# ADVANCED COMPUTING

Exchange

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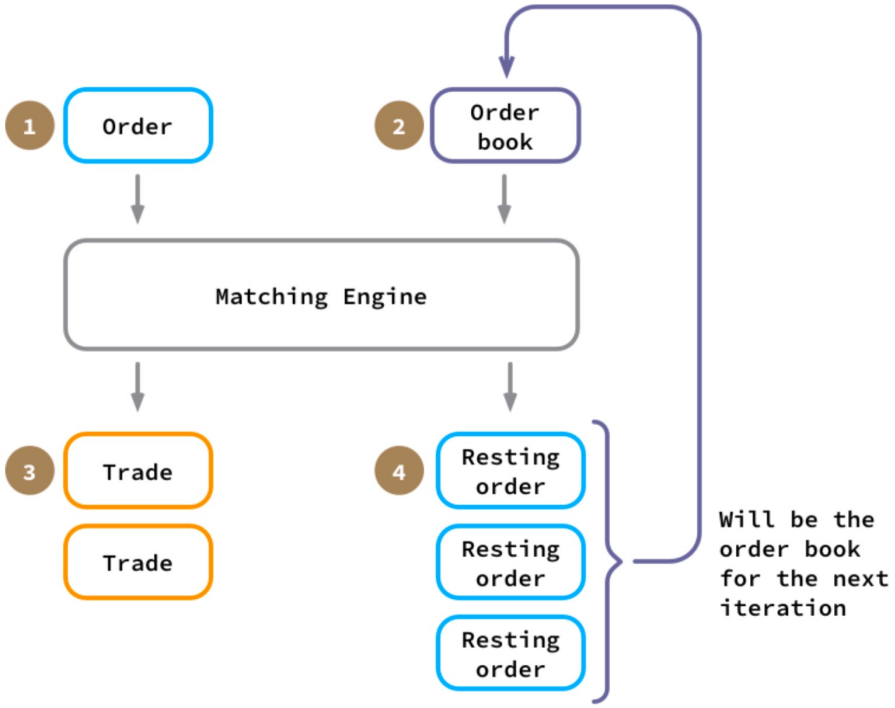
**FINM-32700: Advanced Computing for Finance**

# Matching Engine

A matching engine:

- Algorithm that accepts an order (1) and a "order book" (2) as input parameters
- Returns a list of trades (3)
- Returns remaining orders (4).

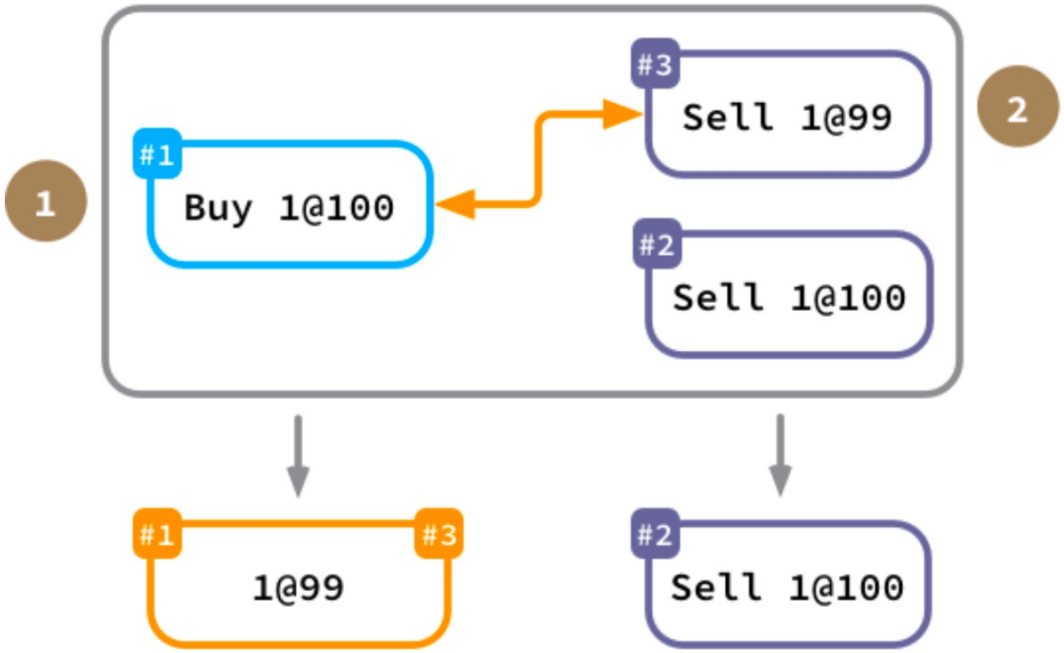
The existing orders will be used as the "order book" for the matching engine's next order.



