51st International Colloquium on Automata, Languages, and Programming

ICALP 2024, July 8–12, 2024, Tallinn, Estonia

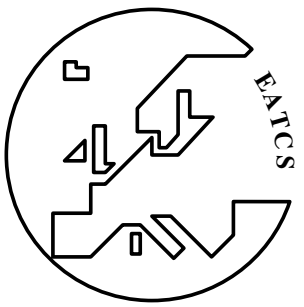
Edited by

Karl Bringmann

Martin Grohe

Gabriele Puppis

Ola Svensson



Editors

Karl Bringmann
Saarland University, Saarland Informatics Campus, Saarbrücken, Germany
Max Planck Institute for Informatics, Saarland Informatics Campus, Saarbrücken, Germany
bringmann@cs.uni-saarland.de

Martin Grohe
RWTH Aachen University, Germany
grohe@informatik.rwth-aachen.de

Gabriele Puppis
University of Udine, Italy
gabriele.puppis@uniud.it

Ola Svensson
EPFL, Lausanne, Switzerland
ola.svensson@epfl.ch

ACM Classification 2012
Theory of computation

ISBN 978-3-95977-322-5

Published online and open access by
Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at https://www.dagstuhl.de/dagpub/978-3-95977-322-5.

Publication date
July, 2024

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 https://portal.dnb.de.

Digital Object Identifier: 10.4230/LIPIcs.ICALP.2024.0

ISBN 978-3-95977-322-5 **ISSN 1868-8969** **https://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.

ISSN 1868-8969

https://www.dagstuhl.de/lipics

Contents

51st International Colloquium on Automata, Languages, and Programming (ICALP 2024).
Editors: Karl Bringmann, Martin Grohe, Gabriele Puppis, and Ola Svensson
Leibniz International Proceedings in Informatics
LIPICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Track B: Automata, Logic, Semantics, and Theory of Programming

Preface

This volume contains the papers presented at the *51st EATCS International Conference on Automata, Languages and Programming (**ICALP 2024**)*, held in Tallinn, Estonia, during July 8–12, 2024. ICALP is a series of annual conferences of the *European Association for Theoretical Computer Science (EATCS)*, which first took place in 1972. This year, ICALP was co-located with the 39th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS) and the 9th International Conference on Formal Structures for Computation and Deduction (FSCD).

The ICALP 2024 program consisted of two tracks:

Track A: Algorithms, Complexity, and Games

Track B: Automata, Logic, Semantics, and Theory of Programming

In response to the call for papers, a total of 519 eligible, anonymous submissions were received: 404 for Track A and 115 for Track B. The committees decided to accept 153 papers for inclusion in the scientific program: 119 papers for Track A and 34 for Track B. The selection was made by the program committees based on originality, quality, and relevance to theoretical computer science. The quality of the submissions was very high, and many deserving papers could not be selected.

The EATCS sponsored awards for both a best paper and a best student paper in each of the two tracks, selected by the program committees. The **best paper awards** were given to the following papers:

Track A: Yuda Feng and Shi Li. *A Note on Approximating Weighted Nash Social Welfare with Additive Valuations.*

Track B: Dmitry Chistikov, Alessio Mansutti, and Mikhail Starchak. *Integer Linear-Exponential Programming in NP by Quantifier Elimination.*

The **best student paper awards**, for papers that are solely authored by students, were given to the following papers:

Track A: Ce Jin and Hongxun Wu. *A Faster Algorithm for Pigeonhole Equal Sums.*

Track A: Kingsley Yung. *Limits of Sequential Local Algorithms on the Random k-XORSAT Problem.*

Track B: Roland Guttenberg. *Flattability of Priority Vector Addition Systems.*

ICALP 2024 included invited presentations by

- Anuj Dawar, University of Cambridge,
- Edith Elkind, University of Oxford (joint with LICS 2024),
- Danupon Nanongkai, MPI Saarbrücken,
- Merav Parter, Weizmann Institute,
- Stephanie Weirich, University of Pennsylvania (joint with LICS 2024 and FSCD 2024).

This volume contains all the contributed papers presented at the conference, and an abstract or paper accompanying some of the invited talks.

The program of ICALP 2024 also included presentations of

- the Gödel Prize 2024 (joint with ACM SIGACT) awarded to Ryan Williams (MIT) for the paper *Non-Uniform ACC Circuit Lower Bounds*: IEEE Conference on Computational Complexity (CCC) 2011. Journal of the ACM 61(1):1–32 (2014).
- the Alonzo Church Award 2024 (joint with LICS), awarded to Thomas Ehrhard (CNRS / IRIF) and Laurent Regnier (Université d'Aix-Marseille).

51st International Colloquium on Automata, Languages, and Programming (ICALP 2024).
Editors: Karl Bringmann, Martin Grohe, Gabriele Puppis, and Ola Svensson
Leibniz International Proceedings in Informatics
LIPICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

- the EATCS Award 2024 to Samson Abramsky (Department of Computer Science, Oxford University),
- the Presburger Award 2024, awarded jointly to Justin Hsu (Cornell University) and Pravesh Kothari (Princeton University).

The EATCS Distinguished Dissertation Award 2023 was awarded jointly to the following PhD dissertations:

- William Kuszmaul (MIT). *Randomized Algorithms that Achieve the Unexpected.*
- Nathan Klein (University of Washington). *Finding Structure in Entropy: Improved Approximation Algorithms for TSP and other Graph Problems.*
- Ruiwen Dong (University of Oxford). *Algorithmic Problems for Subsemigroups of Infinite Groups.*

There was also the announcement of the new EATCS Fellows for 2024, who are:

- Yossi Azar (Blavatnik School of Computer Science, Tel-Aviv University),
- Friedhelm Meyer auf der Heide (Heinz Nixdorf Institute and Department of Computer Science, Paderborn University).

The following workshops were held as satellite events of ICALP 2024, LICS 2024, and FSCD 2024 during July 6-9, 2024:

- Algorithmic Aspects of Temporal Graphs VII (AATG 2024)
- Geometric and Topological Methods in Computer Science (GETCO 2024)
- Intersection Types and Related Systems (ITRS 2024)
- International Workshop on Confluence (IWC 2024)
- Learning and Automata (LearnAut 2024)
- Logical Frameworks and Meta-Languages: Theory and Practice (LFMTP 2024)
- Logic Mentoring Workshop (LMW 2024)
- Mathematically Structured Functional Programming (MSFP 2024)
- Parameterized Approximation Algorithms Workshop (PAAW 2024)
- Parameterized Algorithms and Constraint Satisfaction (PACS 2024)
- Structure meets Power (SmP 2024)
- Trends in Arithmetic Theories (TAT 2024)
- Trends in Linear Logic and Applications (TLLA 2024)
- Women in Logic 2024

We wish to thank all authors who submitted extended abstracts for consideration, the program committees for their scholarly effort, and all the reviewers who assisted the program committees in the evaluation process.

We are very grateful to the Conference General Chair, Pawel Sobocinski, his colleagues from Tallinn University of Technology, and EATCS, for hosting ICALP 2024 in Tallinn.

Finally, we would like to thank Anca Muscholl, the Chair of the ICALP Steering Committee, for her continuous support, Artur Czumaj, the president of EATCS, for his generous advice on the organization of the conference, as well as the editorial office of LIPIcs for their support in editing these proceedings.

July 2024

Karl Bringmann
Martin Grohe
Gabriele Puppis
Ola Svensson

Organization

Program Committees

Track A

Nima Anari	Stanford University
Karl Bringmann (*co-chair*)	Saarland University
Parinya Chalermsook	Aalto University
Vincent Cohen-Addad	Google Research
Jose Correa	Universidad de Chile
Holger Dell	Goethe University Frankfurt
Ilias Diakonikolas	University of Wisconsin-Madison
Yuval Filmus	Technion
Arnold Filtser	Bar Ilan University
Naveen Garg	IIT Delhi
Pawel Gawrychowski	University of Wrocław
Anupam Gupta	Carnegie Mellon University
Samuel Hopkins	MIT
Sophie Huiberts	Columbia University
Giuseppe Italiano	LUISS University
Michael Kapralov	EPFL
Eun Jung Kim	Université Paris-Dauphine
Sándor Kisfaludi-Bak	Aalto University
Tomasz Kociumaka	Max-Planck-Institute for Informatics
Fabian Kuhn	University of Freiburg
Amit Kumar	IIT Delhi
William Kuszmaul	Harvard University
Rasmus Kyng	ETH Zurich
Kasper Green Larsen	Aarhus University
François Le Gall	Nagoya University
Pasin Manurangsi	Google Research
Daniel Marx	CISPA Helmholtz Center for Information Security
Yannic Maus	TU Graz
Nicole Megow	University of Bremen
Ruta Mehta	University of Illinois at Urbana-Champaign
Jakob Nordström	University of Copenhagen
Richard Peng	University of Waterloo
Seth Pettie	University of Michigan
Adam Polak	Bocconi University
Lars Rohwedder	Maastricht University
Eva Rotenberg	DTU Compute
Sushant Sachdeva	University of Toronto
Melanie Schmidt	University of Cologne
Sebastian Siebertz	University of Bremen
Shay Solomon	Tel Aviv University
Nick Spooner	University of Warwick

