

# 9th International Conference on Fun with Algorithms

FUN 2018, June 13–15, 2018, La Maddalena Island, Italy

Edited by

Hiro Ito

Stefano Leonardi

Linda Pagli

Giuseppe Prencipe



### *Editors*

Hiro Ito  
School of Informatics and Engineering  
The University of Electro-Communications  
itohiro@uec.ac.jp

Stefano Leonardi  
Dipartimento di Ing. Informatica Automatica e Gestionale  
Sapienza Università di Roma  
leonardi@diag.uniroma1.it

Linda Pagli  
Dipartimento di Informatica  
Università di Pisa  
linda.pagli@unipi.it

Giuseppe Prencipe  
Dipartimento di Informatica  
Università di Pisa  
giuseppe.prencipe@unipi.it

### *ACM Classification 2012*

Theory of computation → Complexity classes, Theory of computation → Algorithm design techniques,  
Theory of computation → Computability, Theory of computation → Approximation algorithms analysis,  
Mathematics of computing → Combinatorics, Mathematics of computing → Combinatorial algorithms,  
Computing methodologies

## **ISBN 978-3-95977-067-5**

### *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/978-3-95977-067-5>.

### *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.FUN.2018.0

**ISBN 978-3-95977-067-5**

**ISSN 1868-8969**

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

## ■ Contents

|   |      |
|---|------|
| Preface   |      |
| <i>Hiro Ito, Stefano Leonardi, Linda Pagli, and Giuseppe Prencipe</i> ..... | 0:ix |

### Invited Papers

|                                   |         |
|-----------------------------------|---------|
| Mind the Gap                      |         |
| <i>Martín Farach-Colton</i> ..... | 1:1–1:1 |
| Evolution of Impossible Objects   |         |
| <i>Kokichi Sugihara</i> .....     | 2:1–2:8 |

### Regular Papers

|  |            |
|--|------------|
| Who witnesses The Witness? Finding witnesses in The Witness is hard and sometimes impossible   |            |
| <i>Zachary Abel, Jeffrey Bosboom, Erik D. Demaine, Linus Hamilton, Adam Hesterberg, Justin Kopinsky, Jayson Lynch, and Mikhail Rudoy</i> ..... | 3:1–3:21   |
| Tracks from hell – when finding a proof may be easier than checking it   |            |
| <i>Matteo Almanza, Stefano Leucci, and Alessandro Panconesi</i> .....  | 4:1–4:13   |
| How Bad is the Freedom to Flood-It?  |            |
| <i>Rémy Belmonte, Mehdi Khosravian Ghadikolaei, Masashi Kiyomi, Michael Lampis, and Yota Otachi</i> .....                                      | 5:1–5:13   |
| How long does it take for all users in a social network to choose their communities?   |            |
| <i>Jean-Claude Bermond, Augustin Chaintreau, Guillaume Ducoffe, and Dorian Mazauric</i> .....  | 6:1–6:21   |
| On the Complexity of Two Dots for Narrow Boards and Few Colors   |            |
| <i>Davide Bilò, Luciano Gualà, Stefano Leucci, and Neeldhara Misra</i> .....   | 7:1–7:15   |
| On the PSPACE-completeness of Peg Duotaire and other Peg-Jumping Games   |            |
| <i>Davide Bilò, Luciano Gualà, Stefano Leucci, Guido Proietti, and Mirko Rossi</i> ....  | 8:1–8:15   |
| On the Exact Complexity of Polyomino Packing   |            |
| <i>Hans L. Bodlaender and Tom C. van der Zanden</i> .....  | 9:1–9:10   |
| Kings, Name Days, Lazy Servants and Magic  |            |
| <i>Paolo Boldi and Sebastiano Vigna</i> .....  | 10:1–10:13 |
| Computational Complexity of Generalized Push Fight   |            |
| <i>Jeffrey Bosboom, Erik D. Demaine, and Mikhail Rudoy</i> .....   | 11:1–11:21 |
| SUPERSET: A (Super)Natural Variant of the Card Game SET  |            |
| <i>Fábio Botler, Andrés Cristi, Ruben Hoeksma, Kevin Schewior, and Andreas Tönnis</i>  | 12:1–12:17 |
| A Cryptographer’s Conspiracy Santa   |            |
| <i>Xavier Bultel, Jannik Dreier, Jean-Guillaume Dumas, and Pascal Lafourcade</i> ....  | 13:1–13:13 |



