## THE

## JOURNAL OF

## SYMBOLIC LOGIC

EDITED BY

Martin Grohe, Coordinating Editor
Toshiyasu Arai Peter Cholak
Robert Goldblatt Greg Hjorth Michael C. Laskowski
Simon Thomas Stewart Shapiro

Volume 71
2006

Published quarterly by the Association for Symbolic Logic, Inc. WITH SUPPORT FROM INSTITUTIONAL AND CORPORATE MEMBERS

The four numbers of Volume 71 are copyrighted (C)2006 by the Association for Symbolic Logic, Inc. Reproduction of copyrighted numbers of the Journal by photostat, photoprint, microfilm, or like process is forbidden, except by written permission, to be obtained from the Secretary of the Association, Charles Steinhorn, ASL, Box 742, Vassar College, 124 Raymond Avenue, Poughkeepsie, NY 12604, USA.
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 71

Aczel, Peter. See Gambino, Nicola.
Arai, Noriko H., Pitassi, Toniann, and Urquhart, Alasdair. The complexity of analytic tableaux ..... 777
Arai, Toshiyasu. Epsilon substitution method for $\Pi_{2}^{0}$-FIX ..... 1155
Aschenbrenner, Matthias, Moosa, Rahim, and Scanlon, Thomas. Strongly minimal groups in the theory of compact complex spaces ..... 529
Becher, Verónica, Figueira, Santiago, Grigorieff, Serge, and Miller, Joseph S. Randomness and halting probabilities ..... 1411
Beigel, Richard, Buhrman, Harry, Fejer, Peter, Fortnow, Lance, Grabowski, Piotr, Longpré, Luc, Muchnik, Andrej, Stephan, Frank, and Torenvliet, Leen. Enumerations of the Kolmogorov function ..... 501
Bell, Murray and Marciszewski, Witold. Universal spaces for classes of scattered Eberlein compact spaces ..... 1073
Bellé, D. and Parlamento, F. Truth in V for $\exists^{*} \forall \forall$-sentences is decidable ..... 1200
Ben-Yaacov, Itay. On supersimplicity and lovely pairs of cats ..... 763
Berger, Josef, Bridges, Douglas, and Schuster, Peter. The fan theorem and unique existence of maxima ..... 713
Binns, Stephen, Kjos-Hanssen, Biørn, Lerman, Manuel, and Solomon, Reed. On a conjecture of Dobrinen and Simpson concerning almost everywhere domination ..... 119
Brady, Ross T. Normalized natural deduction systems for some relevant logics I: The logic DW ..... 35
Brendle, Jörg and Zhang, Shuguo. Converse dual cardinals ..... 22
Bridges, Douglas. See Berger, Josef.Buhrman, Harry. See Beigel, Richard.Calhoun, William C. Degrees of monotone complexity1327
Calvert, Wesley, Knight, Julia F., and Millar, Jessica. Computable trees of Scott rank $\omega_{1}^{C K}$, and computable approximation ..... 283
Cenzer, Douglas and Remmel, Jeffrey B. Complexity, decidability and completeness ..... 399
Cheney, James. Completeness and Herbrand theorems for nominal logic ..... 299
Cholak, Peter, Greenberg, Noam, and Miller, Joseph S. Uniform almost everywhere domination ..... 1057
Cintula, Petr. See Hájek, Petr.Csima, Barbara F., Downey, Rod, Greenberg, Noam, Hirschfeldt, DenisR., and Miller, Joseph S. Every 1-generic computes a properly 1-generic1385
Csima, Barbara F. and Soare, Robert I. Computability results used in differential geometry ..... 1394
Diaconescu, Răzvan. See Petria, Marius.
Ding, Longyun and Gao, Su. Diagonal actions and Borel equivalence relations ..... 1081
Diordjević, Marko. Finite satisfiability and $\aleph_{0}$-categorical structures with trivial dependence ..... 810
Dobrinen, Natasha and Friedman, Sy-David. Co-stationarity of the ground model ..... 1029
Došen, Kosta and Petrć, Zoran. Associativity as commutativity ..... 217
