

THE  
JOURNAL  
OF  
SYMBOLIC LOGIC

EDITED BY

WILFRIED BUCHHOLZ  
HERBERT B. ENDERTON  
MATTHEW FOREMAN  
NEIL IMMERMANN

GERHARD JÄGER  
RICHARD KAYE  
STEFFEN LEMPP  
PENELOPE MADDY  
DAVID MARKER

WILLIAM J. MITCHELL  
PHILIP SCOWCROFT  
LOU VAN DEN DRIES  
ALBERT VISSER

VOLUME 62  
1997

PUBLISHED QUARTERLY BY THE ASSOCIATION FOR SYMBOLIC LOGIC, INC. WITH  
SUPPORT FROM ICSU AND FROM INSTITUTIONAL AND CORPORATE MEMBERS

---

The four numbers of Volume 62 were issued at the following dates:

- Number 1, pages 1–336, April 8, 1997
- Number 2, pages 337–688, August 5, 1997
- Number 3, pages 689–1056, October 7, 1997
- Number 4, pages 1057–1504, December 18, 1997

Numbers 1–4 of this volume are copyrighted ©1997 by the Association for Symbolic Logic, Inc. Reproduction of copyrighted numbers of the *BULLETIN* by photostat, photoprint, microfilm, or like process is forbidden, except by written permission, to be obtained from the Secretary of the Association, C. Ward Henson, Department of Mathematics, University of Illinois, 1409 W. Green St., Urbana, IL 61801.

The paper used in this *JOURNAL* is acid-free and falls within the guidelines established to ensure *permanence and durability*.

This *JOURNAL* has been registered with the Copyright Clearance Center, Inc. The appearance of a code at the bottom of the first page of an article indicates the copyright owner's consent for copying beyond that permitted by Sections 107 or 108 of the U. S. Copyright Law, provided that the per-copy fee stated in the code is paid directly to Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923. This consent does not extend to copying for general distribution, for advertising or promotion purposes, for creating new collective works, or for resale. Specific written permission for such copying must be obtained from the Association.

CONTENTS OF VOLUME 62

RESEARCH ARTICLES

ADÁMEK, J., JOHNSTONE, P. T., MAKOWSKY, J. A., and ROSICKÝ, J. Finitary sketches ..... 699

ASPERTI, ANDREA and CIABATTONI, AGATA. A sufficient condition for completeness of partial combinatory algebras ..... 1209

BAGARIA, JOAN. A characterization of Martin's axiom in terms of absoluteness ..... 366

BAGARIA, JOAN and WOODIN, W. HUGH.  $\Delta_n^1$  sets of reals ..... 1379

BELL, J. L. Zorn's lemma and complete Boolean algebras in intuitionistic type theories ..... 1265

BÈS, ALEXIS. Undecidable extensions of Büchi arithmetic and Cobham-Semënov Theorem ..... 1280

BIANCONI, RICARDO. Nondefinability results for expansions of the field of real numbers by the exponential function and by the restricted sine function .. 1173

BONET, MARIA, PITASSI, TONIANN, and RAZ, RAN. Lower bounds for cutting planes proofs with small coefficients ..... 708

BRODA, SABINE and DAMAS, LUÍS. Compact bracket abstraction in combinatory logic ..... 729

BURKE, DOUGLAS R. Precipitous towers of normal filters ..... 741

BURKE, DOUGLAS and MATSUBARA, YO. Ideals and combinatorial principles ..... 117

CHAPUIS, OLIVIER.  $\forall$ -free metabelian groups ..... 159

CIABATTONI, AGATA. See ASPERTI, ANDREA.

COQUAND, THIERRY. Minimal invariant spaces in formal topology ..... 689

DAMAS, LUÍS. See BRODA, SABINE.

DANOS, VINCENT, JOINET, JEAN-BAPTISTE, and SCHELLINX, HAROLD. A new deconstructive logic: linear logic ..... 755

DOWNNEY, RODNEY G. and LEMPP, STEFFEN. Contiguity and distributivity in the enumerable Turing degrees ..... 1215

ERDÉLYI-SZABÓ, MIKLÓS. Decidability of Scott's model as an ordered  $\mathbb{Q}$ -vector space ..... 917

FOREMAN, MATTHEW and MAGIDOR, MENACHEM. A very weak square principle ..... 175

FRIEDMAN, SY D. Coding without fine structure ..... 808

GILCHRIST, MARTIN and SHELAH, SAHARON. The consistency of  $ZFC + 2^{\aleph_0} > \aleph_\omega + \mathcal{F}(\aleph_2) = \mathcal{F}(\aleph_\omega)$  ..... 1151

