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Mathematical Logic for Computer Science-Mordechai Ben-Ari 2012-06-16 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 students of computer science. The method of semantic tableaux provides an elegant way to teach logic that is both theoretically sound and easy to understand. The uniform use of tableaux-based techniques facilitates learning advanced logical systems based on what the student has learned from elementary systems. The logical systems presented are: propositional logic, first-order logic, resolution and its application to logic programming, Hoare logic for the verification of sequential programs, and linear temporal logic for the verification of concurrent programs. The third edition has been entirely rewritten and includes new chapters on central topics of modern computer science: SAT solvers and model checking.

Mathematical Logic for Computer Science-Zhongwan Lu 1989 This book describes the aspects of mathematical logic related to computer sciences. The materials adopted in this book are intended to attend to both the peculiarities of logical systems and the requirements of computer science.

Essential Logic for Computer Science-Rex Page 2019-01-08 An introduction to applying predicate logic to testing and verification of software and digital circuits that focuses on applications rather than theory. Computer scientists use logic for testing and verification of software and digital circuits, but many computer science students study logic only in the context of traditional mathematics, encountering the subject in a few lectures and a handful of problem sets in a discrete math course. This book offers a more substantive and rigorous approach to logic that focuses on applications in computer science. Topics covered include predicate logic, equation-based software, automated testing and theorem proving, and large-scale computation. Formalism is emphasized, and the book employs three formal notations: traditional algebraic formulas of propositional and predicate logic; digital circuit diagrams; and the widely used partially automated theorem prover, ACL2, which provides an accessible introduction to mechanized formalism. For readers who want to see formalization in action, the text presents examples using Proof Pad, a lightweight ACL2 environment. Readers will not become ACL2 experts, but will learn how mechanized logic can benefit software and hardware engineers. In addition, 180 exercises, some of them extremely challenging, offer opportunities for problem solving. There are no prerequisites beyond high school algebra. Programming experience is not required to understand the book's equation-based approach. The book can be used in undergraduate courses in logic for computer science and introduction to computer science and in math courses for computer science students.

Logic for Computer Scientists-Uwe Schöning 2008-01-11 This book introduces the notions and methods of formal logic from a computer science standpoint, covering propositional logic, predicate logic, and foundations of logic programming. The classic text is replete with illustrative examples and exercises. It presents applications and themes of computer science research such as resolution, automated deduction, and logic programming in a rigorous but readable way. The style and scope of the work, rounded out by the inclusion of exercises, make this an excellent textbook for an advanced undergraduate course in logic for computer scientists.

Mathematical Logic for Computer Science-Mordechai Ben-Ari 2012-12-06 This is a mathematics textbook with theorems and proofs. 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. In order to provide a balanced treatment of logic, tableaux are related to deductive proof systems. The book presents various logical systems and contains exercises. Still further, Prolog source code is available on an accompanying Web site. The author is an Associate Professor at the Department of Science Teaching, Weizmann Institute of Science.

Mathematical Logic and Theoretical Computer Science-David Kueker 2020-12-18 Mathematical Logic and Theoretical Computer Science covers various topics ranging from recursion theory to Zariski topoi. Leading international authorities discuss selected topics in a number of areas, including denotational semantics, recursion theoretic aspects of computer science, model theory and algebra, Automath and automated reasoning, stability theory, topoi and mathematics, and topoi and logic. The most up-to-date review available in its field, Mathematical Logic and Theoretical Computer Science will be of interest to mathematical logicians, computer scientists, algebraists, algebraic geometers, differential geometers, differential topologists, and graduate students in mathematics and computer science.

