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 ≥ 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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