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Characterising Stable Model by Extended Labelled Dependency Graph

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Abstract : Extended dependency graph (EDG) is a state-of-the-art isomorphic graph to represent normal logic programs (NLPs) that can characterize the consistency of NLPs by graph analysis. To construct the vertices and arcs of an EDG, additional renaming atoms and rules besides those the given program provides are used, resulting in higher space complexity compared to the corresponding traditional dependency graph (TDG). In this article, we propose an extended labeled dependency graph (ELDG) to represent an NLP that shares an equal number of nodes and arcs with TDG and prove that it is isomorphic to the domain program. The number of nodes and arcs used in the underlying dependency graphs are formulated to compare the space complexity. Results show that ELDG uses less memory to store nodes, arcs, and cycles compared to EDG. To exhibit the desirability of ELDG, firstly, the stable models of the kernel form of NLP are characterized by the admissible coloring of ELDG; secondly, a relation of the stable models of a kernel program with the handles of the minimal, odd cycles appearing in the corresponding ELDG has been established; thirdly, to our best knowledge, for the first time an inverse transformation from a dependency graph to the representing NLP w.r.t. ELDG has been defined that enables transferring analytical results from the graph to the program straightforwardly.

Keywords : normal logic program, isomorphism of graph, extended labelled dependency graph, inverse graph transforma-tion, graph colouring
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