Mathematical Logic for Computer Science-Lu Zhongwan 1998-08-22 Mathematical logic is essentially related to computer science. This book describes the aspects of mathematical logic that are closely related to each other, including classical logic, constructive logic, and modal logic. This book is intended to attend to both the peculiarities of logical systems and the requirements of computer science. In this edition, the revisions essentially involve rewriting the proofs, increasing the explanations, and adopting new terms and notations. Contents:Prerequisites:SetsInductive Definitions and ProofsNotationsClassical Propositional Logic:Propositions and ConnectivesPropositional LanguageStructure of FormulasSemanticsTautological ConsequenceFormal DeductionDisjunctive and Conjunctive Normal FormsAdequate Sets of ConnectivesClassical First-Order Logic:Proposition Functions and QuantifiersFirst-Order LanguageSemanticsLogical ConsequenceFormal DeductionPrenex Normal FormAxiomatic Deduction System:Axiomatic Deduction SystemRelation between the Two Deduction SystemsSoundness and Completeness:Satisfiability and ValiditySoundnessCompleteness of Propositional LogicCompleteness of First-Order LogicCompleteness of First-Order Logic with EqualityIndependenceCompactness, Löwenheim-Skolem, and Herbrand Theorems:CompactnessLöwenheim-Skolem's TheoremHerbrand's TheoremConstructive Logic:Constructivity of ProofsSemanticsFormal DeductionSoundnessCompletenessModal Propositional Logic:Modal Propositional LanguageSemanticsFormal DeductionSoundnessCompleteness of TCompleteness of S4, B, S5Modal First-Order Logic:Modal First-Order LanguageSemanticsFormal DeductionSoundnessCompletenessEquality Readership: Computer scientists. keywords:

Logic for Mathematics and Computer Science-Stanley Burris 1998 This text is intended for one semester courses in Logic, it can also be applied to a two semester course, in either Computer Science or Mathematics Departments. Unlike other texts on mathematical logic that are either too advanced, too sparse in examples or exercises, too traditional in coverage, or too philosophical in approach, this text provides an elementary "hands-on" presentation of important mathematical logic topics, new and old, that is readily accessible and relevant to all students of the mathematical sciences -- not just those in traditional pure mathematics.

Logic for Computer Science-Jean H. Gallier 2015-06-18 This advanced text for undergraduate and graduate students introduces mathematical logic with an emphasis on proof theory and procedures for algorithmic construction of formal proofs. The self-contained treatment is also useful for computer scientists and mathematically inclined readers interested in the formalization of proofs and basics of automatic theorem proving. Topics include propositional logic and its resolution, first-order logic, Gentzen's cut elimination theorem and applications, and Gentzen's sharpened Hauptsatz and Herbrand's theorem. Additional subjects include resolution in first-order logic; SLD-resolution, logic programming, and the foundations of PROLOG; and many-sorted first-order logic. Numerous problems appear throughout the book, and two Appendixes provide practical background information.

Logic in Computer Science-Michael Huth 2004-08-26 Recent years have seen the development of powerful tools for verifying hardware and software systems, as companies worldwide realise the need for improved means of validating their products. There is increasing demand for training in basic methods in formal reasoning so that students can gain proficiency in logic-based verification methods. The second edition of this successful textbook addresses both those

requirements, by continuing to provide a clear introduction to formal reasoning which is both relevant to the needs of modern computer science and rigorous enough for practical application. Improvements to the first edition have been made throughout, with extra and expanded sections on SAT solvers, existential/universal second-order logic, micro-models, programming by contract and total correctness. The coverage of model-checking has been substantially updated. Further exercises have been added. Internet support for the book includes worked solutions for all exercises for teachers, and model solutions to some exercises for students.