GOLDRING, NOA. The entire NS ideal on  $\mathcal{P}_\gamma \mu$  can be precipitous ..... 1161

GOTTLÖB, GEORG. Relativized logspace and generalized quantifiers over finite ordered structures ..... 545

HAMKINS, JOEL DAVID. Canonical seeds and Prikry trees ..... 373

HASKELL, DEIRDRE and MACPHERSON, DUGALD. A version of  $o$ -minimality for the  $p$ -adics ..... 1075

HIRSCH, ROBIN and HODKINSON, IAN. Step by step – Building representations in algebraic logic .....	225
—— Complete representations in algebraic logic .....	816
HJORTH, GREG. Some applications of coarse inner model theory .....	337
HODKINSON, IAN. See HIRSCH, ROBIN.	
—— See HIRSCH, ROBIN.	
HOLLY, JAN E. Prototypes for definable subsets of algebraically closed valued fields .....	1093
IOVINO, JOSÉ. Definability in functional analysis .....	493
JÄGER, GERHARD. Power types in explicit mathematics? .....	1142
JAIN, SANJAY and SHARMA, ARUN. The structure of intrinsic complexity of learning .....	1187
JIN, RENLING. Type two cuts, bad cuts and very bad cuts .....	1241
JOHNSTONE, P. T. See ADÁMEK, J.	
JOINET, JEAN-BAPTISTE. See DANOS, VINCENT.	
KANOVEI, VLADIMIR. An Ulm-type classification theorem for equivalence relations in Solovay model .....	1333
KONTOSTATHIS, KYRIAKOS. The combinatorics of the splitting theorem .....	197
KRAJÍČEK, JAN. Interpolation theorems, lower bounds for proof systems, and independence results for bounded arithmetic .....	457
KREMER, PHILIP. On the complexity of propositional quantification in intuitionistic logic .....	529
—— Defining relevant implication in a propositionally quantified $S4$ ....	1057
LAFONT, YVES. The finite model property for various fragments of linear logic	1202
LEMPPE, STEFFEN. See DOWNEY, RODNEY G.	
LEONHARDI, STEVEN D. Generalized nonsplitting in the recursively enumerable degrees .....	397
LIFSCHES, SHMUEL and SHELAH, SAHARON. Peano arithmetic may not be interpretable in the monadic theory of linear orders .....	848
LIU, NIANZHENG. Analytic cell decomposition and the closure of $p$ -adic semi-analytic sets .....	285
LYNCH, JAMES F. Infinitary logics and very sparse random graphs .....	609
MACPHERSON, DUGALD. See HASKELL, DEIRDRE.	
MAGIDOR, MENACHEM. See FOREMAN, MATTHEW.	
MAKOWSKY, J. A. See ADÁMEK, J.	
MARTIN, ERIC and OSHERSON, DANIEL. Scientific discovery based on belief revision .....	1352
MARTIN, URSULA and SCOTT, ELIZABETH. The order types of termination orderings on monadic terms, strings and multisets .....	624
MATSUBARA, YO. See BURKE, DOUGLAS.	
MAURIN, FRANÇOISE. The theory of integer multiplication with order restricted to primes is decidable .....	123
MCGEE, VANN. The complexity of the modal predicate logic of “true in every transitive model of ZF” .....	1371

