Item Pricing for Revenue Maximization in Combinatorial Auctions

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In this talk we present item pricing algorithms and mechanisms for revenue maximization in combinatorial auctions. We start by considering the *unlimited-supply* combinatorial auction setting and present a simple algorithm [1] which achieves an $O(k)$ approximation for the case of *single-minded bidders* who each want at most k items, improving on the $O(k^2)$ bound of Briest and Krysta [3].

We then show that in unlimited-supply combinatorial auctions, randomly choosing a single price to offer for every item achieves expected revenue within a logarithmic factor of the total social welfare for bidders with *general* valuation functions [2]. Guruswami et. al [6] had showed this only for the special cases of *single-minded* and *unit-demand* bidders. Moreover, our result does not even require valuations to be monotone ("free disposal"). This gives the first general logarithmic approximation known for item pricings in unlimited supply combinatorial auctions.

We finally consider the *limited* supply setting (a single copy of each item is available), for which much less is known in terms of revenue maximization. We show here that a random single price achieves a $2^{O(\sqrt{\log n \log \log n})}$ approximation for the class of *subadditive* bidders. This improves over the best previous revenue guarantee for computationally efficient mechanisms, which was an $O(\sqrt{n})$ approximation [5], and furthermore our result applies even to the online case in which bidders arrive and purchase what they like in an arbitrary order. We complement this result with a lower bound showing a sequence of subadditive (in fact, XOS) bidders for which any single price has approximation ratio $\Omega(2^{\log^{\epsilon} n})$ for some $\epsilon > 0$. The lower bound demonstrates a distinction between revenue maximization and social welfare maximization, for which [5, 4] show that a fixed price achieves a logarithmic approximation in the case of XOS [5], and more generally subadditive [4], bidders.

This talk is based in large part on work in [1] and [2], joint with Avrim Blum and Yishay Mansour.

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