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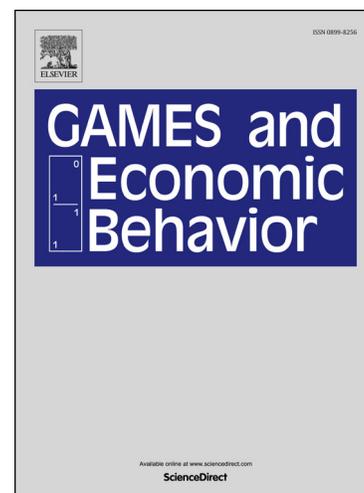
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Welfare Maximization with Production Costs: A Primal Dual Approach

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Abstract

We study online auctions with production costs proposed by Blum et al. [9] using an online primal dual framework. In our model, the seller allocates items to buyers arriving online and can produce multiple copies of each item subject to a non-decreasing marginal cost per copy. The buyers have valuation functions on sets of items and arrive one by one online in some arbitrary order. The goal is to design an online mechanism for the seller to allocate items and maximize the social welfare, that is, the sum of the buyers' values less the total production cost. For any strictly convex and differentiable production cost function, we characterize the optimal competitive ratio achievable by online mechanisms and, more generally, algorithms without incentive guarantees. We show that online posted pricing mechanisms, which are incentive compatible, can achieve competitive ratios arbitrarily close to the optimal, and construct lower bound instances on which no online algorithms, not necessarily incentive compatible, can do better. Our positive results improve or match the results in several previous work, e.g., Bartal et al. [7], Blum et al. [9], and Buchbinder and Gonen [11]. Our lower bounds apply to randomized algorithms and resolve an open problem by Buchbinder and Gonen [11].

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