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Kurt Gödel and the Foundations of Mathematics

Horizons of Truth

Cambridge University Press *This volume commemorates the life, work and foundational views of Kurt Gödel (1906–78), most famous for his hallmark works on the completeness of first-order logic, the incompleteness of number theory, and the consistency - with the other widely accepted axioms of set theory - of the axiom of choice and of the generalized continuum hypothesis. It explores current research, advances and ideas for future directions not only in the foundations of mathematics and logic, but also in the fields of computer science, artificial intelligence, physics, cosmology, philosophy, theology and the history of science. The discussion is supplemented by personal reflections from several scholars who knew Gödel personally, providing some interesting insights into his life. By putting his ideas and life's work into the context of current thinking and perceptions, this book will extend the impact of Gödel's fundamental work in mathematics, logic, philosophy and other disciplines for future generations of researchers.*

Gödel's Theorems and Zermelo's Axioms

A Firm Foundation of Mathematics

Birkhäuser *This book provides a concise and self-contained introduction to the foundations of mathematics. The first part covers the fundamental notions of mathematical logic, including logical axioms, formal proofs and the basics of model theory. Building on this, in the second and third part of the book the authors present detailed proofs of Gödel’s classical completeness and incompleteness theorems. In particular, the book includes a full proof of Gödel’s second incompleteness theorem which states that it is impossible to prove the consistency of arithmetic within its axioms. The final part is dedicated to an introduction into modern axiomatic set theory based on the Zermelo’s axioms, containing a presentation of Gödel’s constructible universe of sets. A recurring theme in the whole book consists of standard and non-standard models of several theories, such as Peano arithmetic, Presburger arithmetic and the real numbers. The book addresses undergraduate mathematics students and is suitable for a one or two semester introductory course into logic and set theory. Each chapter concludes with a list of exercises.*

From Dedekind to Gödel

Essays on the Development of the Foundations of Mathematics

Springer Science & Business Media *Discussions of the foundations of mathematics and their history are frequently restricted to logical issues in a narrow sense, or else to traditional problems of analytic philosophy. From Dedekind to Gödel: Essays on the Development of the Foundations of Mathematics illustrates the much greater variety of the actual developments in the foundations during the period* *covered. The viewpoints that serve this purpose included the foundational ideas of working mathematicians, such as Kronecker, Dedekind, Borel and the early Hilbert, and the development of notions like model and modelling, arbitrary function, completeness, and non-Archimedean structures. The philosophers discussed include not only the household names in logic, but also Husserl, Wittgenstein and Ramsey. Needless to say, such logically-oriented thinkers as Frege, Russell and Gödel are not entirely neglected, either. Audience: Everybody interested in the philosophy and/or history of mathematics will find this book interesting, giving frequently novel insights.*

Godel's Proof

Routledge *The first book to present a readable explanation of Godel's theorem to both scholars and non-specialists, this is a gripping combination of science and accessibility, offering those with a taste for logic and philosophy the chance to satisfy their intellectual curiosity.*

Principia Mathematica

Cambridge University Press *Principia Mathematica was first published in 1910-13; this is the ninth impression of the second edition of 1925-7. The Principia has long been recognised as one of the intellectual landmarks of the century. It was the first book to show clearly the close relationship between mathematics and formal logic. Starting from a minimal number of axioms, Whitehead and Russell display the structure of both kinds of thought. No other book has had such an influence on the subsequent history of mathematical philosophy.*

Harvey Friedman's Research on the Foundations of Mathematics

Elsevier *This volume discusses various aspects of Harvey Friedman's research in the foundations of mathematics over the past fifteen years. It should appeal to a wide audience of mathematicians, computer scientists, and mathematically oriented philosophers.*

From Frege to Gödel

A Source Book in Mathematical Logic, 1879-1931

Harvard University Press *Gathered together here are the fundamental texts of the great classical period in modern logic. A complete translation of Gottlob Frege's Begriffsschrift--which opened a great epoch in the history of logic by fully presenting propositional calculus and quantification theory--begins the volume, which concludes with papers by Herbrand and by Gödel.*

