Bounded-Degree Fixed-Points in Linear Time

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Abstract Solutions to specific problems can be generalized to entire classes of problems defined by logical languages. This is the case of Courcelle's Theorem, which states that any problem of graphs which can be expressed in the language of monadic second-order logic can be decided in linear time on graphs of bounded tree-width.

Another result in the same spirit of Courcelle's Theorem is Seese's Theorem, which states that any property of graphs which can be expressed in first-order logic can be verified in linear time on graphs of bounded degree.

Lindell extended Seese's Theorem to the problem of computing certain sets of vertices inductivelly defined. Such sets can be defined as the least fixed-point of monadic operators on graphs of bounded degree. Lindell shows that such least fixed-points can be computed in linear time using a random access machine (RAM).

We show how to extend Lindell's result to the problem of computing sets of vertex pairs inductivelly defined, provided that these sets have bounded degree as well. We show that these sets can also be computed in linear time using a RAM.