## THE

## JOURNAL OF SYMBOLIC LOGIC

## EDITED BY

ROD DOWNEY, Coordinating Editor
FRANÇOISE DELON JOHN ETCHEMENDY
ROBERT GOLDBLATT MARTIN GROHE GREG HJORTH
MICHAEL RATHJEN SIMON THOMAS

VOLUME 68 2003

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

The four numbers of Volume 68 were issued at the following dates:

Number 1, pages 1–352, March 12, 2003 Number 2, pages 353–712, May 15, 2003 Number 3, pages 713–1064, September 10, 2003 Number 4, pages 1065–1416, November 18, 2003

Numbers 1–4 of this volume are copyrighted ©2003 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 68**

APTER, ARTHUR, W. and HAMKINS, JOEL DAVID. Exactly controlling the	
non-supercompact strongly compact cardinals	669
BALDWIN, JOHN T. Expansions of geometries	803
BARMPALIAS, GEORGE. The approximation structure of a computably approximable real	885
Barney, Christopher. Ultrafilters on the natural numbers	764
BARTOSZYNSKI, TOMEK, SHELAH, SAHARON, and TSABAN, BOAZ. Additivity	1254
properties of topological diagonalizations	1234
BEKLEMISHEV, LEV D. On the induction schema for decidable predicates BEN-YAACOV, ITAY. Discouraging results for ultraimaginary independence	
theory	846
BENEDIKT, MICHAEL and KEISLER, H. JEROME. Definability with a predicate	210
for a semi-linear set  Berarducci, Alessandro and Otero, Margarita. Transfer methods for o-minimal topology	319 785
Berenstein, Alexander. Simple stable homogeneous groups	1145
BIMBÓ, KATALIN. The Church-Rosser property in dual combinatory logic	132
BLACKBURN, PATRICK and MARX, MAARTEN. Constructive interpolation in	132
hybrid logic	463
Blass, Andreas and Gurevich, Yuri. Strong extension axioms and Shelah's	703
zero-one law for choiceless polynomial time	65
BLOSSIER, THOMAS. Automorphism groups of trivial strongly minimal	(11
Brendle, Jörg and Losada, Maria. The cofinality of the infinite symmetric	644
group and groupwise density	1354
Bridges, Douglas and Vîță, Luminița. A proof-technique in uniform	1557
space theory	795
Cantini, Andrea. The axiom of choice and combinatory logic	1091
CARLSON, TIMOTHY J. Ranked partial structures	1109
CHOLAK, PETER A. and HARRINGTON, LEO A. Isomorphisms of splits of	1107
computably enumerable sets	1044
Cluckers, Raf. Presburger sets and p-minimal fields	153
Cummings, James, Foreman, Matthew, and Magidor, Menachem. The	100
non-compactness of square	637
DAVID, RENÉ and NOUR, KARIM. A short proof of the strong normalization	
of classical natural deduction with disjunction	1277
DEISER, OLIVER and DONDER, DIETER. Canonical functions, non-regular	
ultrafilters and Ulam's problem on $\omega_1$	713
DICKMANN, M. A. and MIRAGLIA, F. Elementary properties of the Boolean	
hull and reduced quotient functors	946
DONDER, DIETER. See DEISER, OLIVER.	
VAN DEN DRIES, L. and WILKIE, A.J. The laws of integer divisibility, and	
solution sets of linear divisibility conditions	503
Došen, Kosta and Petrić, Zoran. Generality of proofs and its Brauerian	
representation	740

