

THE
BULLETIN
OF
SYMBOLIC LOGIC

EDITED BY

ROD DOWNEY, Managing Editor

MATTHEW FOREMAN AKIHIRO KANAMORI PHOKION KOLAITIS
MANUEL LERMAN PENELOPE MADDY KATRIN TENT

REVIEWS EDITORS

ALASDAIR URQUHART, Reviews Managing Editor

LEV BEKLEMISHEV MIRNA DŽAMONJA DAVID EVANS
ERICH GRÄDEL GEOFFREY HELLMAN DENIS HIRSCHFELDT
JULIA KNIGHT MICHAEL C. LASKOWSKI ROGER MADDUX
VOLKER PECKHAUS WOLFRAM POHLERS SŁAWOMIR SOLECKI

ALASDAIR URQUHART, Reviews Managing Editor

LEV BEKLEMISHEV MIRNA DŽAMONJA DAVID EVANS
ERICH GRÄDEL GEOFFREY HELLMAN DENIS HIRSCHFELDT
JULIA KNIGHT MICHAEL C. LASKOWSKI ROGER MADDUX
VOLKER PECKHAUS WOLFRAM POHLERS SŁAWOMIR SOLECKI

VOLUME 11 · NUMBER 1 · MARCH 2005
ISSN 1079-8986

TABLE OF CONTENTS

ARTICLES

Mass problems and randomness, by STEPHEN G. SIMPSON	1
---	---

COMMUNICATIONS

Compactness and independence in non first order frameworks, by ITAY BEN-YAACOV	28
Proper forcing, cardinal arithmetic, and uncountable linear orders, by JUSTIN TATCH MOORE	51

REVIEWS

P. Howard and J. E. Rubin <i>Consequences of the axiom of choice</i> . Reviewed by Andreas Blass	61
P. Philipp, <i>Logisch-philosophische Untersuchungen</i> . Reviewed by Alexandra Zinck and Uwe Scheffler	63
P. T. Johnstone, <i>Sketches of an elephant: a topos theory compendium</i> . Reviewed by Steve Awodey	65
R. Brady (editor), <i>Relevant logics and their rivals, Volume II</i> . Reviewed by Nicholas Griffin	70
N. Griffin (editor), Selected papers from <i>The Cambridge companion to Bertrand Russell</i> . Reviewed by Peter Koellner	72
D. M. Gabbay, A. Kurucz, F. Wolter, and M. Zakharyashev, <i>Many-dimensional modal logics: theory and applications</i> . Reviewed by Mark Reynolds	77
C. Chihara, <i>A structural account of mathematics</i> . Reviewed by Fraser MacBride	79
A. W. F. Edwards, <i>Cogwheels of the mind</i> . Reviewed by Katherine Thompson	83
I. Jané and C. Wright, <i>Two articles on "relativity"</i> . Reviewed by Peter Schotch	84
A. Weiermann, <i>An application of results by Hardy, Ramanujan and Karamata to Ackermannian functions</i> . Reviewed by Albert A. Mullin	89
J. Dawson (editor), <i>A Festschrift in honour of Professor Ivor Grattan-Guinness</i> . Reviewed by Risto Vilkkö	89

(Continued on inside back cover)

THE BULLETIN OF SYMBOLIC LOGIC (ISSN 1079-8986) is published quarterly, in the months of March, June, September, and December, by the Association for Symbolic Logic, Inc., 124 Raymond Avenue, Poughkeepsie, NY 12604-0001, USA. Periodicals postage is paid at Poughkeepsie NY and at additional mailing offices. The BULLETIN is distributed with THE JOURNAL OF SYMBOLIC LOGIC; the 2005 annual subscription price for the two journals is \$495. Online subscription is available from Project Euclid; visit <http://projecteuclid.org/bsl>. **Postmaster:** Send address changes to *The Bulletin of Symbolic Logic, Journals Division UIP, 1325 South Oak Street, Champaign, IL 61820-6903, USA*. Business correspondence should be sent to the Secretary-Treasurer of the Association, Charles Steinhorn (address on inside back cover).

