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Fields of Logic and Computation II

Essays Dedicated to Yuri Gurevich on the Occasion of His 75th Birthday

Springer

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The Hebrew legend is from the Book of Psalms 126:5: "They that sow in tears shall reap in joy."

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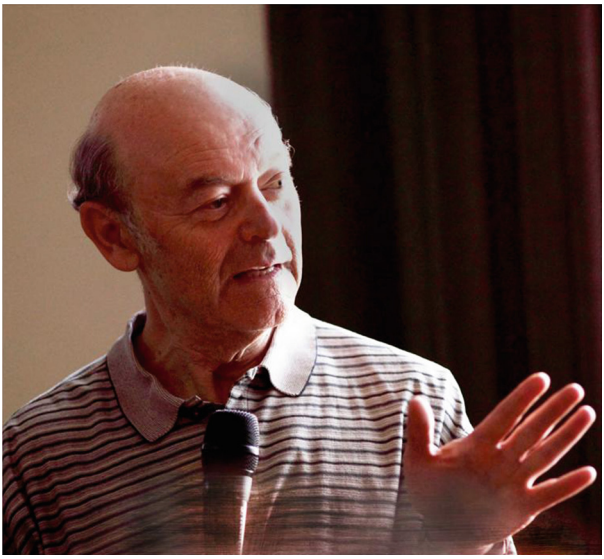

Yuri Gurevich (June 2004 in Kraków, Poland)
Photograph taken by Adam Walanus.

Preface

This Festschrift is published in honor of Yuri Gurevich, on the occasion of his 75th birthday. Yuri Gurevich has made fundamental contributions to the broad spectrum of logic and computer science, including decision procedures, the monadic theory of order, abstract state machines, formal methods, foundations of computer science, security, and much more. Many of these areas are reflected in the articles in this Festschrift and in the presentations at the "Yurifest" symposium, which was held in Berlin, Germany, on September 11 and 12, 2015.

Yuri has spent his life in three different countries—the Soviet Union, Israel, and the USA—and has worked in at least as many scientific fields: on the interface between algebra and logic in the Soviet Union, on the monadic theory of order in Israel, and on logic and computer science in the USA. As Yuri would point out, with characteristic understatement, he has "always had a taste for foundational questions."[1]

The best known work of Yuri's Soviet period is on the decision problem for the ordered abelian groups. His 1964 thesis proved the decidability of the first-order theory of these groups; later, he showed the decidability of the richer theory that includes quantification over convex subgroups. Yuri also worked on the decision problem for first-order logic, completing in particular the decision problem for the prefix-vocabulary fragments of pure logic of predicates and functions. In Israel, Yuri worked with Saharon Shelah on the monadic theory of linear orders. The Forgetful Determinacy Theorem of Gurevich and Harrington is from this period as well. The theorem asserts the existence of a special kind of winning strategy in a class of infinite games, and has lead to a greatly simplified proof of Michael Rabin's result that the monadic theory of two successors is decidable.

In 1982, the University of Michigan hired Yuri as a professor of computer science on the promise that the algebraist and logician would become a computer scientist. And, indeed, Yuri immediately began making deep contributions to his new field. There are numerous results in complexity theory, in particular on average-case complexity. Yuri also worked on many questions on the interface between logic and computer science, including the introduction, together with Erich Grädel, of metafinite model theory, and the formulation of the conjecture that there is no logic that captures polynomial time computability on unordered structures.

Yuri felt that, while many foundational questions in mathematical logic had been settled, the foundational questions about computer science and the nature of computation were still wide open. To answer some of these questions, Yuri invented abstract state machines (ASMs). Unlike most other formal methods at the time, ASMs are operational, rather than declarative. Yuri's "ASM thesis" states that every algorithm can be faithfully represented as an ASM. In 1998, Jim Kajiya at Microsoft Research

[1] Yuri Gurevich. *Logician in the land of OS: Abstract State Machines in Microsoft.* Invited talk at LICS 2001.

realized the potential of ASMs and invited Yuri to start a new group, the Foundations of Software Engineering (FSE) group. At Microsoft, Yuri made many contributions involving ASMs, including the notion of "choiceless polynomial time" computation, and also many other contributions to computer science topics not directly related to ASMs, such as efficient file transfer, software testing, security, and authorization.

