

Morgan Stanley

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Preparation for algo trading interview

Quantitative finance and algo trading can be roughly classified as :

- financial engineering
- algorithmic trading, which is further divided into ...
 - signal trading
 - market making
 - strategic execution (or algorithmic execution)

Financial engineering makes money through structuring exotic products, earning premium, needs to hedge possible risk exposure (delta gamma vega) by participation in liquid vanilla product market. Signal trading refers to set of algorithms that buy low and sell high, such algorithms include technical analysis, trend following, mean reversion, arbitrage such as TraderRun, and even machine learning algorithms. Market making business is neutral to market, it offers liquidity, while earning bid ask spread. Algorithmic execution helps clients to execute big orders with optimal price or minimum impact to the market, without revealing the intentions (or actions) of the client, earning commissions, in case strategic execution performs better than client requirements, extra profit can be contributed to the algo business. Hence both market making and algorithmic execution do not involve in buy low sell high.

Algorithmic execution – Smart order routing

Common algorithmic execution include smart order routing (SOR) and iceberg. Before discussion about SOR, we need to know dark pool. Dark pool is [off-exchange trading venue](#), privately owned by Ibank. Trading mechanism in dark pool is similar to that in exchange, with similar order type using FIX protocol, but [hidden order size](#). Dark pool is also regulated by Securities and Futures Commission, dark pool transaction have to be [reported to OCG](#) in 1 minute if it is a transaction within the same exchange participant, in 15 minutes by sell side if it is a transaction between two exchange participants.

This is why algo trading requires understanding in market microstructure. Now, more about HKEX :

- trade type (automatic vs manual, non direct business transaction vs direct business transaction)
 - automatic trade is transaction done by exchange's matching engine
 - manual trade is transaction done through [interbank negotiation](#) or in [dark pool](#)
 - it is indicated as the following in OMD :

<code>trade_type = "A"</code>	automatic trade between two exchange participants
<code>trade_type = "Y"</code>	automatic trade within one exchange participant
<code>trade_type = "M"</code>	manual trade between two exchange participants
<code>trade_type = "X"</code>	manual trade within one exchange participant (possibly dark pool)
- POS (preopening session)
- CAS (close auction session) auction period at the end of trading day, bounded in range of reference price
- VCM (volatility control mech) introduce cooling period when possible trade price goes outside a range

With the existence of dark pool, SOR makes sense. As the same securities is traded in different venues, price discrepancies exist, there should be low-latency algorithm that explores the favourable venue to place order. Besides, dark pool offers a venue to execute huge order without revealing it to the market, avoiding other participants from trading in prior.

Algorithmic execution – Iceberg

There are different iceberg algorithms :

- TWAP
- VWAP
- POV (percentage of volume)
- step strategy (buy aggressively when price goes down and vice versa)
- minimum implementation shortfall (shortfall = slippage = difference between expected price and execution price)

Possible usages of VWAP

- as an indicator in signal trading
- as a benchmark in strategic execution