

First-Order Dynamic Logic

- Semantics: Transitions between states defined as
 - $R(X := a) = \{ (S, S') : \text{if } S'(x) = S(a) \text{ and } S'(y) = S(y) \text{ for } Y \neq X \}$
 - $R(A?) = \{ (S, S) : S \models A \}$
 - Definitions of $U, ;$ are same as in the propositional case.

First Order Dynamic Logic

David Harel



First Order Dynamic Logic:

First-Order Dynamic Logic David Harel, 1979-04 *First-Order Dynamic Logic* D. Harel, 2014-01-15 *Dynamic Logic* David Harel, Dexter Kozen, Jerzy Tiuryn, 2000-09-29 This book provides the first comprehensive introduction to Dynamic Logic Among the many approaches to formal reasoning about programs Dynamic Logic enjoys the singular advantage of being strongly related to classical logic Its variants constitute natural generalizations and extensions of classical formalisms For example Propositional Dynamic Logic PDL can be described as a blend of three complementary classical ingredients propositional calculus modal logic and the algebra of regular events In First Order Dynamic Logic DL the propositional calculus is replaced by classical first order predicate calculus Dynamic Logic is a system of remarkable unity that is theoretically rich as well as of practical value It can be used for formalizing correctness specifications and proving rigorously that those specifications are met by a particular program Other uses include determining the equivalence of programs comparing the expressive power of various programming constructs and synthesizing programs from specifications This book provides the first comprehensive introduction to Dynamic Logic It is divided into three parts The first part reviews the appropriate fundamental concepts of logic and computability theory and can stand alone as an introduction to these topics The second part discusses PDL and its variants and the third part discusses DL and its variants Examples are provided throughout and exercises and a short historical section are included at the end of each chapter FIRST-ORDER DYNAMIC LOGIC David Harel, 1979 *GABCOM & GABMET* Gmelin Institut, 1993-07-02 The scientific literature in chemistry and physics abounds with abbreviations of chemical compounds physical methods and mathematical procedures Unfortunately many authors take it for granted that the reader knows the meaning of an abbreviation something quite trivial for a specialist For the less informed reader these abbreviations thus present definite communication problems The Gmelin Institute of Inorganic Chemistry of the Max Planck Society has collected more than 4000 abbreviations for methods and terms from chemistry physics and mathematics and more than 4000 chemical compounds mostly ligands in coordination chemistry and standard reagents for physical and analytical methods GABCOM and GABMET provide an overview enabling readers and authors to check the definition of an abbreviation used by an author and to see whether this abbreviation is already being used for other purposes GABCOM and GABMET are also in preparation in electronic form data file and search software for IBM PC or compatible computers **Many-Dimensional Modal Logics: Theory and Applications** A. Kurucz, F. Wolter, M. Zakharyashev, Dov M. Gabbay, 2003-10-21 Modal logics originally conceived in philosophy have recently found many applications in computer science artificial intelligence the foundations of mathematics linguistics and other disciplines Celebrated for their good computational behaviour modal logics are used as effective formalisms for talking about time space knowledge beliefs actions obligations provability etc However the nice computational properties can drastically change if we combine some of these formalisms into a many dimensional system say to reason about knowledge bases developing in time

or moving objects To study the computational behaviour of many dimensional modal logics is the main aim of this book On the one hand it is concerned with providing a solid mathematical foundation for this discipline while on the other hand it shows that many seemingly different applied many dimensional systems e g multi agent systems description logics with epistemic temporal and dynamic operators spatio temporal logics etc fit in perfectly with this theoretical framework and so their computational behaviour can be analyzed using the developed machinery We start with concrete examples of applied one and many dimensional modal logics such as temporal epistemic dynamic description spatial logics and various combinations of these Then we develop a mathematical theory for handling a spectrum of abstract combinations of modal logics fusions and products of modal logics fragments of first order modal and temporal logics focusing on three major problems decidability axiomatizability and computational complexity Besides the standard methods of modal logic the technical toolkit includes the method of quasimodels mosaics tilings reductions to monadic second order logic algebraic logic techniques Finally we apply the developed machinery and obtained results to three case studies from the field of knowledge representation and reasoning temporal epistemic logics for reasoning about multi agent systems modalized description logics for dynamic ontologies and spatio temporal logics The genre of the book can be defined as a research monograph It brings the reader to the front line of current research in the field by showing both recent achievements and directions of future investigations in particular multiple open problems On the other hand well known results from modal and first order logic are formulated without proofs and supplied with references to accessible sources The intended audience of this book is logicians as well as those researchers who use logic in computer science and artificial intelligence More specific application areas are e g knowledge representation and reasoning in particular terminological temporal and spatial reasoning or reasoning about agents And we also believe that researchers from certain other disciplines say temporal and spatial databases or geographical information systems will benefit from this book as well Key Features Integrated approach to modern modal and temporal logics and their applications in artificial intelligence and computer science Written by internationally leading researchers in the field of pure and applied logic Combines mathematical theory of modal logic and applications in artificial intelligence and computer science Numerous open problems for further research Well illustrated with pictures and tables

