

Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

380

J. Csirik J. Demetrovics
F. Gécseg (Eds.)

Fundamentals of Computation Theory

International Conference FCT '89
Szeged, Hungary, August 21–25, 1989
Proceedings



Springer-Verlag

New York Berlin Heidelberg London Paris Tokyo Hong Kong

Editorial Board

D. Barstow W. Brauer P. Brinch Hansen D. Gries D. Luckham
C. Moler A. Pnueli G. Seegmüller J. Stoer N. Wirth

Editors

János Csirik
Ferenc Gécseg
József Attila Tudományegyetem Bolyai Intézete
Aradi vértanúk tere 1, H-6720 Szeged, Hungary

János Demetrovics
Computer and Automation Institute
Hungarian Academy of Sciences
P.O. Box 63, H-1502 Budapest, Hungary

CR Subject Classification (1987): D.2.4, E.5, F, I.1.2, I.2–3

ISBN 3-540-51498-8 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-51498-8 Springer-Verlag New York Berlin Heidelberg

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in other ways, and storage in data banks. Duplication of this publication or parts thereof is only permitted under the provisions of the German Copyright Law of September 9, 1965, in its version of June 24, 1985, and a copyright fee must always be paid. Violations fall under the prosecution act of the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1989
Printed in Germany

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.
2145/3140-543210 — Printed on acid-free paper

P R E F A C E

This volume constitutes the proceedings of the conference on Fundamentals of Computation Theory held in Szeged, Hungary, August 21-25, 1989. The conference is the seventh in the series of the FCT conferences initiated in 1977 in Poznan-Kornik, Poland. The conference was organized by the Attila József University (Szeged) with cooperation of the Computer and Automation Institute of the Hungarian Academy of Sciences.

The papers in this volume are the texts of invited addresses and shorter communications falling in one of the following sections:

Efficient Computation by Abstract Devices: Automata, Computability, Probabilistic Computations, Parallel and Distributed Computing

Logics and Meanings of Programs: Algebraic and Categorical Approaches to Semantics, Computational Logic, Logic Programming, Verification, Program Transformations, Functional Programming

Formal Languages: Rewriting Systems, Algebraic Language Theory

Computational Complexity: Analysis and Complexity of Algorithms, Design of Efficient Algorithms, Algorithms and Data Structures, Computational Geometry, Complexity Classes and Hierarchies, Lower Bounds

The shorter communications were selected on March 21 and 22, 1989 at the Program (Selection) Committee Meeting in Szeged from the large number of papers submitted to FCT '89.

Thanks are due to the members of the Program Committee for their work in evaluating the submitted papers, to the members of the Organizing Committee for their hard job in all organizational matters as well as to all referees of FCT '89.

Szeged, August 1989

János Csirik

János Demetrovics

Ferenc Gécseg

CONFERENCE COMMITTEES

PROGRAM COMMITTEE

G. Ausiello, J. Berstel, L. Budach, R.G. Bukharajev, Phan Dinh Dieu, P. van Emde Boas, the late A.P. Ershov, F. Gécseg, J. Gruska, J. Hartmanis, J. Heintz, G. Hotz, K. Indermark, H. Jürgensen, M. Karpinski, L. Lovász, O.B. Lupanov, G. Mirkowska, A. Mostowski, A. Pultr, J.H. Reif, G. Rozenberg, J. Sakarovitch, A. Salomaa, E. Szemerédi, H. Thiele, I. Wegener, Wu Wen-Tsün

ORGANIZING COMMITTEE

J. Demetrovics (Chairman), J. Csirik (Secretary), Z. Ésik (Secretary), M. Bartha, Gy. Horváth, J. Virág

CONFERENCE CHAIRMAN

Ferenc Gécseg

REFEREES OF FCT '89

- | | | |
|---------------------|---------------------|----------------------|
| Ablayev, F.M. | Harju, T. | Orłowska, E. |
| Adámek, J. | Hoffmann, F. | Pelletier, M. |
| Albrecht, A. | Hromkovič, J. | Perrot, J.-F. |
| America, P.H.M. | Huttenlocher, D. | Pin, J.E. |
| Arnolds, A. | Jędrzejowicz, J. | Privara, I. |
| Asveld, P.R.J. | Jung, H. | Ranjan, D. |
| Badouel, E. | Karhumäki, J. | Reutenauer, C. |
| Banachowski, L. | Kleijn, H.C.M. | Rovan, B. |
| Barendregt, H.P. | Klop, J.W. | Rudak, L. |
| Becker, B. | Kluźniak, F. | Ruohonen, K. |
| Bilardi, G. | Kolla, R. | Ružička, P. |
| Bloom, S.L. | Korec, I. | Salimov, F.I. |
| Boanon, L. | Kreowski, H.-J. | Salwicki, A. |
| Brandenburg, F.J. | Krob, D. | Samitov, R.K. |
| Briot, J.-P. | Kuchen, H. | Schinzel, B. |
| Chlebus, B.S. | Kudlek, M. | Schupp, P.E. |
| Chrétienne, P. | Kusnetsov, S.E. | Seidl, H. |
| Chytil, M. | Lehmann, T. | Sieber, K. |
| Courcelle, B. | Lescanne, P. | Skowron, A. |
| Culik, K. II | Linna, M. | Solovjev, V.D. |
| Dahlhaus, E. | Loeckx, J. | Spaniol, O. |
| Darondeau, P. | Lukaszewicz, W. | Stabler, E.P. Jr. |
| Dassow, J. | Machi, A. | Štěpánek, P. |
| Dauchet, M. | Marek, I. | Štura, J. |
| Delporte-Gallet, C. | Mazoyer, J. | Szepietowski, A. |
| Diekert, V. | Mehlhorn, K. | Teitelbaum, T. |
| Diks, K. | Meinel, C. | Thomas, W. |
| Ďuriš, P. | Ch. Meyer, J.-J. | Treinen, R. |
| Ehrig, P. | Molitor, P. | Validov, F.I. |
| Engelfriet, J. | Müller, F. | Vitányi, P.M.B. |
| Enikeev, A.I. | Nait Abdallah, M.A. | Vogler, H. |
| Grigorieff, S. | Nasirov, I.R. | Waack, S. |
| Habel, A. | Niwiński, D. | van Westrhenen, S.C. |
| Haddad, S. | Nurmeev, N.N. | Wiedermann, J. |
| Hansel, G. | Oberschelp, W. | Wolf, G. |
| | Ollagnier, J.M. | |

