

# 16th Scandinavian Symposium and Workshops on Algorithm Theory

SWAT 2018, June 18–20, 2018,  
Malmö University, Malmö, Sweden

Edited by

David Eppstein



### *Editors*

David Eppstein  
Computer Science Department  
University of California, Irvine  
Irvine, California, USA  
eppstein@uci.edu

### *ACM Classification 2012*

Theory of computation → Design and analysis of algorithms

## **ISBN 978-3-95977-068-2**

### *Published online and open access by*

Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at <http://www.dagstuhl.de/dagpub/978-3-95977-068-2>.

### *Publication date*

June, 2018

### *Bibliographic information published by the Deutsche Nationalbibliothek*

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

### *License*

This work is licensed under a Creative Commons Attribution 3.0 Unported license (CC-BY 3.0): <http://creativecommons.org/licenses/by/3.0/legalcode>.



In brief, this license authorizes each and everybody to share (to copy, distribute and transmit) the work under the following conditions, without impairing or restricting the authors' moral rights:

- Attribution: The work must be attributed to its authors.

The copyright is retained by the corresponding authors.

Digital Object Identifier: 10.4230/LIPIcs.SWAT.2018.0

**ISBN 978-3-95977-068-2**

**ISSN 1868-8969**

**<http://www.dagstuhl.de/lipics>**

## LIPICs – Leibniz International Proceedings in Informatics

LIPICs is a series of high-quality conference proceedings across all fields in informatics. LIPICs volumes are published according to the principle of Open Access, i.e., they are available online and free of charge.

### *Editorial Board*

- Luca Aceto (*Chair*, Gran Sasso Science Institute and Reykjavik University)
- Susanne Albers (TU München)
- Chris Hankin (Imperial College London)
- Deepak Kapur (University of New Mexico)
- Michael Mitzenmacher (Harvard University)
- Madhavan Mukund (Chennai Mathematical Institute)
- Anca Muscholl (University Bordeaux)
- Catuscia Palamidessi (INRIA)
- Raimund Seidel (Saarland University and Schloss Dagstuhl – Leibniz-Zentrum für Informatik)
- Thomas Schwentick (TU Dortmund)
- Reinhard Wilhelm (Saarland University)

**ISSN 1868-8969**

**<http://www.dagstuhl.de/lipics>**



## ■ Contents

Preface	
<i>David Eppstein</i> .....	0:ix

### Invited Talks

Sampling-Based Motion Planning: From Intelligent CAD to Crowd Simulation to Protein Folding	
<i>Nancy M. Amato</i> .....	1:1–1:1
Optimizing Society? Ensuring Fairness in Automated Decision-Making	
<i>Sorelle Friedler</i> .....	2:1–2:1
Robustness Meets Algorithms	
<i>Ankur Moitra</i> .....	3:1–3:1

### Regular Papers

Economical Delone Sets for Approximating Convex Bodies	
<i>Ahmed Abdelkader and David M. Mount</i> .....	4:1–4:12
Computing Shortest Paths in the Plane with Removable Obstacles	
<i>Pankaj K. Agarwal, Neeraj Kumar, Stavros Sintos, and Subhash Suri</i> .....	5:1–5:15
On Romeo and Juliet Problems: Minimizing Distance-to-Sight	
<i>Hee-Kap Ahn, Eunjin Oh, Lena Schlipf, Fabian Stehn, and Darren Strash</i> .....	6:1–6:13
Multistage Matchings	
<i>Euripidis Bampis, Bruno Escoffier, Michael Lampis, and Vangelis Th. Paschos</i> ...	7:1–7:13
Convex Hulls in Polygonal Domains	
<i>Luis Barba, Michael Hoffmann, Matias Korman, and Alexander Pilz</i> .....	8:1–8:13
Tree Containment With Soft Polytomies	
<i>Matthias Bentert, Josef Malík, and Mathias Weller</i> .....	9:1–9:14
On the Size of Outer-String Representations	
<i>Therese Biedl, Ahmad Biniaz, and Martin Derka</i> .....	10:1–10:14
Flip Distance to some Plane Configurations	
<i>Ahmad Biniaz, Anil Maheshwari, and Michiel Smid</i> .....	11:1–11:14
Boundary Labeling for Rectangular Diagrams	
<i>Prosenjit Bose, Paz Carmi, J. Mark Keil, Saeed Mehrabi, and Debajyoti Mondal</i> .	12:1–12:14
Gathering by Repulsion	
<i>Prosenjit Bose and Thomas C. Shermer</i> .....	13:1–13:12
Improved Bounds for Guarding Plane Graphs with Edges	
<i>Ahmad Biniaz, Prosenjit Bose, Aurélien Ooms, and Sander Verdonschot</i> .....	14:1–14:12
Sparse Weight Tolerant Subgraph for Single Source Shortest Path	
<i>Diptarka Chakraborty and Debarati Das</i> .....	15:1–15:15

16th Scandinavian Symposium and Workshops on Algorithm Theory (SWAT 2018).  
Editor: David Eppstein



Leibniz International Proceedings in Informatics  
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

