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Understanding and Testing Iceberg Algorithmic
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ABSTRACT

As Technology has advanced in recent times, it also has impacted the Trading requirements that modern day traders have. Trading now is not a simple Buy and Sell of a Security, but it is way complex involving complex mathematical algorithms programmed to execute Trades at much faster rates and using different trading strategies, also called Algorithmic Trading strategies. Traders' selection of algorithmic strategy/ order types is a critical decision that significantly influences the execution quality and outcome of trades. In this Paper, we will specifically study one of the commonly used Algorithmic strategy/ order type called Iceberg Order. We will try to understand why Iceberg Orders are required, how they are executed with the help of different examples and what Testing should be done to ensure we deploy a Defect free Iceberg Order Strategy to production. A small issue in execution of trading strategy can result in big losses to the company, regulatory fines and reputational loss. So, Test Scenarios to be considered and testing requirements for Iceberg Orders should consider different scenarios which will be discussed in detail in this paper.

Keywords: *Iceberg Order, Algorithmic Trading, Trading Strategy, Software Testing, Quality Assurance*

I. INTRODUCTION

In the last few decades, Trading on Stocks, Fixed Income, FX and other derivatives has become more and more competitive. To counter the competition and get the best prices from the market, investors have turned to efficient algorithmic trading strategies [1]. Algorithmic trading uses a computer program that follows a defined set of instructions (an algorithm) to place a trade. Trade can generate profits at a speed and frequency that is impossible for a human trader [2]. Algorithmic trading strategies are used in trading environments because they offer speed, efficiency, automation, scalability, reduced costs, access to market data, and risk management capabilities, all of which can contribute to improved trading performance and outcomes. One such Algorithmic Trading Strategy which is commonly used in Trading Environments is Iceberg Strategy, or the Iceberg Orders.

Iceberg Orders is particularly useful for traders looking to execute large trades without revealing the full order size to the market, thus maintaining a stable market price. Placing a large order could unsettle other market participants and lead to price fluctuations. Iceberg orders can be used to reduce the impact that introducing large orders can have on the price.

In this paper we would try to understand in detail about Iceberg Orders, why it is required, advantages and risks associated with Iceberg Orders and finally we will discuss the test scenarios and testing required to fully test Iceberg Orders. Testing Iceberg Orders in the Application before it is released to Production Environment is imperative, so that we do not leave Bugs to Production, which could cause huge losses and potential reputation loss to the company.

II. UNDERSTANDING ICEBERG ORDERS AND WHY IT IS REQUIRED

Consider a situation when an Investor wants to Buy or Sell large volume of a specific Security, larger than a normal volume traded on that security on an Exchange or Trading platform. If the Trader puts a Limit Order on that large volume of Security to be Bought or Sold, it may reveal the investor's motives for trading and may raise suspicion that the originator of the large order may have access to private information and based on that Buy or Sell Order is considered on that Security. Consequently, other market participants may change their own order submission strategy for that Security, which in turn lowers the probability of the large order to be executed at the prespecified limit. The Investor would then be required to choose a less favorable Price of the Security. A possible solution is not to submit one large limit order, but to split the order into several smaller limit orders, which are submitted over time. Splitting a large order to smaller orders released over a period is known as Iceberg Order [3].