Foundations of Software Science and Computation Structures Igor Walukiewicz, 2004-03-19 This book constitutes the refereed proceedings of the 7th International Conference on Foundations of Software Science and Computation Structures FOSSACS 2004 held in Barcelona Spain in March April 2004 The 34 revised full papers presented together with the abstracts of 2 invited talks were carefully reviewed and selected from over 130 submissions Among the topics addressed are lambda calculus cryptographic protocol analysis graphs and grammar systems decision theory bisimulation rewriting normalization specification verification process calculi mobile code automata program semantics dynamic logics timed languages security analysis information theoretical aspects Logic-Based Artificial Intelligence Jack Minker, 2012-12-06 The use of

mathematical logic as a formalism for artificial intelligence was recognized by John McCarthy in 1959 in his paper on Programs with Common Sense In a series of papers in the 1960 s he expanded upon these ideas and continues to do so to this date It is now 41 years since the idea of using a formal mechanism for AI arose It is therefore appropriate to consider some of the research applications and implementations that have resulted from this idea In early 1995 John McCarthy suggested to me that we have a workshop on Logic Based Artificial Intelligence LBAI In June 1999 the Workshop on Logic Based Artificial Intelligence was held as a consequence of McCarthy s suggestion The workshop came about with the support of Ephraim Glinert of the National Science Foundation IIS 952013S the American Association for Artificial Intelligence who provided support for graduate students to attend and Joseph JaJa Director of the University of Maryland Institute for Advanced Computer Studies who provided both manpower and financial support and the Department of Computer Science We are grateful for their support This book consists of refereed papers based on presentations made at the Workshop Not all of the Workshop participants were able to contribute papers for the book The common theme of papers at the workshop and in this book is the use of logic as a formalism to solve problems in AI *Automated Reasoning with Analytic Tableaux and Related Methods* Serenella Cerrito, Andrei Popescu, 2019-08-22 This book constitutes the proceedings of the 28th International Conference on Automated Reasoning with Analytic Tableaux and Related Methods TABLEAUX 2019 held in London UK in September 2019 colocated with the 12th International Symposium on Frontiers on Combining Systems FroCoS 2019 The 25 full papers presented were carefully reviewed and selected from 43 submissions They present research on all aspects of the mechanization of tableaux based reasoning and related methods including theoretical foundations implementation techniques systems development and applications The papers are organized in the following topical sections tableau calculi sequent calculi semantics and combinatorial proofs non wellfounded proof systems automated theorem provers and logics for program or system verification **Trustworthy Cyber-Physical Systems Engineering** Alexander Romanovsky, Fuyuki Ishikawa, 2016-10-03 From the Foreword Getting CPS dependability right is essential to forming a solid foundation for a world that increasingly depends on such systems This book represents the cutting edge of what we know about rigorous ways to ensure that our CPS designs are trustworthy I recommend it to anyone who wants to get a deep look at these concepts that will form a cornerstone for future CPS designs Phil Koopman Carnegie Mellon University Pittsburgh Pennsylvania USA Trustworthy Cyber Physical Systems Engineering provides practitioners and researchers with a comprehensive introduction to the area of trustworthy Cyber Physical Systems CPS engineering Topics in this book cover questions such as What does having a trustworthy CPS actually mean for something as pervasive as a global scale CPS How does CPS trustworthiness map onto existing knowledge and where do we need to know more How can we mathematically prove timeliness correctness and other essential properties for systems that may be adaptive and even self healing How can we better represent the physical reality underlying real world numeric quantities in the computing system How can we

