

Rotman Online Trading Competition **2021**



Case Package January 23rd, 2021

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Important Information

Practice Servers

Practice servers will be made available starting on December 21st, 2020 and will operate 24 hours a day, 7 days a week until the start of the competition.

Information on how to download and install the RIT v2.0 Client is available on the [RIT website](#).

We will post information on how to login to any server port on our website. Remember that you can type in any username and password and it will automatically create an account if it does not exist. If you have forgotten your password or the username appears to be taken, simply choose a new username and password to create a new account.

Scoring and Ranking Methodology

The Scoring and Ranking Methodology document will be released prior to the start of the competition on the ROTC website.

Schedule and Timeline

The competition is held online and will **start at 2:00 pm on Saturday, January 23rd 2021 and end at 4:00 pm**. It will be run until the number of heats described further in this document is completed. The Finance Lab team will not wait for anyone who is late. Competition Servers will be set up 10 minutes before the start. In the event of a server failure, the case session will be rerun and the scores from that session will not be kept.

Case Summaries

Sales and Trader Case

The Sales and Trader Case challenges participants to put their critical thinking and analytical abilities to the test in an environment that requires them to evaluate the liquidity risk associated with different tender offers. Participants will be faced with multiple tender offers throughout the case. This will require participants to make rapid judgments on the profitability and subsequent execution, or rejection, of each offer. Profits can be generated by taking advantage of price differentials between market prices and prices offered in the tender offers. Once any tender has been accepted, participants should aim to efficiently close out the large positions to maximize returns.

Algorithmic Trading Case

The Algorithmic Trading Case is designed to challenge participants' programming skills as they are required to develop algorithms using RIT API to automate the market-making process and react to changing market conditions. Throughout the case, these algorithms will submit orders to profit from market-making and from any arbitrage opportunities that may arise. Due to the high-frequency nature of the case, participants will have to develop algorithms to adapt to changes in market dynamics.

Sales & Trader Case

Overview

The Sales and Trader Case challenges participants to put their critical thinking and analytical abilities to the test in an environment that requires them to evaluate the liquidity risk associated with different tender offers. Participants will be faced with multiple tender offers throughout the case. This will require participants to make rapid judgments on the profitability and subsequent execution, or rejection, of each offer. Profits can be generated by taking advantage of price differentials between market prices and prices offered in the tender offers. Once any tender has been accepted, participants should aim to efficiently close out the large positions to maximize returns.

Description

The trading session will consist of five, 10-minute heats with each heat independently traded and representing one month of calendar time. Each heat will have a unique objective and could involve up to four securities with different volatility and liquidity characteristics.

| Parameter | Value |
|-------------------------|---------------------------|
| Number of trading heats | 5 |
| Trading time per heat | 600 seconds (10 minutes) |
| Calendar time per heat | 1 month (20 trading days) |

Tender offers will be generated by computerized traders and distributed at random intervals to random participants. Participants must subsequently evaluate the profitability of these tenders when accepting or bidding on them. Order submission using the RIT API will be disabled. Only data retrieval via Real-Time Data (RTD) links or the RIT API will be enabled.

Market Dynamics

There are five heats, each with unique market dynamics and parameters. Potential parameter changes include factors such as spread of tender orders, liquidity, and volatility. Market dynamics and parameter details regarding each heat can be found below, allowing participants to formulate trading strategies.

