Colloquium on Combinatorial Computing
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Additive approximation for edge-deletion problems

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Abstract

A graph property is monotone if it is closed under removal of vertices and edges. In this talk we consider the following edge-deletion problem; given a monotone property P and a graph G, compute the smallest number of edge deletions that are needed in order to turn G into a graph satisfying P. We denote this quantity by $E_P(G)$. Our first result states that for any monotone graph property P, any $\epsilon > 0$ and n-vertex input graph G one can approximate $E_P(G)$ up to an additive error of ϵn^2.

Our second main result shows that such approximation is essentially best possible and for most properties, it is NP-hard to approximate $E_P(G)$ up to an additive error of $n^{2-\delta}$, for any fixed positive δ.

The proof requires several new combinatorial ideas and involves tools from Extremal Graph Theory together with spectral techniques. Interestingly, prior to this work it was not even known that computing $E_P(G)$ precisely for dense monotone properties is NP-hard. We thus answer (in a strong form) a question of Yannakakis raised in 1981.

Joint work with N. Alon and A. Shapira.

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http://www.math.nyu.edu/p̃ach/public_html/combinatorics_seminar.html