

Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

74

Mathematical Foundations of Computer Science 1979

Proceedings, 8th Symposium,
Olomouc, Czechoslovakia, September 3–7, 1979



Edited by J. Bečvář



Springer-Verlag
Berlin Heidelberg New York 1979

Editorial Board

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

Editor

Jiří Bečvář
Mathematical Institute
Czechoslovak Academy of Sciences
Žitná 25
115 67 Prague 1/Czechoslovakia

AMS Subject Classifications (1970): 02E10, 02E15, 02F10, 02F15,
68A05, 68A20, 68A25, 68A30, 68A45, 68A50
CR Subject Classifications (1974):

ISBN 3-540-09526-8 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-09526-8 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 the publisher, the amount of the fee to be determined by agreement with the publisher.

© by Springer-Verlag Berlin Heidelberg 1979
Printed in Germany

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



MFCS '79

F O R E W O R D

This volume contains the papers which were selected for presentation at the symposium on Mathematical Foundations of Computer Science - MFCS '79, held in Olomouc, Czechoslovakia, September 3 - 7, 1979.

The symposium is the eighth in a series of annual international meetings which take place alternately in Czechoslovakia and Poland. It has been organized by the Mathematical Institute of the Czechoslovak Academy of Sciences, Prague, the Faculty of Mathematics and Physics of Charles University, Prague, and the Faculty of Natural Sciences of Palacký University, Olomouc, in co-operation with the Federal Ministry for Technical and Investment Development, the Technical University, Prague, the Computing Research Centre, Bratislava, the Faculty of Natural Sciences of Komenský University, Bratislava, and the Faculty of Natural Sciences of Šafárik University, Košice.

The articles in these Proceedings include invited papers and short communications. The latter were selected from among 95 extended abstracts submitted in response to the call for papers. Selection was made on the basis of originality and relevance to theoretical computer science by the following Program Committee: J. Bečvář /Chairman/, J. Gruska, P. Hájek, M. Chytil, J. Král, M. Novotný, B. Rován. A number of referees helped the Program Committee in the evaluation of the abstracts.

The papers included in these Proceedings were not formally refereed. It is anticipated that most of them will appear in a polished and completed form in scientific journals.

IV

The organizers of the symposium are much indebted to all those who contributed to the program, in particular to the authors of the papers. Special thanks are due to the referees of the abstracts. Thanks are also due to all the above mentioned co-operating institutions for their valuable assistance and support, and to all the persons who helped in organizing the symposium. The Organizing Committee consisted of J. Bečvář, J. Gregor, J. Gruska, P. Hájek, I. Havel, Š. Hudák, M. Chytil, J. Král, F. Krutský, B. Miniberger, M. Novotný, A. Rázek, Z. Renc, B. Rován, and M. Vlach /Chairman/. The Program Chairman acknowledges with gratitude the extensive assistance of I.M. Havel, P. Pudlák, and S. Žák in editing this volume.

The organizers of the symposium wish to express their thanks to the representatives of the Palacký University in Olomouc for their support and interest in the symposium.

Finally, the help of the Springer-Verlag in the timely publication of this volume is highly appreciated.

Prague, May 1979

Jiří Bečvář

C O N T E N T S

Invited lectures

J.W. de Bakker	
A sound and complete proof system for partial program correctness	1
J.M. Barzdin	
The problem of reachability and verification of programs	13
A.J. Blikle	
Assertion programming	26
R.V. Book	
Complexity classes of formal languages	43
R. Freivalds	
Fast probabilistic algorithms	57
J. Hartmanis and T.P. Baker	
Relative succinctness of representations of languages and separation of complexity classes	70
I.M. Havel	
On two types of loops	89
M.C.B. Hennessy and G.D. Plotkin	
Full abstraction for a simple parallel programming language	108
H.A. Maurer	
On some developments in cryptography and their applications to computer science	121
K. Mehlhorn	
Searching, sorting and information theory	131
R. Milner	
LCF: a way of doing proofs with a machine	146
V.R. Pratt	
Axioms or algorithms	160

A. Salomaa	
Power from power series	170
A.O. Slisenko	
Computational complexity of string and graph identification	182
D. Wood	
A survey of grammar and L forms - 1978	191

Communications

A. Adachi, T. Kasai and E. Moriya	
A theoretical study on the time analysis of programs	201
H. Andréka, I. Németi and I. Sain	
Completeness problems in verification of programs and program schemes	208
J.-M. Autebert	
Relationships between AFDL's and cylinders	219
G. Comyn and G. Werner	
Computable data types	228
G. Cousineau and P. Enjalbert	
Program equivalence and provability	237
K. Culik II and J. Karhumäki	
Interactive L systems with almost interactionless behaviour	246
R.P. Daley	
On the simplification of constructions in degrees of unsolvability via computational complexity	258
W. Damm	
An algebraic extension of the Chomsky-hierarchy	266
M.I. Dekhtjar	
Bounds on computational complexity and approximability of initial segments of recursive sets	277
T. Fischer	
On the weighted path length of binary search trees for unknown access probabilities	284

VII

G.V. Gens and E.V. Levner	
Computational complexity of approximation algorithms for combinatorial problems	292
A. Goralčíková and V. Koubek	
A reduct-and-closure algorithm for graphs	301
L. Gregušová and I. Korec	
Small universal Minski machines	308
T. Kamimura and G. Slutzki	
Parallel and two-way recognizers of directed acyclic graphs	317
A. Kanda	
Fully effective solutions of recursive domain equations	326
I. Kramosil	
A note on computational complexity of a statistical deducibility testing procedure	337
M. Kudlek	
Context free normal systems	346
M. Linna and M. Penttonen	
New proofs for jump DPDA's	354
A. de Luca and A. Restivo	
Synchronization and maximality for very pure subsemigroups of a free semigroup	363
G.B. Marandžjan	
On the sets of minimal indices of partial recursive functions	372
K. Mehlhorn	
Some remarks on Boolean sums	375
G. Mirkowska	
On the propositional algorithmic logic	381
A. Nijholt and E. Soisalon-Soininen	
Ch(k) grammars: a new characterization of LL(k) languages	390
T. Ottmann and D. Wood	
A uniform approach to balanced binary and multiway trees	398

VIII

G. Păun	
On the generative capacity of some classes of grammars with regulated rewriting	408
P. Ružička	
Validity test for Floyd's operator-precedence parsing algorithms	415
P.H. Starke	
On the languages of bounded Petri nets	425
M. Tegze	
Dyck language D_2 is not absolutely parallel	434
J. Tiuryn	
Fixed points in power-set algebra of infinite trees	443
B.A. Trakhtenbrot	
On relaxation rules in algorithmic logic	453
V. Trnková	
L-fuzzy functorial automata	463
G.E. Tseytlin	
Schematics of structural parallel programming and its applications	474
M.K. Valiev	
On axiomatization of deterministic propositional dynamic logic	482
K. Wagner	
Bounded recursion and complexity classes	492
W. Wechler	
Characterization of rational and algebraic power series	499
G. Wechsung	
A crossing measure for 2-tape Turing machines	508
J. Wiedermann	
The complexity of lexicographic sorting and searching	517
J. Winkowski	
An algebraic approach to concurrence	523

H. Yamasaki	
On multitape automata	533
S. Žák	
A Turing machine oracle hierarchy	542

Appendix *

G. Berry and J.-J. Lévy	
A survey of some syntactic results in the λ -calculus	552
G. Cousineau and M. Nivat	
On rational expressions representing infinite rational trees:	
Application to the structure of flow charts	567

* Manuscript received too late to be placed correctly in the alphabetic listing.