Finding a Hamilton cycle fast on average using rotations-extensions

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Abstract

Graph Hamiltonicity is a well-known NP-complete computational problem. As such, no worst-case polynomial time algorithm is known to solve it, and the best algorithm known today is the $O(2^n \cdot n^2)$ time dynamic programming algorithm.

In light of this, one can ask whether a polynomial time algorithm can be achieved, if we replace the worst-case requirement with a weaker average-case requirement. We examine this question in the probability space $G(n,p)$.

We present an algorithm deciding Hamiltonicity in $G(n,p)$ with expected running time $\big(1+o(1)\big)n/p$ (easily shown to be optimal) for edge probability $p \geq 70n^{-\frac{1}{2}}$. This improves substantially best previously known results on the subject, due to Gurevich and Shelah and to Thomason, both from the eighties.

This is a joint work with Michael Krivelevich.