

Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

170

7th International Conference on Automated Deduction

Napa, California, USA
May 14–16, 1984
Proceedings

Edited by R. E. Shostak



Springer-Verlag
Berlin Heidelberg New York Tokyo 1984

Editorial Board

D. Barstow W. Brauer P. Brinch Hansen D. Gries D. Luckham
C. Moler A. Pnueli G. Seegmüller J. Stoer N. Wirth

Editor

R. E. Shostak
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025
U.S.A.

Library of Congress Cataloging in Publication Data
International Conference on Automated Deduction
(7th : 1984 : Napa, Calif.)

Seventh International Conference on Automated
Deduction.

(Lecture notes in computer science ; 170)

1. Automatic theorem proving—Congresses.

2. Logic, Symbolic and mathematical—Congresses.

I. Shostak, Robert. II. Title.

III. 7th International Conference on Automated
Deduction. IV. Series.

QA76.9.A96I58 1984 511.3 84-5441

CR Subject Classification (1982): I.1, J.2.

© 1984 by Springer-Verlag New York Inc.

All rights reserved. No part of this book may be translated or
reproduced in any form without written permission from Springer-Verlag,
175 Fifth Avenue, New York, NY 10010, U.S.A.

Permission to photocopy for internal or personal use, or the internal or
personal use of specific clients, is granted by Springer-Verlag, New York, Inc.
for libraries and other users registered with the Copyright Clearance Center
(CCC), provided that the base fee of \$0.00 per copy, plus \$0.20 per page is
paid directly to CCC, 21 Congress Street, Salem, MA 01970, U.S.A. Special
requests should be addressed directly to Springer-Verlag, New York, 175 Fifth
Avenue, New York, NY 10010, U.S.A.

0-387-96022-8/84 \$0.00 + .20

Printed and bound by R.R. Donnelley & Sons, Harrisonburg, Virginia.
Printed in the United States of America.

9 8 7 6 5 4 3 2 1

3-540-96022-8 Springer-Verlag Berlin Heidelberg New York Tokyo
0-387-96022-8 Springer-Verlag New York Heidelberg Berlin Tokyo

FOREWORD

The Seventh International Conference on Automated Deduction was held May 14-16, 1984, in Napa, California. The conference is the primary forum for reporting research in all aspects of automated deduction, including the design, implementation, and applications of theorem-proving systems, knowledge representation and retrieval, program verification, logic programming, formal specification, program synthesis, and related areas.

The presented papers include 27 selected by the program committee, an invited keynote address by Jorg Siekmann, and an invited banquet address by Patrick Suppes. Contributions were presented by authors from Canada, France, Spain, the United Kingdom, the United States, and West Germany.

The first conference in this series was held a decade earlier in Argonne, Illinois. Following the Argonne conference were meetings in Oberwolfach, West Germany (1976), Cambridge, Massachusetts (1977), Austin, Texas (1979), Les Arcs, France (1980), and New York, New York (1982).

Program Committee

P. Andrews (CMU)
 W.W. Bledsoe (U. Texas) *past chairman*
 L. Henschen (Northwestern)
 G. Huet (INRIA)
 D. Loveland (Duke) *past chairman*
 R. Milner (Edinburgh)
 R. Overbeek (Argonne)
 T. Pietrzykowski (Acadia)
 D. Plaisted (U. Illinois)
 V. Pratt (Stanford)
 R. Shostak (SRI) *chairman*
 J. Siekmann (U. Kaiserslautern)
 R. Waldinger (SRI)

Local Arrangements

R. Schwartz (SRI)

CONTENTS

Monday Morning

Universal Unification (Keynote Address) Jorg H. Siekmann (FRG)	1
A Portable Environment for Research in Automated Reasoning Ewing L. Lusk and Ross A. Overbeek (USA)	43
A Natural Proof System Based on Rewriting Techniques Deepak Kapur and Balakrishnan Krishnamurthy (USA)	53
EKL-A Mathematically Oriented Proof Checker Jussi Ketonen (USA)	65

Monday Afternoon

A Linear Characterization of NP-Complete Problems Silvio Ursic (USA)	80
A Satisfiability Tester for Non-Clausal Propositional Calculus Allen Van Gelder (USA)	101
A Decision Method for Linear Temporal Logic Ana R. Cavalli and Luis Fariñas del Cerro (France)	113
A Progress Report on New Decision Algorithms for Finitely Presented Abelian Groups D. Lankford, G. Butler, and A. Ballantyne (USA)	128
Canonical Forms in Finitely Presented Algebras Philippe LeChenadec (France)	142
Term Rewriting Systems and Algebra Pierre Lescanne (France)	166
Termination of a Set of Rules Modulo a Set of Equations Jean-Pierre Jouannaud (France) and Miguel Muñoz (Spain)	175

*Tuesday Morning***Associative-Commutative Unification**

François Fages (France) 194

A Linear Time Algorithm for a Subcase of Second-Order Instantiation

Donald Simon (USA) 209

A New Equational Unification Method: A Generalisation of Martelli-Montanari's Algorithm

Claude Kirchner (France) 224

**A Case Study of Theorem Proving by the Knuth-Bendix Method
Discovering that $x^3 = x$ Implies Ring Commutativity**

Mark E. Stickel (USA) 248

A Narrowing Procedure for Theories with Constructors

L. Fribourg (France) 259

**A General Inductive Completion Algorithm
and Application to Abstract Data Types**

Hélène Kirchner (France) 282

*Tuesday Evening***The Next Generation of Interactive Theorem Provers (Banquet Address)**

Patrick Suppes (USA) 303

*Wednesday Morning***The Linked Inference Principle, II: The User's Viewpoint**

L. Wos, R. Veroff, B. Smith, and W. McCune (USA) 316

A New Interpretation of the Resolution Principle

Étienne Paul (France) 333

Using Examples, Case Analysis, and Dependency Graphs in Theorem Proving

David A. Plaisted (USA) 356

Expansion Tree Proofs and Their Conversion to Natural Deduction Proofs	
Dale Miller (USA)	375
Analytic and Non-analytic Proofs	
Frank Pfenning (USA)	394
<i>Wednesday Afternoon</i>	
Applications of Protected Circumscription	
Jack Minker and Donald Perlis (USA)	414
Implementation Strategies for Plan-Based Deduction	
Kenneth Forsythe and Stanislaw Matwin (Canada)	426
A Programming Notation for Tactical Reasoning	
David A. Schmidt (USA)	445
The Mechanization of Existence Proofs of Recursive Predicates	
Ketan Mulmuley (USA)	460
Solving Word Problems in Free Algebras Using Complexity Functions	
Alex Pélin and Jean H. Gallier (France)	476
Solving a Problem in Relevance Logic with an Automated Theorem Prover	
Hans-Jurgen Ohlbach and Graham Wrightson (FRG)	496

7th International Conference on Automated Deduction