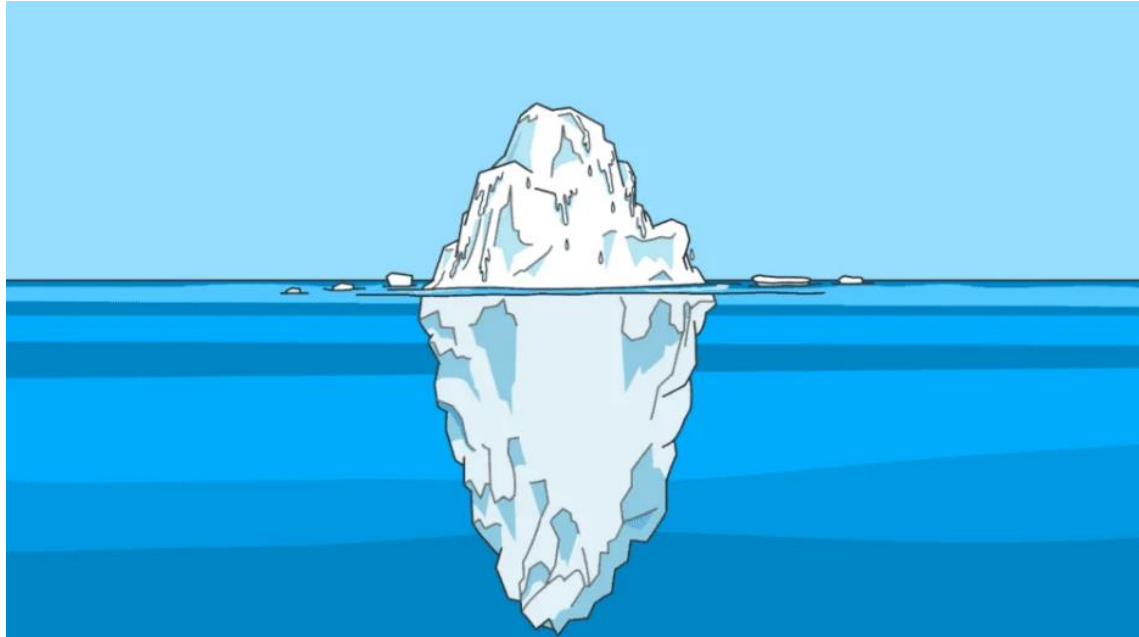


Figure 1: An Iceberg

An iceberg order is also known as "hidden order". It is a large order to buy or sell a security that is divided into smaller, undisclosed quantities, also called Blocks. These smaller orders or the Blocks are released into the market gradually over time, hiding the full size of the order from other market participants.

The purpose of an iceberg order is to avoid impacting the market price of the security by preventing other traders from detecting the full size of the order and adjusting their own trading strategies accordingly [4]. By concealing the true size of the order, the trader can potentially minimize price movements caused by the execution of large trades. They are typically executed using algorithmic trading systems that automatically release portions of the order into the market according to predefined parameters set by the trader [5].

A trader submitting an Iceberg order needs to specify below fields in order to successfully Submit an Iceberg Order:

Total Size: Total Size which Trader/ Investor wants to create Iceberg Order on.

Block Size: Size which will be released to the Market at a time. Block Size is smaller than the Total Size. Block Size can be a Fixed Size released to the Market every time previous order is filled or can be a random Size generated by the computer application. Initially only the Block Size is displayed to the Market and the rest of the order remains hidden.

Price: Price can be Limit Price or Market Price on which Blocks will be executed. If Price is set as Market Price, then the Blocks may be executed at different Prices, depending on the Market Price available at the time Block is available in the Market.

Orders in general disclose the intentions of their Traders. Large trades are more influential on the price and are considered more informed on average, otherwise they wouldn't be large. It is reasonable to follow them or trade on the securities in the same direction. A snapshot or instant state of the market depth doesn't allow detecting Iceberg orders regardless of market data quality. The only way to detect Iceberg orders is by tracking the dynamics of market data. The key for successful Iceberg detection is finding the differences in the sequence of events, comparing it when a regular limit order gets executed vs those when an Iceberg order gets executed.

III. TRADING EXAMPLE OF ICEBERG ORDER

Example: Mr ABC wants to Buy Stock Share of Apple Inc. and has put an Iceberg Order to Buy 100,000 Stocks. There can be different ways different Platforms can use Iceberg Order to be executed.

a) Iceberg Order with Equal Blocks at Market Price

Total Stocks – 100,000

Iceberg Order with Block Size – 20,000

Price - Market Price

In this case, 100,000 Stocks will be executed in the Block Size of 20,000 each at Market Price. So, 5 Trades will be Done of 20,000 each at Market Price to fully execute 100,000 Stocks. Market Price (MP) can be different for each of the Block Size executed.

