Simple, Credible, and Approximately-Optimal auctions

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Key results:

- First revenue guarantees for non-truthful multi-item auctions with additive, asymmetric bidders.
- First static approximately revenue-optimal credible multi-item mechanism.

Motivation:

- Non-truthful auctions are very common in practice. Hence, it is important to understand their revenue-optimality.
- In a credible auction, auctioneers do not have incentive to deviate from the rules of the auction. Therefore, bidders can trust the auctioneer.

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General Framework

Multi-item auction E(A):

The auctioneer

- posts bidders-specific entry fees upfront,
- runs simultaneous single-item A auctions on all items,
- allocates items to those bidders who paid entry fees.

Main theorem:

If every bidder in A auction does not overbid and pays at most bid, then,

Separate First-price auctions with monopoly reserves

or

E(A)

is approximately revenue-optimal.

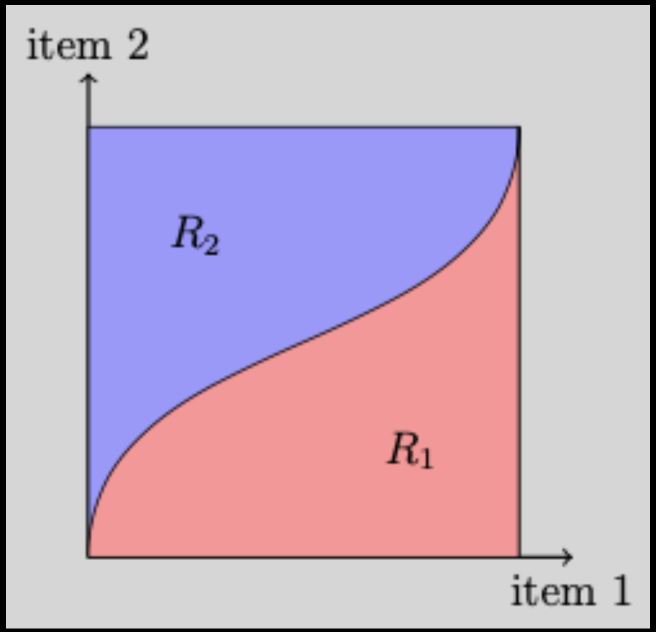
Non-truthful auction: E(First-Price), E(All-Pay)

Credible auction: E(All-Pay)

Proof of main theorem: E(First-Price)

[CDW16] Decomposition of type-space into “upward-closed” regions:

$$(t_1, t_2, t_3, t_4) \to (t_1, t_2, \phi(t_3), t_4)$$



Optimal revenue ≤ Virtual welfare

Goal: Upper bound virtual welfare.

Core problem:

Need to upper bound welfare-loss of first-price auctions.

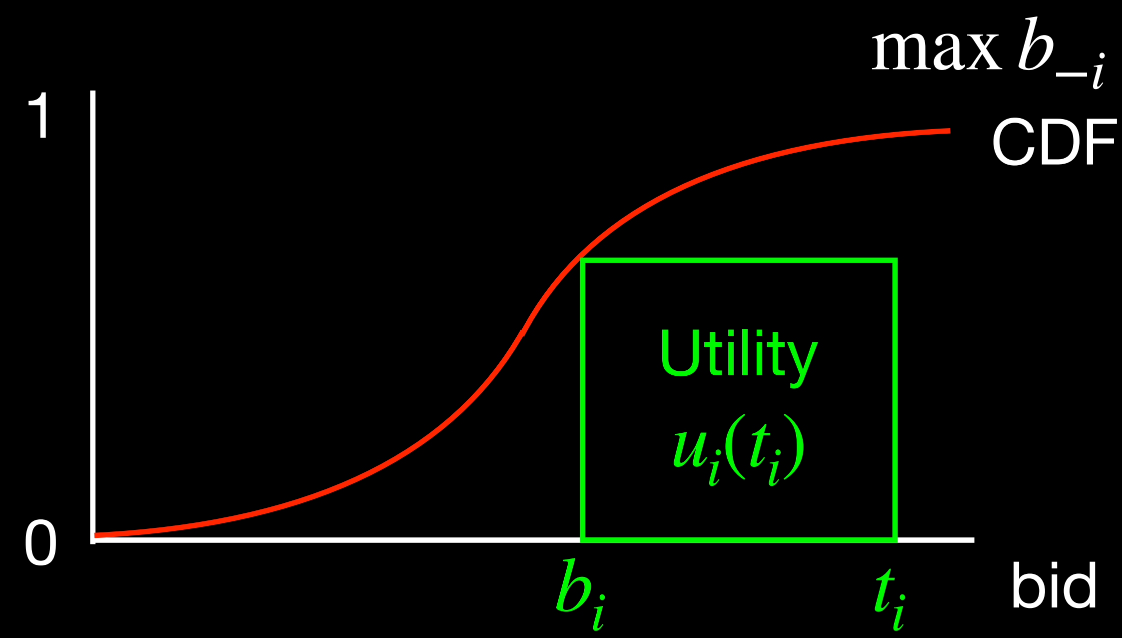
Worst-case scenarios:

- Welfare-loss is a constant fraction of optimal welfare.
- Optimal welfare is arbitrarily larger than optimal revenue.

