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V. Arvind
Sanjiva Prasad (Eds.)

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27th International Conference
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Preface

This volume contains the proceedings of the 27th annual conference on the Foundations of Software Technology and Theoretical Computer Science (FSTTCS 2007) held during December 12–14, 2007 at the India International Centre in New Delhi. The conference was organized under the auspices of the Indian Association for Research in Computing Science (IARCS).

This year's conference attracted 135 submissions from 31 countries. Except for a few papers that were outside the scope of the conference, each submission was assigned to at least three Programme Committee members, who, with the assistance of external expert researchers, ensured that each paper had at least three independent reviews. Given the high quality of the submissions, the Programme Committee decided to accept 40 papers. We thank all the expert reviewers for their invaluable help. We are very grateful to the PC members who put in enormous time and work in selecting the papers. Without their untiring efforts the conference would not have been possible.

The entire process of submission, refereeing, and the subsequent electronic PC meeting for selecting the papers for the conference program was greatly facilitated by the EasyChair conference management system; we would like to thank Andrei Voronkov and his team for this wonderful software.

One of the highlights of FSTTCS is the high quality of the invited talks. This year's conference was fortunate to have five very eminent invited speakers: Maurice Herlihy, Benjamin Pierce, Thomas Reps, Salil Vadhan, and Andrew Yao. Andrew Yao delivered the keynote address at the conference titled "A Modern Theory of Trust-but-Verify." In addition, Richard Karp, who could not make it to the conference to give his invited talk, kindly agreed to send an article for inclusion in the proceedings. It gives us great pleasure to thank all the invited speakers for agreeing to talk at the conference and for contributing to this volume.

Two satellite workshops were organized in conjunction with FSTTCS this year. These workshops were hosted by the Indian Institute of Technology Delhi. The conference was preceded by a one-day workshop on Compiler Techniques on December 11, felicitating Priti Shankar on her 60th birthday. Following the conference, on December 15, there was a one-day workshop on BioInformatics and Systems Biology organized by Neelima Gupta.

We thank the Organizing Committee for making all the arrangements for the conference. We thank IARCS and the sponsors for their support. As always, Alfred Hofmann and his team at Springer were very helpful in preparing the proceedings.

December 2007

V. Arvind
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Table of Contents

Invited Papers

The Multicore Revolution: The Challenges for Theory	1
<i>Maurice Herlihy</i>	
Streaming Algorithms for Selection and Approximate Sorting	9
<i>Richard M. Karp</i>	
Adventures in Bidirectional Programming	21
<i>Benjamin C. Pierce</i>	
Program Analysis Using Weighted Pushdown Systems	23
<i>Thomas Reps, Akash Lal, and Nick Kidd</i>	
The Complexity of Zero Knowledge	52
<i>Salil Vadhan</i>	

Contributed Papers

The Priority k -Median Problem	71
<i>Amit Kumar and Yogish Sabharwal</i>	
“Rent-or-Buy” Scheduling and Cost Coloring Problems	84
<i>Takuro Fukunaga, Magnús M. Halldórsson, and Hiroshi Nagamochi</i>	
Order Scheduling Models: Hardness and Algorithms	96
<i>Naveen Garg, Amit Kumar, and Vinayaka Pandit</i>	
On Simulatability Soundness and Mapping Soundness of Symbolic Cryptography	108
<i>Michael Backes, Markus Dürmuth, and Ralf Küsters</i>	
Key Substitution in the Symbolic Analysis of Cryptographic Protocols	121
<i>Yannick Chevalier and Mounira Kourjeh</i>	
Symbolic Bisimulation for the Applied Pi Calculus	133
<i>Stéphanie Delaune, Steve Kremer, and Mark Ryan</i>	
Non-mitotic Sets	146
<i>Christian Glaßer, Alan L. Selman, Stephen Travers, and Liyu Zhang</i>	
Reductions to Graph Isomorphism	158
<i>Jacobo Torán</i>	

Strong Reductions and Isomorphism of Complete Sets	168
<i>Ryan C. Harkins, John M. Hitchcock, and A. Pavan</i>	
Probabilistic and Topological Semantics for Timed Automata	179
<i>Christel Baier, Nathalie Bertrand, Patricia Bouyer, Thomas Brihaye, and Marcus Größer</i>	
A Theory for Game Theories	192
<i>Michel Hirschowitz, André Hirschowitz, and Tom Hirschowitz</i>	
An Incremental Bisimulation Algorithm	204
<i>Diptikalyan Saha</i>	
Logspace Algorithms for Computing Shortest and Longest Paths in Series-Parallel Graphs	216
<i>Andreas Jakoby and Till Tantau</i>	
Communication Lower Bounds Via the Chromatic Number	228
<i>Ravi Kumar and D. Sivakumar</i>	
The Deduction Theorem for Strong Propositional Proof Systems (Extended Abstract)	241
<i>Olaf Beyersdorff</i>	
Satisfiability of Algebraic Circuits over Sets of Natural Numbers	253
<i>Christian Glaßer, Christian Reitwießner, Stephen Travers, and Matthias Waldherr</i>	
Post Embedding Problem Is Not Primitive Recursive, with Applications to Channel Systems	265
<i>Pierre Chambart and Philippe Schnoebelen</i>	
Synthesis of Safe Message-Passing Systems	277
<i>Nicolas Baudru and Rémi Morin</i>	
Automata and Logics for Timed Message Sequence Charts	290
<i>S. Akshay, Benedikt Bollig, and Paul Gastin</i>	
Propositional Dynamic Logic for Message-Passing Systems	303
<i>Benedikt Bollig, Dietrich Kuske, and Ingmar Meinecke</i>	
Better Algorithms and Bounds for Directed Maximum Leaf Problems	316
<i>Noga Alon, Fedor V. Fomin, Gregory Gutin, Michael Krivelevich, and Saket Saurabh</i>	
Faster Algorithms for All-Pairs Small Stretch Distances in Weighted Graphs	328
<i>Telikepalli Kavitha</i>	

