Termination Analysis of Logic Programs based on Dependency Graphs*

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Abstract. This paper introduces a modular framework for termination analysis of logic programming. To this end, we adapt the notions of dependency pairs and dependency graphs (which were developed for term rewriting) to the logic programming domain. The main idea of the approach is that termination conditions for a program are established based on the decomposition of its dependency graph into its strongly connected components. These conditions can then be analysed separately by possibly different well-founded orders. We propose a constraint-based approach for automating the framework. Then, for example, termination techniques based on polynomial interpretations can be plugged in as a component to generate well-founded orders.

1 Introduction

Termination analysis in logic programming (LP) traditionally aims at proving that a given logic program terminates w.r.t. a specific set of queries. Termination proofs are usually done by finding ranking functions that map the states of the program to a sequence of elements of a well-founded domain such that the sequence is decreasing w.r.t. the well-founded order of the domain. Practically, it is sufficient to consider only the states that are involved in loops of the program.

Techniques in termination analysis of LPs can be divided into two groups: the global versus the local approach [4, 6, 5, 8, 10, 12, 26]. In the global approach, one wants to find only **one ranking function** for all loops [8, 10, 26]. In contrast, techniques in the local approach apply **different ranking functions** for different loops [4, 5, 12]. Some automated techniques in the global approach are based on a constraint-based framework to search for a suitable ranking function. This is done by first generating a set of symbolic constraints from all termination conditions. Then, a constraint solver is used to solve the set of constraints, yielding a suitable ranking function for the proof. In the local approach, most techniques use a given small set of norms, and try to prove that (a combination of) these norms can be applied for the termination proof of the program. It is unclear at

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Termination Proofs For Logic Programs

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Termination Proofs For Logic Programs:

Termination Proofs for Logic Programs Lutz Plümer,1990 Termination proofs constitute a crucial part of program verification Much research about termination has been done in the context of term rewriting systems But until now there was little hope that termination proofs for nontrivial programs could be achieved automatically This book gives a comprehensive discussion of the termination problem in the context of logic programming Although logic programs pose special difficulties for termination proofs it turns out that automation of this task is obtainable to a much larger degree than for programs in imperative languages A technique for the automatic derivation of termination proofs is presented in detail The discussion of several nontrivial examples illustrates its range of applicability The approach is based on the concept of declarative semantics and thus makes use of an important feature of logic programming PUBLISHER S WEBSITE **TERMINATION PROOFS FOR LOGIC PROGRAMS** Lutz Plumer,1990 Termination proofs for logic programs based on predicate inequalities Lutz Plümer,1990 **Deriving Termination Proofs for Logic Programs, Using Abstract Procedures** K. Verschaetse,D. De Schreye,1991 Logic Programming Lee Naish,1997 Covers the latest research in areas such as theoretical foundations constraints concurrency and parallelism deductive databases language design and implementation non monotonic reasoning and logicprogramming and the Internet 8 12 July 1997 Leuven Belgium The International Conference on Logic Programming is the main annual conference sponsored by the Association for Logic Programming It covers the latest research in areas such as theoretical foundations constraints concurrency and parallelism deductive databases language design and implementation non monotonic reasoning and logic programming and the Internet *Logic Programming* Michael Maher,1996 Includes tutorials invited lectures and refereed papers on all aspects of logic programming including Constraints Concurrency and Parallelism Deductive Databases Implementations Meta and Higher order Programming Theory and Semantic Analysis September 2 6 1996 Bonn Germany Every four years the two major international scientific conferences on logic programming merge in one joint event JICSLP 96 is the thirteenth in the two series of annual conferences sponsored by The Association for Logic Programming It includes tutorials invited lectures and refereed papers on all aspects of logic programming including Constraints Concurrency and Parallelism Deductive Databases Implementations Meta and Higher order Programming Theory and Semantic Analysis The contributors are international with strong contingents from the United States United Kingdom France and Japan Logic Programming series Research Reports and Notes **Meta-Programming in Logic** Alberto Pettorossi,1992 This volume contains lectures and papers delivered at Meta 92 the Third International Workshop on Metaprogramming in Logic held in Uppsala Sweden June 1992 The topics covered include foundations of metaprogramming in logic proposals for metaprogramming languages techniques for knowledgerepresentation and belief systems and program transformation and analysis in logic Particular topics include belief revision systems intensionaldeduction belief systems and metaprogramming principles of partial deduction termination in