Dowek, Gilles and Werner, Benjamin. Proof normalization modulo	1289
DOWNEY, RODNEY G., LAFORTE, GEOFFREY L., and SHORE, RICHARD A.	
Decomposition and infima in the computably enumerable degrees	551
DUPARC, J. The Steel hierarchy of ordinal valued Borel mappings	187
Džamonja, Mirna and Shelah, Saharon. Universal graphs at the successor	
of a singular cardinal	366
EVANS, DAVID M. Ample dividing	1385
Foreman, Matthew. See Cummings, James.	
Forster, Thomas. Finite-to-one maps	1251
. ZF + "Every set is the same size as a wellfounded set"	1
Forster, T. E. and Truss, J. K. Non-well-foundedness of well-orderable	
power sets	879
Friedman, Sy D. Cardinal-preserving extensions	1163
FRIEDMAN, SY D., HYTTINEN, TAPANI, and RAUTILA, MIKA. Classification	
theory and 0#	580
FRIEDMAN, SY D. and SCHINDLER, RALF. Universally Baire sets and definable	
well-orderings of the reals	1065
García Ferreira, Salvador. See Hrušák, Michael.	
GIRAUDET, M. and TRUSS, J. K. Recovering ordered structures from quotients	
of their automorphism groups	1189
GIVANT, STEVEN. Inequivalent representations of geometric relation algebras	267
GOGUADZE, GEORGE, PIAZZA, CARLA, and VENEMA, YDE. Simulating	
polyadic modal logics by monadic ones	419
Gurevich, Yuri. See Blass, Andreas.	
HAMKINS, JOEL DAVID. A simple maximality principle	527
——. See Apter, Arthur, W.	
Harrington, Leo A. See Cholak, Peter A.	
HINNION, ROLAND and LIBERT, THIERRY. Positive abstraction and	
extensionality	828
HIRSCHFELDT, DENIS R., KHOUSSAINOV, BAKHADYR, and SHORE, RICHARD A.	
A computably categorical structure whose expansion by a constant has	
infinite computable dimension	1199
Hrušák, Michael and García Ferreira, Salvador. Ordering MAD	
families à la Katětov	1337
Hyttinen, Tapani. See Friedman, Sy D.	
ISHMUKHAMETOV, SHAMIL. On a problem of Cooper and Epstein	52
KANEKO, MAMORU and SUZUKI, NOBU-YUKI. Epistemic models of shallow	
depths and decision making in games: Horticulture	163
Keisler, H. Jerome. See Benedikt, Michael.	
KHOUSSAINOV, BAKHADYR. See HIRSCHFELDT, DENIS R.	
KOIRAN, PASCAL. The theory of Liouville functions	353
KRUEGER, JOHN. Fat sets and saturated ideals	837
KUSHIDA, H. and OKADA, M. A proof-theoretic study of the correspondence	
of classical logic and modal logic	1403
LAFORTE, GEOFFREY L. See DOWNEY, RODNEY G.	4.4.5.
LASKOWSKI MICHAEL C. An application of Kochen's theorem	1181

Lessmann, Olivier. Categoricity and U-rank in excellent classes	1317
LI, ANGSHENG. See WANG, YONG.	
LIBERT, THIERRY. See HINNION, ROLAND.	
Losada, Maria. See Brendle, Jörg.	
MAGIDOR, MENACHEM. See CUMMINGS, JAMES.	
MARTIN, DONALD A., NEEMAN, ITAY, and VERVOORT, MARCO. The strength of	
Blackwell determinacy	615
MARX, MAARTEN. See BLACKBURN, PATRICK.	
MATET, PIERRE and PAWLIKOWSKI, JANUSZ. Q-pointness, P-pointness and	
feebleness of ideals	235
not closed under selecting subsequences	1362
MIRAGLIA, F. See DICKMANN, M. A.	
MITCHELL, WILLIAM J. A Gitik iteration with nearly Easton factoring	481
Montalbán, Antonio. Embedding jump upper semilattices into the Turing	
degrees	989
Moschovakis, Joan Rand. Classical and constructive hierarchies in	
extended intuitionistic analysis	1015
NAKAZAWA, KOJI and TATSUTA, MAKOTO. Strong normalization proof with	
CPS-translation for second order classical natural deduction	851
NAKAZAWA, KOJI and TATSUTA, MAKOTO. Corrigendum to "Strong	
normalization proof with CPS-translation for second order classical	
natural deduction"	1415
NEEMAN, ITAY. See MARTIN, DONALD A.	
Nour, Karim. See David, René.	
Okada, M. See Kushida, H.	
Otero, Margarita. See Berarducci, Alessandro.	
Pawlikowski, Janusz. See Matet, Pierre.	
Petrić, Zoran. See Došen, Kosta.	
Piazza, Carla. See Goguadze, George.	
PIERCE, DAVID. Differential forms in the model theory of differential fields	923
PILLAY, ANAND. On countable simple unidimensional theories	1377
POLLETT, CHRIS. A theory for Log-Space and NLIN versus co-NLIN	1082
PUDLÁK, PAVEL. Parallel strategies	1242
RAATIKAINEN, PANU. Some strongly undecidable natural arithmetical	
problems, with an application to intuitionistic theories	262
Rautila, Mika. See Friedman, Sy D.	
SCHINDLER, RALF. See FRIEDMAN, SY D.	
SCHMERL, JAMES H. Partitioning large vector spaces	1171
SHELAH, SAHARON. See BARTOSZYNSKI, TOMEK.	
———. See Džamonja, Mirna.	
SHLAPENTOKH, ALEXANDRA. Existential definability with bounds on	
archimedean valuations	860
SHORE, RICHARD A. See DOWNEY, RODNEY G.	
See Hirschfeldt, Denis R.	
STANLEY, M. C. Outer models and genericity	389
SUZUKI, NOBU-YUKI. See KANEKO, MAMORU.	