Covering Graphs with Few Complete Bipartite Subgraphs	340
<i>Herbert Fleischner, Egbert Mijuni, Daniel Paulusma, and Stefan Szeider</i>	
Safely Composing Security Protocols	352
<i>Véronique Cortier, Jérémie Delaitre, and Stéphanie Delaune</i>	
Computationally Sound Typing for Non-interference: The Case of Deterministic Encryption	364
<i>Judicaël Courant, Cristian Ene, and Yassine Lakhnech</i>	
Bounding Messages for Free in Security Protocols	376
<i>Myrto Arapinis and Marie Duflot</i>	
Triangulations of Line Segment Sets in the Plane	388
<i>Mathieu Bréviliers, Nicolas Chevallier, and Dominique Schmitt</i>	
Reconstructing Convex Polygons and Polyhedra from Edge and Face Counts in Orthogonal Projections (Extended Abstract)	400
<i>Therese Biedl, Masud Hasan, and Alejandro López-Ortiz</i>	
Finding a Rectilinear Shortest Path in R^2 Using Corridor Based Staircase Structures	412
<i>R. Inkulu and Sanjiv Kapoor</i>	
Compressed Dynamic Tries with Applications to LZ-Compression in Sublinear Time and Space	424
<i>Jesper Jansson, Kunihiko Sadakane, and Wing-Kin Sung</i>	
Stochastic Müller Games are PSPACE-Complete	436
<i>Krishnendu Chatterjee</i>	
Solving Parity Games in Big Steps	449
<i>Sven Schewe</i>	
Efficient and Expressive Tree Filters	461
<i>Michael Benedikt and Alan Jeffrey</i>	
Markov Decision Processes with Multiple Long-Run Average Objectives	473
<i>Krishnendu Chatterjee</i>	
A Formal Investigation of Diff3	485
<i>Sanjeev Khanna, Keshav Kunal, and Benjamin C. Pierce</i>	
Probabilistic Analysis of the Degree Bounded Minimum Spanning Tree Problem	497
<i>Anand Srivastav and Sören Werth</i>	

Undirected Graphs of Entanglement 2 508
 Walid Belkhir and Luigi Santocanale

Acceleration in Convex Data-Flow Analysis 520
 Jérôme Leroux and Grégoire Sutre

Model Checking Almost All Paths Can Be Less Expensive Than
Checking All Paths..... 532
 Matthias Schmalz, Hagen Völzer, and Daniele Varacca

Closures and Modules Within Linear Logic Concurrent Constraint
Programming..... 544
 Rémy Haemmerlé, François Fages, and Sylvain Soliman

Author Index..... 557

The Multicore Revolution

The Challenges for Theory

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Abstract. Computer architecture is undergoing, if not another revolution, then a vigorous shaking-up. The major chip manufacturers have, for the time being, simply given up trying to make processors run faster. Instead, they have recently started shipping "multicore" architectures, in which multiple processors (cores) communicate directly through shared hardware caches, providing increased concurrency instead of increased clock speed. As a result, system designers and software engineers can no longer rely on increasing clock speed to hide software bloat. Instead, they must somehow learn to make effective use of increasing parallelism. This adaptation will not be easy. Conventional synchronization techniques based on locks and conditions are unlikely to be effective in such a demanding environment. Coarse-grained locks, which protect relatively large amounts of data, do not scale, and fine-grained locks introduce substantial software engineering problems. Transactional memory is a computational model in which threads synchronize by optimistic, lock-free transactions. This synchronization model promises to alleviate many (perhaps not all) of the problems associated with locking, and there is a growing community of researchers working on both software and hardware support for this approach. This paper surveys the area, with a focus on open research problems.

1 Introduction

The computer industry is undergoing, if not another revolution, then a vigorous shaking-up. The major chip manufacturers have, for the time being, given up trying to make processors run faster. Moore's law has not been repealed: each year, more and more transistors fit into the same space, but their clock speed cannot be increased without overheating. Instead, attention is turning toward *multicore* architectures, in which multiple computing cores are included on each processor chip. Although these changes are propelled by changes in technology, they also provide a unique opportunity for theoretical distributed computing to have a substantial impact on practice. This paper suggests some promising research directions.

These trends mean that, in the medium term, advances in technology will provide increased parallelism, but not increased single-thread performance. System designers and software engineers can no longer rely on increasing clock speed

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