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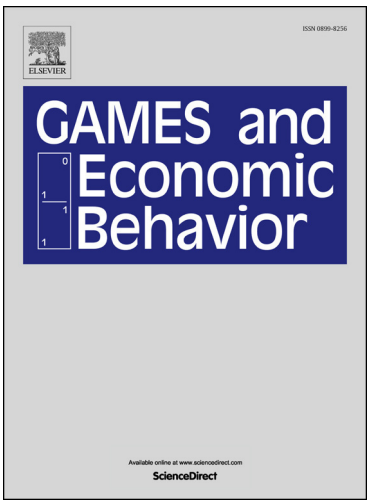

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The Query Complexity of Correlated Equilibria*†

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Abstract

We consider the complexity of finding a *correlated equilibrium* of an n-player game in a model that allows the algorithm to make queries on players' payoffs at pure strategy profiles. Randomized regret-based dynamics are known to yield an approximate correlated equilibrium efficiently, namely, in time that is polynomial in the number of players n. Here we show that ***both*** *randomization* and *approximation* are necessary: no efficient deterministic algorithm can reach even an

*Dedicated to the memory of Lloyd S. Shapley: a giant in the field, a pioneering and inspiring figure, a supportive teacher and mentor, and a friend. The combination of game theory with operations research, combinatorics, probability, and computer science—all present in this paper—has been a cornerstone of Lloyd Shapley's work. Interestingly, the edge iso-perimetric inequality (Hart 1976) that we use here came about in order to solve a problem posed by Lloyd in 1974 in connection with the Banzhaf value.

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