

A LOGICAL APPROACH TO DISCRETE MATH

David Gries
Fred B. Schneider

Theorem:

$$(\forall x | : P \Rightarrow Q) \equiv \{x | P\} \subseteq \{x | Q\}$$

Proof:

$$\begin{aligned} & \{x | P\} \subseteq \{x | Q\} \\ = & \text{(Def. of Subset } \subseteq, \text{ with } v \text{ not} \\ & \text{occurring free in } P \text{ or } Q) \\ & (\forall v | v \in \{x | P\} : v \in \{x | Q\}) \\ = & (v \in \{x | R\} \equiv R[x := v], \text{ twice}) \\ & (\forall v | P[x := v] : Q[x := v]) \\ = & \text{(Trading; Dummy renaming)} \\ & (\forall x | : P[x := v][v := x] \Rightarrow \\ & \quad Q[x := v][v := x]) \\ = & (R[x := v][v := x] \equiv R \text{ if } v \\ & \quad \text{does not occur free in } R, \text{ twice}) \\ & (\forall x | : P \Rightarrow Q) \end{aligned}$$



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Logical Approach To Discrete Math

Jeremy Gibbons, Johan Jeuring



Logical Approach To Discrete Math:

A Logical Approach to Discrete Math David Gries, Fred B. Schneider, 1993-10-22 Here the authors strive to change the way logic and discrete math are taught in computer science and mathematics while many books treat logic simply as another topic of study this one is unique in its willingness to go one step further The book treats logic as a basic tool which may be applied in essentially every other area

A Logical Approach to Discrete Math David Gries, Fred B. Schneider, 2014-01-15

Instructor's Manual, A Logical Approach to Discrete Math David Gries, Fred B. Schneider, 1993

FM 2006: Formal Methods Jayadev Misra, Tobias Nipkow, Emil Sekerinski, 2006-08-10 This book presents the refereed proceedings of the 14th International Symposium on Formal Methods FM 2006 held in Hamilton Canada August 2006 The book presents 36 revised full papers together with 2 invited contributions and extended abstracts of 7 invited industrial presentations organized in topical sections on interactive verification formal modelling of systems real time industrial experience specification and refinement programming languages algebra formal modelling of systems and more

Interactive Theorem Proving Jeremy Avigad, Assia Mahboubi, 2018-07-03 This book constitutes the refereed proceedings of the 9th International Conference on Interactive Theorem Proving ITP 2018 held in Oxford UK in July 2018 The 32 full papers and 5 short papers presented were carefully reviewed and selected from 65 submissions The papers feature research in the area of logical frameworks and interactive proof assistants The topics include theoretical foundations and implementation aspects of the technology as well as applications to verifying hardware and software systems to ensure their safety and security and applications to the formal verification of mathematical results Chapters 2 10 26 29 30 and 37 are available open access under a Creative Commons Attribution 4.0 International License via link [springer.com](https://www.springer.com)

Relational and Algebraic Methods in Computer Science Jules Desharnais, Walter Guttmann, Stef Joosten, 2018-10-22 This book constitutes the proceedings of the 17th International Conference on Relational and Algebraic Methods in Computer Science RAMiCS 2018 held in Groningen The Netherlands in October November 2018 The 21 full papers and 1 invited paper presented together with 2 invited abstracts and 1 abstract of a tutorial were carefully selected from 31 submissions The papers are organized in the following topics Theoretical foundations reasoning about computations and programs and applications and tools

Certified Programs and Proofs Jean-Pierre Jouannaud, Zhong Shao, 2011-11-18 This book constitutes the referred proceedings of the First International Conference on Certified Programs and Proofs CPP 2011 held in Kenting Taiwan in December 2011 The 24 revised regular papers presented together with 4 invited talks were carefully reviewed and selected from 49 submissions They are organized in topical sections on logic and types certificates formalization proof assistants teaching programming languages hardware certification miscellaneous and proof perls