Downey, Rod, Nies, Andre, Weber, Rebecca, and Yu, Liang. Lowness and $\Pi_{2}^{0}$ nullsets ..... 1044
Downey, Rod. See Csima, Barbara F. Fejer, Peter. See Beigel, Richard.
Fernandez, David. A polynomial translation of $S 4$ into intuitionistic logic ..... 989
Ferreira, Fernando and Nunes, Ana. Bounded modified realizability ..... 329
Figueira, Santiago. See Becher, Verónica.
Forster, Thomas. Permutations and wellfoundedness: the true meaning of the bizarre arithmetic of Quine's NF ..... 227
Fortnow, Lance. See Beigel, Richard.
Friedman, Sy-David, Koepke, Peter, and Piwinger, Boris. Hyperfine structure theory and gap 1 morasses ..... 480
Friedman, Sy-David. See Dobrinen, Natasha. Galatos, Nikolaos and Ono, Hiroakira. Glivenko theorems for substructural logics over FL ..... 1353
Gambino, Nicola and Aczel, Peter. The generalised type-theoretic interpretation of constructive set theory ..... 67
Gao, Su. See Ding, Longyun.
Gerla, Giangiacomo. Effectiveness and multivalued logics ..... 137
Giorgi, Matthew, Sorbi, Andrea, and Yang, Yue. Properly $\Sigma_{2}^{0}$ enumeration degrees and the high/low hierarchy ..... 1125
Goldblatt, Robert. See Mares, Edwin D.
Grabowski, Piotr. See Beigel, Richard.
Greenberg, Noam. See Cholak, Peter.
-. See Csima, Barbara F.
Grigorieff, Serge. See Becher, Verónica.
Grossberg, Rami and VanDieren, Monica. Shelah's categoricity conjecture from a successor for tame abstract elementary classes ..... 553
Guzy, Nicolas. 0-D-valued fields ..... 639
Hájek, Petr and Cintula, Petr. On theories and models in fuzzy predicate logics ..... 863
Halbach, Volker and Horsten, Leon. Axiomatizing Kripke's theory of truth ..... 677
Hasson, Assaf and Hils, Martin. Fusion over sublanguages ..... 361
Hils, Martin. See Hasson, Assaf.
Hirschfeldt, Denis R. See Csima, Barbara F.Horsten, leon. See Halbach, Volker.Hrushovski, E. and Tatarsky, A. Stable embeddedness in algebraicallyclosed valued fields831
Jaligot, Eric. Generix never gives up ..... 599
Jones, Albin L. A polarized partition relation for weakly compact cardinals using elementary substructures ..... 1342
Kent, Thomas $F$. The $\Pi_{3}$-theory of the $\Sigma_{2}^{0}$-enumeration degrees is undecidable ..... 1284
Kjos-Hanssen, Bjørn. See Binns, Stephen.
Knight, Julia F. See Calvert, Wesley.
Koepke, Peter. See Friedman, Sy-David.
Kolodziejczyk, Leszek Aleksander. On the Herbrand notion ofconsistency for finitely axiomatizable fragments of bounded arithmetictheories624
Kontinen, Juha. The hierarchy theorem for second order generalized quantifiers ..... 188
Lerman, Manuel. See Binns, Stephen.
Liu, Andreas. Bounds for covering numbers ..... 1303
Longrré, Luc. See Beigel, Richard.
Marciszewski, Witold. See Bell, Murray.Mares, Edwin D. and Goldblatt, Robert. An alternative semantics forquantified relevant logic163
Marker, David. A remark on Zilber's pseudoexponentiation ..... 791
Marshall, M. Local-global properties of positive primitive formulas in the theory of spaces of orderings ..... 1097
Matheron, É., Solecki, S., and Zelený, M. Trichotomies for ideals of compact sets ..... 586
Medeiros, Maria da Paz N. A new S4 classical modal logic in natural deduction ..... 799
Michelbrink, Markus. A Buchholz derivation system for the ordinal analysis of $\mathbf{K P}+\Pi_{3}$-reflection ..... 1237
Millar, Jessica. See Calvert, Wesley.
Miller, Joseph S. See Becher, Verónica.
--. See Csima, Barbara F.
--. See Cholak, Peter.
Moosa, Rahim. See Aschenbrenner, Matthias.Muchnik, Andrej. See Beigel, Richard.