The Foundations of Mathematics

Mathematical logic grew out of philosophical questions regarding the foundations of mathematics, but logic has now outgrown its philosophical roots, and has become an integral part of mathematics in general. This book is designed for students who plan to specialize in logic, as well as for those who are interested in the applications of logic to other areas of mathematics. Used as a text, it could form the basis of a beginning graduate-level course. There are three main chapters: Set Theory, Model Theory, and Recursion Theory. The Set Theory chapter describes the set-theoretic foundations of all of mathematics, based on the ZFC axioms. It also covers technical results about the Axiom of Choice, well-orderings, and the theory of uncountable cardinals. The Model Theory chapter discusses predicate logic and formal proofs, and covers the Completeness, Compactness, and Lowenheim-Skolem Theorems, elementary submodels, model completeness, and applications to algebra. This chapter also continues the foundational issues begun in the set theory chapter. Mathematics can now be viewed as formal proofs from ZFC. Also, model theory leads to models of set theory. This includes a discussion of absoluteness, and an analysis of models such as H( ) and R( ). The Recursion Theory chapter develops some basic facts about computable functions, and uses them to prove a number of results of foundational importance; in particular, Church's theorem on the undecidability of logical consequence, the incompleteness theorems of Godel, and Tarski's theorem on the non-definability of truth.

Feferman on Foundations

Logic, Mathematics, Philosophy

Springer *This volume honours the life and work of Solomon Feferman, one of the most prominent mathematical logicians of the latter half of the 20th century. In the collection of essays presented here, researchers examine Feferman's work on mathematical as well as specific methodological and philosophical issues that tie into mathematics. Feferman's work was largely based in mathematical logic (namely model theory, set theory, proof theory and computability theory), but also branched out into methodological and philosophical issues, making it well known beyond the borders of the mathematics community. With regard to methodological issues, Feferman supported concrete projects. On the one hand, these projects calibrate the proof theoretic strength of subsystems of analysis and set theory and provide ways of overcoming the limitations imposed by Gödel's incompleteness theorems through appropriate conceptual expansions. On the other, they seek to identify novel axiomatic foundations for mathematical practice, truth theories, and category theory. In his philosophical research, Feferman explored questions such as "What is logic?" and proposed particular positions regarding the foundations of mathematics including, for example, his "conceptual structuralism." The contributing authors of the volume examine all of the above issues. Their papers are accompanied by an autobiography presented by Feferman that reflects on the evolution and intellectual contexts of his work. The contributing authors critically examine Feferman's work and, in part, actively expand on his concrete mathematical projects. The volume illuminates Feferman's distinctive work and, in the process, provides an enlightening perspective on the foundations of mathematics and logic.*

An Introduction to Gödel's Theorems

Cambridge University Press *Peter Smith examines Gödel's Theorems, how they were established and why they matter.*

Incompleteness: The Proof and Paradox of Kurt Gödel (Great Discoveries)

W. W. Norton & Company *A portrait of the eminent twentieth-century mathematician discusses his theorem of incompleteness, relationships with such contemporaries as Albert Einstein, and untimely death as a result of mental instability and self-starvation.*

Philosophical Approaches to the Foundations of Logic and Mathematics

In Honor of Stanisław Krajewski

BRILL *Philosophical Approaches to the Foundations of Logic and Mathematics consists of eleven articles addressing various aspects of the "roots" of logic and mathematics, their basic concepts and the mechanisms that work in the practice of their use.*

Kurt Gödel: Collected Works: Volume I

Publications 1929-1936

Oxford University Press, USA *Kurt Gödel (1906 - 1978) was the most outstanding logician of the twentieth century, famous for his hallmark works on the completeness of logic, the incompleteness of number theory, and the consistency of the axiom of choice and the continuum hypothesis. He is also noted for his work on constructivity, the decision problem, and the foundations of computability theory, as well as for the strong individuality of his writings on the philosophy of mathematics. He is less well known for his discovery of unusual cosmological models for Einstein's equations, in theory permitting time travel into the past. The Collected Works is a landmark resource that draws together a lifetime of creative thought and accomplishment. The first two volumes were devoted to Gödel's publications in full (both in original and translation), and the third volume featured a wide selection of unpublished articles and lecture texts found in Gödel's Nachlass. These long-awaited final two volumes contain*