Mathematical Logic for Computer Science Mordechai Ben-Ari, 2012-12-06 Mathematical Logic for Computer Science is a mathematics textbook with theorems and proofs but the choice of topics has been guided by the needs of computer science

students The method of semantic tableaux provides an elegant way to teach logic that is both theoretically sound and yet sufficiently elementary for undergraduates To provide a balanced treatment of logic tableaux are related to deductive proof systems The logical systems presented are Propositional calculus including binary decision diagrams Predicate calculus Resolution Hoare logic Z Temporal logic Answers to exercises for instructors only as well as Prolog source code for algorithms may be found via the Springer London web site <http://www.springer.com> 978 1 85233 319 5 Mordechai Ben Ari is an associate professor in the Department of Science Teaching of the Weizmann Institute of Science He is the author of numerous textbooks on concurrency programming languages and logic and has developed software tools for teaching concurrency In 2004 Ben Ari received the ACM SIGCSE Award for Outstanding Contributions to Computer Science Education

Advances in Sensitivity Analysis and Parametric Programming Tomas Gal,H.J. Greenberg,2012-12-06 The standard view of Operations Research Management Science OR MS dichotomizes the field into deterministic and probabilistic nondeterministic stochastic subfields This division can be seen by reading the contents page of just about any OR MS textbook The mathematical models that help to define OR MS are usually presented in terms of one subfield or the other This separation comes about somewhat artificially academic courses are conveniently subdivided with respect to prerequisites an initial overview of OR MS can be presented without requiring knowledge of probability and statistics text books are conveniently divided into two related semester courses with deterministic models coming first academics tend to specialize in one subfield or the other and practitioners also tend to be expert in a single subfield But no matter who is involved in an OR MS modeling situation deterministic or probabilistic academic or practitioner it is clear that a proper and correct treatment of any problem situation is accomplished only when the analysis cuts across this dichotomy **Set**

Theory for Computing Domenico Cantone,Eugenio Omodeo,Alberto Policriti,2001-06-26 Set Theory for Computing offers an up to date and comprehensive account of set oriented symbolic manipulation and automated reasoning methods Mastering today s variety of systems with crisp formal tools is a prerequisite for a high degree of control over sets and aggregates The many algorithmic methods and deductive techniques in this book offer readers a clear view of the use of set theoretic notions in such critical areas as specification of problems data types and solution methods algorithmic program verification and automated deduction The rigorous and largely self contained style of presentation addresses readers wanting to complement their set intuition with the ability to exploit it in specification and verification and master it by symbolic logically based techniques and methods This book will be of interest to graduates and researchers in theoretical computer science and computational logic and automated reasoning *Teaching Formal Methods* Jeremy Gibbons,Jose Nuno Oliveira,2009-10-26 This volume contains the proceedings of TFM2009 the Second International FME Conference on Teaching Formal Methods organized by the Subgroup of Education of the Formal Methods Europe FME association The conference took place as part of the rst Formal Methods Week FMWeek held in Eindhoven The Netherlands in November 2009

TFM2009 was a one day forum in which to explore the successes and failures of formal method FM education and to promote cooperative projects to further education and training in FMs. The organizers gathered lecturers, teachers and industrial partners to discuss their experience, present their pedagogical methodologies and explore best practices. Interest in FM teaching is growing. TFM2009 followed in a series of events on teaching FMs which includes two BCS FACS TFM workshops: Oxford in 2003 and London in 2006. The TFM2004 conference Ghent 2004 with proceedings published as Springer LNCS Volume 3294. The FM Ed 2006 workshop Hamilton co-located with FM2006 FORMED Budapest at ETAPS2008 and FMET2008 Kitakyushu co-located with ICFEM2008. FMs have an important role to play in the development of complex computing systems, a role acknowledged in industrial standards such as IEC61508 and ISO IEC15408 and in the increasing use of precise modelling notations, semantic markup languages and model driven techniques. There is a growing need for software engineers who can work effectively with simple mathematical abstractions and with practical notions of inference and proof.

Logic, Rewriting, and Concurrency Narciso Martí-Oliet, Peter Csaba Ölveczky, Carolyn Talcott, 2015-08-26. This Festschrift volume contains 28 refereed papers including personal memories, essays and regular research papers by close collaborators and friends of Jos Meseguer to honor him on the occasion of his 65th birthday. These papers were presented at a symposium at the University of Illinois at Urbana-Champaign on September 23-25, 2015. The symposium also featured invited talks by Claude and Helene Kirchner and by Patrick Lincoln. The foreword of this volume adds a brief overview of some of Jos's many scientific achievements followed by a bibliography of papers written by Jos. **Information Technology** Ricardo

