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Breaking the All Subsets Barrier for Min k-Cut

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Abstract: In the {\sc Min k-Cut} problem, the input is a graph G and an integer k. The task is to find a partition of the vertex set of G into k parts, while minimizing the number of edges that go between different parts of the partition. The problem is NP-complete, and admits a simple $3^n \cdot n^{O(1)}$ time dynamic programming algorithm, which can be improved to a $2^n \cdot n^{O(1)}$ time algorithm using the fast subset convolution framework by Bj{\"{o}}rklund et al.~[STOC'07]. In this paper we give an algorithm for {\sc Min k-Cut} with running time $O((2-\varepsilon)^n)$, for $\varepsilon > 10^{-50}$. This is the first algorithm for {\sc Min k-Cut} with running time $O(c^n)$ for $c < 2$.

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