Neeman, Itay. Determinacy for games ending at the first admissible relativeto the play425
Neeman, Itay and Steel, John. Counterexamples to the unique and cofinal branches hypotheses ..... 977
Nies, Andre. See Downey, Rod.
Nunes, Ana. See Ferreira, Fernando.
Nurkhaidarov, Ermek S. Automorphism groups of arithmetically saturated models ..... 203
Ono, Hiroakira. See Galatos, Nikolaos.
Onshuus, Alf. Properties and consequences of Thorn-independence ..... 1
Parlamento, F. See Bellé, D.
Peretz, Assaf. Geometry of forking in simple theories ..... 347
Petré, Zoran. See Dosen, Kosta.Petria, Marius and Diaconescu, Răzvan. Abstract Beth definability ininstitutions1002
Pillay, Anand and Polkowska, Dominika. On PaC and bounded substructures of a stable structure ..... 460
Pitassi, Toniann. See Arai, Noriko H. Piwinger, Boris. See Friedman, Sy-David. Poizat, Bruno. Univers positifs ..... 969
Polkowska, Dominika. See Pillay, Anand.
Probst, Dieter. The proof-theoretic analysis of transfinitely iterated quasi least fixed points ..... 721
Prunescu, Mihai. Structure with fast elimination of quantifiers ..... 321
Radin, Dale. Morley degree in unidimensional compact complex spaces ..... 569
Raftery, J. G. Correspondences between Gentzen and Hilbert systems ..... 903
Remmel, Jeffrey B. See Cenzer, Douglas. Rostanowski, Andrzej. $n$-localization property ..... 881
Sági, Gábor and Shelah, Saharon. On weak and strong interpolation in algebraic logics ..... 104
Scanlon, Thomas. See Aschenbrenner, Matthias. Schindler, Ralf. Core models in the presence of Woodin cardinals ..... 1145
———. Iterates of the core model ..... 241
Schuster, Peter. See Berger, Josef.
Shelah, Saharon. See Sági, Gábor.
Soare, Robert I. See Csima, Barbara F.
Solecki, S. See Matheron, É.
Solomon, Reed. See Binns, Stephen.
Sorbi, Andrea. See Giorgi, Matthew.
Spitters, Bas. A constructive view on ergodic theorems ..... 611
-_. Corrigendum to: 'A constructive view on ergodic theorems' ..... 1431
Steel, John. See Neeman, Itay.
Stephan, Frank. See Beigel, Richard.
Tatarsky, A. See Hrushovski, E.
Tennant, Neil. On the degeneracy of the full $A G M$-theory of theory-revision ..... 661
Thompson, Alex. A metamathematical condition equivalent to the existence of a complete left invariant metric for a Polish group ..... 1108
Torenvliet, Leen. See Beigel, Richard.
Törnquist, Asger. Orbit equivalence and actions of $\mathbb{F}_{n}$ ..... 265
Tsaban, Boaz and Zdomskyy, Lyubomyr. Menger's covering property and groupwise density ..... 1053
Tyne, James. $T$-height in weakly o-minimal structures ..... 747
Urquhart, Alasdair. See Arai, Noriko H.Valentini, Silvio. Every countably presented formal topology is spatial,classically491
VanDieren, Monica. See Grossberg, Rami.
Viale, Matteo. The proper forcing axiom and the singular cardinal hypothesis ..... 473
Visser, Albert. Predicate logics of constructive arithmetical theories ..... 1311
Weber, Rebecca. See Downey, Rod.
Willard, Dan E. On the available partial respects in which an axiomatization for real valued arithmetic can recognize its consistency1189
Wu, Guohua. Jump operator and Yates degrees ..... 252
Yang, Yue and Yu, Liang. On $\Sigma_{1}$-structural differences among finite levelsof the Ershov hierarchy1223
Yang, Yue. See Giorgi, Matthew.
Yu, Liang. Measure theory aspects of locally countable orderings ..... 958
. See Downey, Rod.
. See Yang, Yue.Zdomskyy, Lyubomyr. See Tsaban, Boaz.ZelenÝ, M. See Matheron, É.Zhang, Shuguo. See Brendle, Jörg.