logic programs semantics of the vanilla metainterpreter a complete resolution method for metaprogramming semanticsof demo hierarchical metalogics the naming relation in metalevel systems modules reflective agents compiler optimizations metalogic and object oriented facilities parallel logic languages the use of metaprogramming for legal reasoning representing objects and inheritance transformation of normal programs negation in automatically generated logic programs reordering of literals in deductive databases abstract interpretations and interarguments in constraint logic programs PUBLISHER S WEBSITE Generative Programming and Component Engineering Don Batory,C Consel (Charles),Walid Taha,2002-09-23 This book constitutes the refereed proceedings of the ACM SIGPLAN SIGSOFT Conference on Generative Programming and Component Engineering GPCE 2002 held in Pittsburgh PA USA in October 2002 The 18 revised full papers presented were carefully reviewed and selected from 39 submissions Among the topics covered are generative programming meta programming program specialization program analysis program transformation domain specific languages software architectures aspect oriented programming and component based systems **Modular Termination Proofs for Logic and Pure Prolog Programs** Krzysztof R. Apt,Dino Pedreschi,1993 Abstract We provide a uniform and simplified presentation of the methods of Bezem Bez93 first published as Bez89 and of Apt and Pedreschi AP93 first published as AP90 for proving termination of logic and Prolog programs Then we show how these methods can be refined so that they can be used in a modular way ESOP '92 Bernd Krieg-Brückner,1992-02-19 This volume contains selected papers presented at the European Symposium on Programming ESOP held jointly with the seventeeth Colloquium on Trees in Algebra and Programming CAAP in Rennes France February 26 28 1992 the proceedings of CAAP appear in LNCS 581 The previous symposiawere held in France Germany and Denmark Every even year as in 1992 CAAPis held jointly with ESOP ESOP addresses fundamental issues and important developments in the specification and implementation of programming languages and systems It continues lines begun in France and Germany under the names Colloque sur la Programmation and the GI workshop on Programmiersprachen und Programmentwicklung The programme committee received 71 submissions from which 28 have been selected for inclusion in this volume **Principles and Practice of Declarative Programming** Gopalan Nadathur,2006-12-29 This book constitutes the refereed proceedings of the International Conference on Principles and Practice of Declarative Programming PPDP 99 held in Paris France in September October 1999 The 22 revised full papers presented together with three invited contributions were carefully reviewed and selected from a total of 52 full length papers submitted Among the topics covered are type theory logics and logical methods in understanding defining integrating and extending programming paradigms such as functional logic object oriented constraint and concurrent programming support for modularity the use of logics in the design of program development tools and development and implementation methods *Modular Termination Proofs Forrr Logic and Pure Prolog Programs* Krzysztof R. Apt,Dino Pedreschi,1993 **Foundations of Software Technology and Theoretical Computer Science** Rudrapatna K. Shyamasundar,1993-11-23

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Algebraic Methodology and Software Technology Martin Wirsing,Maurice Nivat,1996-06-19 Content Description Includes bibliographical references and index **Constructing Logic Programs** Jean-Marie Jacquet,1993-09-21 This is an in depth analysis of the complexities and practical advantages of several approaches to logic program development The authors highlight state of the art research illustrating and clarifying each concept by example Exercises and a general tutorial style give the book its practical perspective It addresses the problems which may be encountered in the complicated process of writing a logic program A structured discussion of each facet of this task covers broadly the synthesis derivation and analysis of a logic program as well as the necessary underlying theoretical foundations Page 4 de la couverture

Functional and Logic Programming ,1999 Logic Programming Christoph Beierle,Lutz Plümer,1995 This text aims at promoting a convergence between the technical challenges of developing advanced software systems and the formal techniques tools and features evolving from the logic programming paradigm It provides contributions towards different apsects of logic programming *Algebraic and Logic Programming* ,1992 **Logic Program Synthesis and Transformation** Norbert E. Fuchs,1998-09-09 This book constitutes the strictly refereed post workshop proceedings of the 7th International Workshop on Logic Program Synthesis Transformation LOPSTR 97 held in Leuven Belgium in July 1997 The 15 revised full papers presented have been through two rounds of reviewing selection from a total of initially 33 submissions The topics addressed include program synthesis program transformation program analysis tabling metaprogramming inductive logic programming **Proving Termination of Logic Programs** Bal Wang,Rudrapatna Shyamasundar,1988

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