Gödel's correspondence of logical, philosophical, and scientific interest. Volume IV covers A to G, with H to Z in volume V; in addition, Volume V contains a full inventory of Gödel's Nachlass. L All volumes include introductory notes that provide extensive explanatory and historical commentary on each body of work, English translations of material originally written in German (some transcribed from the Gabelsberger shorthand), and a complete bibliography of all works cited. Kurt Gödel: Collected Works is designed to be useful and accessible to as wide an audience as possible without sacrificing scientific or historical accuracy. The only comprehensive edition of Gödel's work available, it will be an essential part of the working library of professionals and students in logic, mathematics, philosophy, history of science, and computer science and all others who wish to be acquainted with one of the great minds of the twentieth century.

Foundations of Mathematical Logic

Courier Corporation *Written by a pioneer of mathematical logic, this comprehensive graduate-level text explores the constructive theory of first-order predicate calculus. It covers formal methods — including algorithms and epitheory — and offers a brief treatment of Markov's approach to algorithms. It also explains elementary facts about lattices and similar algebraic systems. 1963 edition.*

Gödel, Tarski and the Lure of Natural Language

Logical Entanglement, Formalism Freeness

Cambridge University Press *Introduces an original approach to foundations of mathematics, departing from Gödel and Tarski and spanning many different areas of logic.*

Kurt Gödel

The Genius of Metamathematics

Springer Nature *During his lifetime, Kurt Gödel was not well known outside the professional world of mathematicians, philosophers and theoretical physicists. Early in his career, for his doctoral thesis and then for his Habilitation (Dr.Sci.), he wrote earthshaking articles on the completeness and provability of mathematical-logical systems, upsetting the hypotheses of the most famous mathematicians/philosophers of the time. He later delved into theoretical physics, finding a unique solution to Einstein's equations for gravity, the 'Gödel Universe', and made contributions to philosophy, the guiding theme of his life. This book includes more details about the context of Gödel's life than are found in earlier biographies, while avoiding an elaborate treatment of his mathematical/scientific/philosophical works, which have been described in great detail in other books. In this way, it makes him and his times more accessible to general readers, and will allow them to appreciate the lasting effects of Gödel's contributions (the latter in a more up-to-date context than in previous biographies, many of which were written 15–25 years ago). His work spans or is relevant to a wide spectrum of intellectual endeavor, and this is emphasized in the book, with recent examples. This biography also examines possible sources of his unusual personality, which combined mathematical genius with an almost childlike naiveté concerning everyday life, and striking scientific innovations with timidity and hesitancy in practical matters. How he nevertheless had a long and successful career, inspiring many younger scholars along the way, with the help of his loyal wife Adele and some of his friends, is a fascinating story in human nature.*

Essays on the Foundations of Mathematics and Logic

Polimetrica s.a.s.

Kurt Gödel: Collected Works: Volume III

Unpublished Essays and Lectures

Oxford University Press on Demand *Kurt Gödel was the greatest logician of this century. This third volume of his collected works consists of previously unpublished material, both essays and lectures.*

Can Mathematics Be Proved Consistent?

Gödel's Shorthand Notes & Lectures on Incompleteness

Springer Nature *Kurt Gödel (1906–1978) shook the mathematical world in 1931 by a result that has become an icon of 20th century science: The search for rigour in proving mathematical theorems had led to the formalization of mathematical proofs, to the extent that such proving could be reduced to the application of a few mechanical rules. Gödel showed that whenever the part of mathematics under formalization contains elementary arithmetic, there will be arithmetical statements that should be formally provable but aren't. The result is known as Gödel's first incompleteness theorem, so called because there is a second incompleteness result, embodied in his answer to the question "Can mathematics be proved consistent?" This book offers the first examination of Gödel's preserved notebooks from 1930, written in a long-forgotten German shorthand, that show his way to the results: his first ideas, how they evolved, and how the jewel-like final presentation in his famous publication On formally undecidable propositions was composed.The book also contains the original version of Gödel's incompleteness article, as handed in for publication with no mentioning of the second incompleteness theorem, as well as six contemporary lectures and seminars Gödel gave between 1931 and 1934 in Austria, Germany, and the United States. The lectures are masterpieces of accessible presentations of deep scientific results, readable even for those without special mathematical training, and published here for the first time.*

