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On the impact of singleton strategies in congestion games. (English) Zbl 1448.91020

Summary: To what extent does the structure of the players’ strategy space influence the efficiency of decentralized solutions in congestion games? In this work, we investigate whether better performance is possible when restricting to load balancing games in which players can only choose among single resources. We consider three different solutions concepts, namely, approximate pure Nash equilibria, approximate one-round walks generated by selfish players aiming at minimizing their personal cost and approximate one-round walks generated by cooperative players aiming at minimizing the marginal increase in the sum of the players’ personal costs. The last two concepts can also be interpreted as solutions of simple greedy online algorithms for the related resource selection problem. Under fairly general latency functions on the resources, we show that, for all three types of solutions, better bounds cannot be achieved if players are either weighted or asymmetric. On the positive side, we prove that, under mild assumptions on the latency functions, improvements on the performance of approximate pure Nash equilibria are possible for load balancing games with weighted and symmetric players in the case of identical resources. We also design lower bounds on the performance of one-round walks in load balancing games with unweighted players and identical resources (in this case, solutions generated by selfish and cooperative players coincide).

For the entire collection see Zbl 1372.68019.

MSC:
91A14 Potential and congestion games
91A68 Algorithmic game theory and complexity

Keywords:
congestion games; Nash equilibrium; price of anarchy; online load balancing; greedy algorithms

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References:
balancing. \textit{Algorithmica}, 61(3):606-637, 2011. - \textit{Zbl} 1237.91049


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