51st International Colloquium on Automata, Languages, and Programming (ICALP 2024).
Editors: Karl Bringmann, Martin Grohe, Gabriele Puppis, and Ola Svensson
Leibniz International Proceedings in Informatics
LIPICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Clifford Stein	Columbia University
Ola Svensson (*co-chair*)	EPFL
Luca Trevisan	Bocconi University
Ali Vakilian	Toyota Technological Institute Chicago
Jan van den Brand	Georgia Tech
Erik Jan van Leeuwen	Utrecht University
Oren Weimann	University of Haifa
Nicole Wein	University of Michigan
Andreas Wiese	TU Munich
John Wright	UC Berkeley

Track B

Arnold Beckmann	Swansea University
Manuel Bodirsky	TU Dresden
Patricia Bouyer	CNRS, LMF
Yijia Chen	Shanghai Jiao Tong University
Victor Dalmau	Universitat Pompeu Fabra
Laurent Doyen	CNRS, LMF
Marcelo Fiore	Cambridge University
Stefan Göller	University of Kassel
Martin Grohe (*chair*)	RWTH Aachen University
Sandra Kiefer	Oxford University
Aleks Kissinger	Oxford University
Bartek Klin	Oxford University
Antonin Kucera	Masaryk University Brno
Carsten Lutz	University of Leipzig
Jerzy Marcinkowski	University of Wrocław
Annabelle McIver	Macquaire University Sydney
Andrzej Murawski	Oxford University
Paweł Parys	University of Warsaw
Michał Pilipczuk	University of Warsaw
Joel Ouaknine	Max Planck Institute for Software Systems
Christian Riveros	Pontificia Universidad Catolica de Chile
Alexandra Silva	Cornell University
Balder ten Cate	ILLC Amsterdam
Szymon Toruńczyk	University of Warsaw
Igor Walukiewicz	CNRS, University of Bordeaux
Sarah Winter	IRIF, University Paris Cité
Georg Zetzsche	Max Planck Institute for Software Systems
Martin Ziegler	KAIST

Organizing Committee

Pawel Sobocinski (*chair*)	Tallinn University of Technology
Niccolò Veltri	Tallinn University of Technology
Amar Hadzihasanovic	Tallinn University of Technology
Fosco Loregian	Tallinn University of Technology
Matt Earnshaw	Tallinn University of Technology
Diana Kessler	Tallinn University of Technology
Ekaterina Zhuchko	Tallinn University of Technology
Kristi Ainen	Tallinn University of Technology

ICALP Steering Committee

Luca Aceto	Reykjavik University and Gran Sasso Science Institute, L'Aquila
Artur Czumaj	University of Warwick
Kousha Etessami	University of Edinburgh
Uriel Feige	Weizmann Institute
Sevag Gharibian	University of Paderborn
Thore Husfeldt (co-chair)	Lund University and IT University of Copenhagen
Anca Muscholl (chair)	University of Bordeaux
Luke Ong	NTU Singapore
Yuval Rabani	Hebrew University
Eva Rotenberg	DTU Compute
Paul Spirakis	University of Liverpool and University of Patras
Ola Svensson	EPFL

Financial Sponsors

We extend our gratitude to our generous sponsors for their support in ensuring the success of ICALP 2024:

External Reviewers

Anders Aamand
Mohammad Ali Abam
Amir Abboud
Mikkel Abrahamsen
Duncan Adamson
Deeksha Adil
Isolde Adler
Arpit Agarwal
Jungho Ahn
Michal Ajdarow
Hugo Akitaya
Hannaneh Akrami
Maryam Aliakbarpour
Shaull Almagor
Josh Alman
Jorge Almeida
Andris Ambainis
Afrouz Jabal Ameli
Omar Amer
Alexandr Andoni
Spyros Angelopoulos
Antonios Antoniadis
Simon Apers
Noel Arteche
Sepehr Assadi
Albert Atserias
Clément Aubert
Henry Austin
Per Austrin
Yossi Azar
Amir Azarmehr
Giorgio Bacci
Aras Bacho
Ainesh Bakshi
Nikhil Balaji
A. R. Balasubramanian
Sayan Bandyapadhyay
Kiril Bangachev
Kiarash Banihashem
Chris Barrett
Libor Barto
Mateusz Basiak
Nicolas Basset
Tugkan Batu
Pascal Baumann
Soheil Behnezhad
Amir Ben-Amram
Shalev Ben-David
Omri Ben-Eliezer
Huck Bennett
Matthias Bentert
Ioana Bercea
Benjamin Bergougnoux
Sebastian Berndt
Aaron Bernstein
Raphaël Berthon
Dietmar Berwanger
Alexis Bes
Amey Bhangale
Koustav Bhanja
Umang Bhaskar
Aditya Bhaskara
Anup Bhattacharya
Sayan Bhattacharya
Sujoy Bhore
Marcin Bienkowski
Laurent Bienvenu
Davide Bilò
Andreas Björklund
Jannis Blauth
Joakim Blikstad
Michael Blondin
Achim Blumensath
Markus Bläser
Thomas Bläsius
Greg Bodwin
Jan Bok
Udi Boker
Benedikt Bollig
Ilario Bonacina
Itai Boneh
Benjamin Bordais
Vitor Bosshard
Nicolas Bousquet
Joshua Brakensiek
Marco Bressan
Marcin Briański
Adam Brown
Frederik Brüning
Niv Buchbinder
Moritz Buchem
Maike Buchin
Peter Buergisser
Mark Bun
Jaroslaw Byrka
Kristóf Bérczi
Karthik C. S.
Michaël Cadilhac
Rutger Campbell
Clément Canonne
Ioannis Caragiannis
Arnaud Carayol
Antonio Casares
Arnaud Casteigts
Javier Cembrano
Ruoxu Cen
Jérémie Chalopin
Timothy M. Chan
Karthekeyan Chandrasekaran
Hsien-Chih Chang
Yi-Jun Chang
Panagiotis Charalampopoulos
Witold Charatonik
Krishnendu Chatterjee
Eshan Chattopadhyay
Vaggos Chatziafratis
Bhaskar Ray Chaudhury
Shiri Chechik
Jingbang Chen
Justin Chen
Kuancheng Chen
Li Chen
Yu Chen
Zongchen Chen
Ashish Chiplunkar
Rajesh Chitnis
Eden Chlamtac
Valerio Cini
Emily Clement
Lorenzo Clemente
Raphael Clifford
Christian Coester
Edith Cohen
Sarel Cohen
Amin Coja-Oghlan
Jonas Conneryd
Jonathan Conroy
Alex Conway

Martin Costa
Manuel Cáceres
Clément Dallard
Samir Datta
Max Deppert
Michael Dinitz
Michal Dory
Ran Duan
Paul Duetting
Julien Duron
Nico Döttling
Talya Eden
Eduard Eiben
Marek Elias
Ehsan Emamjomeh-Zadeh
Matthias Englert
Thomas Erlebach
Alireza Farhadi
Moran Feldman
Santiago Figueira
Simon D. Fink
Nick Fischer
Jacob Focke
András Frank
Daniele Friolo
Nicola Galesi
Yu Gao
Stéphane Gaubert
Guillaume Genestier
Frederik Geth
Yassine Ghannane
Suprovat Ghoshal
Ludmila Glinskih
Jesse Goodman
Mayank Goswami
Fabrizio Grandoni
Nathan Grosshans
Manoj Gupta
Waldo Gálvez
Serge Haddad
Lianna Hambardzumyan
Sariel Har-Peled
Koyo Hayashi
Markus Hecher
Danny Hermelin
Lukas Hintze
Petr Hlineny
Jędrzej Hodor

Bruno Courcelle
Rajni Dabas
Rathish Das
Niel De Beaudrap
Josee Desharnais
Yann Disser
Jan Dreier
Aditi Dudeja
Fabien Dufoulon
Pranjal Dutta
Anita Dürr
Klim Efremenko
Kord Eickmeyer
Michael Elkin
Jacopo Emmenegger
David Eppstein
Rolf Fagerberg
John Fearnley
Cristina Fernandes
Nathanaël Fijalkow
Bernd Finkbeiner
Noah Fleming
Florent Foucaud
Cody Freitag
Ameet Gadekar
Arnab Ganguly
Mohit Garg
Floris Geerts
Colin Geniet
Nadim Ghaddar
Surendra Ghentiyala
George Giakkoupis
Shay Golan
Gramoz Goranci
Themistoklis Gouleakis
Daniel Graça
Yuzhou Gu
Siddharth Gupta
Andreas Göbel
Magnús M. Halldórsson
Thekla Hamm
Tim A. Hartmann
Meng He
Reiko Heckel
D. Ellis Hershkowitz
Edward A. Hirsch
Duc A. Hoang
Ruben Hoeksma

