Research Project:

Inefficiency of Corruption in Single-item Auctions

Keywords: Auction Theory, Algorithmic Game Theory, Equilibrium Analysis, Price of Anarchy

Description: We consider auction settings where a seller wants to sell some items and for this purpose recruits an auctioneer to organize an auction on their behalf. Such settings are widely prevalent in practice as they emerge naturally whenever the seller lacks the expertise (or facilities, time, etc.) to host the auction themselves. The dilemma in such settings is that the incentives of the seller and the auctioneer are rather diverse in general: while the seller is interested in extracting the highest payments for the objects (or getting service at the lowest cost), the agent primarily cares about maximizing their own gains from hosting the auction. This misalignment leads (unavoidably) to fraudulent schemes used by the auctioneer to manipulate the auction to their own benefit.

Corruption in auctions, where an auctioneer engages in bid rigging with one (or several) of the bidders, occurs rather frequently in practice, especially in the public sector (e.g., in construction and procurement auctions). Despite this fact, the negative impact of corrupt auctioneers is still poorly understood theoretically and only a few studies exist. The social welfare loss caused by corrupt auctioneers in fundamental first-price auction settings (i.e., single-item and multi-unit auction settings) has recently been studied in [1]. This work focusses on a basic corruption scheme, where the auctioneer colludes with the winning bidders. As it turns out, this setting can be reduced to a *hybrid auction format*, where the items are assigned to the highest bidders and the payments are a convex combination of the first-price and the second-price payments.

In this project, we want to investigate (slightly) more sophisticated corruption schemes in the single-item auction settings. The goal is to study the inefficiency of equilibria of such schemes by deriving bounds on their *(robust) price of anarchy (POA)* through smoothness techniques. Also, an interesting question will be to understand under which circumstances the relation between specific corruption schemes and hybrid auction forms continues to hold.

Prerequisites: Good knowledge of standard auction formats (first-price, second-price single-item auctions) and price of anarchy analysis (robust price of anarchy, smoothness technique); students having followed the Algorithmic Game Theory course should be well equipped.

Supervision: The project will be supervised by

Prof. dr. Guido Schäfer
Networks and Optimization Group, Centrum Wiskunde & Informatica (CWI)
Institute for Logic, Language and Computation (ILLC), University of Amsterdam

If applicable, an internship ("stagiair") status at CWI can be arranged for the student (to be discussed).

Interested? Please get in touch with Guido Schäfer (g.schaefer@cwi.nl).

Note: The above is just one specific proposal of a potential research project related to algorithmic game theory. If you have interesting project proposals yourself or want to discuss other possibilities, please feel free to get in touch.

References

[1] Andries van Beek, Ruben Brokkelkamp, and Guido Schäfer. Capturing corruption with hybrid auctions: Social welfare loss in multi-unit auctions. *CoRR*, abs/2106.01822, 2021. https://arxiv.org/abs/2106.01822.