Logic, Mathematics, and Computer Science-Yves Nievergelt 2015-10-13 This text for the first or second year undergraduate in mathematics, logic, computer science, or social sciences, introduces the reader to logic, proofs, sets, and number theory. It also serves as an excellent independent study reference and resource for instructors. Adapted from Foundations of Logic and Mathematics: Applications to Science and Cryptography © 2002 Birkhäuser, this second edition provides a modern introduction to the foundations of logic, mathematics, and computers science, developing the theory that demonstrates construction of all mathematics and theoretical computer science from logic and set theory. The focuses is on foundations, with specific statements of all the associated axioms and rules of logic and set theory, and provides complete details and derivations of formal proofs. Copious references to literature that document historical development is also provided. Answers are found to many questions that usually remain unanswered: Why is the truth table for logical implication so unintuitive? Why are there no recipes to design proofs? Where do these numerous mathematical rules come from? What issues in logic, mathematics, and computer science still remain unresolved? And the perennial question: In what ways are we going to use this material? Additionally, the selection of topics presented reflects many major accomplishments from the twentieth century and includes applications in game theory and Nash's equilibrium, Gale and Shapley's match making algorithms, Arrow's Impossibility Theorem in voting, to name a few. From the reviews of the first edition: "...All the results are proved in full detail from first principles...remarkably, the arithmetic laws on the rational numbers are proved, step after step, starting from the very definitions!...This is a valuable reference text and a useful companion for anybody wondering how basic mathematical concepts can be rigorously developed within set theory." —MATHEMATICAL REVIEWS "Rigorous and modern in its theoretical aspect, attractive as a detective novel in its applied aspects, this paper book deserves the attention of both beginners and advanced students in mathematics, logic and computer sciences as well as in social sciences." —Zentralblatt MATH

Mathematical Logic-Wei Li 2010-02-26 Mathematical logic is a branch of mathematics that takes axiom systems and mathematical proofs as its objects of study. This book shows how it can also provide a foundation for the development of information science and technology. The first five chapters systematically present the core topics of classical mathematical logic, including the syntax and models of first-order languages, formal inference systems, computability and representability, and Gödel's theorems. The last five chapters present extensions and developments of classical mathematical logic, particularly the concepts of version sequences of formal theories and their limits, the system of revision calculus, proschemes (formal descriptions of proof methods and strategies) and their properties, and the theory of inductive inference. All of these themes contribute to a formal theory of axiomatization and its application to the process of developing information technology and scientific theories. The book also describes the paradigm of three kinds of language environments for theories and it presents the basic properties required of a meta-language environment. Finally, the book brings these themes together by describing a workflow for scientific research in the information era in which formal methods, interactive software and human invention are all used to their advantage. This book represents a valuable reference for graduate and undergraduate students and researchers in mathematics, information science and technology, and other relevant areas of natural sciences. Its first five chapters serve as an undergraduate text in mathematical logic and the last five chapters are addressed to graduate students in relevant disciplines.

Logics for Computer Science-Anita Wasilewska 2018-11-03 Providing an in-depth introduction to fundamental classical and non-classical logics, this textbook offers a comprehensive survey of logics for computer scientists. Logics for Computer Science contains intuitive introductory chapters explaining the need for logical investigations, motivations for different types of logics and some of their history. They are followed by strict formal approach chapters. All chapters contain many detailed examples explaining each of the introduced notions and definitions, well chosen sets of exercises with carefully written solutions, and sets of homework. While many logic books are available, they were written by logicians for logicians, not for computer scientists. They usually choose one particular way of presenting the material and use a specialized language. Logics for Computer Science discusses Gentzen as well as Hilbert formalizations, first order theories, the Hilbert Program, Godel's first and second incompleteness theorems and their proofs. It also introduces and discusses some many valued logics, modal logics and introduces algebraic models for classical, intuitionistic, and modal S4 and S5 logics. The theory of computation is based on concepts defined by logicians and mathematicians. Logic plays a fundamental role in computer science, and this book explains the basic theorems, as well as different techniques of proving them in classical and some non-classical logics. Important applications derived from concepts of logic for computer technology include Artificial Intelligence and Software Engineering. In addition to Computer Science, this book may also find an audience in mathematics and philosophy courses, and some of the chapters are also useful for a course in Artificial Intelligence.

Mathematical Logic for Computer Science-Zhongwan Lu 1998 Mathematical logic is essentially related to computer science. This book describes the aspects of mathematical logic that are closely related to each other, including classical logic, constructive logic, and modal logic. This book is intended to attend to both the peculiarities of logical systems and the requirements of computer science. In this edition, the revisions essentially involve rewriting the proofs, increasing the explanations, and adopting new terms and notations.