Wojciech Czerwiński
Marcel Dall'Agnol
Shagnik Das
Adela DePavia
Martin Dietzfelbinger
Sally Dong
Marina Drygala
Bartlomiej Dudek
Vida Dujmovic
Simon Döring
Franziska Eberle
Charilaos Efthymiou
Friedrich Eisenbrand
Jonas Ellert
Christian Engels
Leah Epstein
Chenglin Fan
Sándor Fekete
Hendrik Fichtenberger
Omrit Filtser
Eldar Fischer
Krzysztof Fleszar
Emily Fox
Zachary Friggstad
Yotam Gafni
Ruiquan Gao
Leszek Gasieniec
Ran Gelles
Evangelia Gergatsouli
Mehrdad Ghadiri
Arka Ghosh
Amin Shiraz Gilani
Petr Golovach
Egor Gorbachev
Dishant Goyal
Joshua Grochow
Quentin Guilmant
Mohit Jayanti Gurumukhani
Inge Li Gørtz
Sean Hallgren
Kathrin Hanauer
Vojtech Havlicek
Qizheng He
Irene Heinrich
Karl Heuer
Richard Hladík
Matty Hoban
Charlotte Hoffmann

Piotr Hofman
Gary Hoppenworth
Pavel Hrubes
Brice Huang
Christopher Hugenroth
Tanmay Inamdar
Palak Jain
Ragesh Jaiswal
Petr Jancar
Klaus Jansen
Haotian Jiang
Yonggang Jiang
Ziyang Jin
Tobias Kaiser
John Kallaugher
Amin Karamlou
Sushrut Karmalkar
Joost-Pieter Katoen
Leon Kellerhals
Sanjeev Khanna
Robbie King
David Klaška
Boris Klemz
Katharina Klost
Alexander Knop
Yusuke Kobayashi
Jochen Koenemann
Hanna Komlos
Vasilis Kontonis
Tuukka Korhonen
Ivan Adrian Koswara
Matt Kovacs-Deak
Wiktor Kuchta
Shubhang Kulkarni
Andrey Kupavskii
O-Joung Kwon
Noleen Köhler
Bundit Laekhanukit
Martin Lange
Alexandra Lassota
Hung Le
Engel Lefaucheux
Jérôme Leroux
Asaf Levin
Bo Li
Jingwei Li
Shi Li
Yong Li

Felix Hommelsheim
Pierre Hosteins
Jun-Ting Hsieh
Chien-Chung Huang
Mikael Møller Høgsgaard
Radu Iosif
Pallavi Jain
Manuel Jakob
Wojciech Janczewski
Rajesh Jayaram
Shaofeng H.-C. Jiang
Ce Jin
Antoine Joux
Naonori Kakimura
Makoto Kanazawa
Neel Karia
Petteri Kaski
Telikepalli Kavitha
Dominik Kempa
Emanuel Kieronski
Evangelos Kipouridis
Pieter Kleer
Denis Kleyko
Alexander Knapp
Dušan Knop
Laura Vargas Koch
Gillat Kol
Christian Komusiewicz
Swastik Kopparty
Maria Kosche
Raoul Koudijs
Laszlo Kozma
Ariel Kulik
Mrinal Kumar
Greg Kuperberg
Jan Kynčl
Oded Lachish
Victor Lagerkvist
John Lapinskas
Rustam Latypov
Euiwoong Lee
Karoliina Lehtinen
Amit Levi
Roie Levin
Huan Li
Lawrence Li
Wenzheng Li
Yuhao Li

Chih-Duo Hong
Mathieu Hoyrup
Sihuang Hu
Neng Huang
Hannes Ihalainen
Taisuke Izumi
Rhea Jain
Arun Jambulapati
Duri Andrea Janett
Artur Jeż
Shunhua Jiang
Wenyu Jin
Marcin Jurdzinski
Iden Kalemaj
Ahmet Kara
Toghrul Karimov
Adam Kasperski
Phillip Keldenich
Arindam Khan
Zachary Kincaid
Peter Kiss
Kim-Manuel Klein
Max Klimm
Paul Knappe
Jakob Bæk Tejs Knudsen
Florent Koechlin
Ilan Komargodski
Athanasios Konstantinidis
Viktoriia Korchemna
Evangelos Kosinas
Martin Koutecky
Andrei Krokhin
Pooja Kulkarni
Nikhil Kumar
Martin Kurečka
Chris Köcher
Aditi Laddha
Michael Lampis
Alberto Larrauri
Michel Laurent
Jasper C.H. Lee
Christophe Lenté
Reut Levi
Nathan Lhote
Jason Li
Ray Li
Xingjian Li
Ya-Chun Liang

Jyun-Jie Liao
Ting-Chun Lin
Chun-Hung Liu
Siyue Liu
Yupan Liu
Guang Hao Low
Will Ma
James C. A. Main
Frederik Mallmann-Trenn
Richard Mandel
Mathieu Mari
Corto Mascle
Davide Mazzali
Simon Meierhans
Darya Melnyk
Andras Meszaros
Joseph Mitchell
Matthias Mnich
Benjamin Monmege
Tomoyuki Morimae
Amer Mouawad
Shay Mozes
Sayan Mukherjee
Aniket Murhekar
Tobias Mömke
Chaitanya Nalam
Anand Natarajan
Yasamin Nazari
Yakov Nekrich
Stefan Neumann
Hoai-An Nguyen
Joris Nieuwveld
Nicolas Nisse
André Nusser
Jack O'Connor
Eunjin Oh
Yoshio Okamoto
Tim Ophelders
Ly Orgo
Hussien Othman
Max Ovsiankin
Ioannis Panageas
Debmalya Panigrahi
Sewon Park
Dhrumil Patel
Angelos Pelecanos
Will Perkins
Giovanni Pighizzini
Bingkai Lin
Alexander Lindermayr
Mingmou Liu
Yang Liu
William Lochet
Xinhang Lu
Matthew Maat
Konstantin Makarychev
Guillaume Malod
Quentin Manière
Nicolas Markey
Elvira Mayordomo
Fionn Mc Inerney
Johannes Meintrup
Arturo Merino
Raphael Meyer
Parth Mittal
Sidhanth Mohanty
Fabrizio Montecchiani
Pat Morin
David Mount
Anna Mpanti
Tamalika Mukherjee
Anca Muscholl
Shivam Nadimpalli
Mikito Nanashima
Bento Natura
Jesper Nederlof
Daniel Neuen
Alantha Newman
Huy Nguyen
Milos Nikolic
Damian Niwinski
Pranav Nuti
Maciej Obremski
Pierre Ohlmann
Neil Olver
Michal Opler
George Osipov
Sang-il Oum
Joseph Paat
Anurag Pandey
Fahad Panolan
Nikos Parotsidis
Shyamal Patel
Vincent Penelle
Daniela Petrisan
Jakob Piribauer
Tao Lin
Allen Liu
Sihan Liu
Yanyi Liu
Bruno Loff
Christof Löding
Andreas Maggiori
Yury Makarychev
Nikhil Mande
Naren Manoj
Barnaby Martin
Filip Mazowiecki
Andrew McGregor
Nikolaos Melissinos
Ian Mertz
Pranabendu Misra
Masayuki Miyamoto
Hendrik Molter
Ryuhei Mori
Ron Mosenzon
Tamer Mour
Anish Mukherjee
Wolfgang Mulzer
Richard Mycroft
Viswanath Nagarajan
Shyam Narayanan
Inbal Livni Navon
Ofer Neiman
Eike Neumann
Hung Ngo
Lê Thành Dũng Nguyễn
Chinmay Nirkhe
Jakob Nogler
Zeev Nutov
Andy Oertel
Argyris Oikonomou
Tim Oosterwijk
Jakub Opršal
Piotr Ostropolski-Nalewaja
Xiating Ouyang
Alexandru Paler
Shuo Pang
Irene Parada
Anat Paskin-Cherniavsky
Ami Paz
Binghui Peng
Canh Pham
Maciej Piróg

Thanasis Pittas
Piotr Polesiuk
Aaron Potechin
Maximilian Probst
Manish Purohit
Luowen Qian
Ritam Raha
Fariba Ranjbar
Abhishek Rathod
Victor Oliveira Reis
Tatiana Rocha Avila
Dana Ron
Peter Rossmanith
Aviad Rubinstein
Janosch Ruff
Paweł Rzążewski
Kunihiko Sadakane
Mohammad Salavatipour
Sylvain Salvati
Ramprasad Saptharishi
Igal Sason
Rahul Savani
Kevin Schewior
Jens Schlöter
Daniel R. Schmidt
Pascal Schweitzer
Lia Schütze
Peter Selinger
Liren Shan
Alexander Sherstov
Xinkai Shu
Sebastian Siebertz
Abhishek Kr Singh
George Skretas
Dmitry Sokolov
Mehdi Soleimanifar
Thomas Soullard
Daniel Stefankovic
Hsin-Hao Su
Warut Suksompong
Varun Suriyanarayana
John Sylvester
Ewin Tang
Andrzej Tarlecki
Viet Cuong Than
K. S. Thejaswini
Mikkel Thorup
Kabir Tomer

