

Generalizing Deferred Acceptance Auctions to Allow Multiple Relinquishment Options [Poster]

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Introduction and the Statement of the Problem. Reallocation of spectrum from current licensees TV broadcasters to mobile uses to promote efficient use of spectrum has become a public policy agenda. The Congress authorized the FCC to conduct incentive auctions for reallocations of spectrum in the UHF band. In this paper, we focus on the design of reverse auctions where TV stations submit bids to voluntarily relinquish spectrum rights to FCC in exchange for payments.

The state of the art of the design of reverse auctions is the framework given in Paul Milgrom, Lawrence Ausubel, Jon Levin, and Ilya Segal (2012) and deferred acceptance auctions proposed by Paul Milgrom and Ilya Segal (2014). In deferred acceptance auctions, each seller submits a single offer. At each round, an offer is evaluated with its scoring function. The buyer deletes the offer with the highest score. Then the set of frozen sellers (i.e., the set of sellers who will be assigned back to the band because the scores are too high) will be updated and offers are re-evaluated. Auctions end when only offers with the zero score remain. The payment rule is determined by the threshold price that is the maximum amount that the seller can offer to sell. When bidders are single-minded (that is, a bidder can make only one bid), then, the deferred acceptance auctions are strategy-proof, can be implemented in descending clock auctions, nearly-optimal, group strategy-proofness, and equivalent to pay-as-bid auctions.

But the Spectrum Act 6403(a)(2) stipulates that bidders shall have multiple relinquishment options such as going off the air, moving to the VHF band, and channel sharing. When the seller can make only one offer, the seller has to choose which auction to bid. Then the payment depends on the choice of auctions by other bidders. Therefore, the seller's choice of auctions can depend on other sellers' choices. Thus sincere bidding may not be an equilibrium.

This work is supported by the National Science Foundation Grant No. 1247988. I thank many people, especially Preston McAfee, for the preparation of this draft. I am thankful for Lawrence Ausubel, Andrew Clegg, Kevin Leyton-Brown, Paul Milgrom, Charles Plott, Ilya Segal, Nikolaos Sidiropoulos, and Xin Wang for helpful conversations for earlier drafts of the paper. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not reflect the views of the National Science Foundation.

Furthermore, just allowing multiple offers to sellers is not feasible since switching to a band can create interferences with stations that are already assigned to this band.

Then it is a significant question to consider the design of reverse auctions to restore strategy-proofness when sellers have multiple relinquishment options.

Main Results. This paper proposes a generalization of Paul Milgrom-Ilya Segal deferred acceptance auctions, called generalized deferred acceptance auctions with the supplementary phase. In this auction, a seller can make multiple offers for multiple options. An offer is scored according to the interference with frozen TV stations and other existing spectrum uses (medical telemetry, radio astronomy, and wireless microphone, and community broadband services.) The threshold price of an offer is the maximum offer that the seller can make to sell through the auction. The seller sells through the option with the highest profit.

In these generalized deferred acceptance auctions, a seller does not need to switch across auctions since the seller can make multiple offers for multiple options from the beginning. Furthermore, a buyer does not need to adjust the interference constraints since a seller does not need to switch. Finally, the final allocation satisfies interference constraints.

This auctions have four desirable properties. First, when sellers have multiple sell options but a unit supply, deferred acceptance auctions are strategy-proof. Second, generalized deferred acceptance auctions can be implemented as a two-stage mechanism where the first stage is descending clock auctions for each relinquishment option and the second stage is the assignment phase. Third, deferred acceptance auctions inherit desirable properties of Milgrom-Segal deferred acceptance auctions. Finally, the generalized deferred acceptance auctions with the supplementary phase are consistent with ladder auctions of Paul Milgrom, Jon Levin, and Ilya Segal (2012) where a seller is allowed to bid in multiple auctions and sell through the option that provides the seller the highest profit.

Contributions. This paper shows that deferred acceptance auctions can be extended to practically important economic environments that allow multiple relinquishment options for a seller while preserving their desirable properties.

References.

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