# Matching Engine: Best price offer default strategy

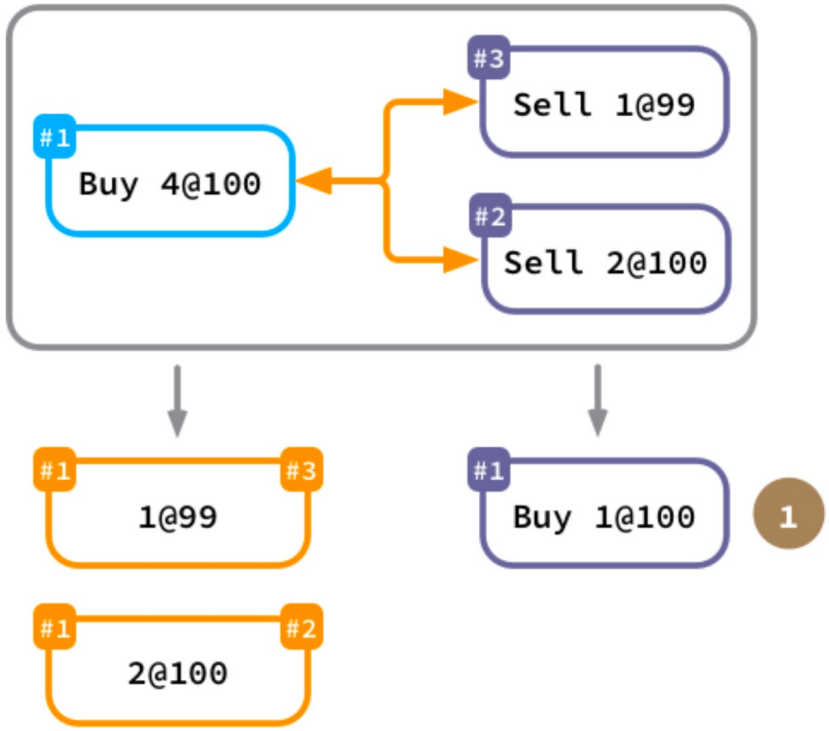
A matching engine will always try to find the best price available (2) for a given order (1).

This type of order (1), which removes orders from the order book, is referred to as an "aggressor order" since it removes liquidity from the market



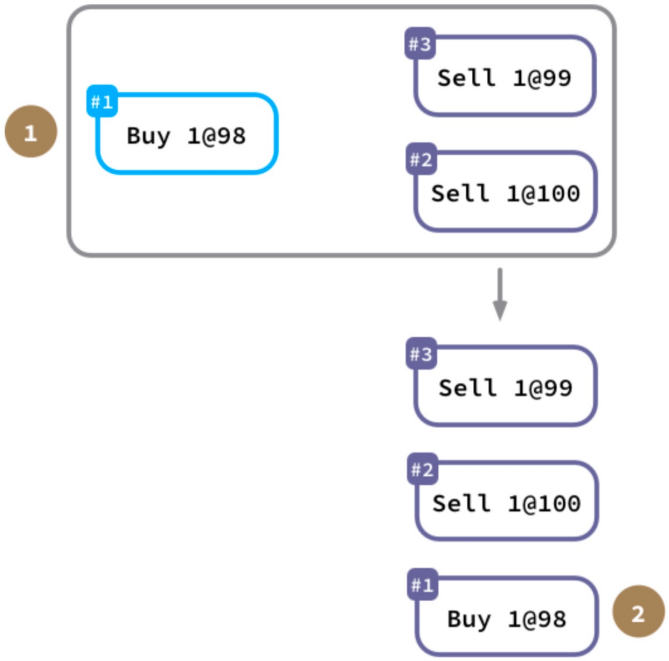
# Matching Engine: Partially filled order

If an order cannot be fulfilled entirely in one transaction, the remaining lots become a “resting order” which is included in the order book (1).