Let us say, below are the Market Prices when 5 Blocks are Executed:

Table 1: Iceberg Order with equal Block Size

Blocks	Block Size	Market Price
1st Block	20,000	162.25
2nd Block	20,000	162.15
3rd Block	20,000	162.1
4th Block	20,000	162.15
5th Block	20,000	162.2

Overall, Price at which 100,000 Stocks are Executed in this case will be:

$$\frac{\{(20,000 * 162.25) + (20,000 * 162.15) + (20,000 * 162.1) + (20,000 * 162.15) + (20,000 * 162.2)\}}{100,000} = \$162.17$$

b) Iceberg Order with Random Blocks at Limit Price

Total Stocks – 100,000

Iceberg Order with Block Size Range – 10,000 - 20,000

Price - Limit Price of \$160

In this case, 100,000 Stocks will be executed with random Block Size within the range of 10,000 - 20,000 generated by the system at Limit Price of \$160. There could be a different number of smaller Iceberg Orders generated depending on the Block Sizes.

Let us say, below are the random system generated Blocks at Limit Price of \$160:

Table 2: Iceberg Order with different Block Size

Blocks	Block Size	Limit Price
1st Block	12,000	160
2nd Block	14,000	160
3rd Block	20,000	160
4th Block	11,000	160
4th Block	13,000	160
6th Block	20,000	160
7th Block	10,000	160

So, 7 Trades will be created to execute 100,000 Stock Shares at a Limit Price of \$160. Similarly, there could be different Block Sizes generated by the system and in that case the number of Trades required to execute 100,000 Stock Shares could be different.

There could be more variations to Iceberg Strategy with random/ Fixed Block Size and Market/ Limit Orders for the Price.

**Please note that for all the examples provided above, any Brokerage Fees/ Commission charged by Broker/ Trading Platform is not taken into account.*

IV. ADVANTAGES AND LIMITATIONS OF ICEBERG ORDERS

Like every other Algorithmic Trading Strategy, Iceberg Orders offers many advantages, but also has some inherent Risks and limitations. Let us see some of the advantages and limitations associated with using Iceberg Orders [6], [7], [8], [9].

Advantages:

- Market impact is minimum when using Iceberg Orders, especially for larger volume trades. Displaying a portion of size at a time to the Market helps reduce the chances of Prices moving in the Market in any direction because of the large volume of trade influence.
- Iceberg Orders being visible to the Market in smaller Block Sizes, helps traders build anonymity of larger trading requirement on a security. The Market does not come to know that there is huge requirement to Buy or Sell on a certain security.
- Iceberg Orders are broken down to smaller visible portions of Orders and more portions are visible as previous Blocks are executed. So, Iceberg orders contribute to maintaining liquidity in the market.
- Iceberg orders can help reduce slippage by preventing sudden price movements that may occur if the entire size of the order were to be revealed at once. Slippage occurs when the execution price of an order differs from the expected price.
- Iceberg orders provide flexibility in execution, allowing traders to gradually enter or exit large positions without causing disruptions in the market. This flexibility can be particularly beneficial in illiquid markets or when trading large volumes.

Limitations and Risks:

- One of the primary limitations of iceberg orders is the risk of incomplete execution. Since only a portion of the order is visible to the market at a time, there is a possibility that the entire order may not be filled.
- The costs of trading are a fundamental consideration for market participants, impacting investment performance, market efficiency, and overall market dynamics. Some brokers may charge additional fees for executing iceberg orders, which could impact overall trading costs. Traders should evaluate Brokerage Fees being charged additionally for Iceberg Orders and their potential benefits of using the Strategy.
- Traders selecting Iceberg orders adds complexity to the trading process. Traders need to carefully manage the visible and hidden portions of their orders to ensure optimal execution while considering factors such as market conditions, liquidity, etc.
- Iceberg orders are designed to minimize market impact, there is still a risk that other market participants may detect the presence of a hidden order through various means, such as price movements, consistent Block Size being requested in the market. This could lead to adverse price movements as traders attempt to exploit the hidden order.
- Although Iceberg Orders is a common and a popular Trading strategy, but it may not be available on all Trading Platforms/ Exchanges as it has technology and infrastructure requirements. This can limit Trader from using this strategy.

