Computational Efficiency Requires Simple Taxation

Abstract:

We characterize the communication complexity of truthful mechanisms. Our departure point is the well known taxation principle. The taxation principle asserts that every truthful mechanism can be interpreted as follows: every player is presented with a menu that consists of a price for each bundle (the prices depend only on the valuations of the other players). Each player is allocated a bundle that maximizes his profit according to this menu. We define the taxation complexity of a truthful mechanism to be the logarithm of the maximum number of menus that may be presented to a player.

Our main finding is that in general the taxation complexity essentially equals the communication complexity. The proof consists of two main steps. First, we prove that for rich enough domains the taxation complexity is at most the communication complexity. We then show that the taxation complexity is much smaller than the communication complexity only in "pathological" cases and provide a formal description of these extreme cases.

Our approach yields several applications, including strengthening the solution concept with low communication overhead, fast computation of prices, and hardness of approximation by computationally efficient truthful mechanisms.