

THE  
JOURNAL  
OF  
SYMBOLIC LOGIC

EDITED BY

PETER ACZEL  
GEORGE BOLOS  
JOHN P. BURGESS  
HERBERT B. ENDERTON

SY D. FRIEDMAN  
AKIHIRO KANAMORI  
JULIA KNIGHT  
MICHAEL MAKKAJ

ANDRE SCEDROV  
RICHARD A. SHORE  
A. S. TROELSTRA  
JOHAN VAN BENTHEM

*Consulting Editors:*

JAMES BAUMGARTNER  
JIŘÍ BEČVÁŘ  
GREGORY L. CHERLIN  
M. J. CRESSWELL

MATTHEW FOREMAN  
SAUL A. KRIPKE  
GRIGORI MINTS

J. DONALD MONK  
GABRIEL SABBAGH  
SCOTT SOAMES  
ALASDAIR URQUHART

VOLUME 55

1990

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

---

The four numbers of Volume 55 were issued at the following dates:

- Number 1, pages 1–448, March 22, 1990
- Number 2, pages 449–896, June 11, 1990
- Number 3, pages 897–1328, September 25, 1990
- Number 4, pages 1329–1792, December 7, 1990

Numbers 1–4 of this volume are copyrighted © 1990 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, 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., 21 Congress Street, Salem, MA 01970. 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 55

## RESEARCH PAPERS

ABRUSCI, V. MICHELE, GIRARD, JEAN-YVES, and VAN DE WIELE, JACQUES. Some uses of dilators in combinatorial problems. II . . . . .	32
AJTAI, MIKLOS and FAGIN, RONALD. Reachability is harder for directed than for undirected finite graphs . . . . .	113
ALBERT, MICHAEL H. and GROSSBERG, RAMI P. Rich models . . . . .	1292
ANDRÉKA, H., NÉMETI, I., and THOMPSON, R. J. Weak cylindric set algebras and weak subdirect indecomposability . . . . .	577
APTER, ARTHUR W. Successors of singular cardinals and measurability revisited . . . . .	492
ARTEMOV, SERGEI and DZHAPARIDZE, GIORGIE. Finite Kripke models and predicate logics of provability . . . . .	1090
AVRON, ARNON. Relevance and paraconsistency—a new approach . . . . .	707
BALDWIN, JOHN T. The spectrum of resplendency . . . . .	626
BANKSTON, PAUL. Taxonomies of model-theoretically defined topological properties . . . . .	589
——— and RUITENBURG, WIM. Notions of relative ubiquity for invariant sets of relational structures . . . . .	948
BERARDUCCI, ALESSANDRO. The interpretability logic of Peano arithmetic . . . . .	1059
BLOSS, ANDREAS. Infinitary combinatorics and modal logic . . . . .	761
BLIZARD, WAYNE D. A formal theory of objects, space and time . . . . .	74
BOOTH, DAVID. Hereditarily finite Finsler sets . . . . .	700
BOROVIK, ALEKSANDR VASILEVICH and POIZAT, BRUNO PETROVICH. Tors et $p$ -groupes . . . . .	478
BUNDER, M. W. Some improvements to Turner's algorithm for bracket ab- straction . . . . .	656
CANTINI, ANDREA. A theory of formal truth arithmetically equivalent to $ID_1$ . . . . .	244
CARROLL, JEFFREY S. Maximal r.e. equivalence relations . . . . .	1048
CHISHOLM, JOHN. Effective model theory vs. recursive model theory . . . . .	1168
———. The complexity of intrinsically r.e. subsets of existentially decidable models . . . . .	1213
CHOLAK, PETER. Boolean algebras and orbits of the lattice of r.e. sets modulo the finite sets . . . . .	744
DAVID, R. Some results on higher Suslin trees . . . . .	526
DUBOSE, DERRICK ALBERT. The equivalence of determinacy and iterated sharps . . . . .	502
DZHAPARIDZE, GIORGIE. See ARTEMOV, SERGE	
FAGIN, RONALD. See AJTAI, MIKLOS	
FARMER, WILLIAM M. A partial functions version of Church's simple theory of types . . . . .	1269
FELDMAN, NORMAN. Cylindric algebras with terms . . . . .	854