Reis, 2006-04-11. This book contains a selection of tutorials on hot topics in information technology which were presented at the IFIP World Computer Congress WCC2004. The congress took place at the Centre de Congrès Pierre Baudis in Toulouse, France, from 22 to 27 August 2004. The 11 chapters included in the book were chosen from tutorial proposals submitted to WCC2004. These papers report on several important and state-of-the-art topics on information technology such as Quality of Service in Information Networks, Risk-Driven Development of Security-Critical Systems Using UMLsec, Developing Portable Software, Formal Reasoning About Systems, Software and Hardware Using Functionals, Predicates and Relations, The Problematic of Distributed Systems, Supervision, Software Rejuvenation, Modeling and Analysis, Test and Design for Test of Mixed-Signal Integrated Circuits, Web Services, Applications of Multi-Agent Systems, Discrete Event Simulation, Human-Centered Automation. We hereby would like to thank IFIP and more specifically WCC2004 Tutorials Committee and the authors for their contribution. We also would like to thank the congress organizers who have done a great job. Ricardo Reis, Editor. **QUALITY OF SERVICE IN INFORMATION NETWORKS** Augusto Casaca, IST/INESC R. Alves Redol, 1000-029 Lisboa, Portugal. **Abstract** This article introduces the problems concerned with the provision of end-to-end quality of service in IP networks which are the basis of information networks, describes the existing solutions for that provision and presents some of the current research items on the subject. **Key words** Information networks, IP networks, Integrated Services, Differentiated Services.

Multiprotocol Label Switching UMTS *Edsger Wybe Dijkstra* Krzysztof R. Apt, Tony Hoare, 2022-07-14 Edsger Wybe Dijkstra 1930 2002 was one of the most influential researchers in the history of computer science making fundamental contributions to both the theory and practice of computing Early in his career he proposed the single source shortest path algorithm now commonly referred to as Dijkstra's algorithm He wrote with Jaap Zonneveld the first ALGOL 60 compiler and designed and implemented with his colleagues the influential THE operating system Dijkstra invented the field of concurrent algorithms with concepts such as mutual exclusion deadlock detection and synchronization A prolific writer and forceful proponent of the concept of structured programming he convincingly argued against the use of the Go To statement In 1972 he was awarded the ACM Turing Award for fundamental contributions to programming as a high intellectual challenge for eloquent insistence and practical demonstration that programs should be composed correctly not just debugged into correctness for illuminating perception of problems at the foundations of program design Subsequently he invented the concept of self stabilization relevant to fault tolerant computing He also devised an elegant language for nondeterministic programming and its weakest precondition semantics featured in his influential 1976 book *A Discipline of Programming* in which he advocated the development of programs in concert with their correctness proofs In the later stages of his life he devoted much attention to the development and presentation of mathematical proofs providing further support to his long held view that the programming process should be viewed as a mathematical activity In this unique new book 31 computer scientists including five recipients of the Turing Award present and discuss Dijkstra's numerous contributions to computing science and assess their impact Several authors knew Dijkstra as a friend teacher lecturer or colleague Their biographical essays and tributes provide a fascinating multi author picture of Dijkstra from the early days of his career up to the end of his life

Algebraic Methodology and Software Technology Michael Johnson, 1997-12 This book constitutes the refereed proceedings of the 6th International Conference on Algebraic Methodology and Software Engineering AMAST 97 held in Sydney Australia in December 1997 The volume presents 48 revised full papers selected from an unusually high number of submissions One of the outstanding features of AMAST is its mix of serious mathematical development of formal methods in software engineering with practical concerns tools case studies and industrial development The volume addresses all current aspects of formal methods in software engineering and programming methodology with a certain emphasis on algebraic and logical foundations

