# Auction Design under Interdependent Values

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## Abstract

We study combinatorial auctions with interdependent valuations. In such settings, every agent has a private signal, and every agent has a valuation function that depends on the private signals of all the agents. Interdependent valuations capture settings where agents lack information to determine their own valuations. Examples include auctions for artwork or oil drilling rights. For single item auctions and assume some restrictive conditions (the so-called single-crossing condition), full welfare can be achieved. However, in general, there are strong impossibility results on welfare maximization in the interdependent setting. This is in contrast to settings where agents are aware of their own valuations, where the optimal welfare can always be obtained by an incentive compatible mechanism.

Motivated by these impossibility results, we study welfare maximization for interdependent valuations through the lens of approximation. We introduce two valuation properties that enable positive results. The first is a relaxed, parameterized version of single crossing; the second is a submodularity condition over the signals. We obtain a host of approximation guarantees under these two notions for various scenarios.

Related publications: [1, 2]

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## References

1 Alon Eden, Michal Feldman, Amos Fiat, and Kira Goldner. Interdependent Values without Single-Crossing. In Éva Tardos, Edith Elkind, and Rakesh Vohra, editors, *Proceedings of the 2018 ACM Conference on Economics and Computation, Ithaca, NY, USA, June 18-22, 2018*, page 369. ACM, 2018. doi:10.1145/3219166.3219173.

2 Alon Eden, Michal Feldman, Amos Fiat, Kira Goldner, and Anna R. Karlin. Combinatorial Auctions with Interdependent Valuations: SOS to the Rescue. In *Proceedings of the 2019 ACM Conference on Economics and Computation, Phoenix, AZ, June 24-28, 2019*. ACM, 2019.



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