

CAMBRIDGE

E-books  
Available  
for most  
titles!

## Cambridge University Press Presents New Titles in Logic Programming

**Second Edition**

### **An Introduction to Gödel's Theorems**

Peter Smith

*Cambridge Introductions to Philosophy*

\$99.00: Hardback: 978-1-107-02284-3: 402 pp.

\$34.99: Paperback: 978-1-107-60675-3

### **Appalachian Set Theory 2006–2012**

*Edited by James Cummings and Ernest Schimmerling*

Papers based on a series of workshops where prominent researchers present exciting developments in set theory to a broad audience.

*London Mathematical Society Lecture Note Series*

\$70.00: Pb: 978-1-107-60850-4: 432 pp.

### **Coherence in Three-Dimensional Category Theory**

Nick Gurski

Serves as an introduction to higher categories as well as a reference point for many key concepts in the field.

*Cambridge Tracts in Mathematics*

\$70.00: Hb: 978-1-107-03489-1: 286 pp.

### **Formal Languages in Logic A Philosophical and Cognitive Analysis**

Catarina Dutilh Novaes

“What does formalisation do for us? Here is an author who dares to attempt answers right across the disciplines of logic and philosophy and their histories, as well as cognitive science. She may set out from logic and mathematics, but what she has to say is relevant to anyone who has ever wondered about natural language as the originating formalisation.”

—*Keith Stenning, University of Edinburgh*

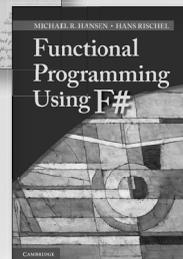
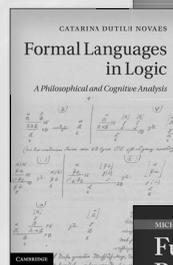
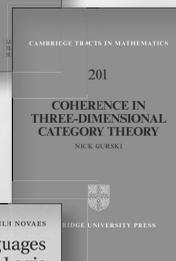
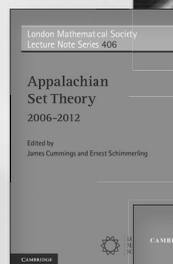
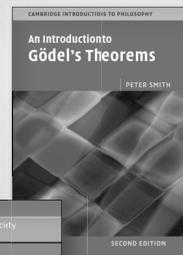
\$95.00: Hb: 978-1-107-02091-7: 282 pp.

### **Functional Programming Using F#**

Michael R. Hansen and Hans Rischel

\$125.00: Hardback: 978-1-107-01902-7: 371 pp.

\$55.00: Paperback: 978-1-107-68406-5



Prices subject to change.

[www.cambridge.org/computerscience](http://www.cambridge.org/computerscience)  
800.872.7423

@cambUP\_maths



CAMBRIDGE  
UNIVERSITY PRESS

CAMBRIDGE

E-books  
Available  
for most  
titles!

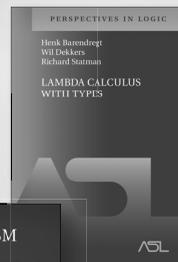
## Cambridge University Press Presents New Titles in Logic Programming

### Lambda Calculus with Types

Henk Barendregt, Wil Dekkers, and Richard Statman

*Perspectives in Logic*

\$90.00: Hardback: 978-0-521-76614-2: 854 pp.

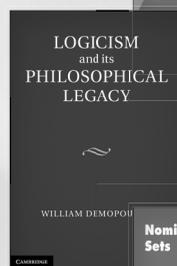


### Logicism and its Philosophical Legacy

William Demopoulos

These essays apply the core conceptual innovation underlying Frege's theory of number to the general analysis of theoretical knowledge.

\$99.00: Hb: 978-1-107-02980-4: 280 pp.



### Nominal Sets

Names and Symmetry in Computer Science

Andrew M. Pitts

*Cambridge Tracts in Theoretical Computer Science*

\$95.00: Hardback: 978-1-107-01778-8: 287 pp.