The BULLETIN and the JOURNAL are the official organs of the Association for Symbolic Logic, an international organization for furthering research in symbolic logic and the exchange of ideas among mathematicians, philosophers, computer scientists, linguists, and others interested in this field. The BULLETIN invites submission of *Articles* and *Communications* and publishes reviews of publications in logic.

Articles should be expository or survey papers of broad interest that are accessible to a wide audience of logicians. They may deal with any areas of logic including mathematical or philosophical logic, logic in computer science or linguistics, the history or philosophy of logic, and applications of logic to other fields.

Continued on inside back cover

2004 Annual Meeting of the Association for Symbolic Logic, Carnegie Mellon University, Pittsburgh, PA, May 19–23, 2004	92
11TH Workshop on Logic, Language, Information and Computation (WoLLIC — '2004), Fontainebleau (Univ. Paris XII), France, July 19–22, 2004	120
Notices	122

Communications should be announcements of important new results and ideas in any aspect of logic; they may be short papers in their final form or preliminary announcements (extended abstracts, position papers) of longer, full papers that will be published elsewhere. In any case, they should include, in addition to a description of the new results or ideas, enough history, background, and explanation to make the significance of the work apparent to a wide audience. *Communications* will be quickly refereed and published within six months of the submission of final versions.

Articles should be submitted to **Akihiro Kanamori**, *Department of Mathematics, Boston University, Boston, MA 02215, USA* (aki@math.bu.edu); *Communications* may be submitted to the Managing Editor **Rod Downey**, *Department of Mathematics, Victoria University of Wellington, Box 600, Wellington, New Zealand* (rod.downey@vuw.ac.nz); or to any of the other editors: **Matthew Foreman**, *Department of Mathematics, University of California, Irvine, CA 92697, USA* (mforeman@math.uci.edu); or **Phokion Kolaitis**, *Department of Computer Science, University of California Santa Cruz, Santa Cruz, CA 95064, USA* (kolaitis@cse.ucsc.edu); or **Manuel Lerman**, *Department of Mathematics, University of Connecticut, Storrs, CT 06269, USA* (mlerman@math.uconn.edu); or **Penelope Maddy**, *Department of Logic and Philosophy of Science, University of California, Irvine, CA 92697, USA* (pjmaddy@uci.edu); or **Katrin Tent**, *Fakultät für Mathematik, Universität Bielefeld, Postfach 100131, D-33501 Bielefeld, Germany* (ktent@math.uni-bielefeld.de).

Books for review in the BULLETIN should be sent to **ASL, Box 742, Vassar College, 124 Raymond Avenue, Poughkeepsie, NY 12604, USA**. The Managing Editor for Reviews is **Alasdair Urquhart**, *Department of Philosophy, University of Toronto, 215 Huron Street, Toronto, Ontario, Canada M5S 1A1* (urquhart@cs.toronto.edu). The other editors of reviews are **Lev Beklemishev** (lev@phil.uu.nl), **Mirna Džamonja** (M.Dzamonja@uea.ac.uk), **David Evans** (d.evans@uea.ac.uk), **Erich Grädel** (graedel@informatik.rwth-aachen.de), **Geoffrey Hellman** (hellm001@umn.edu), **Denis Hirschfeldt** (drh@math.uchicago.edu), **Julia Knight** (knight.1@nd.edu), **Michael C. Laskowski** (mcl@math.umd.edu), **Roger Maddux** (maddux@iastate.edu), **Volker Peckhaus** (peckhaus@hrz.upb.de), **Wolfram Pohlers** (pohlers@escher.uni-muenster.de), and **Stawomir Solecki** (ssolecki@math.uiuc.edu).

Submitted manuscripts should be typewritten with wide margins and with double spacing between the lines, or prepared with a word processor, such as L^AT_EX 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 L^AT_EX or A_MS-L^AT_EX. The JOURNAL and the BULLETIN OF SYMBOLIC LOGIC are typeset in a version of A_MS-L^AT_EX, 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.

Postscript files of articles published in the BULLETIN may be downloaded using a Web browser from <http://www.math.ucla.edu/~asl/bsl1toc.htm>. All volumes of the BULLETIN also are available online in the JSTOR database.

