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

Editors

János Csirik
Férenc 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

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

PREFACE

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. Virágh

CONFERENCE CHAIRMAN

Ferenc Gécseg

REFEREES OF FCT '89

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

Contents