### Practical Foundations for Programming Languages

Robert Harper

In this innovative book, Professor Robert Harper offers a fresh perspective on the fundamentals of programming languages through the use of type theory. Whereas most textbooks on this subject emphasize taxonomy, Harper instead emphasizes genetics, examining the building blocks from which all programming languages are constructed. The result is an introduction to programming theory that is both accessible and practical.

\$75.00: Hb: 978-1-107-02957-6: 487 pp.



### Systematic Program Design

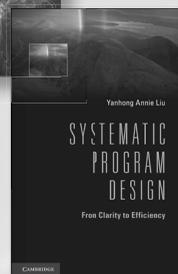
From Clarity to Efficiency

Yanhong Annie Liu

Describes a systematic program design method, starting with specifications of computations and deriving implementations by step-wise program analysis and transformations.

\$99.00: Hb: 978-1-107-03660-4: 252 pp.

\$39.99: Pb: 978-1-107-61079-8



Prices subject to change.

[www.cambridge.org/computerscience](http://www.cambridge.org/computerscience)  
800.872.7423

@cambUP\_maths



CAMBRIDGE  
UNIVERSITY PRESS

CAMBRIDGE

E-books  
Available  
for most  
titles!

## Cambridge University Press Presents New Titles in Logic Programming

**Second Edition**

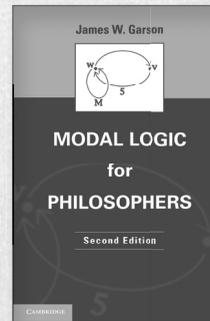
### **Modal Logic for Philosophers**

James W. Garson

Modal logic uses mathematical methods to evaluate the correctness of reasoning involving the concepts of necessity, possibility, and related notions such as obligation, belief, and provability. These ideas are central to the often intricate reasoning found in philosophical argumentation, so a command of modal logic is especially valuable to philosophers. This book provides philosophers with an accessible yet technically sound treatment of modal logic and its philosophical applications. Its novel feature is the extensive use of diagrams to simplify the presentation of mathematical ideas.

\$99.00: Hardback: 978-1-107-02955-2: 508 pp.

\$42.99: Paperback: 978-1-107-60952-5



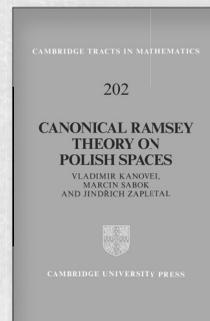
### **Canonical Ramsey Theory on Polish Spaces**

Vladimir Kanovei, Marcin Sabok, and  
Jindřich Zapletal

*Cambridge Tracts in Mathematics*

Lays the foundations for a new area of descriptive set theory: the connection between forcing and analytic equivalence relations.

\$80.00: Hardback: 978-1-107-02685-8: 278 pp.



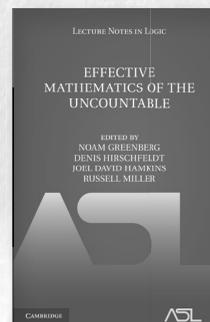
### **Effective Mathematics of the Uncountable**

*Edited by* Noam Greenberg, Denis Hirschfeldt,  
Joel David Hamkins, and Russell Miller

*Lecture Notes in Logic*

This book provides an authoritative and multifaceted introduction to eight major approaches to computation on uncountable mathematical domains. The perspectives explored within reveal different aspects of effective uncountable mathematics, making it an ideal resource for graduate and advanced undergraduate students, and researchers in this exciting new area of study.

\$85.00: Hardback: 978-1-107-01451-0: 204 pp.



Prices subject to change.