# Matching Engine: No match

When there is no match, the order becomes a resting order and is entered into the order book straight.



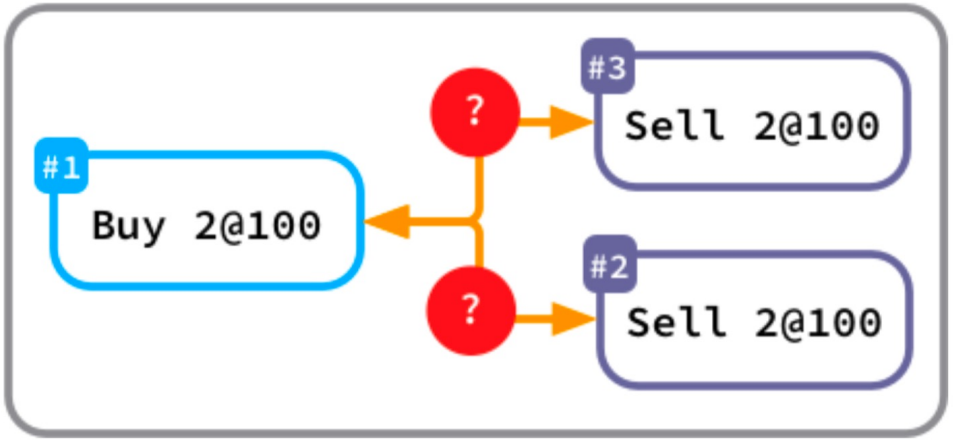
# Matching Engine: Multiple order with the same price

When more than one counter order matches the current order, things get a little difficult. This is where the allocation algorithm for the matching engine comes into play.

The matching engine's algorithm is crucial in determining what kind of behavior we want to encourage in the exchange.

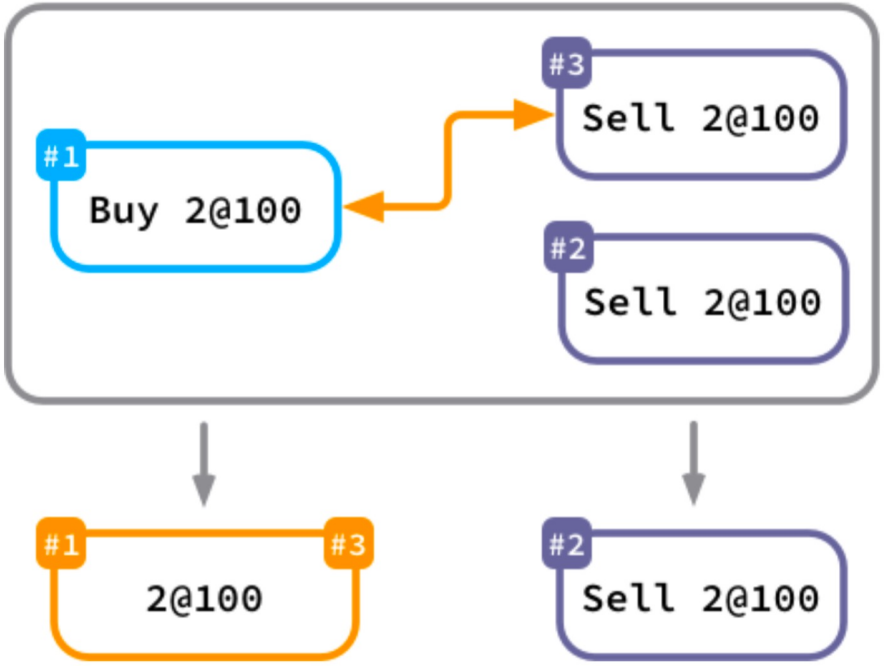
2 Algorithms:

