Answer Set Programming and CLASP
A Tutorial

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Abstract We provide a tutorial on answer set programming, a modern approach towards true declarative programming. We first introduce the required theoretical background in a compact, yet sufficient way and continue to elaborate problem encodings for some well known problems. We do so by also introducing the tools gringo and clasp, a sophisticated state-of-the-art grounder and solver, respectively. In that way we cover theoretical as well as practical aspects of answer set programming, such that the interested reader will gather sufficient knowledge and experience in order to continue discovering the field of answer set programming.

1 Introduction

Answer set programming (ASP) is a modern approach to declarative programming, where a user focusses on declaratively specifying his or her problem. ASP has its roots in deductive databases, logic programming, logic based knowledge representation and reasoning, constraint solving, and satisfiability testing. It can be applied in a uniform way to search problems in the classes P, NP, and NP^{NP} as they occur in application domains like planning, configuration, code optimization, database integration, decision support, model checking, robotics, system syntheses, and many more. We assume the reader to be familiar with propositional and first-order logic as well as with logic programming [5,13,3].

2 The Interview Example

A college in the USA uses the following rules for awarding scholarships to students: (1) Every student with a GPA of at least 3.8 is eligible. (2) Every minority student with a GPA of at least 3.6 is eligible. (3) No student with a GPA under 3.6 is eligible. (4) The students whose eligibility is not determined by these rules are interviewed by the scholarship committee.

These rules can be encoded in the following program:

$$
\begin{aligned}
eligible(X) &\leftarrow highGPA(X) \\
eligible(X) &\leftarrow minority(X) \wedge fairGPA(X) \\
\neg eligible(X) &\leftarrow \neg fairGPA(X) \\
interview(X) &\leftarrow \sim eligible(X) \wedge \sim \neg eligible(X)
\end{aligned}
\tag{1}
$$

Answer Set Programming Tutorial

S Marginson

Answer Set Programming Tutorial:

Theoretical Aspects of Computing - ICTAC 2005 Dang Van Hung,2005-10-04 This book constitutes the refereed proceedings of the Second International Colloquium on Theoretical Aspects of Computing ICTAC 2005 held in Hanoi Vietnam in October 2005 The 35 revised full papers presented together with 5 invited talks and a summary of 5 tutorials were carefully reviewed and selected from 122 submissions The papers are organized in topical sections on formal languages computer science logics program construction real time systems concurrency and refinement software security quantitative logics object orientation and component systems model checking and algorithms and applied logics and computing theory

Correct Reasoning Esra Erdem,Joohyung Lee,Yuliya Lierler,David Pearce,2012-06-03 This Festschrift published in honor of Vladimir Lifschitz on the occasion of his 65th birthday presents 39 articles by colleagues from all over the world with whom Vladimir Lifschitz had cooperation in various respects The 39 contributions reflect the breadth and the depth of the work of Vladimir Lifschitz in logic programming circumscription default logic action theory causal reasoning and answer set programming **Logics in Artificial Intelligence** Sergio Flesca,2002-09-11 This book constitutes the refereed proceedings of the European Conference on Logics in Artificial Intelligence JELIA 2002 held in Cosenza Italy in September 2002 The 41 revised full papers presented together with 11 system descriptions and 3 invited contributions were carefully reviewed and selected from more than 100 submissions The papers are organized in topical sections on multi agent systems evolution and changes description logic and the semantic web complexity issues probabilistic logic AI planning modal logic and causal reasoning theory reasoning under uncertainty satisfiability paraconsisten reasoning actions and caution logic for agents semantics and optimization issues in answer set semantics **What AI Can Do** Manuel Cebral-Loureda,Elvira G. Rincón-Flores,Gildardo Sanchez-Ante,2023-08-01 The philosopher Spinoza once asserted that no one knows what a body can do conceiving an intrinsic bodily power with unknown limits Similarly we can ask ourselves about Artificial Intelligence AI To what extent is the development of intelligence limited by its technical and material substrate In other words what can AI do The answer is analogous to Spinoza s Nobody knows the limit of AI Critically considering this issue from philosophical interdisciplinary and engineering perspectives respectively this book assesses the scope and pertinence of AI technology and explores how it could bring about both a better and more unpredictable future What AI Can Do highlights at both the theoretical and practical levels the cross cutting relevance that AI is having on society appealing to students of engineering computer science and philosophy as well as all who hold a practical interest in the technology **AI*IA 2016 Advances in Artificial Intelligence** Giovanni Adorni,Stefano Cagnoni,Marco Gori,Marco Maratea,2016-11-24 This book constitutes the refereed proceedings of the 15th International Conference of the Italian Association for Artificial Intelligence AI IA 2016 held in Genova Italy in November December 2016 The 39 full papers presented were carefully reviewed and selected from 53 submissions The papers are organized in topical sections on optimization and evolutionary algorithms classification pattern