Handbook of Logic and Proof Techniques for Computer Science-Sтивен G. Krantz 2012-12-06 Logic is, and should be, the core subject area of modern mathematics. The blueprint for twentieth century mathematical thought, thanks to Hilbert and Bourbaki, is the axiomatic development of the subject. As a result, logic plays a central conceptual role. At the same time, mathematical logic has grown into one of the most recondite areas of mathematics. Most of modern logic is inaccessible to all but the specialist. Yet there is a need for many mathematical scientists-not just those engaged in mathematical research-to become conversant with the key ideas of logic. The Handbook of Mathematical Logic, edited by Jon Barwise, is in point of fact a handbook written by logicians for other mathematicians. It was, at the time of its writing, encyclopedic, authoritative, and up-to-the-moment. But it was, and remains, a comprehensive and authoritative book for the cognoscenti. The encyclopedic Handbook of Logic in Computer Science by Abramsky, Gabbay, and Maibaum is a wonderful resource for the professional. But it is overwhelming for the casual user. There is need for a book that introduces important logic terminology and concepts to the working mathematical scientist who has only a passing acquaintance with logic. Thus the present work has a different target audience. The intent of this handbook is to present the elements of modern logic, including many current topics, to the reader having only basic mathematical literacy.

Three Views of Logic-Donald W. Loveland 2014-01-26 Demonstrating the different roles that logic plays in the disciplines of computer science, mathematics, and philosophy, this concise undergraduate textbook covers select topics from three different areas of logic: proof theory, computability theory, and nonclassical logic. The book balances accessibility, breadth, and rigor, and is designed so that its materials will fit into a single semester. Its distinctive presentation of traditional logic material will enhance readers' capabilities and mathematical maturity. The proof theory portion presents classical propositional logic and first-order logic using a computer-oriented (resolution) formal system. Linear resolution and its connection to the programming language Prolog are also treated. The computability component offers a machine model and mathematical model for computation, proves the equivalence of the two approaches, and includes famous decision problems unsolvable by an algorithm. The section on nonclassical logic discusses the shortcomings of classical logic in its treatment of implication and an alternate approach that improves upon it: Anderson and Belnap's relevance logic. Applications are included in each section. The material on a four-valued semantics for relevance logic is presented in textbook form for the first time. Aimed at upper-level undergraduates of moderate analytical background, Three Views of Logic will be useful in a variety of classroom settings. Gives an exceptionally broad view of logic Treats traditional logic in a modern format Presents relevance logic with applications Provides an ideal text for a variety of one-semester upper-level undergraduate courses

Mathematical Logic-R.O. Gandy 2001-12-05 Mathematical Logic is a collection of the works of one of the leading figures in 20th-century science. This collection of A.M. Turing's works is intended to include all his mature scientific writing, including a substantial quantity of unpublished material. His work in pure mathematics and mathematical logic extended considerably further; the work of his last years, on morphogenesis in plants, is also of the greatest originality and of permanent importance. This book is divided into three parts. The first part focuses on computability and ordinal logics and covers Turing's work between 1937 and 1938. The second part covers type theory; it provides a general introduction to Turing's work on type theory and covers his published and unpublished works between 1941 and 1948. Finally, the third part focuses on enigmas, mysteries, and loose ends. This concluding section of the book discusses Turing's Treatise on the Enigma, with excerpts from the Enigma Paper. It also delves into Turing's papers on programming and on minimum cost sequential analysis, featuring an excerpt from the unpublished manuscript. This book will be of interest to mathematicians, logicians, and computer scientists.

Mathematics for Computer Science-Eric Lehman 2017-03-08 This book covers elementary discrete mathematics for computer science and engineering. It emphasizes mathematical definitions and proofs as well as applicable methods. Topics include formal logic notation, proof methods; induction, well-ordering; sets, relations; elementary graph theory; integer congruences; asymptotic notation and growth of functions; permutations and combinations, counting

principles; discrete probability. Further selected topics may also be covered, such as recursive definition and structural induction; state machines and invariants; recurrences; generating functions.

A Concise Introduction to Mathematical Logic-Wolfgang Rautenberg 2010-07-01 Mathematical logic developed into a broad discipline with many applications in mathematics, informatics, linguistics and philosophy. This text introduces the fundamentals of this field, and this new edition has been thoroughly expanded and revised.

