

Takao Asano Shin-ichi Nakano  
Yoshio Okamoto Osamu Watanabe (Eds.)

# Algorithms and Computation

22nd International Symposium, ISAAC 2011  
Yokohama, Japan, December 5-8, 2011  
Proceedings



Springer

# Table of Contents

## Invited Talk I

Algorithm Engineering for Route Planning: An Update . . . . .	1
<i>Dorothea Wagner</i>	

## Invited Talk II

Semidefinite Programming and Approximation Algorithms: A Survey . . .	6
<i>Sanjeev Arora</i>	

## Approximation Algorithms I

The School Bus Problem on Trees . . . . .	10
<i>Adrian Bock, Elyot Grant, Jochen Könemann, and Laura Sanità</i>	

Improved Approximations for Buy-at-Bulk and Shallow-Light $k$ -Steiner Trees and $(k, 2)$ -Subgraph . . . . .	20
<i>M. Reza Khani and Mohammad R. Salavatipour</i>	

Improved Approximation Algorithms for Routing Shop Scheduling . . . . .	30
<i>Wei Yu and Guochuan Zhang</i>	

Contraction-Based Steiner Tree Approximations in Practice . . . . .	40
<i>Markus Chimani and Matthias Woste</i>	

## Computational Geometry I

Covering and Piercing Disks with Two Centers . . . . .	50
<i>Hee-Kap Ahn, Sang-Sub Kim, Christian Knauer, Lena Schlipf, Chan-Su Shin, and Antoine Vigneron</i>	

Generating Realistic Roofs over a Rectilinear Polygon . . . . .	60
<i>Hee-Kap Ahn, Sang Won Bae, Christian Knauer, Mira Lee, Chan-Su Shin, and Antoine Vigneron</i>	

Computing the Visibility Polygon Using Few Variables . . . . .	70
<i>Luis Barba, Matias Korman, Stefan Langerman, and Rodrigo I. Silveira</i>	

Minimizing Interference in Ad-Hoc Networks with Bounded Communication Radius . . . . .	80
<i>Matias Korman</i>	

**Graph Algorithms**

Hamiltonian Paths in the Square of a Tree ..... 90  
*Jakub Radoszewski and Wojciech Rytter*

Dominating Induced Matchings for  $P_7$ -free Graphs in Linear Time ..... 100  
*Andreas Brandstädt and Raffaele Mosca*

Finding Contractions and Induced Minors in Chordal Graphs via  
 Disjoint Paths ..... 110  
*Rémy Belmonte, Petr A. Golovach, Pinar Heggernes,  
 Pim van 't Hof, Marcin Kamiński, and Daniël Paulusma*

Recognizing Polar Planar Graphs Using New Results for  
 Monopolarity ..... 120  
*Van Bang Le and Ragnar Nevries*

Robustness of Minimum Cost Arborescences ..... 130  
*Naoyuki Kamiyama*

**Data Structures I**

Path Queries in Weighted Trees ..... 140  
*Meng He, J. Ian Munro, and Gelin Zhou*

Dynamic Range Majority Data Structures ..... 150  
*Amr Elmasry, Meng He, J. Ian Munro, and Patrick K. Nicholson*

Dynamic Range Selection in Linear Space ..... 160  
*Meng He, J. Ian Munro, and Patrick K. Nicholson*

A Dynamic Stabbing-Max Data Structure with Sub-Logarithmic Query  
 Time ..... 170  
*Yakov Nekrich*

Encoding 2D Range Maximum Queries ..... 180  
*Mordecai Golin, John Iacono, Danny Krizanc, Rajeev Raman, and  
 S. Srinivasa Rao*

**Distributed Systems**

Diameter and Broadcast Time of Random Geometric Graphs in  
 Arbitrary Dimensions ..... 190  
*Tobias Friedrich, Thomas Sauerwald, and Alexandre Stauffer*

Broadcasting in Heterogeneous Tree Networks with Uncertainty ..... 200  
*Cheng-Hsiao Tsou, Gen-Huey Chen, and Ching-Chi Lin*

Optimal File Distribution in Peer-to-Peer Networks .....	210
<i>Kai-Simon Goetzmann, Tobias Harks, Max Klimm, and Konstantin Miller</i>	

## Computational Geometry II

Animal Testing .....	220
<i>Adrian Dumitrescu and Evan Hilscher</i>	
Cutting Out Polygons with a Circular Saw .....	230
<i>Adrian Dumitrescu and Masud Hasan</i>	
Fast Fréchet Queries .....	240
<i>Mark de Berg, Atlas F. Cook IV, and Joachim Gudmundsson</i>	