GERLA, GIANGIACOMO. Pointless metric spaces . . . . .	207
GIRARD, JEAN-YVES. See ABRUSCI, V. MICHELE	
GOODMAN, NICOLAS D. Mathematics as natural science . . . . .	182
GORDEEV, L. Generalizations of the Kruskal-Friedman theorems . . . . .	157
GRIGORIEFF, SERGE. Every recursive linear ordering has a copy in DTIME- SPACE( $n, \log n$ ) . . . . .	260
GROSSBERG, RAMI P. See ALBERT, MICHAEL H.	
GUTE, HANS B. and REUTER, K. K. The last word on elimination of quan- tifiers in modules . . . . .	670
HADDAD, LABIB and MORILLON, MARIANNE. L'axiome de normalité pour les espaces totalement ordonnés . . . . .	277
HAUGHT, CHRISTINE ANN and SHORE, RICHARD A. Undecidability and initial segments of the (r.e.) tt-degrees . . . . .	987
HELLER, ALEX. An existence theorem for recursion categories . . . . .	1252
HENLE, J. M. Partition properties and Prikry forcing on simple spaces . .	938
HINDLEY, J. ROGER and MEREDITH, DAVID. Principal type-schemes and condensed detachment . . . . .	90
HOWARD, PAUL E. Definitions of compact . . . . .	645
HYTTINEN, TAPANI and VÄÄNÄNEN, JOUKO. On Scott and Karp trees of uncountable models . . . . .	897
IVANOV, LYUBOMIR. Operative vs. combinatory spaces . . . . .	561
JECH, THOMAS and SHELAH, SAHARON. Full reflection of stationary sets be- low $\aleph_\omega$ . . . . .	822
JOCKUSCH, CARL G., JR. and OWINGS, JAMES C., JR. Weakly semirecur- sive sets . . . . .	637
JUDAH, HAIM and SHELAH, SAHARON. The Kunen-Miller chart (Lebesgue measure, the Baire property, Laver reals and preservation theorems for forcing) . . . . .	909
JUST, WINFRIED, MATHIAS, A. R. D., PRIKRY, KAREL, and SIMON, PETR. On the existence of large $p$ -ideals . . . . .	457
KNIGHT, J. F. A metatheorem for constructions by finitely many workers . . . . .	787
KUMABE, MASAHIRO. A 1-generic degree which bounds a minimal degree . .	733
LAFLAMME, CLAUDE. Upward directedness of the Rudin-Keisler ordering of $p$ -points . . . . .	449
LELOUP, GÉRARD. Théories complètes de paires de corps valués hen- seliens . . . . .	323
LÓPEZ-ESCOBAR, E. G. K. Remarks on the Church-Rosser property . . . .	106
LOUVEAU, ALAIN and SAINT-RAYMOND, JEAN. On the quasi-ordering of Borel linear orders under embeddability . . . . .	537
LOVEYS, JAMES. Weakly minimal groups of unbounded exponent . . . . .	928
LUBARSKY, ROBERT S. An introduction to $\gamma$ -recursion theory (or what to do in KP – Foundation) . . . . .	194
MALINOWSKI, JACEK. The deduction theorem for quantum logic—some neg- ative results . . . . .	615
MARKER, D. and PILLAY, A. Reducts of $(C, +, \cdot)$ which contain + . . . .	1243

TABLE OF CONTENTS

v

MATHIAS, A. R. D. See JUST, WINFRIED

MEKLER, ALAN H. Universal structures in power  $\aleph_1$  . . . . . 466

MEREDITH, DAVID. See HINDLEY, J. ROGER

MERRILL, JOHN W. L. UFA fails in the Bell-Kunen model . . . . . 284

MILLER, ARNOLD W. Set theoretic properties of Loeb measure . . . . . 1022

MINARI, PIERLUIGI, TAKANO, MITIO and ONO, HIROAKIRA. Intermediate predicate logics determined by ordinals . . . . . 1099

MORILLON, MARIANNE. See HADDAD, LABIB

NADEL, MARK and STAVI, JONATHAN. On models of the elementary theory of  $(\mathbb{Z}, +, 1)$  . . . . . 1

NÉMETI, I. See ANDRÉKA, H.

