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Title:

How To Think About Algorithmic Mechanism Design

Abstract:

Mechanism design studies optimization problems where the underlying data --- such as the value of a good or the cost of performing a task --- is initially unknown to the algorithm designer. Auction settings are canonical examples, where the private data is the willingness to pay the bidders for the goods on sale, and the optimization problem is to allocate the goods to maximize some objective, such as revenue or overall value to society. A "mechanism" is a protocol that interacts with participants and determines a solution to the underlying optimization problem. We first explain why designing mechanisms with good game-theoretic properties boils down to algorithm design in a certain "constrained computational model." We differentiate between single-parameter problems, where this computational model is well understood, and multi-parameter problems, where it is not. We then study two specific problem domains: revenue-maximizing auctions, and the recent idea of analyzing auctions via a "Bayesian thought experiment"; and welfare-maximizing mechanisms, with an emphasis on black-box reductions that transmute approximation algorithms into truthful approximation mechanisms.