establish reason about and ensure trust between CPS components that are designed installed maintained and operated by different organizations and which may never have really been intended to work together Featuring contributions from leading international experts the book contains sixteen self contained chapters that analyze the challenges in developing trustworthy CPS and identify important issues in developing engineering methods for CPS The book addresses various issues contributing to trustworthiness complemented by contributions on TCSP roadmapping taxonomy and standardization as well as experience in deploying advanced system engineering methods in industry Specific approaches to ensuring trustworthiness namely proof and refinement are covered as well as engineering methods for dealing with hybrid aspects

Logical Analysis of Hybrid Systems André Platzer,2010-09-02 Hybrid systems are models for complex physical systems and have become a widely used concept for understanding their behavior Many applications are safety critical including car railway and air traffic control robotics physical chemical process control and biomedical devices Hybrid systems analysis studies how we can build computerized controllers for physical systems which are guaranteed to meet their design goals The author gives a unique logic based perspective on hybrid systems analysis It is the first book that leverages the power of logic for hybrid systems The author develops a coherent logical approach for systematic hybrid systems analysis covering its theory practice and applications It is further shown how the developed verification techniques can be used to study air traffic and railway control systems This book is intended for researchers postgraduates and professionals who are interested in hybrid systems analysis cyberphysical or embedded systems design logic and theorem proving or transportation and automation **Time & Logic** Leonard Bolc,Andrzej Szalas,2019-10-24 Originally published in 1995 Time and Logic

examines understanding and application of temporal logic presented in computational terms The emphasis in the book is on presenting a broad range of approaches to computational applications The techniques used will also be applicable in many cases to formalisms beyond temporal logic alone and it is hoped that adaptation to many different logics of program will be facilitated Throughout the authors have kept implementation orientated solutions in mind The book begins with an introduction to the basic ideas of temporal logic Successive chapters examine particular aspects of the temporal theoretical computing domain relating their applications to familiar areas of research such as stochastic process theory automata theory established proof systems model checking relational logic and classical predicate logic This is an essential addition to the library of all theoretical computer scientists It is an authoritative work which will meet the needs both of those familiar with the field and newcomers to it Foundations of Software Science and Computational Structures Luca De Alfaro,2009-03-09

This book constitutes the refereed proceedings of the 12th International Conference on Foundations of Software Science and Computational Structures FOSSACS 2009 held in York UK in March 2009 as part of ETAPS 2009 the European Joint Conferences on Theory and Practice of Software The 30 revised full papers presented together with two invited talks were carefully reviewed and selected from 102 full paper submissions The topics addressed are semantics logics and automata

algebras automata theory processes and models security probabilistic and quantitative models synthesis and program analysis and semantics **Dynamic Logic. New Trends and Applications** Manuel A. Martins,Igor Sedlár,2020-12-21 This book constitutes the proceedings of the Third International Workshop on Dynamic Logic DaL 2019 held in Prague Czech Republic in October 2020 Due to COVID 19 the workshop has been held online The 17 full papers presented together with 6 short papers were carefully reviewed and selected from 31 submissions The theoretical relevance and practical potential of dynamic logic is a topic of interest in a number of scientific venues from wide scope software engineering conferences to modal logic specific events The DaL 2020 workshop is exclusively dedicated to Dynamic logic and aims at filling this gap and creating a heterogeneous community of colleagues from Academia to Industry from Mathematics to Computer Science

Coordination Models and Languages Marjan Sirjani,2012-06-09 This book constitutes the refereed proceedings of the 14th International Conference on Coordination Models and Languages COORDINATION 2012 held in Stockholm Sweden in June 2012 as one of the DisCoTec 2012 events The 18 revised full papers presented were carefully reviewed and selected from 55 submissions The papers cover a wide range of topics including coordination of social collaboration processes coordination of mobile systems in peer to peer and ad hoc networks programming and reasoning about distributed and concurrent software types contracts synchronization coordination patterns and families of distributed systems *Formal Models and Semantics* Bozzano G Luisa,2014-06-28 The second part of this Handbook presents a choice of material on the theory of automata and rewriting systems the foundations of modern programming languages logics for program specification and verification and some chapters on the theoretic modelling of advanced information processing

