Logic Programming and effectively closed sets

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Abstract

This paper surveys results on index problems for effectively closed sets and their applications to models of logic programs. A new notion of boundedness for trees is introduced and the complexity of index sets for the corresponding closed sets is examined. This paper focuses on the *recognition problem* in the metaprogramming of finite normal predicate logic programs. That is, let $\mathcal{L}$ be a computable first order predicate language with infinitely many constant symbols and infinitely many n-ary predicate symbols and n-ary functions symbols for all $n \geq 1$. Then we can effectively list all the finite normal predicate logic programs $Q_0, Q_1, \ldots$ over $\mathcal{L}$. Given some property $\mathcal{P}$ of finite normal predicate logic programs over $\mathcal{L}$, we define the index set $I_{\mathcal{P}}$ to be the set of indices e such that Q_e has property $\mathcal{P}$. We classify the complexity of the index set $I_{\mathcal{P}}$ within the arithmetic hierarchy for various natural properties of finite predicate logic programs. For example, we determine the complexity of the index sets relative to all finite predicate logic programs and relative to certain special classes of finite predicate logic programs of properties such as (i) having no stable models, (ii) having no recursive stable models, (iii) having exactly c stable models for any given positive integer c, (iv) having exactly c recursive stable models for any given positive integer c, (v) having only finitely many stable models, (vii) having only finitely many recursive stable models.

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