Contents

H. Abdulrab and J.-P. Pécuchet	
On word equations and Makanin's algorithm	1
C. Álvarez, J. Díaz and J. Torán	
Complexity classes with complete problems between P and NP - C	13
M. Bartha	
Interpretations of synchronous flowchart schemes	25
A. Bertoni, D. Bruschi, D. Joseph, M. Sitharam and P. Young	
Generalized Boolean hierarchies and Boolean hierarchies over RP	35
S. L. Bloom	
The equational logic of iterative processes	47
H.L. Bodlaender, S. Moran and M.K. Warmuth	
The distributed bit complexity of the ring: from the anonymous to the non-anonymous case	58
A. Brandstädt	
The jump number problem for biconvex graphs and rectangle covers of rectangular regions	68
J.A. Brzozowski and J.C. Ebergen	
Recent developments in the design of asynchronous circuits	78
B.S. Chlebus, K. Diks, T. Hagerup and T. Radzik	
New simulations between CRCW PRAMs	95

J.-L. Coquidé, M. Dauchet and S. Tison

About connections between syntactical and computational complexity105

P. Crescenzi and A. Panconesi

Completeness in approximation classes116

C. Damm and Ch. Meinel

Separating completely complexity classes related to polynomial size

Ω -decision trees 127

P. Dömösi, Z. Ésik and B. Imreh

On product hierarchies of automata 137

P. Ďuriš and P. Pudlák

On the communication complexity of planarity145

J. Engelfriet

Context-free NCE graph grammars 148

J. Françon, B. Randrianarimanana and R. Schott

Dynamic data structures with finite population: a combinatorial analysis162

Z. Fülöp and S. Vágvolgyi

Iterated deterministic top-down look-ahead 175

D. Geniet and L. Thimonier

Using generating functions to compute concurrency185

A. Gil-Luezas

A logic for nondeterministic functional programs197

B. Graw

Decision problems and Coxeter groups 209

E. Grädel

Complexity of formula classes in first order logic with functions 224

R.R. Howell, L.E. Rosier and Hsu-Chun Yen

Normal and sinkless Petri nets 234

N. Immerman

Descriptive and computational complexity 244

S.P. Jukna

The effect of null-chains on the complexity of contact schemes 246

E. Kinber and T. Zeugmann

Monte-Carlo inference and its relations to reliable frequency identification 257

I. Korec

Semilinear real-time systolic trellis automata 267

T. Kovács

Inducibility of the composition of frontier-to-root tree transformations 277

M. Krause and S. Waack

On oblivious branching programs of linear length 287

M. Liśkiewicz and K. Loryś

Some time-space bounds for one-tape deterministic Turing machines 297

I. Litovsky

Rank of rational finitely generated w-languages 308

W. Maass and T.A. Slaman

Extensional properties of sets of time bounded complexity 318

A. Marchetti-Spaccamela and M. Protasi

Learning under uniform distribution 327

M.A. Nait Abdallah

An extended framework for default reasoning 339

M. A. Nait Abdallah

Logic programming of some mathematical paradoxes 349

R. Orlandic and J.L. Pfaltz

Analysis of compact 0-complete trees: a new access method to large databases ... 362

K. Salomaa

Representation of recursively enumerable languages using alternating
finite tree recognizers 372

P. Séébold

About a family of binary morphisms which stationary words are Sturmian 384

H. Seidl

On the finite degree of ambiguity of finite tree automata 395

H.U. Simon

Approximation algorithms for channel assignment in cellular radio networks 405

J. Skurczyński

The Borel hierarchy is infinite in the class of regular sets of trees416

F. Springsteel and I. Stojmenović

Parallel general prefix computations with geometric, algebraic and
other applications 424

L. Staiger

Kolmogorov complexity and Hausdorff dimension 434

M. Steinby

Tree language problems in pattern recognition theory 444

K. Sutner

The computational complexity of cellular automata 451

Gy. Turán

On restricted Boolean circuits 460

E. Wanke

The complexity of connectivity problems on context-free graph languages 470

K. Weihrauch

Constructivity, computability, and computational complexity in analysis 480