NEWELSKI, LUDOMIR. Omitting types for stable ccc theories . . . . . 1037

OIKKONEN, JUHA. On Ehrenfeucht-Fraïssé equivalence of linear orderings . . . . . 65

ONO, HIROAKIRA. See MINARI, PIERLUIGI

OTERO, MARGARITA. On Diophantine equations solvable in models of open induction . . . . . 779

OWINGS, JAMES C., JR. See JOCKUSCH, CARL G., JR.

PAS, JOHAN. On the angular component map modulo  $P$  . . . . . 1125

PAWLIKOWSKI, JANUSZ. Finite support iteration and strong measure zero sets . . . . . 674

PILLAY, ANAND. Differentially algebraic group chunks . . . . . 1138  
 ———. See MARKER, D.

POIZAT, BRUNO PETROVICH. See BOROVIK, ALEKSANDR VASILEVICH

PRIKRY, KAREL. See JUST, WINFRIED

REUTER, K. K. See GUTE, HANS B.

ROBINSON, EDMUND and ROSOLINI, GIUSEPPE. Colimit completions and the effective topos . . . . . 678

ROSOLINI, GIUSEPPE. See ROBINSON, EDMUND

ROSS, DAVID. The special model axiom in nonstandard analysis . . . . . 1233

RUITENBURG, WIM. See BANKSTON, PAUL

SAINT-RAYMOND, JEAN. See LOUVEAU, ALAIN

SCHMERL, JAMES H. Coinductive  $\aleph_0$ -categorical theories . . . . . 1130

SHELAH, SAHARON. Strong negative partition above the continuum . . . . . 21  
 ———. See JECH, THOMAS  
 ———. See JUDAH, HAIM

SHORE, RICHARD A. See HAUGHT, CHRISTINE ANN

SIMON, PETR. See JUST, WINFRIED

SORBI, ANDREA. Some remarks on the algebraic structure of the Medvedev lattice . . . . . 831

STAVI, JONATHAN. See NADEL, MARK

SUTNER, KLAUS. The ordertype of  $\beta$ -r.e. sets . . . . . 573

TAKANO, MITIO. See MINARI, PIERLUIGI

THOMPSON, R. J. See ANDRÉKA, H.

TOURAILLE, ALAIN. Théories d'algèbres de Boole munies d'idéaux distingués. II . . . . . 1192

TUNG, SHIH-PING. Decidable fragments of field theories . . . . .	1007
VÄÄNÄNEN, JOUKO. See HYTTINEN, TAPANI	
VAN DE WIELE, JACQUES. See ABRUSCI, V. MICHELE	
VAN LAMBALGEN, MICHIEL. The axiomatization of randomness . . . . .	1143
VAN OOSTEN, JAAP. Lifschitz' realizability . . . . .	805
VELLEMAN, DAN. Partitioning pairs of countable sets of ordinals . . . . .	1019
WAGNER, FRANK. Subgroups of stable groups . . . . .	151
WILLIAMS, JAMES G. On the formalization of semantic conventions . . . . .	220
WILLIAMSON, TIMOTHY. Two incomplete anti-realist modal epistemic logics . . . . .	297
YETTER, DAVID N. Quanteles and (noncommutative) linear logic . . . . .	41
ZAFRANY, SAMY. On analytic filters and prefilters . . . . .	315
ŽIVALJEVIĆ, BOŠKO. Some results about Borel sets in descriptive set theory of hyperfinite sets . . . . .	604

### MEETINGS

Annual Meeting of the Association for Symbolic Logic, Los Angeles, 1989 . . . . .	372
European Summer Meeting of the Association for Symbolic Logic (Logic Collo- quium '88), Padova, 1988 . . . . .	387
Logic and linguistics meeting, Tucson, 1989 . . . . .	446
Meeting of the Association for Symbolic Logic, Chicago, 1989 . . . . .	436

### REVIEWS

Reviews . . . . .	340
Reviews . . . . .	867
Reviews . . . . .	1299

### NOTICES

Notices . . . . .	447
Notices . . . . .	895
Notices . . . . .	1327
Notices . . . . .	1790

### OFFICERS AND MEMBERS

List of officers and members of the Association for Symbolic Logic . . . . .	1752
--	------

### INDEXES TO VOLUMES 27–45

Index of contributed papers . . . . .	1330
Index of abstracts . . . . .	1391
Index of reviews by author of work reviewed . . . . .	1480
Index of reviews by reviewer . . . . .	1741

## ERRATA

### VOLUME 31

Page iii, line 9 of table. For «SAMSON», read «SWANSON».