The Journal invites submission of (1) original technical papers in the field of symbolic logic, (2) expository papers in this field, (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 in which modern technical developments are taken into account,

Articles being submitted for publication in the Journal should be sent to one (and only one) of the following editors: Toshiyasu Arai, Grad. Sch. of Sci, \& Tech, Kobe Univ., Rokko-dai, Nada-ku, Kobe 657-8501, Japan (arai@kurt.scitec.kobe-u.ac.jp); or Peter Cholak, Dept. of Math., 255 Hurley, Univ. of Notre Dame, Notre Dame, IN 46556, USA (Peter. Cholak.1@nd.edu); or Robert Goldblatt, Department of Mathematics, Victoria University, Box 600, Wellington, New Zealand (rob. goldblatt@vयw. ac.nz); or Martin Grohe, Laboratory for the Foundations of Computer Science, Division of Informatics, University of Edinburgh, Edinburgh EH9 3JZ, Scotland, U.K. (grohe@dcs.ed.ac.uk); or Greg Hjorth, Department of Mathematics \& Statistics, University of Melbourne, Parkville, VIC, 3010, Australia (greg@math.ucla.edu); or Michael C. Laskowski, Department of Mathematics, University of Maryland, College Park, MD 20742, USA (mcl@math. umd. edu); or Simon Thomas, Department of Mathematics, Rutgers University, New Brunswick, NJ 08903, USA (sthomas@math.rutgers.edu); or Stewart Shapiro, Department of Philosophy, The Ohio State University, 350 University Hall, 230 North Oval Mall, Columbus, Ohio 43210, USA (shapiro.4@osu.edu).

Submitted manuscripts should be typewritten with wide margins and with double spacing between the lines, or prepared with a word processor, such as LATEX or Microsoft Word. Two copies of the manuscript should be sent to the editor, and the author should also keep a complete copy and the electronic file from which the submitted copy was prepared, if a word processor was used. After the paper is accepted in its final form, an electronic copy will be appreciated and will advance the final publication date of the paper, especially if it is in $\mathrm{AT}_{\mathrm{E}} \mathrm{X}$ or $\mathcal{A} \mathcal{M} \mathcal{S}$ - $\mathrm{H} \mathrm{T}_{\mathrm{E}} \mathrm{X}$. The Journal and the Bulletin of Symbolic Logic are typeset in a version of $\mathcal{A}_{\mathcal{M}} \mathcal{S}$ - $\mathrm{HT}_{\mathrm{E}} \mathrm{X}$, using a stylefile which is posted on the ASL Website, http: //www. aslonline.org, along with instructions for its use. Fifty offprints of each article are supplied at no charge, and additional offprints may be purchased if desired.

Volumes 1 through 66 of the Journal are available online in the JSTOR database.
Reviews of articles and books in logic which in the past were published in the Journal have been moved to the Bulletin of Symbolic Logic, beginning with the March 2000 issues.

Individual membership in the Association is open to anyone interested in its work. Annual dues for members are US $\$ 76$ (US $\$ 38$ for students). Dues 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 US $\$ 595$ for 2006. Membership privileges include choices of current subscriptions, back volumes, and student memberships. A detailed description of institutional and corporate memberships is available from the Secretary-Treasurer.

Requests for information, applications for membership, orders for back volumes, business correspondence, and notices and announcements for publication in the Bulletin should be sent to the Secretary-Treasurer of the Association, Charles Steinhorn, ASL, Box 742, Vassar College, 124 Raymond Avenue, Poughkeepsie, NY 12604 USA. The electronic mail address of the Association's business office is asl@vassar.edu. The ASL Website is located at http://www.aslonline.org. Links from that site provide further information on the Journal and on submitting papers for publication.

Notices of change of address, dues payments, and subscription orders to the Journal and Bulletin should be sent to: Association for Symbolic Logic, c/o American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294, USA.

All orders must be accompanied by payment in US dollars; Visa and MasterCard charges 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.

All back volumes of the Journal are available, and they can be purchased by individual members of the Association (for their personal use) or by institutional members at a $50 \%$ discount. Orders should be sent to the Secretary-Treasurer, from whom the current price list is available.

All back volumes of the Journal are available. Volume 26 is an index for Volumes 1-26 and Number 4 of Volume 45 is an index for Volumes $27-45$. Number 4 of Volume 55 is a cumulative index for Volumes 27-55 (it includes the index published in Volume 45, Number 4, except for listings of reviews by subject, which has been discontinued). A revised edition of A Bibliography of Symbolic Logic by Alonzo Church. may be purchased separately. Members of the Association may purchase back volumes for their personal use at a $50 \%$ discount. This discount also applies to institutional members. Orders should be sent to the Secretary-Treasurer, from whom the current price list is available.

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


0022-4812(200612)71:4*;1-6