[www.cambridge.org/mathematics](http://www.cambridge.org/mathematics)  
800.872.7423

 @cambUP\_maths



**CAMBRIDGE**  
UNIVERSITY PRESS

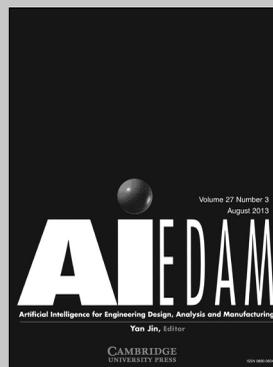
# AI EDAM

Artificial Intelligence for Engineering Design, Analysis and Manufacturing

## Editor

Yan Jin, *University of Southern California, USA*

*AI EDAM* is a journal for engineers and designers who see AI technologies as powerful means for solving difficult engineering problems; and for researchers in AI and computer science who are interested in applications of AI and in the theoretical issues that arise from such applications. The journal publishes original articles about significant theory and applications based on the most up-to-date research in all branches and phases of engineering. Suitable topics include: analysis and evaluation; selection; configuration and design; manufacturing and assembly; and concurrent engineering.



## *AI EDAM*

is available online at:  
<http://journals.cambridge.org/aie>

## To subscribe contact Customer Services

### in Cambridge:

Phone +44 (0)1223 326070  
Fax +44 (0)1223 325150  
Email [journals@cambridge.org](mailto:journals@cambridge.org)

### in New York:

Phone +1 (845) 353 7500  
Fax +1 (845) 353 4141  
Email  
[subscriptions\\_newyork@cambridge.org](mailto:subscriptions_newyork@cambridge.org)

## Free email alerts

Keep up-to-date with new  
material – sign up at

[journals.cambridge.org/register](http://journals.cambridge.org/register)

For free online content visit:  
<http://journals.cambridge.org/aie>



**CAMBRIDGE**  
UNIVERSITY PRESS

## SUBSCRIPTIONS

Theory and Practice of Logic Programming (ISSN 1471-0684), is published bi-monthly in January, March, May, July, September and November by Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 8RU, UK/Cambridge University Press, 32 Avenue of the Americas, New York, N.Y. 10013-2473. The subscription price (excluding VAT) of Volume 13, 2013 is £391 net (USA, Canada and Mexico US\$653), for institutions print and electronic or £331 net, (USA, Canada and Mexico US\$525) electronic only, single parts cost £66, \$110 plus postage. Discounted individual rates (print only) are £88, \$142. There is a preferential rate for members of The Association of Logic Programming and The Association of Computing Machinery – please enquire. Six parts form a volume. EU subscribers (outside the UK) who are not registered for VAT should add VAT at their country's rate. VAT registered subscribers should provide their VAT registration number. Orders, which must be accompanied by payment, may be sent to any bookseller, subscription agent or to the publisher: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 8RU, or in the USA, Canada and Mexico to Cambridge University Press Journals Fulfillment Department, 100 Brook Hill Drive, West Nyack, New York 10994 2133. Prices include delivery by air where appropriate. Periodicals postage paid at New York, NY and at additional mailing offices, Japanese prices are available from Kinokuniya Company Ltd, P.O. Box 55, Chitose, Tokyo, 156, Japan. Postmaster: send address changes in USA, Canada and Mexico to Journal of Theory and Practice of Logic Programming, Cambridge University Press, 100 Brook Hill Drive, West Nyack, New York 10994 2133. Claims for missing issues should be made immediately on receipt of the subsequent issues.

© Cambridge University Press 2013

## INSTRUCTIONS TO AUTHORS

### *Aims and scope*

Theory and Practice of Logic Programming is an international journal that publishes refereed papers covering both the theory and the practice of logic programming. Among the topics covered are AI applications that use logic programming, logic programming methodologies, specification, analysis and verification of systems, inductive logic programming, multi-relational data mining, natural language processing, knowledge representation, nonmonotonic reasoning, semantic web reasoning, databases, implementations and architectures and constraint logic programming.

TPLP is the sole official journal of the Association for Logic Programming (<http://logicprogramming.org/>) and is offered to its members at a preferential rate. It is also endorsed by SPARC, the Scholarly Publishing & Academic Resources Coalition (URL: [www.arl.org/sparc](http://www.arl.org/sparc)).

### *Submission of manuscripts*

Electronic submissions: The preferred form of submission is to send two email messages, the first one with the information containing the title, the author(s), and the abstract of the submission, and the second one with a PDF or a Postscript file. Both emails should be sent to the appropriate Area Editor with a copy to the Editor-in-Chief. If in doubt about the most appropriate area, contact the Editor-in-Chief.

