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Combinatorial Algorithms

27th International Workshop, IWOCA 2016
Helsinki, Finland, August 17–19, 2016
Proceedings

Editors

Veli Mäkinen
University of Helsinki
Helsinki
Finland

Leena Salmela
University of Helsinki
Helsinki
Finland

Simon J. Puglisi
University of Helsinki
Helsinki
Finland

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-44542-7 ISBN 978-3-319-44543-4 (eBook)
DOI 10.1007/978-3-319-44543-4

Library of Congress Control Number: 2016931327

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

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Printed on acid-free paper

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Preface

This volume contains revised versions of papers presented at the 27th International Workshop on Combinatorial Algorithms (IWOCA 2016), held August 17–19, 2016, in Helsinki, Finland.

IWOCA 2016 continued a long and well-established tradition of encouraging high-quality research in theoretical computer science, providing an opportunity to bring together specialists and young researchers working in the area. The IWOCA conference series grew out of a 17-year history of the Australasian Workshop on Combinatorial Algorithms (AWOCA). Previous AWOCA and IWOCA meetings have been held in Australia, Indonesia, South Korea, Japan, Czech Republic, Canada, UK, India, France, the USA, and Italy.

We solicited papers in the broad area of combinatorial algorithms. The Program Committee decided to accept 35 papers, out of a total of 87 submissions. Each submission received at least three reviews. Papers were submitted and reviewed using the EasyChair online system. Authors of accepted papers come from 21 countries, across three continents (Asia, Europe, North America).

The scientific program included three invited lectures, given by:

- Leslie Anne Goldberg on “Approximately Counting list H-Colourings”
- Giuseppe F. Italiano on “2-Connectivity Problems in Directed Graphs”
- Petteri Kaski on “Polynomial Representations in Algorithm Design”

We thank the invited speakers for accepting our invitation and for their excellent presentations at the conference. The program also included an open problem session, chaired by Gabriele Fici. The open problems presented can be found at the open problem collection of IWOCA at <http://iwoca.org>. This year for the second year running, IWOCA had a Best Student Paper Award, sponsored by the European Association for Theoretical Computer Science (EATCS). It was decided to assign this award to the paper “Online Chromatic Number Is PSPACE-Complete” by Martin Böhm and Pavel Veselý.

We thank all authors who submitted their work for consideration to IWOCA 2016. We wish to thank the Program Committee and the external reviewers, whose many thorough reviews helped us select the papers presented. The success of the scientific program is due to their hard work. We also thank the EATCS (European Association for Theoretical Computer Science), Federation of Finnish Learned Societies, and the Helsinki Institute for Information Technology for their support of the conference.

IWOCA 2016 was organized by the Department of Computer Science of the University of Helsinki, whose administrative and financial support we gratefully acknowledge.

August 2016

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Abstracts of Invited Talks

Approximately Counting List H -Colourings

Leslie Ann Goldberg

Department of Computer Science, University of Oxford, Oxford, UK
leslie.goldberg@cs.ox.ac.uk

An H -colouring of a graph G is a homomorphism from G to H (a map from the vertices of G to the vertices of H that maps edges of G to edges of H). The “classification programme” in computational complexity aims to classify graphs H according to the difficulty of algorithmic problems, for example, the problem of constructing a homomorphism from an input graph G to H , or the problem of counting homomorphisms from G to H or (more recently) the problem of approximately counting these homomorphisms. I will explain the classifications that are known, focussing especially on “list H -colouring,” which generalises H -colouring in the same way that “list colouring” generalises ordinary (proper) vertex colouring. We still don’t know a complete classification for approximately counting H -colourings, but for approximately counting list H -colourings, there is more progress. Here it turns out that there is a trichotomy in the approximation complexity, based on hereditary graph classes. The talk will describe joint work with Andreas Galanis and Mark Jerrum.

2-Connectivity Problems in Directed Graphs

Giuseppe F. Italiano

Università di Roma “Tor Vergata,” Rome, Italy
giuseppe.italiano@uniroma2.it

We survey some recent results on 2-edge and 2-vertex connectivity problems in directed graphs. Despite being complete analogs of the corresponding notions on undirected graphs, in digraphs 2-vertex and 2-edge connectivity have a much richer and more complicated structure. It is thus not surprising that 2-connectivity problems on directed graphs appear to be more difficult than on undirected graphs. For undirected graphs it has been known for over 40 years how to compute all bridges, articulation points, 2-edge- and 2-vertex-connected components in linear time, by simply using depth first search. In the case of digraphs, however, the very same problems have been much more challenging and have been tackled only recently.

Polynomial Representations in Algorithm Design

Petteri Kaski

Department of Computer Science,
Helsinki Institute for Information Technology HIIT,
Aalto University, Helsinki, Finland
`petteri.kaski@aalto.fi`

Currently the asymptotically fastest known algorithm designs for a number of *a priori* purely combinatorial problems are based on algebraic techniques. This talk gives a brief survey on the use of polynomials and implicit polynomial representations in such designs. We start by recalling some of the classics and proceed towards recent multivariate polynomial sieving and batch evaluation frameworks that yield the state of the art for a range of problems including k -clique counting, graph coloring, Hamiltonian path, motif search, and so forth. Designs based on polynomials not only can give the fastest known and often embarrassingly parallel algorithms, the polynomial representation in itself may serve as a *proof* that the computation was correctly executed.

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