Overall Iceberg Orders has its advantages, but Traders and Investors also need to analyze the Risks and limitations associated with Iceberg Orders to fully take advantage of the Strategy.

V. TESTING ICEBERG ORDERS

Having understood what an Iceberg Order is and why it is used commonly for Trading, now let us see the Testing Requirements for Iceberg orders.

Testing Iceberg Orders involves simulating its behavior in a controlled QA (Quality Assurance) environment to assess their effectiveness and performance. Below are the areas to consider to effectively test Iceberg orders in QA environment [10].

Understanding the functionality to be Tested: Before even start testing the Requirements, it is important that Test Engineer have a clear understanding of the requirement, in this case of how iceberg orders work, including their mechanics, parameters (such as displayed Total Size, Block Size, Limit Order, Market Order and replenishment rate), and potential impact on trading.

Testing Objectives: Is the Iceberg Order being built from scratch on a trading application, or a new Product is being introduced to use already existing Iceberg Strategy in the system, or effectiveness of iceberg orders in minimizing market impact is being tested. The depth and detail of testing will be different in different scenarios. Products being used to test Iceberg Orders. Equity, Fixed Income, FX, and other derivatives may work similarly for Iceberg Orders for the most part but may also have their nuances in trading. So Testing Objectives should be clearly defined.

Testing/ QA Environment: Choose a testing environment that closely resembles real-market conditions and the products being used. Real Market conditions may have Market Prices moving very fast according to different conditions, so Testing/ QA Environment should have some simulators to move the market as desired.

Testing Strategy: Design a testing strategy that outlines the scenarios, parameters, and metrics that will be used to evaluate Iceberg orders. Consider factors such as order size, market volatility, liquidity conditions, and execution speed.

Test Scenario Execution: Run simulations using iceberg order algorithm across various market conditions and scenarios. Test different order sizes, replenishment rates, and trading strategies to assess their impact on execution quality. Test Boundary conditions such as for Randomized Block Size, Block Size remaining for Iceberg Order is less than the Minimum Size for Trading. Perform Performance Testing to ensure larger trade volumes are broken into smaller Block Sizes and initiating number of automatic trades is not impacting the overall system.

Other Test Scenarios that can be considered for Test Execution could be as below:

- **Order Execution Rate:** Test the rate at which the visible portion of the iceberg order gets executed compared to the hidden portion. Vary parameters such as market volatility and order size to observe how these factors affect execution rates.

- **Market Impact:** Evaluate the market impact of iceberg orders by comparing it with standard limit orders. Measure how the iceberg order affects the market price compared to a similar-sized limit order that is fully visible.
- **Visibility Impact:** Test scenarios where the visibility of the iceberg order changes over time. For instance, start with a small visible portion and gradually increase it, or vice versa. Assess how this impacts market behavior and order execution.
- **Order Size Impact:** Evaluate how changing the total order size affects execution performance. Test both large and small iceberg orders to see if there are significant differences in execution rates and market impact.
- **Timing Strategies:** Test different timing strategies for iceberg orders, such as releasing the hidden portion during specific market conditions (e.g., high volume, low volatility) or at certain times of the trading day. Measure the effectiveness of these strategies in achieving optimal execution.
- **Order Placement:** Test the impact of placing iceberg orders at different price levels relative to the current market price. Assess whether placing the order closer or further away from the market price affects execution efficiency.
- **Market Conditions:** Simulate various market conditions, including bull, bear, and sideways markets, to evaluate how iceberg orders perform under different circumstances. Measure execution performance, market impact, and other relevant metrics in each scenario.
- **Risk Management:** Evaluate the risk management implications of iceberg orders, including the potential for order slippage, partial fills, and market reversals.
- **Regulatory Compliance:** Ensure that iceberg orders comply with relevant regulations and exchange rules. Test scenarios to verify that the order execution process adheres to regulatory requirements.

