



max planck institut
informatik

Automated Reasoning

The Mechanization of Logic

Christoph Weidenbach

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Automated Reasoning Before 1950

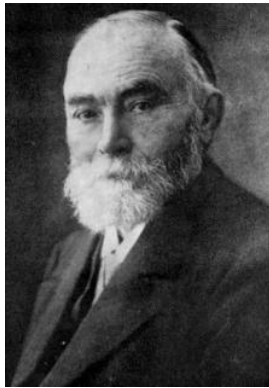
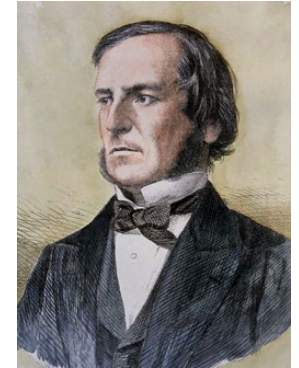


Gottfried Wilhelm Leibniz (1646-1716)

Integral Calculus

George Boole (1815-1864)

Propositional Logic
Boolean Algebra



Gottlob Frege (1848-1925)

First-Order Logic

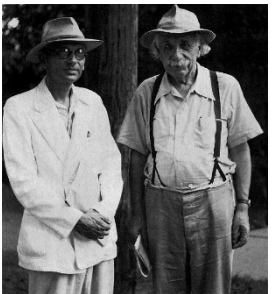


Jacques Herbrand (1908-1931)

Herbrand Model

David Hilbert (1862-1943)

Hilbert Calculus
Visionary



Gödel (1906-1978)

Incompleteness



Löwenheim (1878-1957)

Skolem (1887-1963)

Countable Models



Automated Reasoning Applications Today

Mathematics Conjectures needing large proofs (Combinatorics)

Four-Color, Kepler, Robbins

First-Order

Logics: First-Order, Higher-Order

Verification Hardware: Rigorous Industry Standard

Intel Pentium FLP Bug 1994

Propositional

Logics: Propositional, PLTL

Software: Soft Industry Standard

Theories

Protocols, Embedded System Software

Logics: Propositional with Theories, First-Order, Higher-Order

Artificial Intelligence Knowledge Representation: Partial Standards

OWL, OWL2, ASP

Fragments

Logics: Propositional, First-Order Fragments



Automated Reasoning (AR) Table of Contents

Preliminaries

Abstract Orderings, Induction, Abstract Rewrite Systems

Propositional Logic

Logic: Syntax, Semantics, Normal Forms

AR: Tableau, Resolution, CDCL, Superposition

First-Order Logic

Logic: Syntax, Semantics

AR: Resolution, Superposition

Fragments

Logic: Bernays-Schoenfinkel Fragment

AR: Grounding, NRCL

Theories

Logic: Equational Logic

AR: Congruence Closure, Knuth-Bendix Completion

Logic: Linear Arithmetic

AR: Simplex, Branch & Bound

Weekly Exercises, Midterm-/Endterm-/ReExam

