

# Algorithmic Trading

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# 1 Fundamentals

## 1.1 Securities Trading and Markets

The basic function of a market is to bring buyers and sellers together.

### Process 1.1.1. (*Four Components of a Trade*)

- i. Acquisition of information and quotes
  1. Quality information and transparency are crucial to price discovery
  2. Transparent markets quickly disseminate high-quality information
  3. Opaque markets are those that lack transparency
- ii. Routing of the trade order
  1. Selecting the brokers to handle the trades
  2. Deciding which markets will execute the trades and transmitting the trades to the markets
- iii. Execution. Buys are matched and executed against sells according to the rules of the market
- iv. Confirmation, clearance and settlement
  1. Clearance is the recording and comparison of the trade records
  2. Settlement involves the actual delivery of the security and its payment
  3. Might include trade allocation

Hidden portions of large institutional orders are dark liquidity pools. Orders that are partially revealed are called iceberg or hidden-size orders.

### Remark 1.1.2. (*Risks of Algorithmic Trading*)

- i. Leaks might arise from competitor efforts to reverse engineer them
- ii. Many algorithms lack the capacity to handle or respond to exceptional or rare events.

An auction is a competitive market process involving multiple buyers, multiple sellers, or both. Auctions are useful and cost-effective in pricing a security with an unknown value.

### Definition 1.1.3.

- i. *English auction* is an ascending bid auction.
- ii. *Dutch auction* is a descending bid auction.
- iii. *First-Price Seal-Bid auctions* have all buyers simultaneously submit seal bids so that no bidders knows any of the other bids.
  1. Does not allow for price discovery until the auction concludes.  
Winner submits highest bid and pays bid price.
  2. Winner faces the Winners Curse problem if the auctioned item's value is not known with certainty.
- iv. *Second-Price Seal-Bid (Vickrey) auctions*
  1. Identical to First-Price Sealed-Bid, except winner pays highest losing bid rather than his own bid.
  2. Intended to encourage higher bids by reducing Winner's Curse.
  3. Bidders bid more aggressively as a bid raises probability of winning without increasing expected cost, which is determined by someone else's bid.
- v. *Double auction* or *bilateral auction*