C-single crossing Interdependent valuations

Abstract:

We consider the goal of social welfare maximization where a single item is to be assigned to one of to \( n \) potential agents with interdependent values.

That is, each agent has her own private signal, and the valuation of each agent is a known function of all \( n \) private signals. This captures settings such as valuations for artwork, oil drilling rights, broadcast rights, and many more. In the interdependent value setting, all previous work has assumed a so-called single-crossing condition. Single-crossing means that the impact of agent \( i \)'s private signal, \( s_i \), on her own valuation is greater than the impact of \( s_{ii} \) on the valuation of any other agent. It is known that without the single-crossing condition an efficient outcome cannot be obtained. We study welfare maximization for interdependent valuations through the lens of approximation.

We show that, in general, without the single-crossing condition, one cannot hope to approximate the optimal social welfare any better than the approximation given by assigning the item to a random bidder. Consequently, we introduce a relaxed version of single-crossing, \( c \)-single-crossing, parameterized by \( c \geq 1 \), which means that the impact of \( s_i \) on the valuation of agent \( i \) is at least \( 1/c \) times the impact of \( s_i \) on the valuation of any other agent (\( c = 1 \) is single-crossing). Using this parameterized notion, we obtain a host of positive results. We also consider interdependent settings when valuations are concave and give improved results.

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