**What is Algorithmic Trading?**

**A Brief Introduction to Modern Market Mechanics**



This is Santorini, an island possessed with effortless beauty in Greece. However, this beauty can only be spotted on the top of the island. Imagine that you arrived at the island by ferry and rode up its meandering hill roads by car to reach the island peak. The drive up the Santorini hill relevantly mimics a trading system at work under various market conditions.

To illustrate this trading system, we picture a scenario demonstrating the market price location and entry/exit timing.

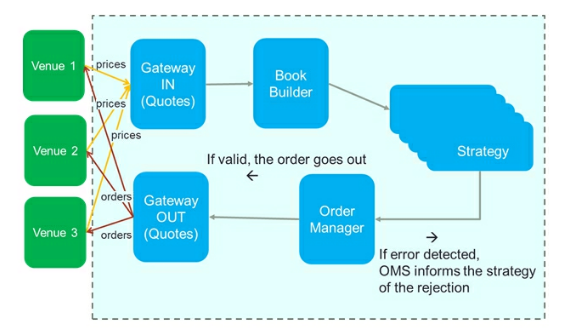
It is a sunny day on Santorini (one when Zeus is feeling jolly, perhaps), which represents a bullish market condition. Tourists, who are traders in this case, crowded onto the island and ride up the hill with you (going long for profits). When enough cars overwhelm the hill road, congestions start to form, slowing down car movements. This situation is equivalent to the market being overbought and traders hesitating whether to stick with the rally. This demonstrates the location where the market price is at and how it is oscillating. It has been over an hour, but not much progress has been made up the hill. You became impatient and decided to take the detour. However, the very second you leave the original route, the traffic eases, and cars move swiftly up the hill. You thought you would have better luck on the detour, but it takes you to a dead end instead. This situation is equivalent to a trader exiting the market too early to seek other opportunities and missing sight of the longer-term momentum in price, which in this case is represented by the traffic clearance far up the hill. This demonstrates the timing at which a trader exits a trade in his or her timeframe without considering much about other timeframe opportunities.

Of course, you may also imagine Santorini on a stormy day, which represents a day with a bearish bias, then apply the same story logic to realize the market price location and entry/exit timing.

If you think through the whole narrative, 3 decisions were made based on 3 criteria. In the context of the trading algorithm, your first decision was to enter a long trade because the market condition was bullish (Santorini was sunny); your second decision was to exit the long trade you just placed because the trade has reached its maximum position holding time, or whatever rule(s) you set to exit a trade (you've been stuck in traffic for an hour and did not make much upward progress); your third decision was to look for a new trade because you believe you can find assets with better chances of reaching your profit target (you believe the alternative route can overcome the uphill traffic).

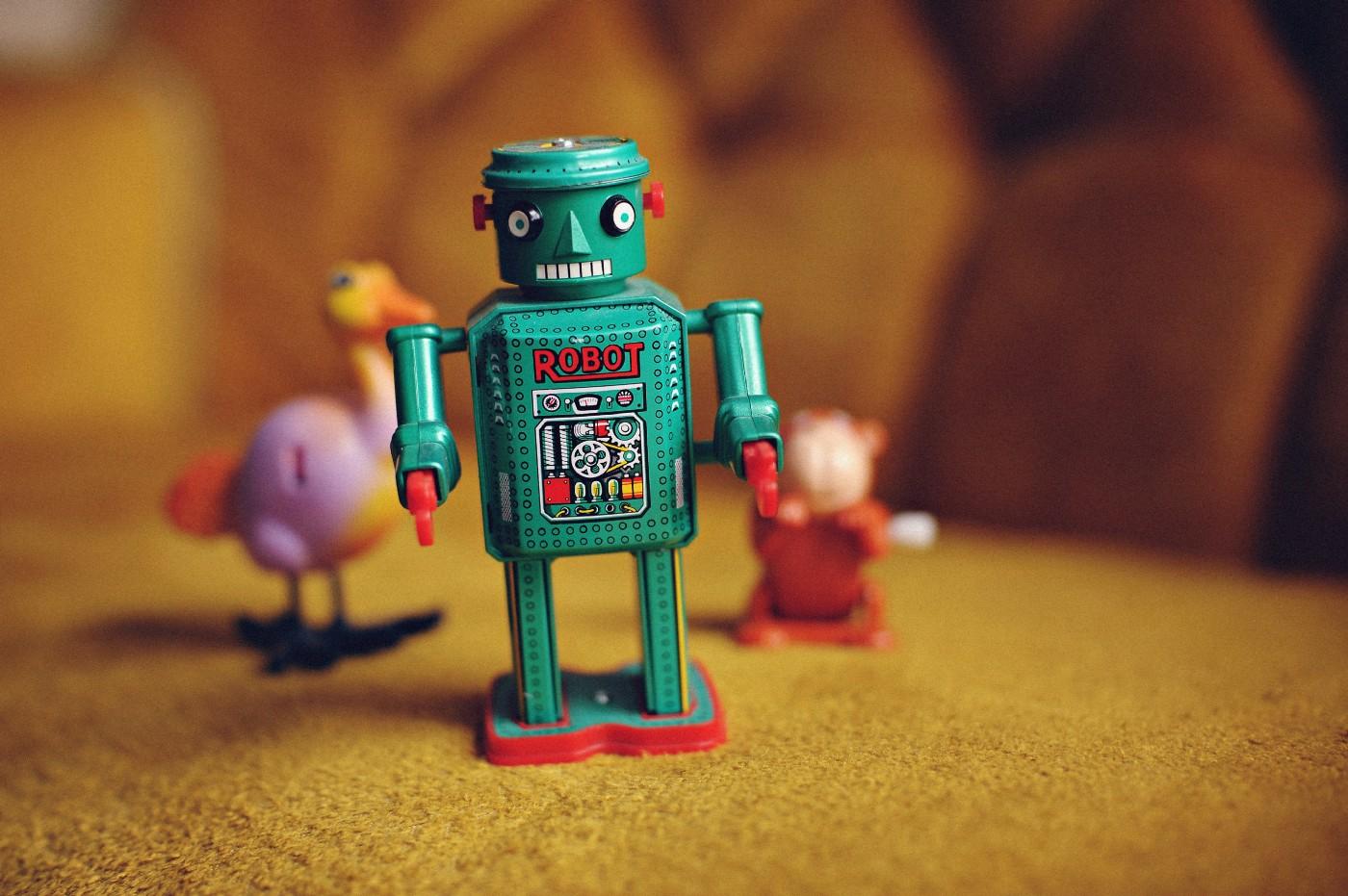
Trading algorithms respect this decision-making scheme and are led by many components to do so.