A Concise Introduction to Mathematical Logic-Wolfgang Rautenberg 2006-09-28 While there are already several well known textbooks on mathematical logic this book is unique in treating the material in a concise and streamlined fashion. This allows many important topics to be covered in a one semester course. Although the book is intended for use as a graduate text the first three chapters can be understood by undergraduates interested in mathematical logic. The remaining chapters contain material on logic programming for computer scientists, model theory, recursion theory, Gödel's Incompleteness Theorems, and applications of mathematical logic. Philosophical and foundational problems of mathematics are discussed throughout the text.

A Friendly Introduction to Mathematical Logic-Christopher C. Leary 2015 At the intersection of mathematics, computer science, and philosophy, mathematical logic examines the power and limitations of formal mathematical thinking. In this expansion of Leary's user-friendly 1st edition, readers with no previous study in the field are introduced to the basics of model theory, proof theory, and computability theory. The text is designed to be used either in an upper division undergraduate classroom, or for self study. Updating the 1st Edition's treatment of languages, structures, and deductions, leading to rigorous proofs of Gödel's First and Second Incompleteness Theorems, the expanded 2nd Edition includes a new introduction to incompleteness through computability as well as solutions to selected exercises.

Mathematical Logic and Programming Languages-Charles Antony Richard Hoare 1985

Logic for Computer Science-Steve Reeves 1990 An understanding of logic is essential to computer science. This book provides a highly accessible account of the logical basis required for reasoning about computer programs and applying logic in fields like artificial intelligence. The text contains extended examples, algorithms, and programs written in Standard ML and Prolog. No prior knowledge of either language is required. The book contains a clear account of classical first-order logic, one of the basic tools for program verification, as well as an introductory survey of modal and temporal logics and possible world semantics. An introduction to intuitionistic logic as a basis for an important style of program specification is also featured in the book.

Introduction to Mathematical Logic-Michał Walicki 2012 This is a systematic and well-paced introduction to mathematical logic. Excellent as a course text, the book does not presuppose any previous knowledge and can be used also for self-study by more ambitious students. Starting with the basics of set theory, induction and computability, it covers propositional and first-order logic their syntax, reasoning systems and semantics. Soundness and completeness results for Hilbert's and Gentzen's systems are presented, along with simple decidability arguments. The general applicability of various concepts and techniques is demonstrated by highlighting their consistent reuse in different contexts.

Unlike in most comparable texts, presentation of syntactic reasoning systems precedes the semantic explanations. The simplicity of syntactic constructions and rules of a high, though often neglected, pedagogical value aids students in approaching more complex semantic issues. This order of presentation also brings forth the relative independence of syntax from the semantics, helping to appreciate the importance of the purely symbolic systems, like those underlying computers. An overview of the history of logic precedes the main text, in which careful presentation of concepts, results and examples is accompanied by the informal analogies and illustrations. These informal aspects are kept clearly apart from the technical ones. Together, they form a unique text which may be appreciated equally by lecturers and students occupied with mathematical precision, as well as those interested in the relations of logical formalisms to the problems of computability and the philosophy of mathematical logic.

Mathematical Logic-George Tourlakis 2011-03-01 A comprehensive and user-friendly guide to the use of logic in mathematical reasoning Mathematical Logic presents a comprehensive introduction to formal methods of logic and their use as a reliable tool for deductive reasoning. With its user-friendly approach, this book successfully equips readers with the key concepts and methods for formulating valid mathematical arguments that can be used to uncover truths across diverse areas of study such as mathematics, computer science, and philosophy. The book develops the logical tools for writing proofs by guiding readers through both the established "Hilbert" style of proof writing, as well as the "equational" style that is emerging in computer science and engineering applications. Chapters have been organized into the two topical areas of Boolean logic and predicate logic. Techniques situated outside formal logic are applied to illustrate and demonstrate significant facts regarding the power and limitations of logic, such as: Logic can certify truths and only truths. Logic can certify all absolute truths (completeness theorems of Post and Gödel). Logic cannot certify all "conditional" truths, such as those that are specific to the Peano arithmetic. Therefore, logic has some serious limitations, as shown through Gödel's incompleteness theorem. Numerous examples and problem sets are provided throughout the text, further facilitating readers' understanding of the capabilities of logic to discover mathematical truths. In addition, an extensive appendix introduces Tarski semantics and proceeds with detailed proofs of completeness and first incompleteness theorems, while also providing a self-contained introduction to the theory of computability. With its thorough scope of coverage and accessible style, Mathematical Logic is an ideal book for courses in mathematics, computer science, and philosophy at the upper-undergraduate and graduate levels. It is also a valuable reference for researchers and practitioners who wish to learn how to use logic in their everyday work.