Foundations of Set Theory

Elsevier *Foundations of Set Theory discusses the reconstruction undergone by set theory in the hands of Brouwer, Russell, and Zermelo. Only in the axiomatic foundations, however, have there been such extensive, almost revolutionary, developments. This book tries to avoid a detailed discussion of those topics which would have required heavy technical machinery, while describing the major results obtained in their treatment if these results could be stated in relatively non-technical terms. This book comprises five chapters and begins with a discussion of the antinomies that led to the reconstruction of set theory as it was known before. It then moves to the axiomatic foundations of set theory, including a discussion of the basic notions of equality and extensionality and axioms of comprehension and infinity. The next chapters discuss type-theoretical approaches, including the ideal calculus, the theory of types, and Quine's mathematical logic and new foundations; intuitionistic conceptions of mathematics and its constructive character; and metamathematical and semantical approaches, such as the Hilbert program. This book will be of interest to mathematicians, logicians, and statisticians.*

The Legacy of Kurt Schütte

Springer Nature *This book on proof theory centers around the legacy of Kurt Schütte and its current impact on the subject. Schütte was the last doctoral student of David Hilbert who was the first to see that proofs can be viewed as structured mathematical objects amenable to investigation by mathematical methods (metamathematics). Schütte inaugurated the important paradigm shift from finite proofs to infinite proofs and developed the mathematical tools for their analysis. Infinitary proof theory flourished in his hands in the 1960s, culminating in the famous bound Γ_0 for the limit of predicative mathematics (a fame shared with Feferman). Later his interests shifted to developing infinite proof calculi for impredicative theories. Schütte had a keen interest in advancing ordinal analysis to ever stronger theories and was still working on some of the strongest systems in his eighties. The articles in this volume from leading experts close to his research, show the enduring influence of his work in modern proof theory. They range from eye witness accounts of his scientific life to developments at the current research frontier, including papers by Schütte himself that have never been published before.*

Lectures on the Curry-Howard Isomorphism

Elsevier *The Curry-Howard isomorphism states an amazing correspondence between systems of formal logic as encountered in proof theory and computational calculi as found in type theory. For instance, minimal propositional logic corresponds to simply typed lambda-calculus, first-order logic corresponds to dependent types, second-order logic corresponds to polymorphic types, sequent calculus is related* *to explicit substitution, etc. The isomorphism has many aspects, even at the syntactic level: formulas correspond to types, proofs correspond to terms, provability corresponds to inhabitation, proof normalization corresponds to term reduction, etc. But there is more to the isomorphism than this. For instance, it is an old idea---due to Brouwer, Kolmogorov, and Heyting---that a constructive proof of an implication is a procedure that transforms proofs of the antecedent into proofs of the succedent; the Curry-Howard isomorphism gives syntactic representations of such procedures. The Curry-Howard isomorphism also provides theoretical foundations for many modern proof-assistant systems (e.g. Coq). This book give an introduction to parts of proof theory and related aspects of type theory relevant for the Curry-Howard isomorphism. It can serve as an introduction to any or both of typed lambda-calculus and intuitionistic logic. Key features - The Curry-Howard Isomorphism treated as common theme - Reader-friendly introduction to two complementary subjects: Lambda-calculus and constructive logics - Thorough study of the connection between calculi and logics - Elaborate study of classical logics and control operators - Account of dialogue games for classical and intuitionistic logic - Theoretical foundations of computer-assisted reasoning · The Curry-Howard Isomorphism treated as the common theme. · Reader-friendly introduction to two complementary subjects: lambda-calculus and constructive logics · Thorough study of the connection between calculi and logics. · Elaborate study of classical logics and control operators. · Account of dialogue games for classical and intuitionistic logic. · Theoretical foundations of computer-assisted reasoning*