- FIFO
- Pure pro-rata



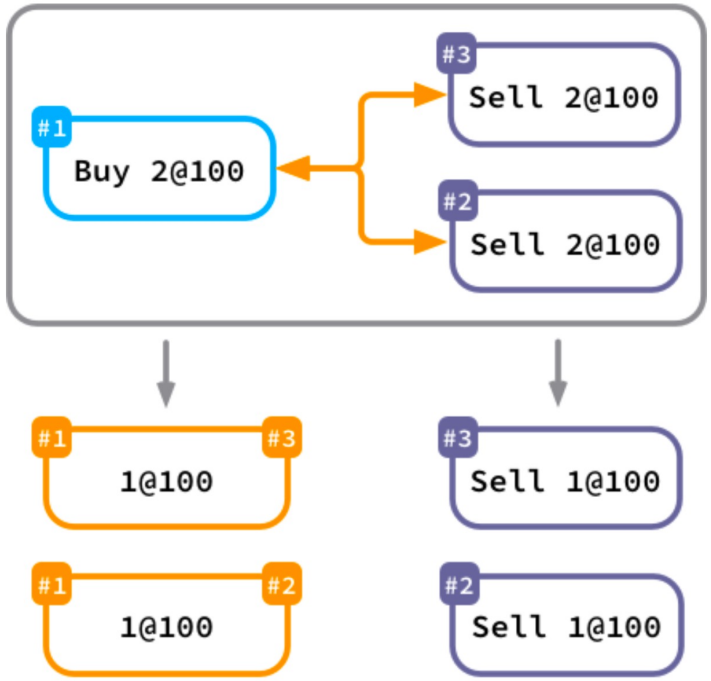
# FIFO Algorithm

Time/price priority, also known as First In First Out (FIFO), is the most widely used algorithm. The oldest counter order that matches at the best available price will be given priority. Of course, any modifications to the orders will result in their position being lost.



# Pure Pro-rata

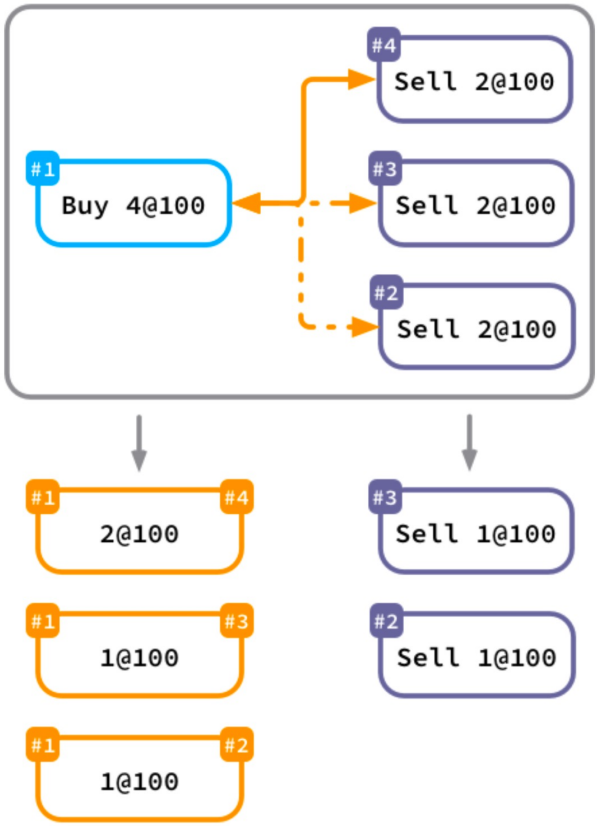
Orders are filled using a pro-rata algorithm that considers pricing, order lot size, and time. A market participant's entering order is shared evenly among matching counter orders proportionally to their magnitude.



# Modified Pro-rata

The pro-rata algorithm is frequently used with other allocation algorithms to incentivize particular behaviors among market participants.

Pro-rata with top-order, for example, is one of the most prevalent methods linked with pro-rata. In this situation, the oldest counter order is completed in full first, followed by a pro-rata distribution of the other counter orders



# Exchange architecture