Madhusudhan Reddy Pittu
Gleb Polevoy
Amaury Pouly
Kirk Pruhs
David Purser
Akbar Rafiey
Vijayaragunathan Ramamoorthi
Sujit Rao
Kavya Ravichandran
Kilian Risse
Liam Roditty
Will Rosenbaum
Jurriaan Rot
Mikhail Rudoy
Zhang Ruilong
Heiko Röglin
Irmak Saglam
Ville Salo
Arnaud Sangnier
Thatchaphol Saranurak
David Saulpic
Philipp Schepper
Šimon Schierreich
Markus L. Schmid
Sylvain Schmitz
Chris Schwiegelshohn
Adam Sealfon
Mark Sellke
Changpeng Shao
Kshiteej Sheth
Sudarshan Shyam
Jamie Sikora
Apoorv Vikram Singh
Michał Skrzypczak
Marek Sokołowski
Zhuoqing Song
Karteek Sreenivasaiah
Rafał Stefański
Sathyawageeswar Subramanian
Aurelio Sulser
Akira Suzuki
Toru Takisaka
Xueyan Tang
Jakub Tarnawski
Sharma V. Thankachan
Anthony Thomas
Cong Tian
Csaba Toth

Vladimir Podolskii
Tristan Pollner
John Power
Krišjānis Prūsis
Edward Pyne
Sharath Raghvendra
C Ramya
Jean-Francois Raskin
Vojtech Rehak
Peter Robinson
Mohammad Roghani
Benjamin Rossman
Arman Rouhani
Atri Rudra
Ignaz Rutter
Karthik C. S.
Jared Saia
Kai Salomaa
Raimundo Saona Urmeneta
Ankita Sarkar
Saket Saurabh
Sven Schewe
Aaron Schild
Todd Schmid
Jason Schoeters
Stefan Schwoon
Igor Sedlar
Rik Sengupta
Eklavya Sharma
Devansh Shringi
Anastasios Sidiropoulos
Kirill Simonov
Mohit Singh
Friedrich Slivovsky
Federico Soldà
José A. Soto
Aleksa Stankovic
Donald Stull
Ondrej Suchy
Xiaorui Sun
Chaitanya Swamy
Zihan Tan
Erasmo Tani
Sébastien Tavenas
Neil Thapen
Clayton Thomas
Konstantin Tikhomirov
Noam Touitou

Vera Traub
Ta-Wei Tu
Marc Uetz
Mihir Vahanwala
Virginia Vassilevska Williams
Moritz Venzin
José Verschae
Emmanouil Vlatakis
Thuy Duong Vuong
Jana Wagemaker
David Wajc
Stefan Walzer
Qisheng Wang
Rémi Watrigant
Alex Wein
Leo Wennmann
Sebastian Wiederrecht
Virginia Vassilevska Williams
Sampson Wong
Michał Wrona
Xudong Wu
Michalis Xefteris
Haifeng Xu
Jie Xue
Yongjie Yang
Penghui Yao
Taisuke Yasuda
Longhui Yin
Emre Yolcu
Huacheng Yu
Konstantin Zabarnyi
Chenyi Zhang
Hengjie Zhang
Ruizhe Zhang
Yibin Zhao
Weiqiang Zheng
Peilin Zhong
Samson Zhou
Marius Zimand
Goran Zuzic
Ronald de Haan
Jesse van Rhijn
Thijs van der Horst
Kenny Štorgel

Gilles Tredan
Malte Tutas
Jara Uitto
Manlio Valenti
Daniel Vaz
Oleg Verbitsky
Alexandre Vigny
Tjark Vredeveld
László Végh
Friedrich Wagner
Bartosz Walczak
Daochen Wang
Zhaozi Wang
Adam Bene Watts
Omri Weinstein
Klaus Wich
Marcus Wilhelm
Karl Wimmer
David R. Wood
Kaiyu Wu
Karol Węgrzycki
Zoe Xi
Yinzhan Xu
Anshu Yadav
Tal Yankovitz
Geva Yashfe
Guanghao Ye
Yitong Yin
Youngho Yoo
Nengkun Yu
Nikos Zarifis
Daniel Zhang
Peng Zhang
Tianyi Zhang
Yiming Zhao
Chenyang Zhong
Hang Zhou
Pawel Zielinski
Alexander Zlokapa
Uri Zwick
Ronald de Wolf
Geert van Wordragen
Tom van der Zanden
Stanislav Živný

Elias Tsigaridas
Nikos Tzevelekos
Seeun William Umboh
Pierre Vandenhove
Yde Venema
Victor Verdugo
Marc Vinyals
Hoa Vu
Maximilian Vötsch
Erik Waingarten
Nathan Wallheimer
Di Wang
Julian Wargalla
Hao-Ting Wei
Philip Wellnitz
Piotr Wieczorek
Gunnar Wilken
Petra Wolf
Marcin Wrochna
Xuan Wu
Michał Włodarczyk
Chao Xu
Zixuan Xu
Takashi Yamakawa
Mihalis Yannakakis
Reem Yassawi
Mingquan Ye
Sorrachai Yingchareonthawornchai
Yuichi Yoshida
Yuancheng Yu
Rico Zenklusen
Fred Zhang
Rachel Zhang
Yuhao Zhang
Da Wei Zheng
Mingxian Zhong
Renfei Zhou
Wieslaw Zielonka
Wiktor Zuba
Mark de Berg
Franck van Breugel
Ivor van der Hoog
Aleksander Łukasiewicz

List of Authors

Fateme Abbasi (5, 6)
University of Wrocław, Poland

Elie Abboud (7)
Department of Computer Science,
University of Haifa, Israel

Pritam Acharya (8)
Department of Mathematics, Indian Institute of Science Education and Research Pune, India

Rohan Acharya (124)
University of Warwick, Coventry, UK

Marek Adamczyk (5)
University of Wrocław, Poland

C. Aiswarya (125)
Chennai Mathematical Institute, India;
CNRS, ReLaX, IRL 2000, Chennai, India

Shyan Akmal (9)
MIT, EECS and CSAIL, Cambridge, MA, USA

Emile Anand (10)
Caltech, Pasadena, CA, USA

Konrad Anand (11)
School of Mathematical Sciences, Queen Mary University of London, London, UK

Noel Arteche (12)
Lund University, Sweden;
University of Copenhagen, Denmark

Srinivasan Arunachalam (13)
IBM Quantum, Thomas J Watson Research Center, Yorktown Heights, NY, USA

Vikraman Arvind (14)
The Institute of Mathematical Sciences (HBNI), Chennai, India;
Chennai Mathematical Institute, Siruseri, Kelambakkam, India

Yossi Azar (15)
School of Computer Science,
Tel Aviv University, Israel

Sandip Banerjee (6)
IDSIA, USI-SUPSI, Lugano, Switzerland

Omkar Baraskar (16)
University of Waterloo, Canada

Surender Baswana (17)
Department of Computer Science & Engineering, IIT Kanpur, India

MohammadHossein Bateni (18)
Google Research, New York, NY, USA

Pascal Baumann (126)
Max Planck Institute for Software Systems (MPI-SWS), Kaiserslautern, Germany

Soheil Behnezhad (19, 121)
Northeastern University, Boston, MA, USA

Djamal Belazzougui (20)
CAPA, DTISI, Centre de Recherche sur l'Information Scientifique et Technique, Algiers, Algeria

Shalev Ben-David (21)
Institute for Quantum Computing, University of Waterloo, Canada

Michael Benedikt (127)
University of Oxford, UK

Massimo Benerecetti (128)
Università di Napoli Federico II, Italy

Matthias Bentert (22)
University of Bergen, Norway

Koustav Bhanja (17)
Department of Computer Science & Engineering, IIT Kanpur, India

Somnath Bhattacharjee (24)
Chennai Mathematical Institute, India

Chiranjib Bhattacharyya (25)
Department of Computer Science and Automation, Indian Institute of Science, Bangalore, India

Sujoy Bhore (8)
Department of Computer Science and Engineering, Indian Institute of Technology Bombay, India

Andreas Björklund (26)
IT University of Copenhagen, Denmark

Manon Blanc (129)
Institut Polytechnique de Paris, Ecole Polytechnique, LIX, 91128 Palaiseau Cedex, France;
Université Paris-Saclay, LISN, 91190 Gif-sur-Yvette, France

Markus Bläser (24)
Saarland University, Saarland Informatics Campus, Saarbrücken, Germany

51st International Colloquium on Automata, Languages, and Programming (ICALP 2024).
Editors: Karl Bringmann, Martin Grohe, Gabriele Puppis, and Ola Svensson
Leibniz International Proceedings in Informatics
LIPICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Greg Bodwin (27, 28)
Computer Science and Engineering, University of Michigan, Ann Arbor, MI, USA

Mikołaj Bojańczyk (130)
University of Warsaw, Poland

Narek Bojikian (29)
Humboldt-Universität zu Berlin, Germany

Itai Boneh (30)
Reichman University, Herzliya, Israel; University of Haifa, Israel

Édouard Bonnet (31)
Univ Lyon, CNRS, ENS de Lyon, Université Claude Bernard Lyon 1, LIP UMR5668, France

Michaela Borzechowski (32)
Department of Mathematics and Computer Science, Freie Universität Berlin, Germany