Introduction to the Foundations of Mathematics

Second Edition

Courier Corporation *Classic undergraduate text acquaints students with fundamental concepts and methods of mathematics. Topics include axiomatic method, set theory, infinite sets, groups, intuitionism, formal systems, mathematical logic, and much more. 1965 second edition.*

Handbook of Proof Theory

Elsevier *This volume contains articles covering a broad spectrum of proof theory, with an emphasis on its mathematical aspects. The articles should not only be interesting to specialists of proof theory, but should also be accessible to a diverse audience, including logicians, mathematicians, computer scientists and philosophers. Many of the central topics of proof theory have been included in a self-contained expository of articles, covered in great detail and depth. The chapters are arranged so that the two introductory articles come first; these are then followed by articles from core classical areas of proof theory; the handbook concludes with articles that deal with topics closely related to computer science.*

Philosophy of Mathematics

Princeton University Press *A sophisticated, original introduction to the philosophy of mathematics from one of its leading thinkers Mathematics is a model of precision and objectivity, but it appears distinct from the empirical sciences because it seems to deliver nonexperiential knowledge of a nonphysical reality of numbers, sets, and functions. How can these two aspects of mathematics be reconciled? This concise book provides a systematic, accessible introduction to the field that is trying to answer that question: the philosophy of mathematics. Øystein Linnebo, one of the world's leading scholars on the subject, introduces all of the classical approaches to the field as well as more specialized issues, including mathematical intuition, potential infinity, and the search for new mathematical axioms. Sophisticated but clear and approachable, this is an essential book for all students and teachers of philosophy and of mathematics.*

Set Theory, Arithmetic, and Foundations of Mathematics

Theorems, Philosophies

Cambridge University Press *This collection of papers from various areas of mathematical logic showcases the remarkable breadth and richness of the field. Leading authors reveal how contemporary technical results touch upon foundational questions about the nature of mathematics. Highlights of the volume include: a history of Tennenbaum's theorem in arithmetic; a number of papers on Tennenbaum phenomena in weak arithmetics as well as on other aspects of arithmetics, such as interpretability; the transcript of Gödel's previously unpublished 1972–1975 conversations with Sue Toledo, along with an appreciation of the same by Curtis Franks; Hugh Woodin's paper arguing against the generic multiverse view; Anne Troelstra's history of intuitionism through 1991; and Aki Kanamori's* *history of the Suslin problem in set theory. The book provides a historical and philosophical treatment of particular theorems in arithmetic and set theory, and is ideal for researchers and graduate students in mathematical logic and philosophy of mathematics.*

A Course on Mathematical Logic

Springer Science & Business Media *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.*

Why Is There Philosophy of Mathematics At All?

Cambridge University Press *This truly philosophical book takes us back to fundamentals - the sheer experience of proof, and the enigmatic relation of mathematics to nature. It asks unexpected questions, such as 'what makes mathematics mathematics?', 'where did proof come from and how did it evolve?', and 'how did the distinction between pure and applied mathematics come into being?' In a wide-ranging discussion that is both immersed in the past and unusually attuned to the competing philosophical ideas of contemporary mathematicians, it shows that proof and other forms of mathematical exploration continue to be living, evolving practices - responsive to new technologies, yet embedded in permanent (and astonishing) facts about human beings. It distinguishes several distinct types of application of mathematics, and shows how each leads to a different philosophical conundrum. Here is a remarkable body of new philosophical thinking about proofs, applications, and other mathematical activities.*

