# Report 1
## Algorithm Trading

## Texas A&M University

[redacted]

*"On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work."*

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## The Stock Market

From the early ages of the 12th century, the French were trading the debts of households with each other. Something that seemed frowned upon and controversial back then has become one of the biggest contributions in the 21st century economy in the forms of credit cards, house ownership, and the world of the stock market. These first brokers in 12th century France planted the seeds of our modern stock markets, where billions of shares are bought and sold each day. Managing and completing these unfathomable numbers are too complicated for us, but computers with incredible software can complete these tasks in a fraction of a second.

## High-Frequency Trading

Algorithm trading or High-Frequency Trading (HFT) is a relatively new concept for the American stock market, starting in the 1970's as a fun and experimental procedure in cashing discrepancies from the markets. However, HFT now dominates today's market, making up to 60% of all the 6 billion trades happening each day (Seth, Shobhit). Here is a short example on how this all works.

Imagine a computer with a million dollars to play with. The computer is set up (coded) to have the ability in buying $1,000,000 worth of shares. Within the next second, the $1,000,000 turns into $1,000,100 as the price of the stock goes up by a few $\frac{1}{100}$ of a cent. This measly 0.01% return might not seem like a lot; however, this was all done in a fraction of a second. The computer can now repeat the same process, and if it goes smoothly, continue to buy and re-sell with more capital.

It might not seem like a lot, but if you are able to successfully make a profit each time and exponentially multiply your profits millions of times within a day, you will be able to make money by doing nothing; You can understand why HFT is such a popular strategy. As you can imagine, in order to facilitate these numbers, powerful computers and software is needed. For example, the Citadel (Citadel Securities) located in Chicago, completes approximately 900 million trades a day while only having 40 people sitting in front of their computers (Farrell, Maureen).

## The Coding Behind It All

To give an example of the software and coding behind these trades, a simple yet effective pseudo code is as follows: Buy when the 50-day moving average goes above the 200-day moving average, and sell when the 50-day moving average goes below the 200-day moving average; this predicts the current up or down trend of the individual stock, and can be seen in Figure 1.

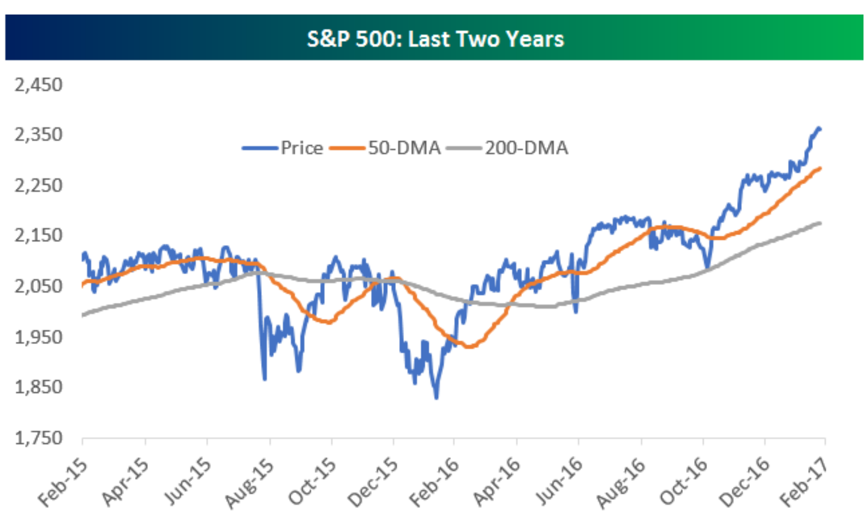
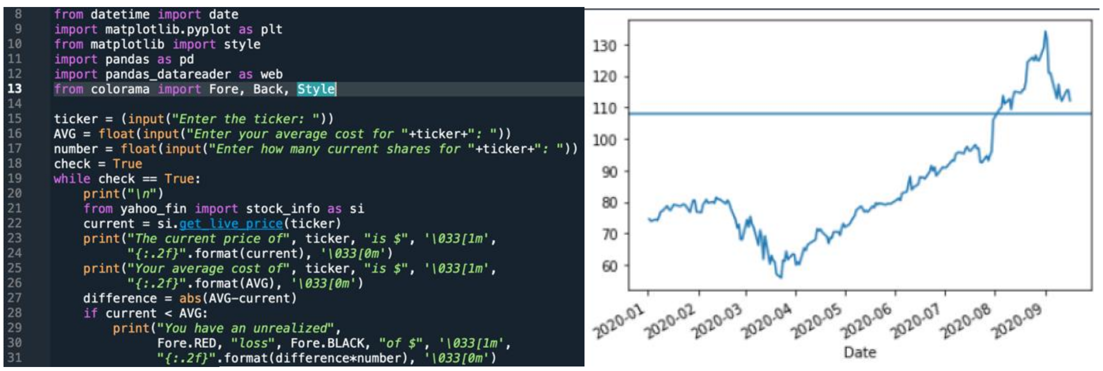



*Figure 1: 50- and 200-day moving averages (Bespoke)*

Learning and starting a journey in algorithmic trading is easy for individuals with coding experience. Popular coding language, Python, is excellent in creating an efficient logic. Both NumPy and Pandas are popular libraries to help coders in Python store, organize, and evaluate data. In Figures 2a and 2b, a short snippet of my personal code is shown that includes around grabbing stock information and graphing them. Anyone with a little background knowledge on how to code can easily pick up on algorithmic trading to some degree.




*Figures 2a, 2b: Personal Python code (Jefferson Lee)*

<u>Why Isn’t Everyone Doing It?</u>

However, these supersonic rides are not as secure and safe as the regular trades that individuals make themselves. Imagine buying a million shares that you expect to resell for a few thousand dollars after half a second, but instead of the price increasing, it drops, drops, and drops. While your supercomputer is struggling to find a point to eke out a profit, your next-door neighbor in wall street is also holding a few millions shares looking to make a slight profit. With all the computers waiting and holding the millions of shares, the coded algorithm might attempt to cut their losses, thus selling millions and millions of shares out of thin air. The spike in supply without any extra incentive of demand will shift the price to crash. This exact scenario happened during the “2010 flash crash” as seen in Figure 3. In the middle of May 6th, 2010, the overall market dropped nearly 9% of its value in a few minutes, and within half an hour it recovered back; it was almost like nothing had happened (Rooney, Ben).


*Figure 3: The "Flash Crash" (Ben Rooney CNN)*

However, with greater research, development, and safety implementations, HFT will likely continue the revolution and set the precedent of trading of big company and firms. As big firms have access to secure connections and massive amounts of purchasing power, HFT allows for quick profits. Money is something that is so loosely attached to what our day-to-day lives expects it to be – money is constantly flowing around us at the speed of light without anyone knowing; it is scary to think of how easily money can just appear and disappear out of thin air. Is money even have a value?

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