Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

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Algebraic Logic and Universal Algebra in Computer Science

Conference, Ames, Iowa, USA
June 1–4, 1988
Proceedings

Springer-Verlag
Berlin Heidelberg New York London Paris Tokyo HongKong

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CR Subject Classification (1987): F.4.1, F.4.3

ISBN 3-540-97288-9 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-97288-9 Springer-Verlag New York Berlin Heidelberg

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.
2145/3140-543210 – Printed on acid-free paper

Dedicated to the memory of
Evelyn M. Nelson

Preface

Algebraic methods, in particular those of universal algebra and algebraic logic, are playing an increasingly important role in computer science, especially in the areas of algebraic specification of data types, relational database theory, logic of programs, functional and logic programming, and semantics of programming languages. To a large extent this work has been carried forward by computer scientists independently of the very active group of mathematicians who work in universal algebra and algebraic logic. In spite of the fundamental differences between the types of problems the two groups of researchers have been working on, we were convinced that a very substantial area of common interest could be uncovered once the problem of communication was overcome. Thus it was decided to hold a conference at Iowa State University from June 1 to 4, 1988. The main purpose of this conference was to bring together leading researchers from both areas to identify this common ground.

Invited hour addresses were given by Joel Berman (Illinois, Chicago), H. Peter Gumm (SUNY New Paltz), Bjarni Jónsson (Vanderbilt), Dexter Kozen (Cornell), István Németi (Hungarian Academy of Sciences, Budapest), Vaughan Pratt (Stanford), Dana Scott (Carnegie-Mellon), and Eric Wagner (IBM, Yorktown Heights). The program also included the presentation of 23 contributed papers and a round-table discussion on the role of algebra and logic in computer science moderated by George Strawn (Iowa State University). There were 78 participants, about evenly divided between those who characterized themselves as computer scientists and those as mathematicians. Papers submitted to the proceedings of the conference were thoroughly refereed. The 16 papers and extended abstracts included here represent a wide range of topics at the interface of algebra and computer science.

The organizers gratefully acknowledge the support of the Mathematics and Computer Science Departments, the Graduate College and the Computation Center of Iowa State University. The conference was also supported by grants from the National Science Foundation, the Office of Naval Research, and the Institute for Applied Mathematics in Minneapolis. We greatly appreciate the fine job performed by the referees. Finally the organizers want to thank the editorial staff of Springer-Verlag for their help and encouragement.

The editors
Ames, Iowa
November 24, 1989

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Conference Program

Wednesday, June 1

MORNING SESSION — GEORGE MCNULTY, MODERATOR

Invited Address: Eric Wagner, IBM, *All recursive types defined using products and sums can be implemented using pointers*

Ivo Rosenberg, Univ. of Montreal, *Term equations via Mal'cev preiterative algebras*

Ildikó Sain, Hungarian Academy of Sciences, *Comparative study of distinguished program verification methods*

AFTERNOON SESSION — WILLIAM LAMPE, MODERATOR

Invited Address: Joel Berman, Univ. of Illinois, Chicago, *The value of free algebras*

Lawrence Moss, Univ. of Michigan, *Final algebra semantics for insufficiently complete specifications*

Ivan Rival, Univ. of Ottawa, *Graphical data structures for ordered sets*

Hong X. Dang, SUNY Geneseo, *On sublattice lattice varieties*

George McNulty, Univ. South Carolina, *Avoidable words*

Thursday, June 2

MORNING SESSION — DAVID SCHMIDT, MODERATOR

Invited Address: Dana Scott, Carnegie-Mellon University, *Domains and algebras*

Zbigniew Stachniak, York University, *The resolution rule: an algebraic perspective*

Alan Day, Lakehead University, *The interval construction revisited*

Ernie Manes, Univ. of Massachusetts, *Assertions, interleavings and atoms*

AFTERNOON SESSION — STEPHEN COMER, MODERATOR

Invited Address: István Németi, Hungarian Academy of Sciences, *Epimorphisms in algebraic logic with applications to the Beth definability theorem*

Marek Zaionc, Univ. of Alabama, Birmingham, *A characteristic of definable tree operations*

H. Albert Lilly, Univ. of Alabama, Birmingham, *A survey of current research into the use of functional specifications for the compilation of programming languages*

Ivo Düntsch, Univ. of Brunei, Darussalam, *On Galois closed algebras of binary relations*

Richard Thompson, Univ. of California, Berkeley *The manipulatory foundations of non-parallel programming*

EVENING SESSION

Round-table discussion: The role of algebra and logic in computer science. Moderator: George Strawn, Iowa State University

Friday, June 3

MORNING SESSION — DAVID B. BENSON, MODERATOR

Invited Address: Dexter Kozen, Cornell University, *Stone duality in programming language semantics*

H.P. Sankappanavar, SUNY New Paltz, *Linked double weak Stone algebras*

Erzsébet Lukács, Vanderbilt University, *Representability of finite relation algebras with many identity atoms*

Mitsuhiro Okada, Concordia University, *Algebraic proof of normalization theorems for polymorphic lambda calculus and higher order logics*

AFTERNOON SESSION — IVO ROSENBERG, MODERATOR

Invited Address: H.P. Gumm, SUNY New Paltz, *The role of universal algebra in computer science*

Fernando Guzmán, SUNY Binghamton, *Conditional logic*

George Nelson, Univ. of Iowa, *Other logics for equational theories*

Robert W. Quackenbush, Univ. of Manitoba, *The completeness theorem for the universal logic of algebras via congruences*

Irving Anellis, Philosophia Mathematica, *Maslov's inverse method and its application to programming logic*

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Invited Address: Vaughan Pratt, Stanford University, *Dynamic algebras II: the constructive fragment*

Marek Suchenek, Wichita State University, *Incremental models of incomplete information data bases*

Nistala V. Murthy, Univ. of Toledo, *Essentially algebraic categories*

W.D. Maurer, George Washington University, *Three fundamental correctness theorems for the modification index method*

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Invited Address: Bjarni Jónsson, Vanderbilt University, *Relatively free relation algebras*

David Benson, Washington State University, *Interaction automata*

R. Padmanabhan, Univ. of Manitoba, *Equational logic on algebraic curves*

Chihyi Ying, *First-order Boolean-valued semantics*

List of Participants

J.C. Abbott	U.S. Naval Academy
Hajnal Andréka	Hungarian Academy of Sciences
Irving H. Anellis	Philosophia Mathematica
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Clifford Bergman	Iowa State Univeristy
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Jim Bieman	Iowa State University
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Isidore Fleischer	University of Iowa
Gebhard Fuhrken	University of Minnesota
Hernando Gaitan	Iowa State University
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Fernando Guzmán	SUNY Binghamton
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Margret Höft	University of Michigan
Bjarni Jónsson	Vanderbilt University
David Kelly	University of Manitoba
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Peter Ladkin	Kestrel Institute
William Lampe	University of Hawaii
Dean R. Lass	Iowa State University
Albert Lilly	University of Alabama at Birmingham
Erzsébet Lukács	Vanderbilt University
George McNulty	University of South Carolina
Wendy MacCaull	Francis Xavier University
Roger Maddux	Iowa State University
Ernie Manes	University of Massachusetts
W.D. Maurer	George Washington University
J.D. Monk	University of Colorado
David L. Morgan	Kennesaw College

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Jacob Shapiro	Baruch College
Jerry Shelton	Computer Sciences Corporation
Giora Slutzki	Iowa State University
Laura Smith	Iowa State University
Zbigniew Stachniak	York University
Michael Stone	University of Calgary
George Strawn	Iowa State University
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