Abstract

In a combinatorial auction with item bidding, agents participate in multiple single-item second-price auctions at once. As some items might be substitutes, agents need to strategize in order to maximize their utilities. A number of results indicate that high welfare can be achieved this way, giving bounds on the welfare at equilibrium. Recently, however, criticism has been raised that equilibria are hard to compute and therefore unlikely to be attained. In this paper, we take a different perspective. We study simple best-response dynamics. That is, agents are activated one after the other and each activated agent updates his strategy myopically to a best response against the other agents' current strategies. Often these dynamics may take exponentially long before they converge or they may not converge at all. However, as we show, convergence is not even necessary for good welfare guarantees. Given that agents' bid updates are aggressive enough but not too aggressive, the game will remain in states of good welfare after each agent has updated his bid at least once. In more detail, we show that if agents have fractionally subadditive valuations, natural dynamics reach and remain in a state that provides a $1/3$ approximation to the optimal welfare after each agent has updated his bid at least once. For subadditive valuations, we can guarantee an $\Omega(1/\log m)$ approximation in case of m items that applies after each agent has updated his bid at least once and at any point after that. The latter bound is complemented by a negative result, showing that no kind of best-response dynamics can guarantee more than a an $o(\log \log m/ \log m)$ fraction of the optimal social welfare.