MCLEISH, S. J. The forth part of the back and forth map in countable homogeneous structures .....	873
MILDENBERGER, HEIKE. Non-constructive Galois-Tukey connections .....	1179
MOERDIJK, IEKE and PALMGREN, ERIK. Minimal models of Heyting arithmetic	1448
NARENDRAN, PALIATH, PFENNING, FRANK, and STATMAN, RICHARD. On the unification problem for Cartesian closed categories .....	636
NEGRI, SARA and VALENTINI, SILVIO. Tychonoff's theorem in the framework of formal topologies .....	1315
NIWIŃSKI, DAMIAN. See STOLBOUSHKIN, ALEXEI.	
OIKKONEN, JUHA. Undefinability of $\kappa$ -well-orderings in $L_{\infty\kappa}$ .....	999
OSHERSON, DANIEL. See MARTIN, ERIC.	
PALMGREN, ERIK and STOLTENBERG-HANSEN, VIGGO. A logical presentation of the continuous functionals .....	1021
PALMGREN, ERIK. See MOERDIJK, IEKE.	
PARIGOT, MICHEL. Proofs of strong normalisation for second order classical natural deduction .....	1461
PENTUS, MATI. Product-free Lambek calculus and context-free grammars ...	648
PETERSON, DOUGLAS. Cardinal functions on ultraproducts of Boolean algebras .....	43
PFENNING, FRANK. See NARENDRAN, PALIATH.	
PILLAY, ANAND. Remarks on Galois cohomology and definability .....	487
PILLAY, ANAND and TSUBOI, AKITO. Amalgamations preserving $\aleph_0$ -categoricity .....	1070
PINCUS, DAVID. The dense linear ordering principle .....	438
PITASSI, TONIANN. See BONET, MARIA.	
PUDLÁK, PAVEL. Lower bounds for resolution and cutting plane proofs and monotone computations .....	981
RAZ, RAN. See BONET, MARIA.	
ROSICKÝ, JIŘÍ. Accessible categories, saturation and categoricity .....	891
——— See ADÁMEK, J.	
ROSLANOWSKI, ANDRZEJ and SHELAH, SAHARON. Simple forcing notions and forcing axioms .....	1297
SCHEEPERS, MARION. Rothberger's property and partition relations .....	976
SCHEEPERS, MARION and WEISS, WILLIAM. Variations on a game of Gale (III): remainder strategies .....	1253
SHELLINX, HAROLD. See DANOS, VINCENT.	
SCHILLING, KENNETH and ŽIVALJEVIĆ, BOŠKO. Louveau's theorem for the descriptive set theory of internal sets .....	595
SCOTT, ELIZABETH. See MARTIN, URSULA.	
SCOWCROFT, PHILIP. More on imaginaries in $p$ -adic fields .....	1
SHARMA, ARUN. See JAIN, SANJAY.	
SHAVRUKOV, V. YU. Undecidability in diagonalizable algebras .....	79

SHELAH, SAHARON and THOMAS, SIMON. The cofinality spectrum of the infinite symmetric group .....	902
SHELAH, SAHARON. See LIFSCHES, SHMUEL.	
——— See GILCHRIST, MARTIN.	
——— See ROSŁANOWSKI, ANDRZEJ.	
SIMONETTA, PATRICK. Une correspondance entre anneaux partiels et groupes	60
STATMAN, RICHARD. See NARENDRAN, PALIATH.	
STOLBOUSHKIN, ALEXEI, and NIWIŃSKI, DAMIAN. $y = 2x$ vs. $y = 3x$ .....	661
STOLTENBERG-HANSEN, VIGGO. See PALMGREN, ERIK.	
STRAHM, THOMAS. Polynomial time operations in explicit mathematics .....	575
THOMAS, SIMON. See SHELAH, SAHARON.	
TITANI, SATOKO. Completeness of global intuitionistic set theory .....	506
TOFFALORI, CARLO. Wildness implies undecidability for lattices over group rings .....	1429
TSUBOI, AKITO. See PILLAY, ANAND.	
VALENTINI, SILVIO. See NEGRI, SARA.	
VAN DALEN, DIRK. How connected is the intuitionistic continuum? .....	1147
VAN DEN DRIES, LOU. $T$ -convexity and tame extensions II .....	14
VARDI, MOSHE Y. Special selection in logic in computer science .....	608
VEDØ, ANNE. Asymptotic probabilities for second-order existential Kahr-Moore-Wang sentences .....	304
WEISS, WILLIAM. See SCHEEPERS, MARION.	
WOLTER, FRANK. Completeness and decidability of tense logics closely related to logics above $K4$ .....	131
WOODIN, W. HUGH. See BAGARIA, JOAN.	
WOODS, ALAN R. Counting finite models .....	925
ZAKHARYASCHEV, MICHAEL. Canonical formulas for $K4$ . Part III: the finite model property .....	950
ZAPLETAL, JINDŘICH. Splitting number at uncountable cardinals .....	35
ZAPLETAL, JINDŘICH. Small forcings and Cohen reals .....	280
ŽIVALJEVIĆ, BOŠKO. See SCHILLING, KENNETH.	

## REVIEWS

Reviews .....	320
Reviews .....	673
Reviews .....	1035
Reviews .....	1480
Index of reviews .....	1497

## ERRATA

### VOLUME 58

Page 1529, column 1, line 21. In the entry for Alchourrón et al., for «LVII 1149», read «LVII 1479».