Miguel Bosch-Calvo (5)
IDSIA, USI-SUPSI, Lugano, Switzerland

Marin Bougeret (33)
LIRMM, Université de Montpellier, CNRS, France

Olivier Bournez (129)
Institut Polytechnique de Paris, Ecole Polytechnique, LIX, 91128 Palaiseau Cedex, France

Laura Bozzelli (128)
Università di Napoli Federico II, Italy

Jarosław Byrka (5, 6)
University of Wrocław, Poland

Kristóf Bérczi (23)
MTA-ELTE Matroid Optimization Research Group and HUN-REN-ELTE Egerváry Research Group, Department of Operations Research, Eötvös Loránd University, Budapest, Hungary

Barış Can Esmer (34)
CISPA Helmholtz Center for Information Security, Saarbrücken, Germany; Saarbrücken Graduate School of Computer Science, Saarland Informatics Campus, Germany

Arnaud Carayol (131)
Univ Gustave Eiffel, CNRS, LIGM, F-77454 Marne-la-Vallée, France

Charlie Carlson (35)
Department of Computer Science, University of California Santa Barbara, CA, USA

Maxime Cautrès (36)
Université Grenoble Alpes, CEA-Léti, F-38054 Grenoble, France; École Normale Supérieure de Lyon, F-69007 Lyon, France

Keren Censor-Hillel (37)
Department of Computer Science, Technion, Haifa, Israel

Parinya Chalermsook (6, 38)
Aalto University, Finland

Karthekeyan Chandrasekaran (23)
University of Illinois, Urbana-Champaign, IL, USA

Panagiotis Charalampopoulos (39)
School of Computing and Mathematical Sciences, Birkbeck, University of London, UK

Lucien Charamond (131)
Univ Gustave Eiffel, CNRS, LIGM, F-77454 Marne-la-Vallée, France

Shiri Chechik (40, 41, 42)
Tel Aviv University, Israel

Chung Shue Chen (43)
Nokia Bell Labs, Nozay, France

Junjie Chen (44)
City University of Hong Kong, Hong Kong, China

Li Chen (45)
Carnegie Mellon University, Pittsburgh, PA, USA

Yu Chen (46, 47)
EPFL, Lausanne, Switzerland

Dmitry Chistikov (132)
Centre for Discrete Mathematics and its Applications (DIMAP) & Department of Computer Science, University of Warwick, Coventry, UK

Nathan Claudet (36)
Inria Mocqua, LORIA, CNRS, Université de Lorraine, F-54000 Nancy, France

Andrei Constantinescu (48)
ETH Zürich, Switzerland

Mónika Csikós (49)
Université Paris Cité, IRIF, CNRS UMR 8243 and DI-ENS, Université PSL, France

Artur Czumaj (50)
Department of Computer Science, University of Warwick, Coventry, UK

Clément Dallard (51)
Department of Informatics, University of Fribourg, Switzerland

Mohan Dantam (133)
School of Informatics, University of Edinburgh, UK

Ewan Davies (35)
Department of Computer Science, Colorado State University, Fort Collins, CO, USA

Sami Davies (52)
Department of EECS and Simons Institute, University of California at Berkeley, CA, USA

Anuj Dawar (1)
Department of Computer Science and Technology, University of Cambridge, UK

Arthur Azevedo de Amorim (157)
Rochester Institute of Technology, NY, USA

Élie de Panafieu (43)
Nokia Bell Labs, Nozay, France

Tijn de Vos (58)
Department of Computer Science, University of Salzburg, Austria

Argyrios Deligkas (53)
Department of Computer Science, Royal Holloway, University of London, Egham, UK

Holger Dell (54)
Goethe University Frankfurt, Germany; IT University of Copenhagen and Basic Algorithms Research Copenhagen (BARC), Denmark

Chengyuan Deng (27)
Department of Computer Science, Rutgers University, Piscataway, NJ, USA

Agrim Dewan (16)
Indian Institute of Science, Bengaluru, India

Laxman Dhulipala (18)
University of Maryland, College Park, MD, USA

Konstantinos Dogeas (55)
Department of Computer Science, Durham University, UK

Ilan Doron-Arad (56, 57)
Computer Science Department, Technion, Haifa, Israel

Michal Dory (58)
University of Haifa, Israel

Amina Doumane (135)
Plume, LIP, CNRS, ENS de Lyon, France

Pål Grønås Drange (22)
University of Bergen, Norway

Aditi Dudeja (59)
University of Salzburg, Austria

Julien Duron (31)
Univ Lyon, CNRS, ENS de Lyon, Université Claude Bernard Lyon 1, LIP UMR5668, France

Arkopal Dutt (13)
IBM Quantum, IBM Research Cambridge, MA, USA

Pranjal Dutta (24)
School of Computing, National University of Singapore, Singapore

Julian Dörfler (134)
Saarland Informatics Campus (SIC), Saarbrücken Graduate School of Computer Science, Saarland University, Germany

Talya Eden (60)
Department of Computer Science, Bar-Ilan University, Ramat-Gan, Israel

Eduard Eiben (53)
Department of Computer Science, Royal Holloway, University of London, Egham, UK

Edith Elkind (2)
University of Oxford, UK; Alan Turing Institute, London, UK

Thomas Erlebach (55)
Department of Computer Science, Durham University, UK

Francisco Escudero Gutiérrez (13)
CWI & QuSoft, Amsterdam, The Netherlands

Tomer Even (37)
Department of Computer Science, Technion, Haifa, Israel

John Fearnley (32)
Department of Computer Science, University of Liverpool, UK

Andreas Emil Feldmann (61)
Department of Computer Science, University of Sheffield, UK

Weiming Feng (11, 62)
Institute for Theoretical Studies, ETH Zürich, Switzerland

Yuda Feng (63)
Department of Computer Science and Technology, Harbin Institute of Technology, Heilongjiang, China

Nick Fischer (64)
Weizmann Institute of Science, Rehovot, Israel

Cella Florescu (65)
ETH Zürich, Switzerland

Jacob Focke (34)
CISPA Helmholtz Center for Information Security, Saarbrücken, Germany

Fedor V. Fomin (22, 51)
University of Bergen, Norway

Sebastian Forster (58)
Department of Computer Science, University of Salzburg, Austria

Florent Foucaud (66)
Université Clermont Auvergne, CNRS, Mines Saint-Étienne, Clermont Auvergne INP, LIMOS, 63000 Clermont-Ferrand, France

Graham Freifeld (11)
School of Informatics, University of Edinburgh, UK

Yuxi Fu (136)
BASICS, Shanghai Jiao Tong University, China

Marco Gaboardi (157)
Boston University, MA, USA

Ameet Gadekar (6)
Bar-Ilan University, Ramat-Gan, Israel

Jakub Gajarský (137)
University of Warsaw, Poland

Esther Galby (66, 67)
Department of Computer Science and Engineering, Chalmers University of Technology, Gothenburg, Sweden;
University of Gothenburg, Sweden

Paul Gallot (138)
Universität Bremen, Germany

Robert Ganian (53, 68)
Algorithms and Complexity Group, TU Wien, Austria

Guichen Gao (50)
School of Computer Science, Peking University, Beijing, China

Jie Gao (27)
Department of Computer Science, Rutgers University, Piscataway, NJ, USA

Serge Gaspers (69)
UNSW Sydney, Australia

Paweł Gawrychowski (39)
Institute of Computer Science, University of Wrocław, Poland

Mehrdad Ghadiri (10)
MIT, Cambridge, MA, USA

Sevag Gharibian (70)
Department of Computer Science and Institute for Photonic Quantum Systems (PhoQS), Paderborn University, Germany

Samah Ghazawi (39)
Department of Computer Science, University of Haifa, Israel;
Department of Software Engineering, Braude, College of Engineering, Karmiel, Israel

Prantar Ghosh (71)
Georgetown University, Washington, DC, USA

Yiannis Giannakopoulos (72)
School of Computing Science, University of Glasgow, UK

Matan Gilboa (73)
University of Oxford, UK

Raphael Douglas Giles (139)
The University of Melbourne, Australia

Shay Golan (30)
Reichman University, Herzliya, Israel;
University of Haifa, Israel

Guy Goldberg (74)
Weizmann Institute of Science, Rehovot, Israel

Petr A. Golovach (22, 51)
University of Bergen, Norway

Spencer Gordon (32)
Department of Computer Science, University of Liverpool, UK

Kishen N. Gowda (18)
University of Maryland, College Park, MD, USA

Fabrizio Grandoni (5)
IDSIA, USI-SUPSI, Lugano, Switzerland

Lucas Gretta (75)
University of California, Berkeley, CA, USA

Mario Grobler (76)
University of Bremen, Germany

Carla Groenland (77)
Delft Institute of Applied Mathematics, The Netherlands

Martin Grohe (78)
RWTH Aachen University, Germany

Alexander Grosz (72)
School of Computation, Information and Technology, Technical University of Munich, Germany

Quentin Guilmant (140)
Max Planck Institute for Software Systems, Saarland Informatics Campus, Saarbrücken, Germany

Heng Guo (11, 62)
School of Informatics,
University of Edinburgh, UK

Aaryan Gupta (8)
Department of Computer Science and Engineering, Indian Institute of Technology Bombay, India

