

Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

118

Mathematical Foundations of Computer Science 1981

Proceedings, 10th Symposium
Štrbské Pleso, Czechoslovakia
August 31 – September 4, 1981



Edited by J. Gruska and M. Chytil



Springer-Verlag
Berlin Heidelberg New York 1981

Editorial Board

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

Editors

Jozef Gruska
Computer Research Centre
Dúbravská 3, 885 31 Bratislava, Czechoslovakia

Michal Chytil
Faculty of Mathematics and Physics, Charles University
Malostranské náměstí 25, 118 00 Praha, Czechoslovakia

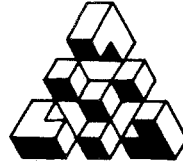
CR Subject Classifications (1974): 5.1, 5.2, 5.3.

ISBN 3-540-10856-4 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-10856-4 Springer-Verlag New York Heidelberg Berlin

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically those of translation, reprinting, re-use of illustrations, broadcasting, reproduction by photocopying machine or similar means, and storage in data banks. Under § 54 of the German Copyright Law where copies are made for other than private use, a fee is payable to "Verwertungsgesellschaft Wort", Munich.

© by Springer-Verlag Berlin Heidelberg 1981
Printed in Germany

Printing and binding: Beltz Offsetdruck, Hemsbach/Bergstr.
2145/3140-543210



MFCS'81

FOREWORD

This volume contains papers which were contributed for presentation at the 10th Symposium on Mathematical Foundations of Computer Science - MFCS'81, held at Štrbské Pleso, Czechoslovakia, from August 31 - September 4, 1981.

The symposium is the tenth in the series of annual international meetings which take place alternately in Poland and Czechoslovakia. The previous MFCS meetings took place in Jablonna, 1972; Štrbské Pleso, 1973; Jadwisin, 1974; Mariánské Lázně, 1975; Gdańsk, 1976; Tatranská Lomnica, 1977; Zakopane, 1978; Olomouc, 1979; Rydzina, 1980.

The symposium was organized by the Computing Research Centre in Bratislava in cooperation with Computer Science Department of the Purkyně University, Brno, Faculty of Mathematics and Physics of the Komen-ský University, Bratislava, Faculty of Mathematics and Physics of the Charles University, Prague, Faculty of Natural Sciences of the Šafárik University, Košice, Federal Ministry of Technology and Investments, Faculty of Electrical Engineering of the Slovak Technical University, Bratislava, Institute of Technical Cybernetics of the Slovak Academy of Sciences, Bratislava and the Slovak Cybernetical Society.

The articles in these Proceedings include 12 invited papers and 45 short communications. The latter were selected by the international program committee from a total of 124 submitted papers on the basis of originality and relevance.

The program committee of MFCS'81 consisted of A. Blikle /Warsaw/, R. V. Book /Santa Barbara/, W. Brauer /Hamburg/, M. Chytil /Prague/ - chairman, P. Dembiński /Warsaw/, P. van Emde Boas /Amsterdam/, E. Engeler /Zürich/, A. P. Ershov /Novosibirsk/, J. Gruska /Bratislava/, J. Hartmanis /Ithaca/, I. M. Havel /Prague/, R. A. Karp /Berkeley/, H. A. Maurer /Graz/, V. R. Pratt /Cambridge/, H. Rasiowa /Warsaw/, A. Salomaa /Turku/, A. O. Slisenko /Leningrad/, G. Wechsung /Jena/.

The editors would like to thank the other members of the program committee for their meritorious work on evaluating the submitted papers, as well as the following referees who assisted to the members of the program committee: W. Ainhirn, J. Albert, P. M. G. Apers, J. de Bakker, A. Brandstädt, W. Bucher, E. Creutzburg, J. J. M. Cuppen, J. Dassow, M. I. Dekhtyar, Yu. P. Drobyshev, L. Efros, T. Fehlmann, Te Yung Fu, M. Grabowski, E. Graf, P. Hájek, G. Haring, C. Hauser, H. D. Hecker, O. Herzog, T. Imieliński, M. Isoldi, V. E. Itkin, R. Janicki, M. Jantzen, M. Karpiński, V. N. Kasyanov, J. Kelemen, M. L. Kersten, R. Knest, I. Korec, V. E. Kotov, V. Koubek, I. Kramosil, J. Krempa, A. Krezmar, W. Kwasowiec, S. Lomecky, W. Lamersdorf, M. Langmaack, J. Leszczylowski, M. Linna, G. Lischke, R. Mäder, W. Manek, O. Mayer, A. Mazurkiewicz, Z. Michalewicz, G. Mirkowska, B. Monien, V. A. Nepomiaschy, E.R.Olderog, E. Orłowska, T. Ottman, R. Peikerd, M. Penttonen, L. T. Petrova, I. Prívar, J. Pittl, J. Pokorný, G. Riedewald, J. Reiterman, V. K. Sabelfeld, A. Salwicki, S. Sippu, A. Skowron, E. O. Soisalon-Soininen, L. Staiger, P. H. Starke, M. Steinby, O. Štěpánková, J. Šturc, Svizidenko, O. Sýkora, A. Tarlecki, E. Thomas, V. Trnková, M. K. Valiev, R. Valk, J. van Leeuwen, R. P. van de Riet, P. M. B. Vitányi, M. Vlach, L. Voelkel, K. Wagner, S. Waligórski, K. Weihrach, E. Welzl, J. Wiedermann, R. Wiehagen, J. Winkowski.