| Heat 1 | | | | | |
|--------|-------|-------------|---------------|------------|-----------|
| Stock | Price | Commissions | Tender Spread | Volatility | Liquidity |
| MPL | \$15 | \$0.02 | Medium | Medium | Medium |
| TREE | \$30 | \$0.02 | Medium | Low | High |

| Heat 2 | | | | | |
|--------|-------|-------------|---------------|------------|-----------|
| Stock | Price | Commissions | Tender Spread | Volatility | Liquidity |
| YYZ | \$15 | \$0.02 | Medium | Medium | Medium |
| YVR | \$30 | \$0.05 | Large | High | Medium |

| Heat 3 | | | | | |
|--------|-------|-------------|---------------|------------|-----------|
| Stock | Price | Commissions | Tender Spread | Volatility | Liquidity |
| DWHT | \$25 | \$0.05 | Large | Medium | Medium |
| MCHL | \$30 | \$0.02 | Low | Medium | Low |
| CRED | \$40 | \$0.01 | Large | High | High |

| Heat 4 | | | | | |
|--------|-------|-------------|---------------|------------|-----------|
| Stock | Price | Commissions | Tender Spread | Volatility | Liquidity |
| RCK | \$55 | \$0.03 | Medium | Medium | Medium |
| JZZ | \$45 | \$0.02 | Medium | High | High |
| HPHP | \$35 | \$0.02 | Medium | High | Medium |

| Heat 5 | | | | | |
|--------|-------|-------------|---------------|------------|-----------|
| Stock | Price | Commissions | Tender Spread | Volatility | Liquidity |
| LKRS | \$25 | \$0.05 | Medium | Medium | Medium |
| RPTS | \$30 | \$0.05 | Large | Medium | High |
| BCKS | \$20 | \$0.01 | Large | Low | Medium |
| CLPS | \$30 | \$0.02 | Medium | High | Medium |

During each sub-heat, participants will occasionally receive one of three different types of tender offers: private tenders, competitive auctions, and winner-take-all tenders. Tender offers are generated by the server and randomly distributed to random participants at different times. **Each participant will get the same number of tender offers with variations in price and quantity.** No trading commission will be paid on tenders.

Private Tenders are routed to individual participants and are offers to purchase or sell a fixed volume of stock at a fixed price. The tender price is influenced by the current market price.

Competitive Auction offers will be sent to every participant at the same time. Participants will be required to determine a competitive, yet profitable price to submit for a given volume of stock from the auction. Any participant that submits an order that is better than the base-line reserve price (hidden from participants) will automatically have their order filled, regardless of other participants' bids. If accepted, the fills will occur at the price that the participant submits.

Winner-take-all Tenders request participants to submit bids to buy or sell a fixed volume of stock. After all prices have been received, the tender is awarded to the single highest bidder or lowest offer. The winning price however must meet a base-line reserve price. If no offer

meets the reserve price, then the trade will not be awarded to anyone (i.e. if all participants bid \$2.00 for a \$10 stock, nobody will win).

Calculation of the Profit or Loss

The prices generated by the RIT for this case follow a random walk process using a return drawn from a normal distribution with a mean of zero. That is, at any point in the simulation, the probability that the price will go up is equal to the probability that the price will go down. This means that participants cannot predict the future price of the stocks without 'taking a bet'. Therefore, the scoring committee will consider buying (selling) stocks for reasons other than reducing the exposure associated with accepting a tender offer to be equivalent to speculating (taking a bet) on the price movement. These types of trades will be marked as 'speculative trades'.

Participants will have time to think about the offer before they accept it. For example, one may receive a tender offer at time $t = 0$ and will have until $t = 30$ to decide whether to accept. Any trades made by a participant during this time without accepting the tender offer will be considered as 'front-running'¹ since the participant had the advance knowledge of a pending institutional order. The scoring committee will mark these trades as 'front-running trades'.

This case is designed to only reward participants for identifying, accepting, and closing out² tender offer positions at a profit while managing liquidity risk and execution risk. Any other strategy will not be considered. In particular, the total profit of each participant³ will be categorized into two parts: 'profits from tender offers' and 'profit from speculation'; the latter category includes the profits that are a result of either speculative trades or front-running trades.

Profits from tenders are the profits (or losses) gained from efficiently closing out the position from accepted tenders into the market. Profits from speculation are profits (or losses) generated through trades that are not associated with tenders (speculative trades or front-running trades). An 'adjusted P&L' will be calculated based on the following formula:

$$\text{Adjusted P\&L} = \text{Profit From Tenders} + \text{Min}(0, \text{Profit From Speculation})$$

Participants will be **ranked and scored** based on their *Adjusted P&L*.

