_model.add(Dense(13, kernel_initializer='normal', activation='relu'))
l_model.add(Dense(6, kernel_initializer='normal', activation='relu'))
l_model.add(Dense(1, kernel_initializer='normal'))
l_model.compile(loss='mean_squared_error', optimizer='adam')
print("Done with model construction")
estimators = []
estimators.append(('standardize', StandardScaler()))
estimators.append(('mlp', KerasRegressor(model=l_model, epochs=50,
batch_size=5,verbose=0)))
pipeline = Pipeline(estimators)
kfold = KFold(n_splits=10)
results = cross_val_score(pipeline, X, Y, cv=kfold)
print("Standardized: %.2f (%.2f) MSE" % (results.mean(), results.std()))
print("")
```

```
Xnew = array([[650.28]]) #Number To Predict  
ynew = l_model.predict(Xnew)  
print("X=%s, Predicted=%s" % (Xnew[0], ynew[0]))
```

9.4