|  |            |
|--|------------|
| Cooperating in Video Games? Impossible! Undecidability of Team Multiplayer Games   |            |
| <i>Michael J. Coulombe and Jayson Lynch</i> .....  | 14:1–14:16 |
| A Muffin-Theorem Generator   |            |
| <i>Guangqi Cui, John Dickerson, Naveen Durvasula, William Gasarch, Erik Metz, Jacob Prinz, Naveen Raman, Daniel Smolyak, and Sung Hyun Yoo</i> .....     | 15:1–15:19 |
| God Save the Queen   |            |
| <i>Jurek Czyzowicz, Konstantinos Georgiou, Ryan Killick, Evangelos Kranakis, Danny Krizanc, Lata Narayanan, Jaroslav Opatrny, and Sunil Shende</i> ..... | 16:1–16:20 |
| Restricted Power – Computational Complexity Results for Strategic Defense Games  |            |
| <i>Ronald de Haan and Petra Wolf</i> .....   | 17:1–17:14 |
| Computational Complexity of Motion Planning of a Robot through Simple Gadgets  |            |
| <i>Erik D. Demaine, Isaac Grosf, Jayson Lynch, and Mikhail Rudoy</i> .....   | 18:1–18:21 |
| The Computational Complexity of Portal and Other 3D Video Games  |            |
| <i>Erik D. Demaine, Joshua Lockhart, and Jayson Lynch</i> .....  | 19:1–19:22 |
| Faster Evaluation of Subtraction Games   |            |
| <i>David Eppstein</i> .....  | 20:1–20:12 |
| Making Change in 2048  |            |
| <i>David Eppstein</i> .....  | 21:1–21:13 |
| Pick, Pack, & Survive: Charging Robots in a Modern Warehouse based on Online Connected Dominating Sets   |            |
| <i>Heiko Hamann, Christine Markarian, Friedhelm Meyer auf der Heide, and Mostafa Wahby</i> .....   | 22:1–22:13 |
| Selection Via the Bogo-Method – More on the Analysis of Perversely Awful Randomized Algorithms   |            |
| <i>Markus Holzer and Jan-Tobias Maurer</i> .....   | 23:1–23:21 |
| Herugolf and Makaro are NP-complete  |            |
| <i>Chuzo Iwamoto, Masato Haruishi, and Tatsuaki Ibusuki</i> .....  | 24:1–24:11 |
| The Fewest Clues Problem of Picross 3D   |            |
| <i>Kei Kimura, Takuya Kamehashi, and Toshihiro Fujito</i> .....  | 25:1–25:13 |
| Uniform Distribution On Pachinko   |            |
| <i>Naoki Kitamura, Yuya Kawabata, and Taisuke Izumi</i> .....  | 26:1–26:14 |
| The complexity of speedrunning video games   |            |
| <i>Manuel Lafond</i> .....   | 27:1–27:19 |
| Gender-Aware Facility Location in Multi-Gender World   |            |
| <i>Valentin Polishchuk and Leonid Sedov</i> .....  | 28:1–28:16 |
| Card-Based Zero-Knowledge Proof for Sudoku   |            |
| <i>Tatsuya Sasaki, Takaaki Mizuki, and Hideaki Sone</i> .....  | 29:1–29:10 |

The Complexity of Escaping Labyrinths and Enchanted Forests  
*Florian D. Schwahn and Clemens Thielen* ..... 30:1–30:13

Card-based Protocols Using Triangle Cards  
*Kazumasa Shinagawa and Takaaki Mizuki* ..... 31:1–31:13

The Power of One Secret Agent  
*Tami Tamir* ..... 32:1–32:15