¹ *Front-running is the unethical and illegal practice of trading a security for your own account while taking advantage of the information contained in the pending orders from your institutional clients.*

² *"Closing out" a position means that a participant is executing a trade that is the opposite of the current position in order to eliminate the exposure.*

³ *Total profit of each participant is the profit (or loss) that you can observe in the RIT at the end of a heat/iteration.*

For example, consider a participant who has made \$10,000 from tenders and \$50,000 from speculation, the total profit is \$60,000 ($= \$10,000 + \$50,000$) but the *Adjusted P&L* will be only \$10,000 [$= \$10,000 + \min(0, \$50,000)$]. Another example, consider a participant who has made \$35,000 from tenders and lost \$20,000 from speculation (*Profit From Speculation* = $-\$20,000$); the total profit is \$15,000 ($\$35,000 - \$20,000$) and it is the same as the *Adjusted P&L* [$\$15,000 = \$35,000 + \min(0, -\$20,000)$]. From the last example, please note that any losses from speculation will still be considered and, therefore, negatively affect your *Adjusted P&L*.

The *Adjusted P&L* will be calculated by the ROTC scoring committee at the end of each heat and will **not be included** in the P&L calculation in RIT. However, participants will be provided with an Excel tool⁴, the 'Performance Evaluation Tool', that will allow them to calculate the *Adjusted P&L*.

Trading Limits and Transaction Costs

Each participant will be subject to gross and net trading limits: the net and gross trading limits for all of the versions are NET 250,000 shares, or GROSS 250,000 shares. The gross trading limit reflects the sum of the absolute values of the long and short positions across all securities, while the net trading limit reflects the sum of long and short positions such that short positions negate any long positions. Trading limits will be strictly enforced and participants will not be able to exceed them.

The maximum trade size will be 25,000 shares, restricting the volume of shares transacted per trade to 25,000.

There is a maximum stop loss of \$1.5 Million per person for each trading heat. If a participant loses more than \$1.5 Million, he/she will be forced to stop trading for the remainder of the heat.

Position Close-Out

Any non-zero position will be closed out at the end of trading based on the last traded price. This includes any long or short position open in any security. Computerized market makers will increase the liquidity in the market towards the end of trading to ensure the closing price cannot be manipulated.

Key Objective

Evaluate the profitability of tender offers by analyzing the market liquidity. Participants will accept the tenders that will generate positive profits while rejecting the others. Submit competitive, yet profitable, bids and offers on above reserve and winner-take-all tenders to maximize potential profits while managing liquidity and market risk. There is a chance that the market may move away from your transactions prices, so maintaining large short or long positions may result in losses. Use a combination of limit, market orders and, marketable limit orders to mitigate any liquidity and price risks from holding open positions.

⁴ The 'Performance Evaluation Tool' is uploaded on the ROTC website.

Algorithmic Trading Case

OVERVIEW

The Algorithmic Trading Case is designed to challenge participants' programming skills since they are required to develop algorithms using RIT API to automate the market-making process and react to changing market conditions. Throughout the case, these algorithms will submit orders to profit from market-making and also from any arbitrage opportunities that may arise. Due to the high-frequency nature of the case, participants will have to develop algorithms to adapt to changes in market dynamics.

DESCRIPTION

There will be five, 5-minute heats with each heat independently traded and representing one day of trading.

| Parameter | Value |
|-------------------------|-------------------------|
| Number of trading heats | 5 |
| Trading time per heat | 300 seconds (5 minutes) |
| Calendar time per heat | 1 day of trading |

All trades must be automatically executed by a trading algorithm. Participants will not be allowed to trade through the RIT Client once the case begins. However, participants are allowed and encouraged to use and modify their algorithms in response to prevailing market conditions and competition from the algorithms of other teams. In addition, there will be 2 minutes in between each sub-heat to alter the algorithms. A base template algorithm will be provided for participants and can be directly modified for use in the competition. Alternatively, participants can create their own algorithms using RIT API.

