Linear Certifying Algorithms for Simple Graph Classes

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A graph is $(2,1)$-*colourable* if it admits a partition of its vertex set into two independent sets and one clique (a $(2,1)$-*colouring*). There are algorithms to determine whether a graph is $(2,1)$-colourable, with a running time of $O(|V|^3)$, and with the disadvantage that they do not seem to be easy to implement. Also these algorithms are not certifying. An algorithm is *certifying* if, along with a boolean response to the problem they are supposed to solve, they return a *certificate*, i.e., an object which can be used to verify efficiently that the answer provided is correct. The classic algorithm to test bipartiteness of a graph G, which returns a bipartition (*yes-certificate*) when G is bipartite, and an odd cycle (*no-certificate*) when G is not, is the archetype of certifying algorithm we are looking for. We suspect the existence of certifying algorithms to recognize $(2,1)$-colourable graphs, more efficient than the ones currently known. In this talk, we present certifying algorithms to recognize some graph classes obtained from $(2,1)$-colourable graphs by imposing some additional restrictions on the $(2,1)$-colouring. We also present a new certifying algorithm for recognizing split graphs. All our algorithms run in $O(|V| + |E|)$ and are easy to implement.

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