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Advisory Board: W. Brauer D. Gries J. Stoer

Faron Moller Graham Birtwistle (Eds.)

Logics for Concurrency

Structure versus Automata

Springer

Volume Editors

Faron Moller
Department of Teleinformatics, Kungl Tekniska Högskolan
Electrum 204, S-164 40 Kista, Sweden

Graham Birtwistle
School of Computer Studies, University of Leeds
Woodhouse Road, Leeds LS2 9JT, United Kingdom

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Preface

This volume is a result of the VIIITH BANFF HIGHER ORDER WORKSHOP held from August 27th to September 3rd, 1994, at the Banff Centre in Banff, Canada. The aim of this annual workshop (of which the VIIITH was the final) was to gather together researchers studying a specific, well-focussed topic, to present and contrast various approaches to the problems in their area. The workshop has been locally organised and hosted in Banff by Graham Birtwistle, at that time Professor of Computer Science at the University of Calgary, but currently Professor of Formal Methods at the University of Leeds.

Originally the topics were chosen to reflect some aspect of higher-order reasoning, thus justifying the name of the workshop series, but the topics were allowed to diversify more and more as the years passed, so that the higher-order aspect became less and less adhered to. Thus for example, the previous three workshops were subtitled *Functional Programming Research* (1991, chaired by John Hughes, Glasgow); *Advanced Tutorials on Process Algebra* (1992, chaired by Faron Moller, Edinburgh); and *Advanced Tutorials on Asynchronous Hardware Design* (1993, chaired by Al Davis, HP Labs, Palo Alto).

The final workshop, held in 1994, was subtitled *Logics for Concurrency: Structure versus Automata* and was chaired by Faron Moller, Stockholm. The basic motivation for the workshop was to explore the apparent dichotomy which exists in the area of process logics, particularly in the study of various temporal logics. On the one hand, the traditional approach has exploited automata-theoretic techniques which have been studied for decades; this approach is dominant in research carried out in North America. On the other hand, the "Eurotheory" approach is based more on exploiting structural properties involving aspects such as congruence and decomposability. The relaxed workshop format of having a set of three lectures from each of five speakers spread over eight days allowed this dichotomy to be revealed, dissected, and discussed in detail, providing for a great deal of friendly debate between proponents of each school. The five series of lectures were presented by Samson Abramsky (London); E. Allen Emerson (Austin); Yoram Hirshfeld (Tel Aviv) and Faron Moller (Stockholm); Colin Stirling (Edinburgh); and Moshe Vardi (Rice).

The proceedings of the workshop series have generally only been available informally; indeed they have usually only been informal documents, sometimes nothing more than photocopies of slides. However, as the final workshop so successfully met its goal of creating an environment for contrasting approaches, it was deemed a worthy exercise by all of the lecturers to provide post-workshop tutorial-style lecture notes, which explored the individual presentations with the benefit of hindsight, so as to provide a record of the presentations and discussions carried out at the workshop.

Acknowledgements. The workshop from which this volume emerged was made possible through an operating grant from the Natural Sciences and Engineering Research Council of Canada. The ever-obliging staff of the Banff Centre made sure that everything ran smoothly and to plan. Professor Richard Guy presented an entertaining evening lecture midway through the workshop on Conway's "Game of Life," demonstrating how to construct a computer from components of "Life" such as gliders, ponds, spaceships, and eaters. Professor Przemyslaw Prusinkiewicz ("Dr P") gave an equally delightful after-dinner lecture following the final-evening banquet in which he presented a fascinating range of fractally-generated plants, including fractal reproductions of the works of Monet and Van Gogh.

The notes included in this volume were reviewed openly and extensively by the editors and the various authors, as well as the following people, most of whom were attendees of the workshop (more specific acknowledgements are included with the various papers): Howard Barringer, Rick Blute, Robin Cockett, Oystein Haugen, Carron Kirkwood, Orna Kupferman, Phil Scott, David Spooner, Perdita Stevens, and David Walker. Finally, we would like to thank the lecturers themselves for their efforts in producing the following carefully considered lecture notes.