### VOLUME 32

Page 643, column 2, line 19. For «(XXXI 679)», read «(XXXI 678)».

### VOLUME 34

Page 718, column 2, line 15. After «algebra», insert «. Second edition».

### VOLUME 35

Page iii, line 5 of table. For «Turning», read «Turing».

### VOLUME 39

Page 622, line 14. For «(XXXIV 107)», read «(XL 498)».

### VOLUME 40

Page 712, column 1, line 2 from below. Before «Hesse», insert «Clendinnen (XL 496),».  
Page 716, column 2, line 27. Before «Russian», insert «Review by Constantinesco (XL 491).».  
Page 718, column 1, line 9 from below. For «XXXVIII», read «XXXVII».  
Page 725, column 2, line 19 from below. For «XXXIX», read «XXIX».

### VOLUME 43

Page v, line 10. For « $\delta\beta$ », read « $\lambda\beta$ ».

### VOLUME 45

Page 648. Insert before line 12 «DENTON, John. *See* Dreben, Burton, and John Denton.».  
Page 659, line 9. Insert «McCall, Storrs, and R. K. Meyer;» before «Meyer, Robert K.».  
Page 659, line 30 from below. For «XXXIX», read «XXXIV».  
Page 659, line 21 from below. For «103–106», read «103–108».  
Page 662, line 32 from below. For «192–211», read «193–211».  
Page 674. Insert before line 10 «Bounded ultraproducts . . . . . XXXI 291».  
Page 675. Insert after line 4 from below «Continuum hypothesis in intuitionism . . . XLIII 616».  
Page 686, line 19. For «XLII», read «XLIII».  
Page 691, line 15 from below. For «XLVI», read «XXXVI».

### VOLUME 51

Page 1084. Replace line 13 by «data base theory whose significance has not been understood by the data base community. It defines».

### VOLUME 55

Page 342, line 16. For «XXXII», read «XXXVII».

*Continued from inside front cover*

Articles being submitted for publication in the JOURNAL should be sent in duplicate to one of the following editors: **Peter Aczel**, *Department of Mathematics, Manchester University, Manchester M13 9PL, England*; or **Sy D. Friedman**, *Department of Mathematics, Massachusetts Institute of Technology, Cambridge, MA 02139*; or **Julia Knight**, *Department of Mathematics, University of Notre Dame, Notre Dame, IN 46556*; or **Andre Scedrov**, *Department of Mathematics, University of Pennsylvania, 209 South 33rd Street, Philadelphia, PA 19104-6395*; or **Richard Shore**, *Department of Mathematics, Cornell University, Ithaca, NY 14853*; or **A. S. Troelstra**, *Mathematisch Instituut, Universiteit van Amsterdam, Roetersstraat 15, Amsterdam 1018 WB, The Netherlands*; or **Johan van Benthem**, *Mathematisch Instituut, Universiteit van Amsterdam, Roetersstraat 15, Amsterdam 1018 WB, The Netherlands*. The editor in charge of survey and expository articles is **John P. Burgess**, *Department of Philosophy, Princeton University, Princeton, NJ 08544*.

Each manuscript should be typewritten with wide margins and with double spacing between the lines. Footnotes should be numbered consecutively and should also be typed with wide margins and double spacing, preferably on a separate sheet. Two copies of the manuscript should be sent to the editor, and the author should also keep a complete copy. Fifty reprints of each article are supplied at no charge, and additional reprints may be purchased if desired.

The JOURNAL no longer requests payment of page charges for the articles it publishes.

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.

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., 27 Congress Street, Salem, MA 01970. 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.