A Hierarchy of Turing Degrees-Rod Downey 2020-06-16 Computability theory is a branch of mathematical logic and computer science that has become increasingly relevant in recent years. The field has developed growing connections in diverse areas of mathematics, with applications in topology, group theory, and other subfields. In A Hierarchy of Turing Degrees, Rod Downey and Noam Greenberg introduce a new hierarchy that allows them to classify the combinatorics of constructions from many areas of computability theory, including algorithmic randomness, Turing degrees, effectively closed sets, and effective structure theory. This unifying hierarchy gives rise to new natural definability results for Turing degree classes, demonstrating how dynamic constructions become reflected in definability. Downey and Greenberg present numerous construction techniques involving high-level nonuniform arguments, and their self-contained work is appropriate for graduate students and researchers. Blending traditional and modern research results in computability theory, A Hierarchy of Turing Degrees establishes novel directions in the field.

Logic and Discrete Mathematics-Winfried Karl Grassmann 1996 This book covers all the traditional topics of discrete mathematics— logic, sets, relations, functions, and graphs— and reflects recent trends in computer science. Shows how to use discrete mathematics and logic for specifying new computer applications, and how to reason about programs in a systematic way. Describes Prolog, a programming language based on logic, and a section on Miranda, language based on functions. Features numerous examples which relate the mathematical concepts to problems in computer science.

Modal Logic-Patrick Blackburn 2002-08-22 A 2001 graduate text on modal logic, a field which has caught the attention of computer scientists, economists and computational linguists.

Applied Logic for Computer Scientists-Mauricio Ayala-Rincón 2017-02-04 This book provides an introduction to logic and mathematical induction which are the basis of any deductive computational framework. A strong mathematical foundation of the logical engines available in modern proof assistants, such as the PVS verification system, is essential for computer scientists, mathematicians and engineers to increment their capabilities to provide formal proofs of theorems and to certify the robustness of software and hardware systems. The authors present a concise overview of the necessary computational and mathematical aspects of 'logic', placing emphasis on both natural deduction and sequent calculus. Differences between constructive and classical logic are highlighted through several examples and exercises. Without neglecting classical aspects of computational logic, the authors also highlight the connections between logical deduction rules and proof commands in proof assistants, presenting simple examples of formalizations of the correctness of algebraic functions and algorithms in PVS. Applied Logic for Computer Scientists will not only benefit students of computer science and mathematics but also software, hardware, automation, electrical and mechatronic engineers who are interested in the application of formal methods and the related computational tools to provide mathematical certificates of the quality and accuracy of their products and technologies.

Mathematical Logic-Ian Chiswell 2007-05-17 Assuming no previous study in logic, this informal yet rigorous text covers the material of a standard undergraduate first course in mathematical logic, using natural deduction and leading up to the completeness theorem for first-order logic. At each stage of the text, the reader is given an intuition based on standard mathematical practice, which is subsequently developed with clean formal mathematics. Alongside the practical examples, readers learn what can and can't be calculated; for example the correctness of a derivation proving a given sequent can be tested mechanically, but there is no general mechanical test for the existence of a derivation proving the given sequent. The undecidability results are proved rigorously in an optional final chapter, assuming Matiyasevich's theorem characterising the computably enumerable relations. Rigorous proofs of the adequacy and completeness proofs of the relevant logics are provided, with careful attention to the languages involved. Optional sections discuss the classification of mathematical structures by first-order theories; the required theory of cardinality is developed from scratch. Throughout the book there are notes on historical aspects of the material, and connections with linguistics and computer science, and the discussion of syntax and semantics is influenced by modern linguistic approaches. Two basic themes in recent cognitive science studies of actual human reasoning are also introduced. Including extensive exercises and selected solutions, this text is ideal for students in Logic, Mathematics, Philosophy, and

Computer Science.