**Trading System Make-up**:

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These decisions can be made because the trading system was set up in a way that allows for these. However, the function of the system isn't as simple as just making several decisions. In reality, there must be a gateway where price updates are converted from the venues, then transferred to the book builder. The book builder then groups and sorts the prices into bid and ask tables. Based on these data, a trading strategy is formed; a set of user-defined criteria is used to generate trading signals, ones that direct the algorithm to take a long or short position, size an appropriate position, and construct a stop-loss level, and so on. There is also an execution portion of the trading strategy, one responsible for handling responses from the market, for example, what should happen when an order gets rejected. Last but not least, there must be an Order Management System (OMS), where strategy orders are gathered and analyzed upon creation, execution, amendment, cancelation, and rejection.

**Backtesting Trading Algorithms:**

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An algorithm that satisfies the above components can grant you a strict discipline on trading, but neither accuracy nor reliability. Accuracy can be improved by passing strategies through a backtester to calculate metrics and simulate portfolio movements. One backtester is the for-loop backtester that can handle price line by line and produce metrics and trading signals to make conditional decisions. For example, moving averages can be computed to hint at trend movements. Another widely used backtester is an event-driven backtester that reads input data, then based on some derived calculations, generates an event. For example, when volume and time data are passed into the backtester, some statistics identify noon as when the market is the least liquid, an event condition will be in place to ensure the algorithm trades mostly outside noon.

**Doubt of the Benefit:**

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A trading algorithm typically assigns 70-80% of the data to model training, hence 20-30% to backtesting and validation. However, these historical data may not reflect the behaviors of the current market. For instance, who other than the market makers, knows about the Meme stock short squeeze in January 2021 beforehand? Here, we will address the reliability problem.

If the market data played back in historical research is not identical to what is received in live trading strategies, then the signal predictions and performance observed in historical research is not realized in live trading and can kill the profitability of a trading strategy. In this scenario, we might just end up including strategies that appear to be profitable in simulations that do not perform well in the live market and might also miss out on strategies that appear to not be as profitable in simulations but actually perform well in the live market. Such dislocations may be due to the underlying assumptions of trading strategies, unaccounted trading fees, manual intervention, latency issues, and more.

Methods such as adjusting strategy assumptions, isolating backtester bias, treating latencies, and extensive Post-Trade Analytics (PTA) can be done to improve the backtesters' synchrony with the live market. However, like many others, these solutions could only be fleeting because of the ever-changing noise in the live market. For that, I will expect the backtesters to still be deemed unreliable in this era.

**Closing Remarks:**

It is not enough to just be able to set up an algorithmic trading business; it is also mandatory to be able to adapt to all of these possible changing conditions and market risks to continue to stay profitable. This is more difficult than getting a blind one-armed monkey to make you a beef tartare.

Someday, your trading signals will face decay and the statistical relationships in your strategies will break; someday, someone from the trading pool will discover your trading strategy and replace them so they would be obsolete; someday, someone will have more information to trade on than you so you can no longer rely your strategy on the less informed behaviors; someday, maybe you will profit from a few trades using a trading algorithm but then give the profit all back in just one trade.

A successful trading algorithm takes years to build, and then more years to refine. One can be persistent in their research but cannot expect a consistent return from an algorithm. Our views of the market, most importantly, technological ones must stay innovated to adapt to the competing minds in today's market pit.

**References:**

[Link to Sebastien Donadio’s Book](https://www.amazon.com/Learn-Algorithmic-Trading-algorithmic-strategies/dp/178934834X/ref=asc_df_178934834X/?tag=hyprod-20&linkCode=df0&hvadid=385609353592&hvpos=&hvnetw=g&hvrand=16195129689033688721&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9021710&hvtargid=pla-839906058953&psc=1&tag=&ref=&adgrpid=77500930054&hvpone=&hvptwo=&hvadid=385609353592&hvpos=&hvnetw=g&hvrand=16195129689033688721&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9021710&hvtargid=pla-839906058953)