December 1995

Faron Moller, Stockholm
Graham Birtwistle, Leeds

Contributors

SAMSON ABRAMSKY is currently Professor of Computer Science at Imperial College of Science, Technology and Medicine, London, but will be moving to the University of Edinburgh in January 1996 to take up the newly-created Chair of Theoretical Computer Science. He has a Diploma in Computer Science from Cambridge University, and a PhD in Computer Science from London University. His research includes: domain theory in logical form, the lazy lambda calculus, computational interpretations of linear logic, strictness analysis for higher-order and polymorphic functions, proofs as processes, game semantics and full abstraction for PCF, and interaction categories. His research interests include: programming language semantics and logics; concurrency; semantics-based program analysis; linear logic; and the integration of functional and process-based programming paradigms.

E. ALLEN EMERSON is a Bruton Centennial Professor in the Computer Sciences Department at the University of Texas at Austin. His general research interests include formal methods, distributed computing, real-time systems, logics of programs, and other applications of logic to computer science. Areas of special interest include the complexity and expressiveness of logical formalisms and automata on infinite objects. He has published a variety of papers in these areas. He received the BS degree in Mathematics from the University of Texas at Austin, and the PhD degree in Applied Mathematics from Harvard University. He serves on the editorial boards of several journals relating to formal methods and applied logic.

SIMON GAY is a Lecturer in Computer Science at Royal Holloway, University of London. He has an MA in Mathematics and a Diploma in Computer Science from the University of Cambridge, and a PhD in Computer Science from the University of London. His research interests include programming language semantics, concurrency theory, type theory, and linear logic. His current work focuses on the interaction categories approach to type systems for concurrency.

YORAM HIRSHFELD received an MSc in Mathematics (non-standard analysis) from the Hebrew University, Jerusalem in 1969, and a PhD in Mathematical Logic (models of arithmetic) from Yale in 1972. Since then he has been at Tel Aviv University where his mathematical areas of research have been centred on mathematical logic, model theory and non-standard analysis. Since 1987 his main interests have been with applications of logic to computer science, particularly in concurrency theory.

FARON MOLLER is currently Vikariat Professor of Distributed Systems in the Department of Teleinformatics at the Kungl Tekniska Högskolan, Stockholm. He finished his PhD thesis in Edinburgh under Robin Milner's guidance in 1988. In his thesis he studied the decomposability of concurrent systems and its theoretical applicability. His present interests include the study of infinite state systems, particularly with a view of exploiting decomposability, as well as formalisms for real-time systems and automated proof systems.

RAJAGOPAL NAGARAJAN is currently completing his PhD degree at Imperial College of Science, Technology and Medicine, London under the supervision of Professor Samson Abramsky. He received a Bachelor's degree in Chemical Engineering from the Indian Institute of Technology, Madras, and a Master's degree in Computer Science from the University of Delaware, Newark. He was employed as a Computer Scientist at ORA Corporation, Ithaca, New York, and as a Research Associate at the University of Calgary. His research interests include logic, concurrency theory, programming language semantics, automated reasoning, specification and verification of hardware and software, and semantic techniques for complexity.

COLIN STIRLING is Professor of Computer Science at the University of Edinburgh. He has researched for over 10 years in the theory of computation, particularly in concurrency theory and the application of modal and temporal logics to this area. With David Walker he introduced the notion of local model checking using semantic tableaux. He has also applied this technique to decidability results for bisimulation equivalence.

MOSHE Y. VARDI is a Noah Harding Professor and Chair of Computer Science at Rice University. His research interests include database theory, finite-model theory, knowledge theory, and program specification and verification. Before joining Rice University in 1993, he was a department manager at the IBM Almaden Research Center. Vardi is the recipient of 3 IBM Outstanding Innovation Awards. He was the program chair of the 6th ACM Symposium on the Principles of Database Systems (1987), the 2nd Conference on Theoretical Aspects of Reasoning about Knowledge (1988), and the 8th IEEE Symposium on Logic in Computer Science (1993). He is currently an editor of Information and Computation and the Journal of Computer and System Sciences.

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