

The use of modular decomposition to design linear time algorithms for (P_5, gem) -free graphs

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Abstract

A graph is (P_5, gem) -free, when it contains neither a P_5 (an induced path with five vertices) nor a gem (a graph formed by making an universal vertex adjacent to each of the four vertices of the induced path P_4) as an induced subgraph.

Using a characterization of (P_5, gem) -free graphs by their prime graphs with respect to modular decomposition and their modular decomposition trees, linear time algorithms can be established for the following NP-complete problems on (P_5, gem) -free graphs: Minimum Coloring, Maximum Weight Stable Set, Maximum Weight Clique, and Minimum Clique Cover.

We present a linear time algorithm to optimally color (P_5, gem) -free graphs. Our approach uses the modular decomposition tree and solves the minimum weight coloring problem on all prime graphs. The previously best known algorithm could have been obtained by combining the fact that (P_5, gem) -free graphs have small clique-width with a coloring algorithm for graphs of bounded clique-width. The running time of this algorithm is polynomial; but the exponent is larger than 2000.

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