Manoj Gupta (38)
IIT Gandhinagar, India

Leonid Gurvits (79)
City College New York, NY, USA

Maximilian Probst Gutenberg (65)
ETH Zürich, Switzerland

Roland Guttenberg (141, 156)
Technical University of Munich, Germany

Daniel Găină (143)
Kyushu University, Fukuoka, Japan

Christoph Haase (142)
Department of Computer Science,
University of Oxford, UK

Mohammad T. HajiAghayi (80)
University of Maryland,
College Park, MD, USA

Sariel Har-Peled (81)
Department of Computer Science, University of Illinois, Urbana, IL, USA

Elfarouk Harb (81)
Department of Computer Science, University of Illinois, Urbana, IL, USA

Go Hashimoto (143)
Kyushu University, Fukuoka, Japan

Hamed Hatami (82)
School of Computer Science, McGill University, Montreal, Canada

Klaus Heeger (83)
Department of Industrial Engineering and Management, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Sophia Heimann (84)
Research Institute for Discrete Mathematics, University of Bonn, Germany

Diptarama Hendrian (89)
Tokyo Medical and Dental University, Japan

Danny Hermelin (83)
Department of Industrial Engineering and Management, Ben-Gurion University of the Negev, Beer-Sheva, Israel

D. Ellis Hershkowitz (18)
Brown University, Providence, RI, USA

Shuichi Hirahara (85)
National Institute of Informatics, Tokyo, Japan

Hung P. Hoang (84)
Algorithms and Complexity Group,
Faculty of Informatics, TU Wien, Austria

Gary Hoppenworth (27, 28)
Computer Science and Engineering, University of Michigan, Ann Arbor, MI, USA

Kaave Hosseini (82)
Department of Computer Science, University of Rochester, NY, USA

Stefan Hougardy (84)
Research Institute for Discrete Mathematics and Hausdorff Center for Mathematics, University of Bonn, Germany

Kevin Hua (87)
University of Michigan, Ann Arbor, MI, USA

Samuel Humeau (135)
Plume, LIP, CNRS, ENS de Lyon, France

Florian Hörsch (86)
Algorithms and Complexity Group, CISPA, Saarbrücken, Germany

Tomohiro I (89)
Kyushu Institute of Technology, Japan

Christian Ikenmeyer (134)
University of Warwick, Coventry, UK

András Imolay (86)
MTA-ELTE Matroid Optimization Research Group, Department of Operations Research, ELTE Eötvös Loránd University, Budapest, Hungary

Tanmay Inamdar (88)
Indian Institute of Technology Jodhpur, India

Kento Iseri (89)
Kyushu Institute of Technology, Japan

Vincent Jackson (139)
The University of Melbourne, Australia

Pallavi Jain (88)
Indian Institute of Technology Jodhpur, India

Bart M. P. Jansen (33)
Eindhoven University of Technology, The Netherlands

Rajesh Jayaram (18, 90)
Google Research, New York, NY, USA

Agastya Vibhuti Jha (91)
École polytechnique fédérale de Lausanne, Switzerland

Wanchote Jiamjitrak (38)
University of Helsinki, Finland

Shaofeng H.-C. Jiang (50, 92)
School of Computer Science, Peking University, Beijing, China

Ce Jin (93, 94)
MIT, Cambridge, MA, USA

Pushkar S. Joglekar (14)
Vishwakarma Institute of Technology, Pune, India

Marcin Jurdziński (124)
University of Warwick, Coventry, UK

Frank Kammer (55)
THM, University of Applied Sciences Mittelhessen, Gießen, Germany

Jonas Kamminga (70)
Department of Computer Science and Institute for Photonic Quantum Systems (PhoQS), Paderborn University, Germany

Iyad Kanj (53)
School of Computing, DePaul University, Chicago, IL, USA

Ravindran Kannan (25)
Department of Operations Research, Carnegie Mellon University, Pittsburgh, USA

Haim Kaplan (120)
Tel Aviv University, Israel

Michael Kapralov (46, 93)
EPFL, Lausanne, Switzerland

Adam Karczmarz (95)
University of Warsaw, Poland;
IDEAS NCBR, Warsaw, Poland

Petteri Kaski (26)
Aalto University, Finland

Yasushi Kawase (96)
University of Tokyo, Japan

Pavol Kebis (144)
Department of Computer Science, University of Oxford, UK

Peter Keevash (43)
Mathematical Institute, University of Oxford, UK

George Kenison (145)
School of Computer Science and Mathematics, Liverpool John Moores University, UK

Sean Kennedy (43)
Nokia Bell Labs, Ottawa, Canada

Yotam Kenneth (97)
Weizmann Institute of Science, Rehovot, Israel

Eren Keskin (126)
TU Braunschweig, Germany

Arindam Khan (8)
Department of Computer Science and Automation, Indian Institute of Science Bengaluru, India

Erfan Khaniki (12)
Institute of Mathematics of the Czech Academy of Sciences, Prague, Czech Republic

Sanjeev Khanna (98)
School of Engineering and Applied Sciences, University of Pennsylvania, Philadelphia, PA, USA

Liana Khazaliya (66)
Technische Universität Wien, Austria

Kamyar Khodamoradi (6)
University of Regina, Canada

Sandra Kiefer (156)
University of Oxford, UK

Tamás Király (23)
MTA-ELTE Matroid Optimization Research Group and HUN-REN-ELTE Egerváry Research Group, Department of Operations Research, Eötvös Loránd University, Budapest, Hungary

Sándor Kisfaludi-Bak (67)
Department of Computer Science, Aalto University, Finland

Nathan Klein (79)
Institute for Advanced Study, Princeton, NJ, USA

Boris Klemz (99)
Universität Würzburg, Germany

Yusuke Kobayashi (100)
Research Institute for Mathematical Sciences, Kyoto University, Japan

Alexandra Kolla (35)
Computer Science and Engineering, University of California Santa Cruz, CA, USA

Tsvi Kopelowitz (101)
Bar-Ilan University, Ramat-Gan, Israel

Tuukka Korhonen (22, 51)
University of Bergen, Norway

Ariel Korin (101)
Bar-Ilan University, Ramat-Gan, Israel

Dariusz R. Kowalski (80)
School of Computer and Cyber Sciences, Augusta University, GA, USA

Stefan Kratsch (29)
Humboldt-Universität zu Berlin, Germany

Robert Krauthgamer (50, 97)
Department of Computer Science and Applied Mathematics, Weizmann Institute of Science, Rehovot, Israel

Shankara Narayanan Krishna (142)
Department of Computer Science & Engineering, IIT Bombay, India

Gregory Kucherov (20)
LIGM, CNRS, Université Gustave Eiffel, Marne-la-Vallée, France

Ariel Kulik (56)
Computer Science Department, Technion, Haifa, Israel

Shubhang Kulkarni (23)
University of Illinois, Urbana-Champaign, IL, USA

Soh Kumabe (102)
CyberAgent, Tokyo, Japan

Akash Kumar (91)
Indian Institute of Technology, Bombay, India

Amit Kumar (25)
Department of Computer Science and Engineering, Indian Institute of Technology Delhi, India

Srijita Kundu (21)
Institute for Quantum Computing, University of Waterloo, Canada

William Kuszmaul (103)
Harvard University, Cambridge, MA, USA

Rasmus Kyng (65)
ETH Zürich, Switzerland

Dominik Köppl (89)
University of Yamanashi, Japan

Michael Lampis (61)
Université Paris-Dauphine, PSL University, CNRS UMR7243, LAMSADE, Paris, France

John Lapinskas (54)
University of Bristol, UK

Alberto Larrauri (146)
Department of Computer Science, University of Oxford, UK

Kasper Green Larsen (104)
Aarhus University, Denmark

Jonathan Leake (79)
University of Waterloo, Canada

Eunou Lee (105)
Korea Institute for Advanced Study, Seoul, South Korea

Engel Lefaucheux (140)
Loria, Nancy, France

Pascal Lenzner (48)
Hasso Plattner Institute, University of Potsdam, Germany

Reut Levi (60)
Efi Arazi School of Computer Science, Reichman University, Herzliya, Israel

Shahar Lewkowicz (15)
School of Computer Science, Tel Aviv University, Israel

Daniel Li (87)
University of Michigan, Ann Arbor, MI, USA

Jerry Zirui Li (69)
James Ruse Agricultural High School, Carlingford, Australia;
UNSW Sydney, Australia

Minming Li (44)
City University of Hong Kong, Hong Kong, China

Shaohua Li (66)
CISPA Helmholtz Center for Information Security, Saarbrücken, Germany

Shi Li (63, 106)
Department of Computer Science and Technology, Nanjing University, Jiangsu, China

Shuangle Li (107)
State Key Laboratory for Novel Software Technology, Nanjing University, China

Xin Li (108)
Johns Hopkins University, Baltimore, MD, USA

Bingkai Lin (107)
State Key Laboratory for Novel Software Technology, Nanjing University, China

Yuwei Liu (107)
BASICS, Shanghai Jiao Tong University, China

Vasilis Livanos (81)
Department of Industrial Engineering, University of Chile, Santiago, Chile

