

# Simple, Credible, and Approximately-Optimal Auctions

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We present a general framework for designing approximately revenue-optimal mechanisms for multi-item additive auctions. Our approach adapts the duality framework of Cai et al [CDW16], and applies to both truthful and non-truthful auctions. Given a (not necessarily truthful) single-item auction format  $A$  satisfying certain technical conditions, we run simultaneous item auctions augmented with a personalized entry fee for each bidder that must be paid before the auction can be accessed. These entry fees depend only on the prior distribution of bidder types, and in particular are independent of realized bids. We bound the revenue of the resulting two-part tariff mechanism using a novel geometric technique that enables revenue guarantees for many common non-truthful auctions that previously had none.

Our framework can be used with many common auction formats, such as simultaneous first-price, simultaneous second-price, and simultaneous all-pay auctions. Our results for first price and all-pay are the first revenue guarantees of non-truthful mechanisms in multi-dimensional environments, addressing an open question in the literature [RST17]. If all-pay auctions are used, we prove that the resulting mechanism is also credible in the sense that the auctioneer cannot benefit by deviating from the stated mechanism after observing agent bids. This is the first static credible mechanism for multi-item additive auctions that achieves a constant factor of the optimal revenue. If second-price auctions are used, we obtain a truthful  $O(1)$ -approximate mechanism with fixed entry fees that are amenable to tuning via online learning techniques.

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## REFERENCES

- [CDW16] Yang Cai, Nikhil R. Devanur, and S. Matthew Weinberg. A duality-based unified approach to bayesian mechanism design. *SIGecom Exch.*, 15(1):71–77, September 2016.
- [RST17] Tim Roughgarden, Vasilis Syrgkanis, and Eva Tardos. The price of anarchy in auctions. *Journal of Artificial Intelligence Research*, 59:59–101, 2017.

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A full version of this paper is available at <https://arxiv.org/abs/2002.06702>.

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