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Weighted upper edge cover: complexity and approximability. (English) Zbl 1433.05261

Summary: Optimization problems consist of either maximizing or minimizing an objective function. Instead of looking for a maximum solution (resp. minimum solution), one can find a minimum maximal solution (resp. maximum minimal solution). Such “flipping” of the objective function was done for many classical optimization problems. For example, minimum vertex cover becomes maximum minimal vertex cover, maximum independent set becomes minimum maximal independent set and so on. In this paper, we propose to study the weighted version of maximum minimal edge cover called upper edge cover, a problem having application in genomic sequence alignment. It is well-known that minimum edge cover is polynomial-time solvable and the “flipped” version is NP-hard, but constant approximable. We show that the weighted upper edge cover is much more difficult than upper edge cover because it is not \( O\left(\frac{1}{\sqrt{n}}\right) \) approximable, nor \( O\left(\frac{1}{\Delta}\right) \) in edge-weighted graphs of size \( n \) and maximum degree \( \Delta \) respectively. Indeed, we give some hardness of approximation results for some special restricted graph classes such as bipartite graphs, split graphs and \( k \)-trees. We counter-balance these negative results by giving some positive approximation results in specific graph classes.

MSC:
05C70 Edge subsets with special properties (factorization, matching, partitioning, covering and packing, etc.)
05C69 Vertex subsets with special properties (dominating sets, independent sets, cliques, etc.)
05C22 Signed and weighted graphs

Keywords:
weighted version of maximum minimal edge cover; upper edge cover; maximum independent set

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References:

Graph terminology and definitions Related work Contributions Approximation of Weighted Upper Edge Cover in complete graphs Approximation of Weighted Upper Edge Cover in bipartite graphs Approximation of Weighted Upper Edge Cover in split graphs Approximation of Weighted Upper Edge Cover in \( k \)-trees Hardness of approximation Positive approximation result Approximation of Weighted Upper Edge Cover in bounded degree graphs Conclusion · Zbl 1213.68322 · doi:10.4086/toc.2007.v003a006

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