An Improved Algorithm for Incremental DFS Tree in Undirected Graphs <i>Lijie Chen, Ran Duan, Ruosong Wang, Hanrui Zhang, and Tianyi Zhang</i> .....	16:1–16:12
Succinct Dynamic One-Dimensional Point Reporting <i>Hicham El-Zein, J. Ian Munro, and Yakov Nekrich</i> .....	17:1–17:11
Enumerating Vertices of 0/1-Polyhedra associated with 0/1-Totally Unimodular Matrices <i>Khaled Elbassioni and Kazuhisa Makino</i> .....	18:1–18:14
The Parameterized Hardness of the k-Center Problem in Transportation Networks <i>Andreas Emil Feldmann and Dániel Marx</i> .....	19:1–19:13
Algorithms for the Discrete Fréchet Distance Under Translation <i>Omrit Filtser and Matthew J. Katz</i> .....	20:1–20:14
Partial Complementations of Graphs <i>Fedor V. Fomin, Petr A. Golovach, Torstein J. F. Strømme, and Dimitrios M. Thilikos</i> .....	21:1–21:13
New Algorithms for Distributed Sliding Windows <i>Sutanu Gayen and N. V. Vinodchandran</i> .....	22:1–22:15
Parameterized Aspects of Strong Subgraph Closure <i>Petr A. Golovach, Pinar Heggernes, Athanasios L. Konstantinidis, Paloma T. Lima, and Charis Papadopoulos</i> .....	23:1–23:13
Parameterized Orientable Deletion <i>Tesshu Hanaka, Ioannis Katsikarelis, Michael Lampis, Yota Otachi, and Florian Sikora</i> .....	24:1–24:13
SVM via Saddle Point Optimization: New Bounds and Distributed Algorithms <i>Lingxiao Huang, Yifei Jin, and Jian Li</i> .....	25:1–25:13
Lower Bounds on Sparse Spanners, Emulators, and Diameter-reducing shortcuts <i>Shang-En Huang and Seth Pettie</i> .....	26:1–26:12
Reconfiguration of Colorable Sets in Classes of Perfect Graphs <i>Takehiro Ito and Yota Otachi</i> .....	27:1–27:13
Tight Lower Bounds for List Edge Coloring <i>Lukasz Kowalik and Arkadiusz Socala</i> .....	28:1–28:12
Load Thresholds for Cuckoo Hashing with Double Hashing <i>Michael Mitzenmacher, Konstantinos Panagiotou, and Stefan Walzer</i> .....	29:1–29:9
A Greedy Algorithm for Subspace Approximation Problem <i>Nguyen Kim Thang</i> .....	30:1–30:7
Planar 3-SAT with a Clause/Variable Cycle <i>Alexander Pilz</i> .....	31:1–31:13
Tree-Residue Vertex-Breaking: a new tool for proving hardness <i>Erik D. Demaine and Mikhail Rudoy</i> .....	32:1–32:14

Nearly Optimal Separation Between Partially and Fully Retroactive Data Structures

*Lijie Chen, Erik D. Demaine, Yuzhou Gu, Virginia Vassilevska Williams, Yinzhan Xu, and Yuancheng Yu* ..... 33:1–33:12





## ■ Preface

The Scandinavian Symposium and Workshops on Algorithm Theory (SWAT, formerly the Scandinavian Workshop on Algorithm Theory) has been offered every two years beginning in 1988, when it was offered in Halmstaf, Sweden. It alternates with its sister conference, the Algorithms and Data Structures Symposium (WADS), usually held in Canada. This year marks the 16th SWAT, and the fourth time the conference has been in Sweden.

92 regular papers were submitted to the conference; four were withdrawn, and the program committee selected 30 of the remaining 88 papers for presentation at the conference. In addition, the conference program includes three invited talks, whose abstracts are included in the proceedings.

The SWAT conference series is run by a steering committee consisting of Lars Arge (Aarhus University), Magnús M. Halldórsson (Reykjavík University), Andrzej Lingas (Lund University), Jan Arne Telle (University of Bergen), and Esko Ukkonen (University of Helsinki). This year's conference is organized by Jesper Larsson and Bengt J. Nilsson (both of Malmö University).

The program committee consisted of Mikkel Abrahamsen (University of Copenhagen), Joan Boyar (University of Southern Denmark), Jingsen Chen (Luleå University of Technology), Devdatt Dubhashi (Chalmers University of Technology), David Eppstein (chair; University of California, Irvine), Zachary Friggstad (University of Alberta), Travis Gagie (Diego Portales University), Serge Gaspers (University of New South Wales), Iyad Kanj (DePaul University), Viggo Kann (KTH Royal Institute of Technology), Tsvi Kopelowitz (University of Waterloo), Christian Knauer (University of Bayreuth), Irina Kostitsyna (Eindhoven University of Technology), Shi Li (University at Buffalo), Daniel Lokshtanov (University of Bergen), Matthias Mnich (Maastricht University and Rheinische Friedrich-Wilhelms-Universität Bonn), Sang-il Oum (Korea Advanced Institute of Science and Technology), Daniel Paulusma (Durham University), Marcin Pilipczuk (University of Warsaw), Benjamin Raichel (University of Texas at Dallas), Marcel Roeloffzen (National Institute of Informatics), Barna Saha (University of Massachusetts Amherst), Jukka Suomela (Aalto University), and Haitao Wang (Utah State University).