The organizing committee of MFCS '81 consisted of G. Andrejková, M. Benešovský, A. Černý, M. Chytil, Z. Durayová, R. Filustek, J. Gruska /Symposium chairman/, J. Hvorecký, P. Mikulecký, Ľ. Molnár, I. Šujan, M. Vlach, J. Wiedermann /Organizing Secretary/.

As symposium and program chairmen we are much indebted to all of the contributors to the scientific program of the symposium, especially to the authors of the papers. We would also like to gratefully acknowledge the support of all above mentioned cooperating institutions. Last but not least, we want to thank the members of the organizing committee for their help in organizing the symposium and Springer-Verlag for excellent co-operation in the publication of this volume.

CONTENTS

INVITED LECTURES

J. L. Bentley and T. Ottman

The complexity of manipulating hierarchically defined
sets of rectangles 1

A. P. Ershov

The transformational machine; theme and variations 16

R. Freivalds

Probabilistic two-way machines 33

D. Joseph and P. Young

A survey of some recent results on computational complexity
in weak theories of arithmetic 46

B. Korte and R. Schrader

A survey on oracle techniques 61

B. Monien and I. H. Sudborough

Time and space bounded complexity classes and bandwidth
constrained problems 78

J. Nešetřil	
Representations of graphs by means of products and their complexity	94
A. Nijholt	
Parsing strategies; a concise survey	103
J. van Leeuwen and M. H. Overmars	
The art of dynamizing	121
L. G. Valiant and S. Skyum	
Fast parallel computation of polynomials using few processors	132
R. Valk	
Generalizations of Petri nets	140
 COMMUNICATIONS	
H. Alt, K. Mehlhorn and J. I. Munro	
Partial match retrieval in implicit data structures	156
H. Andréka, I. Németi and I. Sain	
A characterization of Floyd-provable programs	162
E. Astesiano and E. Zucca	
Semantics of CSP via translation into CCS	172

H. D. Ehrich	
On realization and implementation	271
D. Yu. Grigor'ev	
Multiplicative complexity of a bilinear form over a commutative ring	281
P. Hájek	
Making dynamic logic first-order	287
J. Hořejš	
Partial interpretations of program schemata	296
J. Hromkovič	
Closure properties of the family of languages recognized by one-way two-head deterministic finite state automata ..	304
L. Janiga	
Another hierarchy defined by multihead finite automata ...	314
J. W. Jaromczyk	
An extension of Rabin's complete proof concept	321
K. Jensen	
How to find invariants for coloured Petri nets	327
H. Jung	
Relationships between probabilistic and deterministic tape complexity	339

VIII

J. Beauquier and J. Berstel	
More about the "geography" of context-free languages	183
J. A. Bergstra, M. Broy, J. V. Tucker and M. Wirsing	
On the power of algebraic specifications	193
A. Bertoni, M. Brambilla, G. Mauri and N. Sabadini	
An application of the theory of free partially commutative monoids: asymptotic densities of trace languages	205
R. Book, M. Jantzen, B. Monien, C. O'Dúnlaing and C. Wrathall	
On the complexity of word problems in certain Thue systems	216
F. J. Brandenburg	
On the transformation of derivation graphs to derivation trees	224
A. Brandstädt	
Pushdown automata with restricted use of storage symbols .	234
L. A. Cherkasova and V. E. Kotov	
Structured nets	242
R. P. Daley	
Retraceability, repleteness and busy beaver sets	252
W. Damm and I. Guessarian	
Combining T and level-N	262

A. Kelemenová	
Grammatical levels of the position restricted grammars ...	347
H. C. M. Kleijn and G. Rozenberg	
A general framework for comparing sequential and parallel rewriting	360
W. Knödel	
A bin packing algorithm with complexity $O(n \log n)$ and performance 1 in the stochastic limit	369
I. Korec	
Codings of nonnegative integers	379
V. Koubek and A. Říha	
The maximum k-flow in a network	389
H. J. Kreowski and G. Rozenberg	
On the constructive description of graph languages accepted by finite automata	398
H. P. Kriegel and V. K. Vaishnavi	
Weighted multidimensional B-trees used as nearly optimal dynamic dictionaries	410
L. Kučera	
Maximum flow in planar networks	418
K. Lieberherr	
Probabilistic combinatorial optimization	423

F. Meyer auf der Heide	
Time-processor trade-offs for universal parallel computers	433
J. Pittl	
Negative results on the size of deterministic right parsers	442
J. Pokorný	
Key-equivalence of functional dependency statements systems	452
J. Reiterman and V. Trnková	
On representation of dynamic algebras with reversion	463
B. Rován	
A framework for studying grammars	473
V. Yu. Sazanov	
On existence of complete predicate calculus in meta-mathematics without exponentiation	483
E. Soisalon-Soininen and D. Wood	
On structural similarity of context-free grammars	491
S. Sokółowski	
Axioms for the term-wise correctness of programs	499
L. Staiger	
Complexity and entropy	508

J. Steiner	
Axiomatic semantics of indirect addressing	515
K. Tanaka and Y. Kambayashi	
Testing of join dependency by a modified chase method	524
H. Wedde	
A starvation-free solution of the dining philosophers' problem by use of interaction systems	534
K. Weihrauch and G. Schäfer	
Admissible representations of effective cpo's	544
J. Wiedermann	
Preserving total order in constant expected time	554
A. Kanda	
Constructive category theory (No. 1)	563
APPENDIX	
INVITED LECTURES	
L. Budach	
Two pebbles don't suffice	578