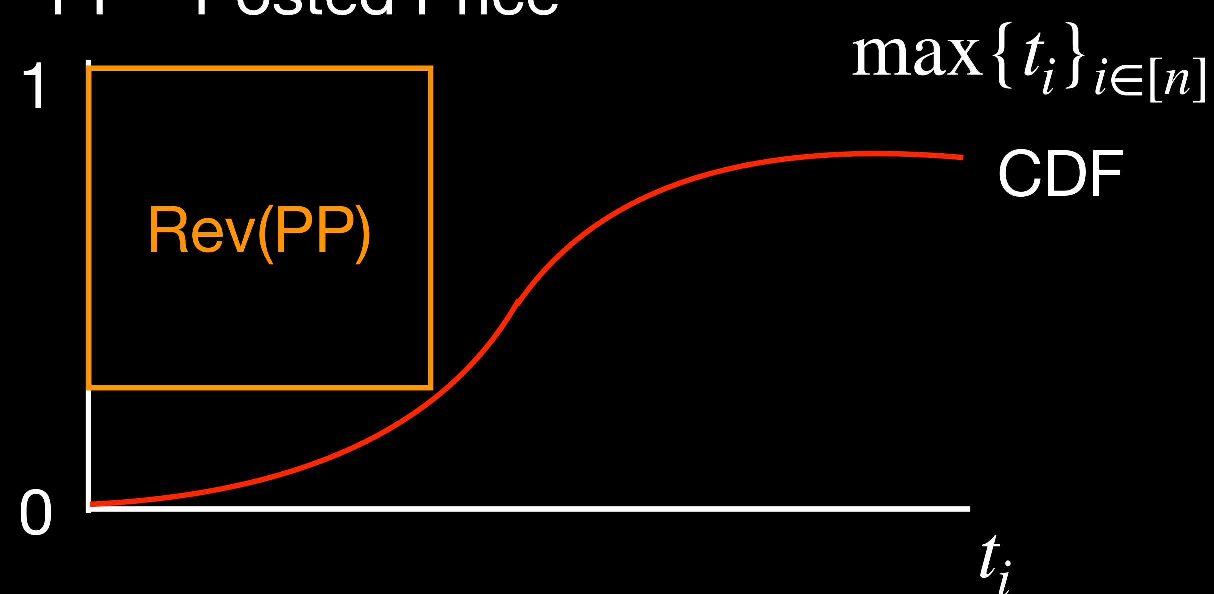
Main idea: Both worst cases cannot co-exist!

[CDW16] - Yang Cai, Nikhil R. Devanur, and S. Matthew Weinberg. A duality-based unified approach to bayesian mechanism design, STOC 2016.

Box-Lemma

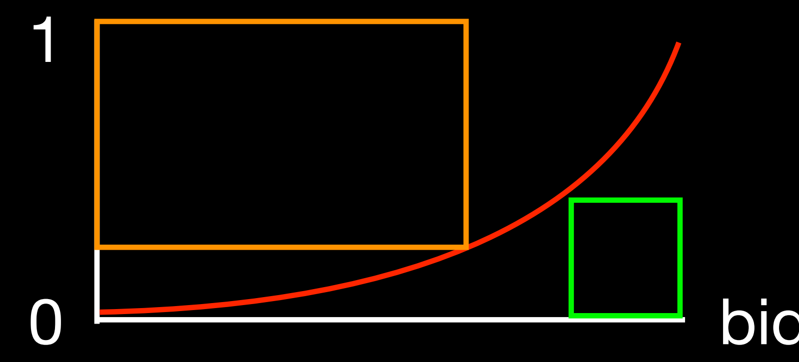


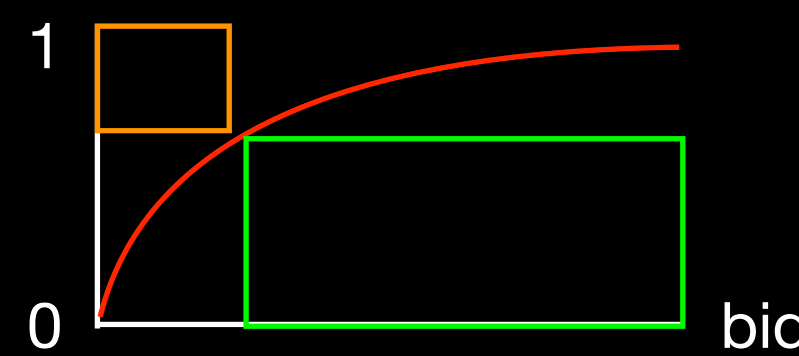
PP - Posted Price



$\max b_{-i}$ lies above $\max\{t_i\}_{i\in[n]}$

$$\sqrt{\text{Rev(PP)}} + \sqrt{u_i(t_i)} \geq \sqrt{t_i}$$





Welfare loss of first-price auctions
≤ 4•Rev(PP)