Collect and Analyze Data: Collect data on order execution, market impact, slippage, and other relevant metrics during the testing process. Use this data to evaluate the performance of iceberg orders against your predefined criteria and objectives. Analyze the results of your testing and identify areas for improvement. Iterate on your testing strategy, algorithm parameters, or trading strategies to optimize the performance of iceberg orders based on your findings.

Analyze Results: Document the testing process, results, and insights gained from the analysis. Summarize key findings, lessons learned, and recommendations for using iceberg orders effectively in live trading environments. If possible, validate the effectiveness of iceberg orders in a live trading environment.

By following these steps, you can systematically test iceberg orders and gain valuable insights into their effectiveness and performance in different trading scenarios.

VI. CONCLUSION

The decision to use equal blocks or the random blocks for Iceberg Orders impacts how the trading activity impacts the market. Equal blocks ensure that each piece of the order is of the same size, which can make it easier to manage and predict the impact of each trade. Also, by executing the order in equal-sized blocks, traders can spread the impact of each block trade evenly over time. Whereas, randomly sized blocks can help obscure the trader's intentions, making it harder for other market participants to detect the full size of the order. In highly volatile or unpredictable markets, random block sizes can adapt to changing market conditions. Example, if the market is rapidly moving, varying the size of the order blocks can help in reacting to price fluctuations more dynamically.

It is equally important to test different Iceberg Trading scenarios before rolling out the strategy to Production. Testing of Iceberg Orders effectively with different scenarios also helps traders ensure defect free trading strategy. Algorithmic trading brings together computer software, and financial markets to open and close trades based on programmed code and traders' inputs. Investors and traders can set when they want trades to be bought or sold. Iceberg Order is one such way to execute large Size requirements on Securities without impacting the Market and without having to reveal the full amount. So, Iceberg Orders can attract Big Traders and Financial Institutions who seek liquidity. Iceberg Order can be a great tool to use by financial institutions, if considering limitations and risk into consideration. Overall, Iceberg orders help traders execute large transactions more efficiently while minimizing their market impact.

VII. REFERENCES

- [1] R. Kissell, "Algorithmic trading strategies", Fordham University ProQuest Dissertations Publishing, pp. 17-22, 2006.
- [2] S. Seth. "Basics of Algorithmic Trading: Concepts and Examples" Investopedia.com. Available at: <https://www.investopedia.com/articles/active-trading/101014/basics-algorithmic-trading-concepts-and-examples.asp>
- [3] B. Monch. The Navigation of an Iceberg: The Optimal Use of Hidden Orders. In: Strategic Trading in Illiquid Markets. Lecture Notes in Economics and Mathematical Systems, vol 553. Springer, Berlin, Heidelberg, 2005. https://doi.org/10.1007/3-540-26315-2_4
- [4] M. Taylor. "Iceberg Order: Definition, Identifying Them & Examples" shiftingshares.com. Available at: <https://www.shiftingshares.com/iceberg-order/>
- [5] S. Frey, P. Sandas, "The Impact of Iceberg Orders in Limit Order Books", AFA 2009 San Fransisco Meetings Paper, pp. 1-15, 2009.
- [6] Y. Lokesh, "The Context of Trading: Market Microstructure", International Journal of Multidisciplinary Innovative Research, pp. 344-352, Oct' 2022.

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- [7] T. Lagoarde-Segot, "Financial reforms and time-varying microstructures in emerging equity markets," *J. Bank. Financ.*, 2009, doi: 10.1016/j.jbankfin.2009.01.007.
- [8] A. Mandes, "Microstructure-based order placement in a continuous double auction agent based model," *Algorithmic Financ.*, 2015, doi: 10.3233/AF-150049.
- [9] C. Brummer, "Disruptive technology and securities regulation," *Fordham Law Review*. 2015. doi: 10.2139/ssrn.2546930.
- [10] Raschner, Patrick, Algorithms put to test: Control of algorithms in securities trading through mandatory market simulations? (February 26, 2021). European Banking Institute Working Paper Series 2021 - no. 87, Available at SSRN: <https://ssrn.com/abstract=3807935> or <http://dx.doi.org/10.2139/ssrn.3807935>



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