Paper submissions: These are also acceptable, but their handling may be delayed (four copies to the appropriate Area Editor and one copy to the Editor-in-Chief).

The submitted manuscripts should not be published or simultaneously submitted to another journal or to a conference. Full versions of important conference papers are welcome. Upon acceptance of an article by the journal, the author(s) will be asked to transfer copyright of the article to Cambridge University Press.

### *Book Reviews*

Books for review, or suggestions for reviews, should be sent to the book reviews editor.

### *Technical notes*

Technical notes should not exceed 5000 words in length, excluding tables, figures, and the bibliography. They are given quick turnaround and should be submitted, preferably electronically, to the Technical Notes editor. Submissions should include an abstract and a reasonable accurate word count for the paper (excluding tables and figures, and the bibliography).

### *Electronic manuscripts*

The publisher encourages the submission of final manuscripts written in LaTeX which can be used for direct typesetting. Authors can download style files from the CUP anonymous ftp site in a packed or unpacked form. The packed form is available from: <ftp://ftp.cambridge.org/pub/texarchive/journals/latex/tp-cls> and the unpacked files are in a directory / unpacked.

### *Layout*

Manuscripts should begin with an abstract of not more than 300 words at the end of which are 4 or 5 keywords. Avoid footnotes whenever possible. Papers should conform to a good standard of English prose; please consult a style guide such as 'The Elements of Style' by Strunk and White, Macmillan, New York. Presenting Programs in one of the following two styles is encouraged: either with identifiers in italic and keywords in bold or entirely in a fixed-width teletype font. Do not begin a sentence with a symbol or identifier name.

### *Illustrations*

Supply these as eps files as the publisher cannot use original TeX files of illustrations. A hardcopy printout needs to be supplied of each illustration.

### *References*

The Harvard system of references should be used. See style files.

### *Proofreading*

Be sure to submit papers in their final form. Typographical and factual errors only may be changed at proof stage. The publisher reserves the right to charge authors for extensive changes to their paper. No page charge is made. The spelling policy of the journal is to follow author's American or British spelling as long as it is consistent within the paper.

### *Offprints*

A free pdf of the published article will be supplied to each first named author. Papers offprints may be purchased upon request.

Please contact the editors for additional information or clarification of anything above.

## COPYING

The journal is registered with the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA, 01923, USA. Organisations in the USA who are also registered with the CCC may therefore copy material (beyond the limits permitted by sections 107 and 108 of the US copyright law) subject to payment to CCC of the per-copy fee of \$16.00. This consent does not extend to multiple copying for promotional or commercial purposes. Code 1471-0684/12 \$16.00. Organisations authorised by the Copyright Licensing Agency may also copy material subject to the usual conditions.

ISI Tear Service, 3501 Market Street, Philadelphia, Pennsylvania 19104, USA, is authorised to supply single copies of separate articles for private use only. For all other use, permission should be sought from Cambridge University Press or the American Branch of Cambridge University Press.

This journal issue has been printed on FSC-certified paper and cover board. FSC is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests. Please see [www.fsc.org](http://www.fsc.org) for information.

Printed in the UK by Bell & Bain

# Theory and Practice of Logic Programming

VOLUME 13 PART 6 NOVEMBER 2013

## Contents

### *Regular papers*

- 893 Dynamics of knowledge in *DeLP* through Argument Theory Change  
MARTÍN O. MOGUILLANSKY, NICOLÁS D. ROTSTEIN, MARCELO A. FALAPPA,  
ALEJANDRO J. GARCÍA AND GUILLERMO R. SIMARI
- 959 Region-based memory management for Mercury programs  
QUAN PHAN, GERDA JANSSENS AND ZOLTAN SOMOGYI

Endorsed by  SPARC

Cambridge Journals Online  
For further information about this journal  
please go to the journal website at:  
[journals.cambridge.org/tlp](http://journals.cambridge.org/tlp)



MIX  
Paper from  
responsible sources  
FSC® C007785

CAMBRIDGE  
UNIVERSITY PRESS