Automated Reasoning Nicolas Peltier,Viorica Sofronie-Stokkermans,2020-06-30 This two volume set LNAI 12166 and 12167 constitutes the refereed proceedings of the 10th International Joint Conference on Automated Reasoning IJCAR 2020 held in Paris France in July 2020 In 2020 IJCAR was a merger of the following leading events namely CADE International Conference on Automated Deduction FroCoS International Symposium on Frontiers of Combining Systems ITP International Conference on Interactive Theorem Proving and TABLEAUX International Conference on Analytic Tableaux and Related Methods The 46 full research papers 5 short papers and 11 system descriptions presented together with two invited talks were carefully reviewed and selected from 150 submissions The papers focus on the following topics Part I SAT SMT and QBF decision procedures and combination of theories superposition proof procedures non classical logics Part II interactive theorem proving HOL formalizations verification reasoning systems and tools The conference was held virtually due to the COVID 19 pandemic Chapter Constructive Hybrid Games is available open access under a Creative Commons Attribution 4 0 International License via link [springer.com](https://www.springer.com) *Model-Driven Architecture in Practice* Oscar Pastor,Juan Carlos Molina,2007-06-14 Formal specification languages object oriented methods CASE tools component based software production agent oriented aspect oriented During the last two decades many techniques have been proposed from both

research and industry in order to generate a correct software product from a higher level system specification Nevertheless the many failures in achieving this goal have resulted in scepticism when facing any new proposal that offers a press the button get all the code strategy And now the hype around OMG s MDA has given a new push to these strategies Oscar Pastor and Juan Carlos Molina combine a sound theoretical approach based on more than 10 years research with industrial strength and practical software development experience They present a software process based on model transformation technology thus making the statement the model is the code instead of the common the code is the model finally come true They clearly explain which conceptual primitives should be present in a system specification how to use UML to properly represent this subset of basic conceptual constructs how to identify just those diagrams and modeling constructs that are actually required to create a meaningful conceptual schema and finally how to accomplish the transformation process between the problem space and the solution space Their approach is fully supported by commercially available tools and the subsequent software production process is dramatically more efficient than today s conventional software development processes saving many man days of work For software developers and architects project managers and people responsible for quality assurance this book introduces all the relevant information required to understand and put MDA into industrial practice Handbook of Philosophical Logic Dov M. Gabbay, Franz Guenther, 2012-12-06 The chapters in the present volume go beyond classical extensional logic with respect to one important factor they all include among the semantic constituents representations of so called possible worlds The inclusion of such indices has turned out to be the semantic mainstay in dealing with a number of issues having to do with intensional features of natural and artificial languages It is of course an open question whether possible world semantics is in the final analysis the proper solution to the many problems and puzzles intensional constructions raise for the logical analysis of the many varieties of discourse At present there seem to be about as many opponents as proponents with regard to the usefulness of having the semantics of intensional languages based on possible world constructs Some attempts to come to grips with intensional phenomena which are not couched in the possible world framework are discussed in Volume IV of the Handbook Chapter 1 is an extensive survey of the main systems of propositional modal logic including the most important meta mathematical results and the techniques used in establishing these It introduces the basic terminology and semantic machinery applied in one way or another in many of the subsequent chapters Chapter 2 discusses the most significant developments in propositional tense logic which can of course be regarded as a special kind of modal logic where the possible world indices are simply ordered moments of time Relational Methods in Computer Science Harrie C.M. de Swart, 2003-07-01 This book constitutes the thoroughly refereed joint post proceedings of the 6th International Conference on Relational Methods in Computer Science RelMICS 2001 and the 1st Workshop of COST Action 274 TARSKI Theory and Application of Relational Structures as Knowledge Instruments held in Oisterwijk The Netherlands in October 2001 The 20 revised full papers presented together with an invited paper were carefully reviewed

and selected The papers are organized in topical sections on algebraic and logical foundations of real world relations
mechanization of relational reasoning and relational scaling and preferences

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First Order Dynamic Logic Introduction

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