Computing Independent Transversals for H-Free Graphs of Bounded Diameter

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Several important graph transversal problems can also be viewed as graph modification problems. For example 3-Colouring can be viewed as deciding whether some independent set can be deleted from a graph to leave it bipartite whilst Independent Odd Cycle transversal is the problem of deciding whether there exists such a set of size at most k. Similarly, Near-Bipartiteness is the problem of deciding whether some independent set of vertices can be deleted from a graph to obtain a forest whilst Independent Feedback Vertex Set requires deciding whether there exists such a set of size at most k.

All these problems are NP-complete even after restricting the input to classes of H-free graphs for many graphs H (a graph is H-free if it does not contain H as an *induced* subgraph). However, this may change once we bound some graph parameter in addition (which may imply the graph class is no longer hereditary). For example, it can be observed that the computational complexity of all problems restricted to claw-free graphs jumps from being NP-complete to being constant-time solvable if we assume any constant upper bound on the diameter of the graph. Starting from this initial observation, we determine the complexity of the above problems for H-free graphs, exploiting the effect of additionally bounding the diameter of the input graph in order to obtain new polynomial-time results.

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