# RSM434 - Initial Pitch

Kelvin Wallace, 1005314964
Algorithm PD3

**Summary of the Case**

The Price Discovery 3 case dealt with the exchange of three securities, being UB, GEM and an ETF consisting of one share of the other two securities. Throughout the simulation, private information was provided to each of the traders with price estimates of the security in the future. East estimate had an attached error equal to a uniform distributed random variable with width proportional to the number of second left in the simulation. This data came in the form of news items that were parsed by the algorithm and then used to generate a range of possible final prices for each security and the ETF.

**Function of the Algorithm**

The Algorithm at its core does a few basic things:

- Parses news items supplied by RIT and extracts the relevant security, price estimate, and tick number
    - This information is used to generate a final minimum price and final maximum price for each security which is stored as a two index list.
    - If an updated news item raises has a higher minimum, or a lower maximum, the values are updated
    - A vector for the minimum and maximum values of the ETF is generated by adding the respective values from the individual securities.
- If a security is trading below the minimum price, the security is bought through limit orders at min until the ask price is greater than the min price.
- If a security is trading above the maximum price, the security is short sold through limit orders at max (or normally sold if a position has already been obtained) until market is less than maximum.
- Additionally, limit orders are placed at the max or min to realize quick purchases if the stock moves outside its max and min ranges.
- ETF Arbitrage:
    - If the price of the ETF is less than the sum of the shares by more than $2, the shares are shorted and the ETF is bought in equal amounts, this is then converted manually.
    - The opposite is done if the ETF is overprices compared to the shares.

**Profit Generation**

This algorithm generated profits by simply aggressively purchasing or shorting shares that were underpriced/overpriced based on private information or realizing ETF arbitrages when available. This algorithm also held all the assets until being forced to close at simulation end unless the asset was shown to be overpriced. The additional edge provided in this strategy was the placing of limit orders on the max and mins of the projected spreads, allowing the algorithm to realize profits quicker and get in more volume while the opportunity was there.

This was considerably less aggressive when dealing with ETF arbitrage because of the manual nature of conversion and some errors that came up and resulted in realizing losses when the spread was close. As such, the algorithm only acted when the gap was wide.

Overall this strategy was profitable, with high variance of returns relating to the quality of private information in providing profitable insight, along with the opportunity for ETF arbitrage and no user error in converting.

Some sample results:

| P&L Overall | Sim Avg | Volume UB | Volume Gem | Volume ETF | Fines |
|---|---|---|---|---|---|
| $25,448 | $17,599.53 | 12,000 | 22,000 | 0 | 0 |
| $330,109.00 | $47,158.43 | 10,000 | 47,500 | 62,000 | 0 |
| $181,914.00 | $26,587.50 | 51,048 | 88,680 | 42,186 | 0 |

**Conclusion and Reflection**

Overall this algorithm was fairly profitable compared to the average trader in each simulation. However, the implementation of the ETF arbitrage component was extremely spotty and opportunities were not realized most likely due to the $2 spread constraint. This is however preferrable to the massive losses incurred when the algorithm to aggressively pursued tighter ETF arbitrage opportunities and did not get them filled properly.

The profitability was also directly tied to the quality of the inside information, as in the $25,488 profit trial, there was limited actionable information and the algorithm traded on slim margins. While in the $330,109 trial, the news items and ETF arbitrage opportunities allowed for the realization of lots of easy profits. Optimizing the ETF Arbitrage component to more easily recognize pricing discrepancies while also being able to more efficiently utilize inside info will be the goal before the final graded run.