TAIT, W. W. The completeness of Heyting first-order logic	751
Tatsuta, Makoto. See Nakazawa, Koji.	
See Nakazawa, Koji.	
Truss, J. K. See Forster, T. E.	
See GIRAUDET, M.	
TSABAN, BOAZ. See BARTOSZYNSKI, TOMEK.	
VENEMA, YDE. Atomless varieties	607
See Goguadze, George.	
VERVOORT, MARCO. See MARTIN, DONALD A.	
Vîță, Luminița. See Bridges, Douglas.	
WANG, YONG and LI, ANGSHENG. A hierarchy for the plus cupping Turing degrees	972
Wansing, Heinrich. Correction to 'Displaying the modal logic of consistency'	712
WEIERMANN, ANDREAS. An application of graphical enumeration to PA*	5
Welch, P. D. On revision operators	689
Wencel, Roman. Definable sets in Boolean ordered o-minimal structures. II	35
WERNER, BENJAMIN. See DOWEK, GILLES.	
WILKIE, A.J. See VAN DEN DRIES, L.	
Yorioka, Teruyuki. Distinguishing types of gaps in $\mathcal{P}(\omega)$ /fin	1261
YOSHINOBU, YASUO. Approachability and games on posets	589
ZIEGLER, MARTIN. Separably closed fields with Hasse derivations	311

On countable simple unidimensional theories, by ANAND PILLAY	1377	
Ample dividing, by David M. Evans	1385	
A proof-theoretic study of the correspondence of classical logic and modal		
logic, by H. Kushida and M. Okada	1403	
Corrigendum to "Strong normalization proof with CPS-translation for		
second order classical natural deduction", by Koji Nakazawa		
and Makoto Tatsuta	1415	

Articles being submitted for publication in the Journal should be sent to one (and only one) of the following editors: Françoise Delon, UFR de Math., Univ. Paris VII, 2 pl. Jussieu, case 7012, F-75251 Paris cédex 05, France (delon@logique.jussieu.fr): or Rod Downey, Department of Mathematics, Victoria University of Wellington, Box 600, Wellington, New Zealand (rod.downey@vuw.ac.nz): or John Etchemendy, Department of Philosophy, Stanford University, Stanford, CA 94305, USA (jetch@csli.stanford.edu): or Robert Goldblatt, Department of Mathematics, Victoria University, Box 600, Wellington, New Zealand (rob.goldblatt@vuw.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, University of California, Los Angeles, CA 90095-1555, USA (greg@math.ucla.edu): or Michael Rathjen, School of Mathematics, University of Leeds, Leeds LS2 9JT, England (rathjen@amsta.leeds.ac.uk): or Simon Thomas, Department of Mathematics, Rutgers University, New Brunswick, NJ 08903, USA (sthomas@math.rutgers.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 LATEX or AMS-LATEX. The JOURNAL and the BULLETIN OF SYMBOLIC LOGIC are typeset in a version of AMS-LATEX, 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 63 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 \$70 (\$35 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 \$575 for 2003. 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, Journals Division UIP, 1325 South Oak Street, Champaign, IL 61820-6903, 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. 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(200312)68:4\*;1-Q