Elements of Mathematics

From Euclid to Gödel

Princeton University Press *An exciting look at the world of elementary mathematics Elements of Mathematics takes readers on a fascinating tour that begins in elementary mathematics—but, as John Stillwell shows, this subject is not as elementary or straightforward as one might think. Not all topics that are part of today's elementary mathematics were always considered as such, and great mathematical advances and discoveries had to occur in order for certain subjects to become "elementary." Stillwell examines elementary mathematics from a distinctive twenty-first-century viewpoint and describes not only the beauty and scope of the discipline, but also its limits. From Gaussian integers to propositional logic, Stillwell delves into arithmetic, computation, algebra, geometry, calculus, combinatorics, probability, and logic. He discusses how each area ties into more advanced topics to build mathematics as a whole. Through a rich collection of basic principles, vivid examples, and interesting problems, Stillwell demonstrates that elementary mathematics becomes advanced with the intervention of infinity. Infinity has been observed throughout mathematical history, but the recent development of "reverse mathematics" confirms that infinity is essential for proving well-known theorems, and helps to determine the nature, contours, and borders of elementary mathematics. Elements of Mathematics gives readers, from high school students to professional mathematicians, the highlights of elementary mathematics and glimpses of the parts of math beyond its boundaries.*

Interpreting Godel

Critical Essays

Cambridge University Press *In this groundbreaking volume, leading philosophers and mathematicians explore Kurt Gödel's work on the foundations and philosophy of mathematics.*

Sequential Experiments with Primes

Springer *With a specific focus on the mathematical life in small undergraduate colleges, this book presents a variety of elementary number theory insights involving sequences largely built from prime numbers and contingent number-theoretic functions. Chapters include new mathematical ideas and open problems, some of which are proved in the text. Vector valued MGPF sequences, extensions of Conway's Subprime Fibonacci sequences, and linear complexity of bit streams derived from GPF sequences are among the topics covered in this book. This book is perfect for the pure-mathematics-minded educator in a small undergraduate college as well as graduate students and advanced undergraduate students looking for a significant high-impact learning experience in mathematics.*

Model Theory and the Philosophy of Mathematical Practice

Cambridge University Press *Recounts the modern transformation of model theory and its effects on the philosophy of mathematics and mathematical practice.*

Gödel, Escher, Bach

An Eternal Golden Braid

Penguin Group(CA) *'What is a self and how can a self come out of inanimate matter?' This is the riddle that drove Douglas Hofstadter to write this extraordinary book. In order to impart his original and personal view on the core mystery of human existence - our intangible sensation of 'I'-ness - Hofstadter defines the playful yet seemingly paradoxical notion of 'strange loop', and explicates this idea using analogies from many disciplines.*

Gödel's Disjunction

The Scope and Limits of Mathematical Knowledge

Oxford University Press *The logician Kurt Godel in 1951 established a disjunctive thesis about the scope and limits of mathematical knowledge: either the mathematical mind is not equivalent to a Turing machine (i.e., a computer), or there are absolutely undecidable mathematical problems. In the second half of the twentieth century, attempts have been made to arrive at a stronger conclusion. In particular, arguments have been produced by the philosopher J.R. Lucas and by the physicist and mathematician Roger Penrose that intend to show that the mathematical mind is more powerful than any computer. These arguments, and counterarguments to them, have not convinced the logical and philosophical community. The reason for this is an insufficiency if rigour in the debate. The contributions in this volume move the debate forward by formulating rigorous frameworks and formally spelling out and evaluating arguments that bear on Godel's disjunction in these frameworks. The contributions in this volume have been written by world leading experts in the field.*

Mathematical Foundations of Advanced Informatics

Volume 1: Inductive Approaches

Springer *The books in this trilogy capture the foundational core of advanced informatics. The authors make the foundations accessible, enabling students to become effective problem solvers. This first volume establishes the inductive approach as a fundamental principle for system and domain analysis. After a brief introduction to the elementary mathematical structures, such as sets, propositional logic, relations, and functions, the authors focus on the separation between syntax (representation) and semantics (meaning), and on the advantages of the consistent and persistent use of inductive definitions. They identify compositionality as a feature that not only acts as a foundation for algebraic proofs but also as a key for more general scalability of modeling and analysis. A core principle throughout is invariance, which the authors consider a key for the mastery of change, whether in the form of extensions, transformations, or abstractions. This textbook is suitable for undergraduate and graduate courses in computer science and for self-study. Most chapters contain exercises and the content has been class-tested over many years in various universities.*