## Graph Drawing and Information Visualization

Angle-Restricted Steiner Arborescences for Flow Map Layout .....	250
<i>Kevin Buchin, Bettina Speckmann, and Kevin Verbeek</i>	
Treemaps with Bounded Aspect Ratio .....	260
<i>Mark de Berg, Bettina Speckmann, and Vincent van der Weele</i>	
Simultaneous Embedding of Embedded Planar Graphs .....	271
<i>Patrizio Angelini, Giuseppe Di Battista, and Fabrizio Frati</i>	
Linear-Time Algorithms for Hole-Free Rectilinear Proportional Contact Graph Representations .....	281
<i>Muhammad Jawaherul Alam, Therese Biedl, Stefan Felsner, Andreas Gerasch, Michael Kaufmann, and Stephen G. Kobourov</i>	

## Data Structures II

Fully Retroactive Approximate Range and Nearest Neighbor Searching .....	292
<i>Michael T. Goodrich and Joseph A. Simons</i>	
Compact Representation of Posets .....	302
<i>Arash Farzan and Johannes Fischer</i>	
Explicit Array-Based Compact Data Structures for Triangulations .....	312
<i>Luca Castelli Aleardi and Olivier Devillers</i>	
Space-Efficient Data-Analysis Queries on Grids .....	323
<i>Gonzalo Navarro and Luís M.S. Russo</i>	

## Parameterized Algorithms I

A Polynomial Kernel for FEEDBACK ARC SET on Bipartite Tournaments . . . . .	333
<i>Pranabendu Misra, Venkatesh Raman, M.S. Ramanujan, and Saket Saurabh</i>	
Fixed-Parameter Complexity of Feedback Vertex Set in Bipartite Tournaments . . . . .	344
<i>Sheng-Ying Hsiao</i>	
Parameterized Algorithms for Inclusion of Linear Matchings . . . . .	354
<i>Sylvain Guillemot</i>	
Computational Study on Bidimensionality Theory Based Algorithm for Longest Path Problem . . . . .	364
<i>Chunhao Wang and Qian-Ping Gu</i>	

## Parallel and External Memory Algorithms

Sorting, Searching, and Simulation in the MapReduce Framework . . . . .	374
<i>Michael T. Goodrich, Nodari Sitchinava, and Qin Zhang</i>	
External-Memory Multimaps . . . . .	384
<i>Elaine Angelino, Michael T. Goodrich, Michael Mitzenmacher, and Justin Thaler</i>	
External Memory Orthogonal Range Reporting with Fast Updates . . . . .	395
<i>Yakov Nekrich</i>	
Analysis of Speedups in Parallel Evolutionary Algorithms for Combinatorial Optimization (Extended Abstract) . . . . .	405
<i>Jörg Lässig and Dirk Sudholt</i>	

## Game Theory and Internet Algorithms

Verifying Nash Equilibria in PageRank Games on Undirected Web Graphs . . . . .	415
<i>David Avis, Kazuo Iwama, and Daichi Paku</i>	
Improved Collaborative Filtering . . . . .	425
<i>Aviv Nisgav and Boaz Patt-Shamir</i>	
Asymptotic Modularity of Some Graph Classes . . . . .	435
<i>Fabien de Montgolfier, Mauricio Soto, and Laurent Viennot</i>	

## Computational Complexity

Program Size and Temperature in Self-assembly . . . . .	445
<i>Ho-Lin Chen, David Doty, and Shinnosuke Seki</i>	
Optimization, Randomized Approximability, and Boolean Constraint Satisfaction Problems . . . . .	454
<i>Tomoyuki Yamakami</i>	
Lower Bounds for Myopic DPLL Algorithms with a Cut Heuristic . . . . .	464
<i>Dmitry Itsykson and Dmitry Sokolov</i>	

## Approximation Algorithms II

Algorithm for Single Allocation Problem on Hub-and-Spoke Networks in 2-Dimensional Plane . . . . .	474
<i>Ryuta Ando and Tomomi Matsui</i>	
Packing-Based Approximation Algorithm for the $k$ -Set Cover Problem . . . . .	484
<i>Martin Fürer and Huiwen Yu</i>	
Capacitated Domination: Constant Factor Approximations for Planar Graphs . . . . .	494
<i>Mong-Jen Kao and D.T. Lee</i>	

## Randomized Algorithms

On Power-Law Distributed Balls in Bins and Its Applications to View Size Estimation . . . . .	504
<i>Ioannis Atsonios, Olivier Beaumont, Nicolas Hanusse, and Yusik Kim</i>	
A Randomized Algorithm for Finding Frequent Elements in Streams Using $O(\log \log N)$ Space . . . . .	514
<i>Masatora Ogata, Yukiko Yamauchi, Shuji Kijima, and Masafumi Yamashita</i>	
A Nearly-Quadratic Gap between Adaptive and Non-adaptive Property Testers (Extended Abstract) . . . . .	524
<i>Jeremy Hurwitz</i>	

