

Lecture Notes in Computer Science

621

Edited by G. Goos and J. Hartmanis

Advisory Board: W. Brauer D. Gries J. Stoer



O. Nurmi E. Ukkonen (Eds.)

Algorithm Theory – SWAT '92

Third Scandinavian Workshop on Algorithm Theory
Helsinki, Finland, July 8-10, 1992
Proceedings

Springer-Verlag

Berlin Heidelberg New York
London Paris Tokyo
Hong Kong Barcelona
Budapest

Series Editors

Gerhard Goos
Universität Karlsruhe
Postfach 69 80
Vincenz-Priessnitz-Straße 1
W-7500 Karlsruhe, FRG

Juris Hartmanis
Department of Computer Science
Cornell University
5149 Upson Hall
Ithaca, NY 14853, USA

Volume Editors

Otto Nurmi
Esko Ukkonen
Department of Computer Science, University of Helsinki
Teollisuuskatu 23, SF-00510 Helsinki, Finland

CR Subject Classification (1991): F.1-2, E.1-2, G.2-3

ISBN 3-540-55706-7 Springer-Verlag Berlin Heidelberg New York

ISBN 0-387-55706-7 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 any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1992

Printed in Germany

Typesetting: Camera ready by author/editor

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.

45/3140-543210 - Printed on acid-free paper

Preface

The papers in this volume were presented at SWAT '92, the Third Scandinavian Workshop on Algorithm Theory. The workshop, which continues the tradition of SWAT '88, SWAT '90, and the Workshop on Algorithms and Data Structures (WADS '89, WADS '91), is intended as an international forum for researchers in the area of design and analysis of algorithms. The call for papers sought contributions in algorithms and data structures, in all areas, including combinatorics, computational geometry, data bases, parallel and distributed computing, and graphics. There were 120 papers submitted, of which the program committee selected 34 for presentation. In addition, invited lectures were presented by Leslie G. Valiant (Direct bulk-synchronous parallel algorithms), Alexander A. Razborov (On small depth threshold circuits), Gaston Gonnet (Efficient two-dimensional searching), and Emo Welzl (New results on linear programming and related problems).

SWAT '92 was held in Helsinki, July 8–10, 1992, and was organized in cooperation with the Department of Computer Science of the University of Helsinki. The organizing committee consisted of B. Aspvall (University of Bergen), H. Hafsteinsson (University of Iceland), R. Karlsson (Lund University), E. M. Schmidt (Aarhus University), O. Nurmi, J. Tarhio, and E. Ukkonen (University of Helsinki).

The program committee wishes to thank all referees who aided in evaluating the papers. The organizers would like to thank J. Kivinen, S. Palander, and J. Vilo for excellent service in all organizational matters related to the conference. Finally, we are very grateful to Nordiska Forskarutbildningsakademien, Ministry of Education (Finland), the Academy of Finland, University of Helsinki, EATCS, the Finnish Society for Computer Science, SUN Microsystems Oy, and ICL Data Oy for sponsoring the workshop.

Helsinki, May 1992

Otto Nurmi
Esko Ukkonen

Program Committee

S. Arnborg (Royal Institute of Technology)
B. Aspvall (University of Bergen)
J. Gilbert (Xerox PARC and University of Bergen)
T. Hagerup (Max-Planck-Institut)
T. Leighton (MIT)
C. Levcopoulos (Lund University)
A. Lingas (Lund University)
Th. Ottmann (University of Freiburg)
M. Overmars (University of Utrecht)
M. Penttonen (University of Joensuu)
W. Rytter (University of Warsaw)
N. Santoro (Carleton University)
S. Skyum (Aarhus University)
E. Ukkonen (chairman, University of Helsinki)

List of Referees for SWAT '92

Alt, H.	Kari, J.	Munthe-Kaas, E.
Anderson, R.	Kari, L.	Nevalainen, O.
Bang-Jensen, J.	Karlsson, R.	Newman, I.
Bodlaender, H. L.	Karpinski, M.	Nielsen, M.
Boyar, J.	Katajainen, J.	Nilsson, B.
Brüggemann-Klein, A.	Kaufmann, M.	Nurmi, O.
Carlsson, S.	Kivinen, J.	Orponen, P.
Casas, R.	Klasing, R.	Pennings, M.
Chen, J.	Klein, R.	Raita, T.
Chlebus, B. S.	Kloks, T.	Raman, R.
Cole, R.	Kløve, T.	Reich, G.
Cowen, L. J.	Klugerman, M.	Rossmanith, P.
de Berg, M.	Knuutila, T.	Schirra, S.
Dietzfelbinger, M.	Kowaluk, M.	Schmidt, E.
Diks, K.	Kozen, D. C.	Schuijter, S.
Eckerle, J.	Kravets, D.	Schwartzbach, M.
Fleischer, R.	Kroghdahl, S.	Schwarzkopf, O.
Floréen, P.	Kunde, M.	Singh, M.
Forsell, M.	Kutyłowski, M.	Smid, M.
Frandsen, G. S.	Lagergren, S.	Syslo, M.
Garrido, O.	Langemyr, L.	Szymacha, T.
Gąsieniec, L.	Langholm, T.	Tarhio, J.
Goldmann, M.	Laver, T.	Teia, B.
Golin, M. J.	Lenhof, H.-P.	Teuhola, J.
Håstad, J.	Lisper, B.	Uhrig, C.
Heinz, A.	Luccio, F.	van Kreveld, M.
Huber-Wäschle, F.	Mannila, H.	Veldhorst, M.
Ihler, E.	Mattsson, C.	Vilo, J.
Jennings, E.	Mehlhorn, K.	Voutilainen, P.
Jonssons, H.	Meiser, S.	Wanka, R.
Kahan, S. H.	Miltersen, P. B.	Welzl, E.
Kant, G.	Monien, B.	Williamson, D. P.
Karabeg, D.	Müller, N.	Winter, P.