Bemerkungen Über Die Grundlagen Der Mathematik

Reflections on the Foundations of Mathematics

Univalent Foundations, Set Theory and General Thoughts

Springer Nature *This edited work presents contemporary mathematical practice in the foundational mathematical theories, in particular set theory and the univalent foundations. It shares the work of significant scholars across the disciplines of mathematics, philosophy and computer science. Readers will discover systematic thought on criteria for a suitable foundation in mathematics and philosophical reflections around the mathematical perspectives. The volume is divided into three sections, the first two of which focus on the two most prominent candidate theories for a foundation of mathematics. Readers may trace current research in set theory, which has widely been assumed to serve as a framework for foundational issues, as well as new material elaborating on the univalent foundations, considering an approach based on homotopy type theory (HoTT). The third section then builds on this and is centred on philosophical questions connected to the foundations of mathematics. Here, the authors contribute to discussions on foundational criteria with more general thoughts on the foundations of mathematics which are not connected to particular theories. This book shares the work of some of the most important scholars in the fields of set theory (S. Friedman), non-classical logic (G. Priest) and the philosophy of mathematics (P. Maddy). The reader will become aware of the advantages of each theory and objections to it as a foundation, following the latest and best work across the disciplines and it is therefore a valuable read for anyone working on the foundations of mathematics or in the philosophy of mathematics.*

Mathematical Logic

Springer Science & Business Media *This introduction to first-order logic clearly works out the role of first-order logic in the foundations of mathematics, particularly the two basic questions of the range of the axiomatic method and of theorem-proving by machines. It covers several advanced topics not commonly treated in introductory texts, such as Fraïssé's characterization of elementary equivalence, Lindström's theorem on the maximality of first-order logic, and the fundamentals of logic programming.*

Enterprise Interoperability III

New Challenges and Industrial Approaches

Springer Science & Business Media *Interoperability: the ability of a system or a product to work with other systems or products without special effort from the user is a key issue in manufacturing and industrial enterprise generally. It is fundamental to the production of goods and services quickly and at low cost at the same time as maintaining levels of quality and customisation. Composed of over 50 papers, Enterprise Interoperability III ranges from academic research through case studies to industrial and administrative experience of interoperability. The international nature of the authorship* *continues to broaden. Many of the papers have examples and illustrations calculated to deepen understanding and generate new ideas. A concise reference to the state of the art in software interoperability, Enterprise Interoperability III will be of great value to engineers and computer scientists working in manufacturing and other process industries and to software engineers and electronic and manufacturing engineers working in the academic environment.*

The Search for Mathematical Roots, 1870-1940

Logics, Set Theories and the Foundations of Mathematics from Cantor through Russell to Gödel

Princeton University Press *While many books have been written about Bertrand Russell's philosophy and some on his logic, I. Grattan-Guinness has written the first comprehensive history of the mathematical background, content, and impact of the mathematical logic and philosophy of mathematics that Russell developed with A. N. Whitehead in their Principia mathematica (1910-1913). ? This definitive history of a critical period in mathematics includes detailed accounts of the two principal influences upon Russell around 1900: the set theory of Cantor and the mathematical logic of Peano and his followers. Substantial surveys are provided of many related topics and figures of the late nineteenth century: the foundations of mathematical analysis under Weierstrass; the creation of algebraic logic by De Morgan, Boole, Peirce, Schröder, and Jevons; the contributions of Dedekind and Frege; the phenomenology of Husserl; and the proof theory of Hilbert. The many-sided story of the reception is recorded up to 1940, including the rise of logic in Poland and the impact on Vienna Circle philosophers Carnap and Gödel. A strong American theme runs though the story, beginning with the mathematician E. H. Moore and the philosopher Josiah Royce, and stretching through the emergence of Church and Quine, and the 1930s immigration of Carnap and Gödel. Grattan-Guinness draws on around fifty manuscript collections, including the Russell Archives, as well as many original reviews. The bibliography comprises around 1,900 items, bringing to light a wealth of primary materials. Written for mathematicians, logicians, historians, and philosophers--especially those interested in the historical interaction between these disciplines--this authoritative account tells an important story from its most neglected point of view. Whitehead and Russell hoped to show that (much of) mathematics was expressible within their logic; they failed in various ways, but no definitive alternative position emerged then or since.*