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>.

All back volumes of the BULLETIN are available, from the Office of the Secretary-Treasurer who has information on prices and discounts to individual and institutional members.

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

THE
BULLETIN
OF
SYMBOLIC LOGIC

EDITED BY

ROD DOWNEY, Managing Editor

MATTHEW FOREMAN AKIHIRO KANAMORI PHOKION KOLAITIS
MANUEL LERMAN PENELOPE MADDY KATRIN TENT

REVIEWS EDITORS

ALASDAIR URQUHART, Reviews Managing Editor

STEVE AWODEY JOHN BALDWIN LEV BEKLEMISHEV
MIRNA DŽAMONJA DAVID EVANS ERICH GRÄDEL
DENIS HIRSCHFELDT ROGER MADDUX LUKE ONG
VOLKER PECKHAUS WOLFRAM POHLERS SŁAWOMIR SOLECKI

VOLUME 11
2005

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

The four numbers of Volume 11 are copyrighted ©2005 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, Charles Steinhorn, ASL, Box 742, Vassar College, 124 Raymond Avenue, Poughkeepsie, NY 12604, USA.

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

This BULLETIN 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, USA. 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 11

Kurt Gödel (1906–1978)	129
KANAMORI, AKIHIRO. Preface	131

ARTICLES

DAVIS, MARTIN. What did Gödel believe and when did he believe it?	194
DAWSON, JR., JOHN W. and DAWSON, CHERYL A. Future tasks for Gödel scholars ..	150
FEFERMAN, SOLOMON. The Gödel editorial project: A synopsis	132
GOLDFARB, WARREN. On Gödel’s way in: the influence of Rudolf Carnap	185
KOEPEKE, PETER. Turing computations on ordinals	377
MADDY, PENELOPE. Mathematical existence	351
MARTIN, DONALD A. Gödel’s conceptual realism	207
SAYED AHMED, TAREK. Algebraic logic, where does it stand today?	465
SIEG, WILFRIED. Only two letters: The correspondence between Herbrand and Gödel	172
SIMMONS, HAROLD. Tiering as a recursion technique	321
SIMPSON, STEPHEN G. Mass problems and randomness	1
TAIT, W. W. Gödel’s reformulation of Gentzen’s first consistency proof for arithmetic: the no-counterexample interpretation	225

COMMUNICATIONS

BEN-YAACOV, ITAY. Compactness and independence in non first order frameworks	28
GREENBERG, NOAM. The role of true finiteness in the admissible recursively enumer- able degrees	398
KONTCHAKOV, ROMAN, KURUCZ, AGI, and ZAKHARYASCHEV, MICHAEL. Undecidabil- ity of first-order intuitionistic and modal logics with two variables	428
MILETI, JOSEPH R. Partition theorems and computability theory	411
MOORE, JUSTIN TATCH. Proper forcing, cardinal arithmetic, and uncountable linear orders	51
MUMMERT, CARL and SIMPSON, STEPHEN G. Reverse mathematics and Π_2^1 compre- hension	526
STĒPRĀNS, JURIS. Geometric cardinal invariants, maximal functions and a measure theoretic pigeonhole principle	517

REVIEWS

P. Howard and J. E. Rubin <i>Consequences of the axiom of choice</i> . Reviewed by Andreas Blass	61
P. Philipp, <i>Logisch-philosophische Untersuchungen</i> . Reviewed by Alexandra Zinck and Uwe Scheffler	63