Teaching and Learning Formal Methods C. Neville Dean, Michael G. Hinchey, 1996-09-17 As computer systems continue to advance the positions they hold in human society continue to gain power Computers now control the flight of aircraft the cooling systems in chemical plants and feedback loops in nuclear reactors Because of the vital roles these systems play there has been growing concern about the reliability and safety of these advanced computers Formal methods are now widely recognized as the most successful means of assuring the reliability of complex computer systems Because formal methods are being mandated in more and more international standards it is critical that engineers

managers and industrial project leaders are well trained and conversant in the application of these methods This book covers a broad range of issues relating to the pedagogy of formal methods The contributors all acknowledged experts have based their contributions on extensive experiences teaching and applying formal methods in both academia and industry The two editors both well known in this area propose various techniques that can help to dismiss myths that formal methods are difficult to use and hard to learn Teaching and Learning Formal Methods will be an indispensable text for educators in the fields of computer science mathematics software engineering and electronic engineering as well as to management and product leaders concerned with training recent graduates Offers proven methods for teaching formal methods even to students who lack a strong background in mathematics Addresses the important role that formal methods play in society and considers their growing future potential Includes contributions from several pioneers in the area Features a foreword written by Edsger W Dijkstra

Effective Theories in Programming Practice Jayadev Misra, 2022-12-27 Set theory logic discrete mathematics and fundamental algorithms along with their correctness and complexity analysis will always remain useful for computing professionals and need to be understood by students who want to succeed This textbook explains a number of those fundamental algorithms to programming students in a concise yet precise manner The book includes the background material needed to understand the explanations and to develop such explanations for other algorithms The author demonstrates that clarity and simplicity are achieved not by avoiding formalism but by using it properly The book is self contained assuming only a background in high school mathematics and elementary program writing skills It does not assume familiarity with any specific programming language Starting with basic concepts of sets functions relations logic and proof techniques including induction the necessary mathematical framework for reasoning about the correctness termination and efficiency of programs is introduced with examples at each stage The book contains the systematic development from appropriate theories of a variety of fundamental algorithms related to search sorting matching graph related problems recursive programming methodology and dynamic programming techniques culminating in parallel recursive structures

Generic Programming Jeremy Gibbons, Johan Jeuring, 2013-04-17 Generic programming is about making programs more adaptable by making them more general Generic programs often embody non traditional kinds of polymorphism ordinary programs are obtained from them by suitably instantiating their parameters In contrast with normal programs the parameters of a generic program are often quite rich in structure for example they may be other programs types or type constructors class hierarchies or even programming paradigms Generic programming techniques have always been of interest both to practitioners and to theoreticians but only recently have generic programming techniques become a specific focus of research in the functional and object oriented programming language communities Generic Programming comprises the edited proceedings of the Working Conference on Generic Programming which was sponsored by the International Federation for Information Processing IFIP and held in Dagstuhl Germany in July 2002 With contributions from leading

researchers around the world this volume captures the state of the art in this important emerging area **Number Theory for Computing** Song Y. Yan, 2013-11-11 Modern cryptography depends heavily on number theory with primality testing factoring discrete logarithms indices and elliptic curves being perhaps the most prominent subject areas Since my own graduate study had emphasized probability theory statistics and real analysis when I started working in cryptography around 1970 I found myself swimming in an unknown murky sea I thus know from personal experience how inaccessible number theory can be to the uninitiated Thank you for your efforts to ease the transition for a new generation of cryptographers Thank you also for helping Ralph Merkle receive the credit he deserves Diffie Rivest Shamir Adleman and I had the good luck to get expedited review of our papers so that they appeared before Merkle's seminal contribution Your noting his early submission date and referring to what has come to be called Diffie Hellman key exchange as it should Diffie Hellman Merkle key exchange is greatly appreciated It has been gratifying to see how cryptography and number theory have helped each other over the last twenty five years Number theory has been the source of numerous clever ideas for implementing cryptographic systems and protocols while cryptography has been helpful in getting funding for this area which has sometimes been called the queen of mathematics because of its seeming lack of real world applications Little did they know Stanford 30 July 2001 Martin E Hellman Preface to the Second Edition Number theory is an experimental science

Lectures in Logic and Set Theory: Volume 1, Mathematical Logic George Tourlakis, 2003-01-09 This two volume work bridges the gap between introductory expositions of logic or set theory on one hand and the research literature on the other It can be used as a text in an advanced undergraduate or beginning graduate course in mathematics computer science or philosophy The volumes are written in a user friendly conversational lecture style that makes them equally effective for self study or class use Volume 1 includes formal proof techniques a section on applications of compactness including nonstandard analysis a generous dose of computability and its relation to the incompleteness phenomenon and the first presentation of a complete proof of Gödel's 2nd incompleteness since Hilbert and Bernays' Grundlagen theorem

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