Mathematics of Discrete Structures for Computer Science-Gordon J. Pace 2012-07-09 Mathematics plays a key role in computer science, some researchers would consider computers as nothing but the physical embodiment of mathematical systems. And whether you are designing a digital circuit, a computer program or a new programming language, you need mathematics to be able to reason about the design -- its correctness, robustness and dependability. This book covers the foundational mathematics necessary for courses in computer science. The common approach to presenting mathematical concepts and operators is to define them in terms of properties they satisfy, and then based on these definitions develop ways of computing the result of applying the operators and prove them correct. This book is mainly written for computer science students, so here the author takes a different approach: he starts by defining ways of calculating the results of applying the operators and then proves that they satisfy various properties. After justifying his underlying approach the author offers detailed chapters covering propositional logic, predicate calculus, sets, relations, discrete structures, structured types, numbers, and reasoning about programs. The book contains chapter and section summaries, detailed proofs and many end-of-section exercises -- key to the learning process. The book is suitable for undergraduate and graduate students, and although the treatment focuses on areas with frequent applications in computer science, the book is also suitable for students of mathematics and engineering.

A Course in Mathematical Logic-Yu.I. Manin 2013-06-29 1. This book is above all addressed to mathematicians. It is intended to be a textbook of mathematical logic on a sophisticated level, presenting the reader with several of the most significant discoveries of the last ten or fifteen years. These include: the independence of the continuum hypothesis, the Diophantine nature of enumerable sets, the impossibility of finding an algorithmic solution for one or two old problems. All the necessary preliminary material, including predicate logic and the fundamentals of recursive function theory, is presented systematically and with complete proofs. We only assume that the reader is familiar with "naive" set theoretic arguments. In this book mathematical logic is presented both as a part of mathematics and as the result of its self-perception. Thus, the substance of the book consists of difficult proofs of subtle theorems, and the spirit of the book consists of attempts to explain what these theorems say about the mathematical way of thought. Foundational problems are for the most part passed over in silence. Most likely, logic is capable of justifying mathematics to no greater extent than biology is capable of justifying life. 2. The first two chapters are devoted to predicate logic. The presentation here is fairly standard, except that semantics occupies a very dominant position, truth is introduced before deducibility, and models of speech in formal languages precede the systematic study of syntax.

Sets, Logic and Maths for Computing-David Makinson 2012-02-27 This easy-to-follow textbook introduces the mathematical language, knowledge and problem-solving skills that undergraduates need to study computing. The language is in part qualitative, with concepts such as set, relation, function and recursion/induction; but it is also partly quantitative, with principles of counting and finite probability. Entwined with both are the fundamental notions of logic and their use for representation and proof. Features: teaches finite math as a language for thinking, as much as knowledge and skills to be acquired; uses an intuitive approach with a focus on examples for all general concepts; brings out the interplay between the qualitative and the quantitative in all areas covered, particularly in the treatment of recursion and induction; balances carefully the abstract and concrete, principles and proofs, specific facts and general perspectives; includes highlight boxes that raise common queries and clear confusions; provides numerous exercises, with selected solutions.