P. T. Johnstone, <i>Sketches of an elephant: a topos theory compendium</i> . Reviewed by Steve Awodey.....	65
R. Brady (editor), <i>Relevant logics and their rivals, Volume II</i> . Reviewed by Nicholas Griffin.....	70
N. Griffin (editor), Selected papers from <i>The Cambridge companion to Bertrand Russell</i> . Reviewed by Peter Koellner.....	72
D. M. Gabbay, A. Kurucz, F. Wolter, and M. Zakharyashev, <i>Many-dimensional modal logics: theory and applications</i> . Reviewed by Mark Reynolds.....	77
C. Chihara, <i>A structural account of mathematics</i> . Reviewed by Fraser MacBride....	79
A. W. F. Edwards, <i>Cogwheels of the mind</i> . Reviewed by Katherine Thompson.....	83
I. Jané and C. Wright, <i>Two articles on "relativity"</i> . Reviewed by Peter Schotch.....	84
A. Weiermann, <i>An application of results by Hardy, Ramanujan and Karamata to Ackermannian functions</i> . Reviewed by Albert A. Mullin.....	89
J. Dawson (editor), <i>A Festschrift in honour of Professor Ivor Grattan-Guinness</i> . Reviewed by Risto Vilkkö.....	89
W. Sieg, R. Sommer, and C. Talcott (editors), <i>Reflections on the foundations of mathematics: Essays in honor of Solomon Feferman</i> . Reviewed by David Charles McCarty.....	239
G. Tourlakis, <i>Lectures in logic and set theory, vols. I & II</i> . Reviewed by Joel David Hamkins.....	241
T. Jech, <i>Set theory</i> . Reviewed by Greg Hjorth.....	243
D. Perrin and J.-E. Pin, <i>Infinite words: automata, semigroups, logic and games</i> . Reviewed by Thomas Wilke.....	246
R. Zach, <i>Hilbert's 'Verunglückter Beweis', the first epsilon theorem, and consistency proofs</i> . Reviewed by Dirk Schlimm.....	247
G. Mints and R. Muskens (editors), <i>Games, logic, and constructive sets</i> . Reviewed by Ian Hodkinson.....	439
B. Russell, <i>Correspondance avec Louis Couturat (1897–1913)</i> . Reviewed by Alasdair Urquhart.....	442
M. Wolff, <i>Abhandlung über die Prinzipien der Logik</i> . Reviewed by Ignacio Angelelli.....	444
E. H. Reck and S. Awodey (editors), <i>Frege's lectures on logic</i> . Reviewed by Michael Beaney.....	445
M. Bremer, <i>An introduction to paraconsistent logics</i> . Reviewed by Casey McGinnis.....	447
S. Shelah, <i>On cardinal invariants of the continuum</i> . Reviewed by Juris Steprāns.....	451
D. Christensen, <i>Putting logic in its place</i> . Reviewed by Henry E. Kyburg, Jr.....	534
A. B. Feferman and S. Feferman, <i>Alfred Tarski, Life and Logic</i> . Reviewed by Roger D. Maddux.....	535
B. J. Copeland (editor), <i>The essential Turing</i> . Reviewed by Jan Obdržálek.....	541
Three papers by I. Neeman. Reviewed by Paul B. Larson.....	542

MEETINGS OF THE ASSOCIATION FOR SYMBOLIC LOGIC

2004 Annual Meeting of the Association for Symbolic Logic, Carnegie Mellon University, Pittsburgh, PA, May 19–23, 2004.....	92
---	----

2004 Summer Meeting of the Association for Symbolic Logic, Torino, Italy, July 25–31, 2004	249
2004–05 Winter Meeting of the Association for Symbolic Logic, Atlanta Marriott Marquis, Atlanta, Georgia, January 7–8, 2005	454
2005 Spring Meeting of the Association for Symbolic Logic, The Westin St. Francis Hotel, San Francisco, CA, March 25–26, 2005	547

MEETINGS SPONSORED BY THE ASSOCIATION FOR SYMBOLIC LOGIC

11th Workshop on Logic, Language, Information and Computation (WoLLIC '2004), Fontainebleau (Univ. Paris XII), France, July 19–22, 2004	120
Logic, Computability, and Randomness, Córdoba, Argentina, September 20–24, 2004	557
12th Workshop on Logic, Language, Information and Computation (WoLLIC '2005), Florianópolis (Santa Catarina), Brazil, July 19–22, 2005	558
Corrigendum to “In memoriam: Walter Felscher, 1931–2000”	545
Erratum	319
Notices	122, 313, 461, 620
Officers and Committees of the Association for Symbolic Logic	560
Members of the Association	564