### VOLUME 61

Page iii, line 1. For «**CONTENTS OF VOLUME 60**», read «**CONTENTS OF VOLUME 61**».

### VOLUME 62

Page 330, line 3 from below. For «*Adam's*», read «*Adams'*».

Continued from inside front cover

The complexity of the modal predicate logic of “true in every transitive model of ZF”, by VANN MCGEE .....	1371
$\Delta_n^1$ sets of reals, by JOAN BAGARIA and W. HUGH WOODIN .....	1379
Wildness implies undecidability for lattices over group rings, by CARLO TOFFALORI .....	1429
Minimal models of Heyting arithmetic, by IEKE MOERDIJK and ERIK PALMGREN .....	1448
Proofs of strong normalisation for second order classical natural deduction, by MICHEL PARIGOT .....	1461
Reviews .....	1480
Index of reviews .....	1497

---

The JOURNAL and the BULLETIN are the official organs of the Association for Symbolic Logic, an international organization for furthering research in logic and exchange of ideas among mathematicians, computer scientists, philosophers, linguists, and others interested in logic.

Individual membership in the Association is open to anyone interested in its work. Annual dues for members are \$52, or \$26 for students, and they include subscriptions to the current volumes of the JOURNAL and the BULLETIN.

Institutional membership in the Association is available to any academic institution or department. Annual institutional dues are \$450 for 1997. Membership privileges include choices of current subscriptions, of back volumes, and of student memberships.

Requests for information, applications for membership, orders for back volumes, and general business correspondence should be sent to the Secretary-Treasurer of the Association, *C. Ward Henson, ASL, Department of Mathematics, University of Illinois, 1409 W. Green Street, Urbana, IL 61801, U.S.A.* The Internet address of the Association's business office is [asl@math.uiuc.edu](mailto:asl@math.uiuc.edu). To see the ASL Homepage, point your browser to <http://www.math.uiuc.edu/~asl>.

Notices of change of address, dues, and subscriptions to the JOURNAL should be sent to the *Association for Symbolic Logic, Journals Division UIP, 1325 South Oak Street, Champaign, IL 61820-6903, U.S.A.* All orders must be accompanied by payment in dollars; Visa and Mastercard are accepted. To receive a replacement copy of the JOURNAL, please report damaged, defective, or missing issues within nine months of the date of publication.

The JOURNAL invites submission of (1) original technical papers in logic or its applications; (2) expository papers; (3) papers whose main point is philosophical and which either bear upon logic or make use of its methods; and (4) studies in the history of logic.

Articles for publication in the JOURNAL should be submitted in duplicate to one (and only one) of the following editors: *Wilfried Buchholz, Mathematisches Institut, Universität München, Theresienstrasse 39, D-80333 München, Germany*; or *Neil Immerman, Department of Computer Science, University of Massachusetts, Amherst, MA 01003, U.S.A.*; or *Richard Kaye, School of Mathematics and Statistics, University of Birmingham, Edgbaston, Birmingham B15 2TT, England*; or *Steffen Lempp, Department of Mathematics, University of Wisconsin, Madison, WI 53706, U.S.A.*; or *David Marker, Department of Mathematics, m/c 249, University of Illinois at Chicago, 851 S. Morgan Street, Chicago, IL 60607, U.S.A.*; or *William J. Mitchell, Department of Mathematics, University of Florida, Gainesville, FL 32611, U.S.A.*; or *Lou van den Dries, Department of Mathematics, University of Illinois, 1409 W. Green Street, Urbana, IL 61801, U.S.A.*; or *Albert Visser, Department of Philosophy, Utrecht University, Heidelberglaan 8, P. O. Box 80126, 3508 TC Utrecht, The Netherlands*.

Each manuscript should be typewritten neatly or prepared with a word processor, with wide margins, double spacing, and the footnotes numbered consecutively. After the paper is accepted in its final form, an electronic copy (preferably in L<sup>A</sup>T<sub>E</sub>X or A<sub>M</sub>S-L<sup>A</sup>T<sub>E</sub>X) will simplify and shorten the typesetting process. Fifty offprints of each article are supplied at no charge, and additional offprints may be purchased.

Books for review in the JOURNAL should be sent to *Herbert Enderton, The Journal of Symbolic Logic, U.C.L.A., Los Angeles, CA 90095, U.S.A.* The other editors of reviews are *Matthew Foreman, Gerhard Jäger, Penelope Maddy, and Philip Scowcroft*.



**0022-4812(199712)62:4;1-2**