recognition and computer vision multi agent systems machine learning semantic web and description logics natural language processing planning and scheduling and formal verification   *Web Technologies* Arthur Tatnall,2009-10-31 With the technological advancement of mobile devices social networking and electronic services Web technologies continues to play an ever growing part of the global way of life incorporated into cultural economical and organizational levels Web Technologies Concepts Methodologies Tools and Applications 4 Volume provides a comprehensive depiction of current and future trends in support of the evolution of Web information systems Web applications and the Internet Through coverage of the latest models concepts and architectures this multiple volume reference supplies audiences with an authoritative source of information and direction for the further development of the Internet and Web based phenomena   **Pascal Programming Guide and Man Pages** Robert Reimann,1991   **Tutorial Programming Productivity** Capers Jones,1986 This tutorial volume on productivity issues for the eighties attempts to place programming in context with other disciplines and address five major topis programming measurements programming life cycle analysis programming equipment and design methods programming environmental and the new science of software Abstract   **Mathematical Reviews** ,2004   *School and Home Guide to IBM-compatible Personal Computers* Everett Murdock,Susan Sudbury,1985 Answers Questions As to What Is Is Not IBM Compatible Includes an Index of Products Features Designed for IBMs IBM Compatibles   *Software Ergonomics* Hans-Jörg Bullinger,Rul Gunzenhäuser,1988   Theory and Applications of Answer Set Programming Esra Erdem,2002 Answer set programming ASP is a new form of declarative logic programming ASP interprets a logic program as a constraint on sets of literals just as a propositional formula can be viewed as a constraint on assignments of truth values to atoms The concept of an answer set was originally proposed as a semantics of negation as failure in Prolog Instead of traditional Prolog systems ASP uses answer set solvers The input of Prolog consists of a logic program and a query and Prolog computes answer substitutions the input of an answer set solver is a logic program and the solver computes the program s answer sets The idea of ASP is to represent a given computational problem as a logic program whose answer sets correspond to solutions and to use an answer set solver to find an answer set We have investigated the application of ASP to several combinatorial search problems including planning wire routing and phylogeny reconstruction Planning is the problem of finding a sequence of actions that leads to a given goal Wire routing is the problem of determining the physical locations of all wires interconnecting the circuit components on a chip Phylogeny reconstruction is the problem of constructing and labeling an evolutionary tree for a set of taxa taxonomic units which describes the evolution of the taxa in that set from their most recent common ancestor In our work on phylogeny reconstruction we have generated several conjectures about the evolutionary history of Indo European languages The work on the use of ASP for planning has led us to the investigation of some theoretical questions related to answer sets One is the problem of equivalent transformations of logic programs under what conditions can we replace a program by an equivalent program that can be processed by an

answer set solver more efficiently Another problem is related to completion a process that can translate a logic program into a set of formulas of classical logic In some cases the interpretations satisfying the completion of a program are also the answer sets for that program In such cases we can use propositional solvers systems that compute a model of a given set of clauses to find the program s answer sets For some problems propositional solvers are more efficient than answer set solvers Therefore we have investigated under what conditions we can use propositional solvers to find the program s answer sets

Teaching Philosophy ,1978   Educational Technology ,1982   *Instructional Computing with the TRS-80* Herbert Nickles,George H. Culp,1984   *Web Techniques* ,1997   Journal of Object-oriented Programming ,1996

Bowker/Bantam ... Complete Sourcebook of Personal Computing ,1984   **Proceedings** Digital Equipment Computer Users Society,1976   *JNDI API Tutorial and Reference* Rosanna Lee,Scott Seligman,2000 PLEASE PROVIDE DESCRIPTION

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