Ascendin Auctions
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Ausubel and Milgrom observed that the Vickrey auction, while elegant in theory, is not prevalent in practice. We discuss some advantages of open-outcry, ascending (a.k.a. English) auctions over sealed-bid auctions. We then characterize ascending auctions in general, and describe several specific instances.

1 Single-Parameter Ascending Auctions

“The Lovely by Lonely Vickrey Auction” is the title of a paper by two prominent economists, Ausubel and Milgrom,1 who note that the Vickrey auction is indeed lovely in theory but rarely used in practice.2 On the contrary, most auction houses sell their wares via an open-outcry, ascending (a.k.a. English) auction. Why is this?

One likely reason is the fact that bidders rarely have a precise number in mind that articulates what a good might be worth to them. Indeed, for companies bidding on contracts of some sort, it may be computationally intensive to compute such a number. On the other hand, even without knowledge of a precise number, it may be still be possible to answer (so-called demand) queries of the form, “Are you willing to pay \( x \) for a good?”. Hence, such auctions may be less challenging and hence more inviting to bidders; and remember, attracting bidders is essential to running a profitable auction.

Second, and arguably even more powerful, bidders tend to engage in bidding wars during English auctions. Even if bidders knew their precise value for the good at hand, they still might bid beyond that value. This behavior is rooted in our psychology; in particular, “losses loom larger than gains”.3 Applied to auctions, this maxim suggests that someone can become attached to a good while they are winning that good, and might therefore be willing to bid higher than their value to hold on to their tentative winnings. Furthermore, some might associate shame with losing, and pride with winning, especially when auction results are made public.

Remark 1.1. It has been said that “the only thing worse than losing an auction is winning.” Winning bidders often regret having won an auction, because upon winning, it is revealed to them that their bid was greater than everyone else’s bid, and hence everyone else’s value (assuming no overbidding). If they are unsure of their own value, and it is not definitively greater than their bid, then they may experience buyer’s remorse, a feeling of post-purchase regret.

2 A notable exception were stamp auctions during the 19th century, in which bids were sent via post to auctioneers in sealed envelopes.

Finally, if there are any doubts about an auctioneer’s integrity, an English auction is preferable to a sealed-bid auction. Since they are more transparent, bidders can trust the outcome of an open-outcry mechanism much more readily than that of a sealed-bid mechanism. Although auctioneers can, and sometimes do, hire shill (i.e., fake) bidders to artificially raise the price of a good, it is riskier to do so in an open-outcry rather than a sealed-bid environment, as these shill bidders would be on display for all to witness.

In sum, the following three phenomena help explain why English auctions are more common than Vickrey auctions:

1. greater transparency
2. potentially more revenue, because bidding wars can arise
3. less information revelation of bidders’ values, to other bidders and the auctioneer alike

Since the Vickrey auction is rarely used in practice, an alternative model of auctions is needed. In search of such an alternative, we now turn our attention to indirect mechanisms, specifically ascending auctions, in which prices are adjusted over time.

For our purposes, an ascending auction is an iterative algorithm that operates as follows:

- The auction proceeds in discrete rounds, \( t \in \{0, \ldots, \} \).
- At each round \( t \), the auction maintains a state \( s^t = (x^t, p^t) \), consisting of the current (tentative) allocation \( x^t \) and price vector \( p^t \).
- An allocation \( x^t \) at round \( t \) is an assignment of goods to bidders.
- Prices are per good (as opposed to per bundle). This vector of prices is initialized at zero (i.e., \( p^0 = 0 \)), and can only increase as the auction proceeds (i.e., \( p^{t+1} \geq p^t \), for all \( t \in \{0, \ldots, \} \)). The amount by which the price increases at round \( t \) is called the price increment, and it is denoted \( \epsilon^t \). So, if the price of good \( j \) increases during round \( t + 1 \), then \( p^{t+1}_j = p^t_j + \epsilon^t \). In general, the price increment need not be constant across rounds.
- Given the current state, queries can take the form of demand queries, in which bidders are asked what bundle of goods they prefer, or value queries (common in sealed-bid auctions), in which bidders are asked their value(s) for a bundle(s) of goods.
- The final allocation and prices may be any (even randomized) function of the auction’s history (i.e., the sequence of states).

An ascending auction is further specified by a set of rules:
• Allocation and pricing (i.e., payment) rules determine the next state (i.e., allocation and price vector), given the bidders’ replies to their queries. An example allocation rule might be to allocate each good to a bidder that demands it. An example pricing rule might be to increase prices on all overdemanded goods (i.e., goods for which the total demand exceeds supply).

• The auction’s termination rule determines when the auction ends, which is usually when at most one bidder’s reply to their query is non-empty: i.e., no further goods are overdemanded.

• An information revelation policy determines what part of the state is revealed to each bidder. For example, the current prices might be revealed to all bidders, while the tentative winners might be revealed only to the tentative winners themselves.

• There may be some additional activity rules, such as a bidder cannot exit the auction and then re-enter again later. The auction may also terminate if none of the bidders’ replies to their queries are valid, meaning they do not satisfy the activity rules.

We depict the rules for three ascending auctions for a single good in the tables below—specifically, for an English auction, for a Japanese auction (a demand query version of the English auction with an activity rule that forbids bidders from coming and going), and for an eBay auction.

We do not elaborate on how the price increment $\epsilon^t$ at round $t$ is determined, as it may be at the discretion of a seasoned auctioneer (i.e., heuristic!). We do note, however, that Japanese auctions are also known as clock auctions, as the incremental price increases are somewhat analogous to a ticking clock.

Although they may be unlikely in auctions with value queries, ties are common in auctions with demand queries, especially when the price increment is large. Thus, all auctions need a tie-breaking rule. We assume ties are broken uniformly at random among the last remaining bidders in English and Japanese auctions. In eBay auctions, ties are broken in favor of the earliest bidder.
### Rules

<table>
<thead>
<tr>
<th></th>
<th>English Auction</th>
<th>Japanese Auction</th>
<th>eBay Auction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Revelation</td>
<td>All (even bidding) information is public</td>
<td>All (even bidding) information is public</td>
<td>The current price and the tentative winner are public</td>
</tr>
<tr>
<td>Value Query</td>
<td>“Do I hear $x?””, where $x = p^t + \epsilon^t$</td>
<td>Hold your hands up if $x$ is acceptable, where $x = p^{t+1}$</td>
<td>“What is your value?”</td>
</tr>
<tr>
<td>Allocation Rule</td>
<td>A highest bidder</td>
<td>A random bidder with their hand up</td>
<td>A highest bidder</td>
</tr>
<tr>
<td>Pricing Rule</td>
<td>The highest bid</td>
<td>The broadcast price, $x$</td>
<td>The second-highest bid plus $\epsilon^t$</td>
</tr>
<tr>
<td>Activity Rule</td>
<td>None</td>
<td>Once a bidder’s hand goes down, they forfeit</td>
<td>None (so bids can oscillate up and down)</td>
</tr>
<tr>
<td>Termination Rule</td>
<td>At most one reply</td>
<td>At most one hand up</td>
<td>At a set time, or after a set number of rounds</td>
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### References

