A Simple and Approximately Optimal Mechanism for a Buyer with Complements [Abstract]

ALON EDEN, Tel-Aviv University
MICHAL FELDMAN, Tel-Aviv University
OPHIR FRIEDLER, Tel-Aviv University
INBAL TALGAM-COHEN, The Hebrew University of Jerusalem
S. MATTHEW WEINBERG, Princeton University

We consider a revenue-maximizing seller with m heterogeneous items and a single buyer whose valuation v for the items may exhibit both substitutes (i.e., for some S, T, $v(S \cup T) < v(S) + v(T)$) and complements (i.e., for some S, T, $v(S \cup T) > v(S) + v(T)$). We show that the mechanism first proposed by Babaioff et al. [2014] – the better of selling the items separately and bundling them together – guarantees a $\Theta(d)$ fraction of the optimal revenue, where d is a measure on the degree of complementarity. Note that this is the first approximately optimal mechanism for a buyer whose valuation exhibits any kind of complementarity. It extends the work of Rubinstein and Weinberg [2015], which proved that the same simple mechanisms achieve a constant factor approximation when buyer valuations are subadditive, the most general class of complement-free valuations.

Our proof is enabled by the recent duality framework developed in Cai et al. [2016], which we use to obtain a bound on the optimal revenue in this setting. Our main technical contributions are specialized to handle the intricacies of settings with complements, and include an algorithm for partitioning edges in a hypergraph. Even nailing down the right model and notion of "degree of complementarity" to obtain meaningful results is of interest, as the natural extensions of previous definitions provably fail.

CCS Concepts: •**Theory of computation → Algorithmic game theory and mechanism design;**

Additional Key Words and Phrases: Revenue maximization; degree of complementarity; hypergraph representation

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Author's email addresses: alonarden@gmail.com; mfeldmantau@gmail.com; ophirfriedler@gmail.com; inbaltalgam@gmail.com; smweinberg@princeton.edu.

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