A Course on Mathematical Logic-Shashi Mohan Srivastava 2013-01-16 This is a short, modern, and motivated introduction to mathematical logic for upper undergraduate and beginning graduate students in mathematics and computer science. Any mathematician who is interested in getting acquainted with logic and would like to learn Gödel's incompleteness theorems should find this book particularly useful. The treatment is thoroughly mathematical and prepares students to branch out in several areas of mathematics related to foundations and computability, such as logic, axiomatic set theory, model theory, recursion theory, and computability. In this new edition, many small and large changes have been made throughout the text. The main purpose of this new edition is to provide a healthy first introduction to model theory, which is a very important branch of logic. Topics in the new chapter include ultraproduct of models, elimination of quantifiers, types, applications of types to model theory, and applications to algebra, number theory and geometry. Some proofs, such as the proof of the very important completeness theorem, have been completely rewritten in a more clear and concise manner. The new edition also introduces new topics, such as the notion of elementary class of structures, elementary diagrams, partial elementary maps, homogeneous structures, definability, and many more.

Fundamentals of Mathematical Logic-Peter G. Hinman 2018-10-08 This introductory graduate text covers modern mathematical logic from propositional, first-order and infinitary logic and Gödel's Incompleteness Theorems to extensive introductions to set theory, model theory and recursion (computability) theory. Based on the author's more than 35 years of teaching experience, the book develops students' intuition by presenting complex ideas in the simplest context for which they make sense. The book is appropriate for use as a classroom text, for self-study, and as a reference on the state of modern logic.

Logic for Applications-Anil Nerode 2012-12-06 In writing this book, our goal was to produce a text suitable for a first course in mathematical logic more attuned than the traditional textbooks to the recent dramatic growth in the applications of logic to computer science. Thus our choice of topics has been heavily influenced by such applications. Of course, we cover the basic traditional topics - syntax, semantics, soundness, completeness and compactness - as well as a few more advanced results such as the theorems of Skolem-Lowenheim and Herbrand. Much of our book, however, deals with other less traditional topics. Resolution theorem proving plays a major role in our treatment of logic, especially in its application to Logic Programming and PROLOG. We deal extensively with the mathematical foundations of all three of these subjects. In addition, we include two chapters on nonclassical logic- modal and intuitionistic - that are becoming increasingly important in computer science. We develop the basic material on the syntax and semantics (via Kripke frames) for each of these logics. In both cases, our approach to formal proofs, soundness and completeness uses modifications of the same tableau method introduced for classical logic. We indicate how it can easily be adapted to various other special types of modal logics. A number of more advanced topics (including nonmonotonic logic) are also briefly introduced both in the nonclassical logic chapters and in the material on Logic Programming and PROLOG.

Principles of the Spin Model Checker-Mordechai Ben-Ari 2008-04-13 This is the first introductory textbook on Spin, the only requirement is a background in programming. Spin models are written in the Promela language which is easily learned by students and programmers. Spin is easy to install and use. The Spin model checker is not only a widely used professional tool but it is also a superb tool for teaching important concepts of computer science such as verification, concurrency and nondeterminism. The book introduces Spin-based software that the author has developed for teaching. Complete programs demonstrate each construct and concept and these programs are available on a companion website.

Arithmetic and Logic in Computer Systems-Mi Lu 2005-03-04 Arithmetic and Logic in Computer Systems provides a useful guide to a fundamental subject of computer science and engineering. Algorithms for performing operations like addition, subtraction, multiplication, and division in digital computer systems are presented, with the goal of explaining the concepts behind the algorithms, rather than addressing any direct applications. Alternative methods are examined, and explanations are supplied of the fundamental materials and reasoning behind theories and examples. No other current books deal with this subject, and the author is a leading authority in the field of computer arithmetic. The text introduces the Conventional Radix Number System and the Signed-Digit Number System, as well as Residue Number System and Logarithmic Number System. This book serves as an essential, up-to-date guide for students of electrical engineering and computer and mathematical sciences, as well as practicing engineers and computer scientists involved in the design, application, and development of computer arithmetic units.

Foundations of Logic and Mathematics-Yves Nievergelt 2012-12-06 This modern introduction to the foundations of logic and mathematics not only takes theory into account, but also treats in some detail applications that have a substantial impact on everyday life (loans and mortgages, bar codes, public-key cryptography). A first college-level introduction to logic, proofs, sets, number theory, and graph theory, and an excellent self-study reference and resource for instructors.

The Science of Programming-David Gries 2012-12-06 Describes basic programming principles and their step-by-step applications. Numerous examples are included.

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