Table of Contents

Direct Bulk-Synchronous Parallel Algorithms (Invited)	
<i>A. V. Gerbessiotis and L. G. Valiant</i>	1
Memory Limited Inductive Inference Machines	
<i>R. Freivalds and C. H. Smith</i>	19
Retrieval of Scattered Information by EREW, CREW and CRCW PRAMs	
<i>F. Fich, M. Kowaluk, K. Loryś, M. Kutylowski, and P. Ragde</i>	30
On Small Depth Threshold Circuits (Invited)	
<i>A. A. Razborov</i>	42
An Elementary Approach to Some Analytic Asymptotics	
<i>N. Pippenger</i>	53
An Optimal Parallel Algorithm for Computing a Near-Optimal Order of Matrix Multiplications	
<i>A. Czumaj</i>	62
Generating Sparse 2-Spanners	
<i>G. Kortsarz and D. Peleg</i>	73
Low-Diameter Graph Decomposition is in NC	
<i>B. Awerbuch, B. Berger, L. Cowen, and D. Peleg</i>	83
Parallel Algorithm for Cograph Recognition with Applications	
<i>X. He</i>	94
Parallel Algorithms for All Minimum Link Paths and Link Center Problems	
<i>S. K. Ghosh and A. Maheshwari</i>	106
Optimal Multi-Packet Routing on the Torus	
<i>M. Kaufmann and J. F. Sibeyn</i>	118
Parallel Algorithms for Priority Queue Operations	
<i>M. C. Pinotti and G. Pucci</i>	130
Heap Construction in the Parallel Comparison Tree Model	
<i>P. F. Dietz</i>	140
Efficient Rebalancing of Chromatic Search Trees	
<i>J. Boyar and K. S. Larsen</i>	151
The Complexity of Scheduling Problems with Communication Delays for Trees	
<i>A. Jakoby and R. Reischuk</i>	165
The List Update Problem and the Retrieval of Sets	
<i>F. d'Amore and V. Liberatore</i>	178
GKD-Trees: Binary Trees that Combine Multi-Dimensional Data Handling, Node Size, and Fringe Reorganization	
<i>W. Cunto and V. Yriarte</i>	192
Fractional Cascading Simplified	
<i>S. Sen</i>	212
Dynamic 2- and 3-Connectivity on Planar Graphs	
<i>D. Giammarresi and G. F. Italiano</i>	221

Fully Dynamic 2-Connectivity in Planar Graphs	
<i>J. Hershberger, M. Rauch, and S. Suri</i>	233
Non-Interfering Network Flows	
<i>C. McDiarmid, B. Reed, A. Schrijver, and B. Shepherd</i>	245
Triangulating Planar Graphs While Minimizing the Maximum Degree	
<i>G. Kant and H. L. Bodlaender</i>	258
How to Draw a Series-Parallel Digraph	
<i>P. Bertolazzi, R. F. Cohen, G. Di Battista, R. Tamassia, and I. G. Tollis</i>	272
Coloring Random Graphs	
<i>M. Fürer and C. R. Subramanian</i>	284
Testing Superperfection of k -Trees	
<i>T. Kloks and H. Bodlaender</i>	292
Parametric Problems on Graphs of Bounded Tree-Width	
<i>D. Fernández-Baca and G. Slutzki</i>	304
Efficient Two-Dimensional Searching (Invited)	
<i>G. Gonnet</i>	317
Improvements on Geometric Pattern Matching Problems	
<i>L. P. Chew and K. Kedem</i>	318
Determining DNA Sequence Similarity Using Maximum Independent Set	
Algorithms for Interval Graphs	
<i>D. Joseph, J. Meidanis, and P. Tiwari</i>	326
New Results on Linear Programming and Related Problems (Invited)	
<i>E. Welzl</i>	338
Dynamic Closest Pairs — A Probabilistic Approach	
<i>M. J. Golin</i>	340
Two- and Three-Dimensional Point Location in Rectangular Subdivisions	
<i>M. de Berg, M. van Kreveld, and J. Snoeyink</i>	352
Decomposing the Boundary of a Nonconvex Polyhedron	
<i>B. Chazelle and L. Palios</i>	364
Convex Polygons Made from Few Lines and Convex Decompositions of Polyhedra	
<i>J. Hershberger and J. Snoeyink</i>	376
Maintaining the Visibility Map of Spheres While Moving the Viewpoint on a Circle at Infinity	
<i>H.-P. Lenhof and M. Smid</i>	388
Voronoi Diagrams of Moving Points in Higher Dimensional Spaces	
<i>G. Albers and T. Roos</i>	399
Sorting Multisets Stably in Minimum Space	
<i>J. Katajainen and T. Pasanen</i>	410
A Framework for Adaptive Sorting	
<i>O. Petersson and A. Moffat</i>	422
Author Index	434