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On Improved Exact Algorithm for $L(2,1)$-labeling of Graphs

$L(2,1)$-labeling is a graph coloring model inspired by a channel assignment problem in telecommunication. It asks for such a labeling of vertices with nonnegative integers that adjacent vertices get labels that differ by at least 2 and vertices in distance 2 get different labels. It is proved by Fiala *et al.* [1] that for any fixed $k \geq 4$ it is NP-complete to determine if a graph has an $L(2,1)$-labeling with no label greater than k.

Havet *et al.* [1] presented an algorithm for finding an optimal $L(2,1)$-labeling (i.e. an $L(2,1)$-labeling in which the largest label is the least possible) of a graph whose time complexity is $O^*(3.8739^n)$.

In this talk we present and analyze an improved version of this algorithm. The time complexity bound $O^*(3.5616^n)$ of our algorithm is substantially better than the time complexity of the original one. The difference lies in a better bound on the number of 2-packings, a smaller number of triples considered in the main loop of the algorithm and more carefully formulated conditions for this loop.

Moreover space complexity of our algorithm is improved from $O^*(3^n)$ to $O(2.56^n)$.

References

[1] J. Fiala, J. Kratochvíl, T. Kloks, *Fixed-parameter Complexity of λ-labelings*, Discrete Applied Mathematics 113, 1 (2001), 59–72

[2] F. Havet, M. Klazar, J. Kratochvíl, D. Kratsch, M. Liedloff, *Exact Algorithms for $L(2,1)$-labeling of Graphs*, Algorithmica DOI 10.1007/s00453-009-9302-7