MARKET DYNAMICS

This case will involve 3 stocks and 1 ETF with varying levels of volatility and liquidity. This dynamic exposes participants to the basics of market microstructure in the context of algorithmic trading. Participants can manage the market price impact of trades and automate market making operations by dividing larger volume orders into smaller trades and submitting pairs of trades electronically. The ETF pricing will reflect the following weighted sum of the 3 stocks traded, subject to periodic shocks to its price.

$$CND = BEAV + 2 * MAPL + 2 * COLD$$

Each participant will be able to trade 4 securities of which the details are shown below.

| Ticker | BEAV | MAPL | COLD | CND |
|--|---------|---------|---------|---------|
| Starting Price | \$15 | \$15 | \$15 | \$75 |
| Fee/share (Market orders) | \$0.01 | \$0.01 | \$0.01 | \$0.02 |
| Rebate/share (Limit/Passive orders) | \$0.005 | \$0.005 | \$0.005 | \$0.015 |
| Max order size | 10,000 | 10,000 | 10,000 | 5,000 |
| Annualized volatility | 26% | 17% | 35% | 16% |
| Liquidity | Medium | High | Low | Medium |
| Type | Stock | Stock | Stock | ETF |

There will be no information provided that will allow participants to predict the future price or direction of any security. A fee-rebate structure will be instituted to compensate participants for the addition of liquidity through limit orders. As such, participants will have the opportunity to generate returns by market making.

TRADING LIMITS AND TRANSACTION COSTS

| Time of Sub-heat (tick) | 0 ~ 240 | 240 ~ 299 | 300 |
|-------------------------|----------------|----------------|-----------|
| Gross/Net | 200,000/50,000 | 100,000/50,000 | 100,000/0 |

Each participant will be subject to gross and net trading limits which will change over each heat. The gross trading limit reflects the sum of the absolute values of the long and short positions across all securities and the net trading limit reflects the sum of long and short positions such that short positions negate any long positions. Trading limits will be strictly enforced and participants will not be able to exceed them. Each position in stock will be counted towards trading limits with a multiplier of 1, while each position in the ETF will be counted with a multiplier of 5 (i.e. if you long 100 shares of any stocks, your gross and the net trading limits will increase by 100. If you long 100 positions of CND, your gross and net trading limits will increase by 500 (100 positions * multiplier of 5).

Participants will be penalized for having a non-zero net position at the end of any individual heat. This penalty will be levied against the final P&L for that heat. The calculation for the penalty is as follows:

$$\text{Penalty} = |\text{Net position}_{t=300}| * \$0.50$$

The maximum trade size will be 10,000 shares for stocks and 5,000 shares for the ETF, restricting the volume of shares transacted per trade to 10,000 shares for stocks and 5,000 shares for the ETF. Transaction fees will be set at \$0.01 per share for stocks and \$0.02 per share for the ETF on all market orders filled. Subsequently, a rebate of \$0.005 per share for stocks and \$0.015 per share for the ETF will be given for all submitted limit orders that are filled. Due to this rebate structure, it is possible for a participant to be profitable after buying and selling a security at the same price, provided that the participant uses limit orders.

POSITION CLOSE-OUT

Any non-zero position in either stock will be closed out at the end of trading based on the last traded price. It is strongly suggested that participants close out their positions prior to the end of trading period as open positions will be subject to the penalty described above.

KEY OBJECTIVE

Edit the template provided and optimize the trading parameters such that the algorithm efficiently balances positions while submitting orders to profit from capturing bid-ask spreads and/or from capturing arbitrage opportunities. Consider rewriting and redesigning the algorithm using your own logic. Since the same template is being provided to all participants, there is a limitation on your ability to differentiate yourself by simply modifying the base template.