To a great number of researchers in algebra, logic, and computer science, Yuri Gurevich is a unique integrating figure, a cherished colleague, and a dear friend. In 2010, on the occasion of Yuri's 70th birthday, a symposium took place in Brno, the Czech Republic, that brought together many of Yuri's collaborators. Now, five years later, we have again asked Yuri's colleagues to come together for a symposium and to contribute to a volume in his honor. This Festschrift is the result of this effort. The articles cover a wide range of topics and still merely give a glimpse of the scope and depth of Yuri's many areas of interest.

The Yurifest symposium was co-located with the 24th EACSL Annual Conference on Computer Science Logic (CSL 2015). The editors would like to thank the organizers of CSL for their help with many practical issues. The symposium received generous support from the German Research Foundation (DFG) and from Microsoft Research. Thanks are also due to the anonymous referees of the contributions to this volume, and, last but not least, to the contributors for their immediate and enthusiastic commitment to participating in the second Yurifest.

To Yuri Gurevich, the great logician in the land of OS, with deep admiration, gratitude, and affection. Happy birthday!

July 2015

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Andreas Blass
Nachum Dershowitz
Bernd Finkbeiner
Wolfram Schulte

Contents

K-trivial, *K*-low and MLR-low Sequences: A Tutorial 1
Laurent Bienvenu and Alexander Shen

Horn Clause Solvers for Program Verification 24
Nikolaj Bjørner, Arie Gurfinkel, Ken McMillan, and Andrey Rybalchenko

Existential Fixed-Point Logic as a Fragment of Second-Order Logic 52
Andreas Blass

On the Unpredictability of Individual Quantum Measurement Outcomes 69
Alastair A. Abbott, Cristian S. Calude, and Karl Svozil

The Ehrenfeucht-Fraïssé Method and the Planted Clique Conjecture 87
Yijia Chen and Jörg Flum

Monadic Theory of a Linear Order Versus the Theory of Its Subsets with the Lifted Min/Max Operations 109
Christian Choffrut and Serge Grigorieff

Regularity Equals Monadic Second-Order Definability for Quasi-trees 129
Bruno Courcelle

Capturing MSO with One Quantifier 142
Anuj Dawar and Luc Segoufin

Logics for Weighted Timed Pushdown Automata 153
Manfred Droste and Vitaly Perevoshchikov

Inherent Vacuity in Lattice Automata 174
Hila Gonen and Orna Kupferman

Is Polynomial Time Choiceless? 193
Erich Grädel and Martin Grohe

Arithmetical Congruence Preservation: From Finite to Infinite 210
Patrick Cégielski, Serge Grigorieff, and Irène Guessarian

An Extension of the Ehrenfeucht-Fraïssé Game for First Order Logics Augmented with Lindström Quantifiers 226
Simi Haber and Saharon Shelah

Logics of Finite Hankel Rank 237
Nadia Labai and Johann A. Makowsky

The Strategy of Campaigning 253
Rohit Parikh and Çağıl Taşdemir

On Almost Future Temporal Logics 261
Alexander Rabinovich

Minsky Machines and Algorithmic Problems 273
Mark Sapir

On Failure of 0-1 Laws 293
Saharon Shelah

Composition over the Natural Number Ordering with an Extra Binary Relation. 297
Wolfgang Thomas

The Fundamental Nature of the Log Loss Function 307
Vladimir Vovk

Erratum to: The Fundamental Nature of the Log Loss Function E1
Vladimir Vovk

Author Index 319