## Online and Streaming Algorithms

Online Linear Optimization over Permutations . . . . .	534
<i>Shota Yasutake, Kohei Hatano, Shuji Kijima, Eiji Takimoto, and Masayuki Takeda</i>	

On the Best Possible Competitive Ratio for Multislope Ski Rental . . . . . 544  
*Hiroshi Fujiwara, Takuma Kitano, and Toshihiro Fujito*

Input-Thrifty Extrema Testing . . . . . 554  
*Kuan-Chieh Robert Tseng and David Kirkpatrick*

Edit Distance to Monotonicity in Sliding Windows . . . . . 564  
*Ho-Leung Chan, Tak-Wah Lam, Lap-Kei Lee, Jiangwei Pan, Hing-Fung Ting, and Qin Zhang*

**Computational Geometry III**

Folding Equilateral Plane Graphs . . . . . 574  
*Zachary Abel, Erik D. Demaine, Martin L. Demaine, Sarah Eisenstat, Jayson Lynch, Tao B. Schardl, and Isaac Shapiro-Ellowitz*

Efficient Algorithms for the Weighted  $k$ -Center Problem on a Real Line . . . . . 584  
*Danny Z. Chen and Haitao Wang*

Outlier Respecting Points Approximation . . . . . 594  
*Danny Z. Chen and Haitao Wang*

An Improved Algorithm for Reconstructing a Simple Polygon from the Visibility Angles . . . . . 604  
*Danny Z. Chen and Haitao Wang*

**Parameterized Algorithms II**

The Parameterized Complexity of Local Search for TSP, More Refined . . . . . 614  
*Jiong Guo, Sepp Hartung, Rolf Niedermeier, and Ondřej Suchý*

On the Parameterized Complexity of Consensus Clustering . . . . . 624  
*Martin Dörnfelder, Jiong Guo, Christian Komusiewicz, and Mathias Weller*

Two Fixed-Parameter Algorithms for the Cocoloring Problem . . . . . 634  
*Victor Campos, Sulamita Klein, Rudini Sampaio, and Ana Silva*

Parameterized Complexity of the Firefighter Problem . . . . . 643  
*Cristina Bazgan, Morgan Chopin, and Michael R. Fellows*

## String Algorithms

Faster Approximate Pattern Matching in Compressed Repetitive Texts . . . . .	653
<i>Travis Gagie, Paweł Gawrychowski, and Simon J. Puglisi</i>	
A New Algorithm for the Characteristic String Problem under Loose Similarity Criteria . . . . .	663
<i>Yoshifumi Sakai</i>	
Succinct Indexes for Circular Patterns . . . . .	673
<i>Wing-Kai Hon, Chen-Hua Lu, Rahul Shah, and Sharma V. Thankachan</i>	
Range LCP . . . . .	683
<i>Amihhood Amir, Alberto Apostolico, Gad M. Landau, Avivit Levy, Moshe Lewenstein, and Ely Porat</i>	

## Optimization

Computing Knapsack Solutions with Cardinality Robustness . . . . .	693
<i>Naonori Kakimura, Kazuhisa Makino, and Kento Seimi</i>	
Max-Throughput for (Conservative) $k$ -of- $n$ Testing . . . . .	703
<i>Lisa Hellerstein, Özgür Özkan, and Linda Sellie</i>	
Closest Periodic Vectors in $L_p$ Spaces . . . . .	714
<i>Amihhood Amir, Estrella Eisenberg, Avivit Levy, and Noa Lewenstein</i>	
Maximum Weight Digital Regions Decomposable into Digital Star-Shaped Regions . . . . .	724
<i>Matt Gibson, Dongfeng Han, Milan Sonka, and Xiaodong Wu</i>	

## Computational Biology

Finding Maximum Sum Segments in Sequences with Uncertainty . . . . .	734
<i>Hung-I Yu, Tien-Ching Lin, and D.T. Lee</i>	
Algorithms for Building Consensus MUL-trees . . . . .	744
<i>Yun Cui, Jesper Jansson, and Wing-Kin Sung</i>	
Adaptive Phenotype Testing for AND/OR Items . . . . .	754
<i>Francis Y.L. Chin, Henry C.M. Leung, and S.M. Yiu</i>	
An Index Structure for Spaced Seed Search . . . . .	764
<i>Taku Onodera and Tetsuo Shibuya</i>	

<b>Author Index</b> . . . . .	773
-------------------------------	-----