Bruno Loff (147)
LASIGE, Faculdade de Ciências, Universidade de Lisboa, Portugal

Daniel Lokshtanov (88)
University of California Santa Barbara, CA, USA

Yaowei Long (109)
University of Michigan, Ann Arbor, MI, USA

Shachar Lovett (82)
Department of Computer Science and Engineering, University of California at San Diego, La Jolla, CA, USA

Chia-Hsuan Lu (127)
University of Oxford, UK

Zhenjian Lu (110)
University of Warwick, UK

Florian Luca (144)
Mathematics Division, Stellenbosch University, Stellenbosch, South Africa

Stephanie Maaz (76)
University of Waterloo, Canada

Khushraj Madnani (142)
Max Planck Institute for Software Systems (MPI-SWS), Kaiserslautern, Germany

Sepideh Mahabadi (93)
Microsoft Research-Redmond, WA, USA

Mikhail Makarov (46)
EPFL, Lausanne, Switzerland

Yury Makarychev (111)
Toyota Technological Institute at Chicago, IL, USA

Sebastian Maneth (138)
Universität Bremen, Germany

Isja Mannens (77)
Department of Information and Computing Sciences, Utrecht University, The Netherlands

Alessio Mansutti (132)
IMDEA Software Institute, Madrid, Spain

Amaldev Manuel (125)
Indian Institute of Technology Goa, India

Dániel Marx (6, 34, 67)
CISPA Helmholtz Center for Information Security, Saarbrücken, Germany

Corto Mascle (156)
LaBRI, Université de Bordeaux, France

Richard Mayr (133)
School of Informatics, University of Edinburgh, UK

Davide Mazzali (46)
EPFL, Lausanne, Switzerland

Fionn Mc Inerney (66)
Technische Universität Wien, Austria

Rose McCarty (137)
School of Mathematics and School of Computer Science, Georgia Institute of Technology, Altanta, GA, USA

Kitty Meeks (54)
University of Glasgow, UK

Nicole Megow (76)
University of Bremen, Germany

Johannes Meintrup (55)
HM, University of Applied Sciences Mittelhessen, Gießen, Germany

Themistoklis Melissourgos (72)
School of Computer Science and Electronic Engineering, University of Essex, UK

Roland Meyer (126)
TU Braunschweig, Germany

Mehdi Mhalla (36)
Université Grenoble Alpes, CNRS, Grenoble INP, LIG, F-38000 Grenoble, France

Martin Milanič (51)
FAMNIT and IAM, University of Primorska, Koper, Slovenia

Om Swostik Mishra (142)
Department of Mathematics, IIT Bombay, India

Slobodan Mitrović (90)
University of California Davis, CA, USA

Ryuhei Mizutani (86)
Department of Mathematical Informatics, Graduate School of Information Science and Technology, The University of Tokyo, Japan

Matthias Mnich (83)
Institute for Algorithms and Complexity, Hamburg University of Technology, Hamburg, Germany

Augusto Modanese (112)
Aalto University, Finland

Fabio Mogavero (128)
Università di Napoli Federico II, Italy

Bratin Mondal (8)
Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, India

Benjamin Moseley (52)
Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, USA

William K. Moses Jr. (55)
Department of Computer Science, Durham University, UK

Boris Motik (127)
University of Oxford, UK

Antoine Mottet (148)
Research Group on Theoretical Computer Science, Hamburg University of Technology, Germany

Amer E. Mouawad (76)
American University of Beirut, Lebanon

Shay Mozes (30)
Reichman University, Herzliya, Israel

Saswata Mukherjee (24)
Chennai Mathematical Institute, India

Doron Mukhtar (40)
Tel Aviv University, Israel

Nabil H. Mustafa (49)
Université Sorbonne Paris Nord, Laboratoire LIPN, CNRS 7030, France

Haiko Müller (68)
School of Computing, University of Leeds, UK

Tomáš Nagy (148)
Theoretical Computer Science Department, Jagiellonian University, Kraków, Poland

Keisuke Nakano (138)
Tohoku University, Sendai, Japan

Danupon Nanongkai (3)
Max Planck Institute for Informatics, Saarland Informatics Campus, Saarbrücken, Germany; KTH Royal Institute of Technology, Stockholm, Sweden

Joseph (Seffi) Naor (57)
Computer Science Department, Technion, Haifa, Israel

Yasamin Nazari (58)
Vrije Universiteit Amsterdam, The Netherlands

Jesper Nederlof (26, 77)
Utrecht University, The Netherlands

Daniel Neuen (78)
University of Regensburg, Germany

Heather Newman (52)
Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA, USA

Lê Thành Dũng (Tito) Nguyễn (130)
École normale supérieure de Lyon, France

Koichi Nishimura (96)
CRESCO LTD., Japan

Naoto Ohsaka (85, 113)
CyberAgent, Inc., Tokyo, Japan

Taihei Oki (86)
Department of Mathematical Informatics, Graduate School of Information Science and Technology, The University of Tokyo, Japan

Jan Olkowski (80)
University of Maryland, College Park, MD, USA

Krzysztof Onak (90)
Boston University, USA

Sebastian Ordyniak (68)
School of Computing, University of Leeds, UK

Anthony Ostuni (82)
Department of Computer Science and Engineering, University of California at San Diego, La Jolla, CA, USA

Joël Ouaknine (140, 144)
Max Planck Institute for Software Systems, Saarland Informatics Campus, Saarbrücken, Germany

Max Ovsiankin (111)
Toyota Technological Institute at Chicago, IL, USA

Giacomo Paesani (68)
School of Computing, University of Leeds, UK

Rasmus Pagh (104)
BARC, University of Copenhagen, Denmark

Carlos Palazuelos (13)
Dpto. Análisis Matemático y Matemática Aplicada, Fac. Ciencias Matemáticas, Universidad Complutense de Madrid, Spain; Instituto de Ciencias Matemáticas, Madrid, Spain

Akash Pareek (38)
IIT Gandhinagar, India

Ojas Parekh (105)
Sandia National Laboratories, Albuquerque, NM, USA

Jaewoo Park (87)
University of Michigan, Ann Arbor, MI, USA

Merav Parter (4)
Weizmann Institute of Science, Rehovot, Israel

Christophe Paul (114)
LIRMM, Univ Montpellier, CNRS, Montpellier, France

Simon Perdrix (36)
Inria Mocqua, LORIA, CNRS, Université de Lorraine, F-54000 Nancy, France

Adriano Peron (128)
Università di Trieste, Italy

Giuseppe Persiano (104)
Università di Salerno, Italy;
Google, New York, NY, USA

Charles Peyrat (138)
ENS Paris-Saclay, France

Ján Pich (12)
University of Oxford, UK

Marta Piecyk (77)
Warsaw University of Technology, Poland

Michael Pinsker (148)
Institut für Diskrete Mathematik und Geometrie, Technische Universität Wien, Austria

Toniann Pitassi (104)
Columbia University, New York, NY, USA

Orestis Plevrakis (115)
Department of Computer Science, Princeton University, NJ, USA

Vladimir V. Podolskii (116)
Tufts University, Medford, MA, USA

Aaron Potechin (117)
University of Chicago, IL, USA

Aditya Potukuchi (35)
Department of Electrical Engineering and Computer Science, York University, Toronto, Canada

Damien Pous (135)
Plume, LIP, CNRS, ENS de Lyon, France

Aditya Prakash (124)
University of Warwick, Coventry, UK

Eric Price (75)
University of Texas at Austin, TX, USA

Evangelos Protopapas (114)
LIRMM, Univ Montpellier, CNRS, Montpellier, France

Aaron (Louie) Putterman (98)
School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, USA

Kent Quanrud (118)
Dept. of Computer Science, Purdue University, West Lafayette, IN, USA

Seyoon Ragavan (115)
Computer Science and Artificial Intelligence Lab, Massachusetts Institute of Technology, Cambridge, MA, USA

Vijayaragunathan Ramamoorthi (76)
University of Bremen, Germany

M. S. Ramanujan (53)
Department of Computer Science, University of Warwick, Coventry, UK

Rebecca Reiffenhäuser (48)
University of Amsterdam, The Netherlands

Christine Rizkallah (139)
The University of Melbourne, Australia

Liam Roditty (101)
Bar-Ilan University, Ramat-Gan, Israel

Mohammad Roghani (19)
Stanford University, CA, USA

Dana Ron (60)
School of Electrical Engineering, Tel Aviv University, Israel

Noga Ron-Zewi (7)
Department of Computer Science, University of Haifa, Israel

Aviad Rubinstein (19)
Stanford University, CA, USA

Mateusz Rychlicki (68)
School of Computing, University of Leeds, UK

Jakub Rydval (150, 151)
Technische Universität Wien, Austria

Paweł Rzążewski (34, 77)
Warsaw University of Technology, Poland; University of Warsaw, Poland

Wojciech Różowski (149)
Department of Computer Science, University College London, UK

Amin Saberi (19)
Stanford University, CA, USA

Sushant Sachdeva (65, 119)
University of Toronto, Canada

Yaniv Sadeh (120)
Tel Aviv University, Israel

Chandan Saha (16)
Indian Institute of Science, Bengaluru, India

Abhishek Sahu (88)
National Institute of Science, Education and Research Bhubaneswar, HBNI, India

Mohammad Saneian (121)
Northeastern University, Boston, MA, USA

Piotr Sankowski (90)
IDEAS NCBR, University of Warsaw, Poland; MIM Solutions, Warsaw, Poland

Rahul Santhanam (12, 110)
University of Oxford, UK

Thatchaphol Saranurak (87)
University of Michigan, Ann Arbor, MI, USA

Ignasi Sau (33)
LIRMM, Université de Montpellier, CNRS, France

Saket Saurabh (88)
The Institute of Mathematical Sciences, HBNI, Chennai, India;
University of Bergen, Norway

Rahul Savani (32)
The Alan Turing Institute, London, UK;
and Department of Computer Science, University of Liverpool, UK

Valentin Savin (36)
Université Grenoble Alpes, CEA-Léti, F-38054 Grenoble, France

Benjamin Scheidt (152)
Humboldt-Universität zu Berlin, Germany

Niklas Schlomberg (122)
Research Institute for Discrete Mathematics and Hausdorff Center for Mathematics, University of Bonn, Germany

Daniel Schmand (48, 76)
University of Bremen, Germany

Sylvain Schmitz (153)
Université Paris Cité, CNRS, IRIF, Paris, France

Patrick Schnider (32)
Department of Computer Science, ETH Zürich, Switzerland

Tamás Schwarcz (86)
MTA-ELTE Matroid Optimization Research Group, Department of Operations Research, ELTE Eötvös Loránd University, Budapest, Hungary

Lia Schütze (153)
Max Planck Institute for Software Systems (MPI-SWS), Kaiserslautern, Germany

Andrew Scoones (144)
Department of Computer Science, University of Oxford, UK

Žaneta Semanišinová (151)
Technische Universität Dresden, Germany

Dvir Shabtay (83)
Department of Industrial Engineering and Management, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Hadas Shachnai (56)
Computer Science Department, Technion, Haifa, Israel

Roohani Sharma (6, 66, 67)
University of Bergen, Norway

Ayumi Shinohara (89)
Tohoku University, Sendai, Japan

Sebastian Siebertz (76)
University of Bremen, Germany

Marie Diana Sieper (99)
Universität Würzburg, Germany

Pulkit Sinha (16)
University of Waterloo, Canada

Mateusz Skomra (147)
LAAS-CNRS, Université de Toulouse, CNRS, Toulouse, France

Dmitrii Sluch (116)
Nebius, Tel Aviv, Israel

Marcin Smulewicz (95)
University of Warsaw, Poland

Krzysztof Sornat (5)
AGH University, Kraków, Poland

Joachim Spoerhase (6)
University of Sheffield, UK

Mikhail R. Starchak (132)
St. Petersburg State University, Russia

Rafał Stefański (130)
University of Warsaw, Poland

Manuel Stoeckl (71)
Dartmouth College, Hanover, NH, USA

Madhu Sudan (98)
School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, USA

Hanna Sumita (96)
Tokyo Institute of Technology, Japan

Saina Sunny (125)
Indian Institute of Technology Goa, India

John Sylvester (31)
Department of Computer Science, University of Liverpool, UK

Prafullkumar Tale (66)
Indian Institute of Science Education and Research Pune, India

Tony Tan (127)
University of Liverpool, UK

Zihan Tan (47)
Rutgers University, Piscataway, NJ, USA

Erasmo Tani (111)
University of Chicago, IL, USA

Tatsuya Terao (100)
Research Institute for Mathematical Sciences, Kyoto University, Japan

Guillaume Theyssier (154)
I2M, CNRS, Université Aix-Marseille, France

Dimitrios M. Thilikos (114)
LIRMM, Univ Montpellier, CNRS, Montpellier, France

Stéphan Thomassé (36)
Université de Lyon, École Normale Supérieure de Lyon, UCBL, CNRS, LIP, F-69007 Lyon, France

Anvith Thudi (119)
University of Toronto, Canada

Antoine Tinguely (5)
IDSIA, USI-SUPSI, Lugano, Switzerland

Yuya Uezato (155)
CyberAgent, Inc., Tokyo, Japan;
National Institute of Informatics, Tokyo, Japan

Jalaj Upadhyay (27)
Management Science and Information Systems, Rutgers University, Piscataway, NJ, USA

Anannya Upasana (88)
The Institute of Mathematical Sciences, HBNI, Chennai, India

Danny Vainstein (15)
School of Computer Science, Tel Aviv University, Israel;
Google Research, Tel Aviv, Israel

Ali Vakilian (93)
Toyota Technological Institute at Chicago (TTIC), IL, USA

Steffen van Bergerem (156)
Humboldt-Universität zu Berlin, Germany

Jan van den Brand (10)
Georgia Tech, Atlanta, GA, USA

Giovanna Varricchio (48)
University of Calabria, Rende, Italy

Virginia Vassilevska Williams (9, 28, 37)
MIT, EECS and CSAIL, Cambridge, MA, USA

Pavel Veselý (50)
Computer Science Institute of Charles University, Prague, Czech Republic

Adrian Vetta (43)
McGill University, Montreal, Canada

Nicolas Waldburger (156)
IRISA, Université de Rennes, France

Stefan Walzer (20)
Karlsruhe Institute of Technology, Germany

Chen Wang (27)
Department of Computer Science, Rice University, Houston, TX, USA;
Computer Science and Engineering, Texas A&M University, College Station, TX, USA

Jiaheng Wang (11)
School of Informatics,
University of Edinburgh, UK

Wenqian Wang (92)
School of Electronic, Information and Electrical Engineering, Shanghai Jiao Tong University, China

Yunfan Wang (109)
Tsinghua University, Beijing, China

Simon Weber (32)
Department of Computer Science, ETH Zürich, Switzerland

Chana Weil-Kennedy (156)
IMDEA Software Institute, Madrid, Spain

Oren Weimann (30)
University of Haifa, Israel

Nicole Wein (9, 28)
University of Michigan, Ann Arbor, MI, USA

S. Matthew Weinberg (115)
Department of Computer Science, Princeton University, NJ, USA

Leo Wennmann (64)
Maastricht University, The Netherlands

Sebastian Wiederrecht (114)
Discrete Mathematics Group, Institute for Basic Science, Daejeon, South Korea

Andreas Wiese (8)
Department of Mathematics, Technical University of Munich, Germany

James Worrell (140, 144)
Department of Computer Science,
University of Oxford, UK

Michał Wrona (151)
Jagiellonian University, Kraków, Poland

Hongxun Wu (94)
University of California Berkeley, CA, USA

Zoe Xi (103)
Massachusetts Institute of Technology, Cambridge, MA, USA

Chenyang Xu (106)
Shanghai Key Laboratory of Trustworthy Computing, East China Normal University, China

Haifeng Xu (44)
University of Chicago, IL, USA

Zixuan Xu (28)
Massachusetts Institute of Technology, Cambridge, MA, USA

Qizhe Yang (136)
Shanghai Normal University, China

Mingquan Ye (45)
University of Illinois at Chicago, IL, USA

Kevin Yeo (104)
Columbia University, New York, NY, USA;
Google, New York, NY, USA

Sorrachai Yingchareonthawornchai (38)
The Hebrew University of Jerusalem, Israel

Yuichi Yoshida (102, 112)
National Institute of Informatics, Tokyo, Japan

Ryo Yoshinaka (89)
Tohoku University, Sendai, Japan

Kingsley Yung (123)
The Chinese University of Hong Kong, Hong Kong, China

Viktor Zamaraev (31)
Department of Computer Science,
University of Liverpool, UK

Or Zamir (104)
Tel Aviv University, Israel

Georg Zetzsche (126, 142)
Max Planck Institute for Software Systems (MPI-SWS), Kaiserslautern, Germany

Aaron Zhang (117)
The Voleon Group, Berkeley, CA, USA

Cheng Zhang (157)
Boston University, MA, USA

Daniel J. Zhang (10)
Georgia Tech, Atlanta, GA, USA

Ruilong Zhang (106)
Department of Computer Science, City University of Hong Kong, Hong Kong, China

Tianyi Zhang (40, 41, 42)
Tel Aviv University, Israel

Yubo Zhang (92)
School of Computer Science, Peking University, Beijing, China

Yuhao Zhang (92)
John Hopcroft Center for Computer Science, Shanghai Jiao Tong University, China

Yibin Zhao (119)
University of Toronto, Canada

Yangluo Zheng (136)
BASICS, Shanghai Jiao Tong University, China

Yan Zhong (108)
Johns Hopkins University, Baltimore, MD, USA

Maksim Zhukovskii (31)
Department of Computer Science, University of Sheffield, UK

Song Zuo (44)
Google Research, New York, NY, USA

Jakub Łącki (18, 90)
Google Research, New York, NY, USA

Ionuţ Ţuţu (143)
Simion Stoilow Institute of Mathematics of the Romanian Academy, Bucharest, Romania

Stanislav Živný (146)
Department of Computer Science, University of Oxford, UK