

*Commenced Publication in 1973*

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

## Editorial Board

David Hutchison, UK

Josef Kittler, UK

Alfred Kobsa, USA

John C. Mitchell, USA

Oscar Nierstrasz, Switzerland

Bernhard Steffen, Germany

Demetri Terzopoulos, USA

Gerhard Weikum, Germany

Takeo Kanade, USA

Jon M. Kleinberg, USA

Friedemann Mattern, Switzerland

Moni Naor, Israel

C. Pandu Rangan, India

Doug Tygar, USA

## Advanced Research in Computing and Software Science

Subline of Lectures Notes in Computer Science

### Subline Series Editors

Giorgio Ausiello, *University of Rome 'La Sapienza', Italy*

Vladimiro Sassone, *University of Southampton, UK*

### Subline Advisory Board

Susanne Albers, *University of Freiburg, Germany*

Benjamin C. Pierce, *University of Pennsylvania, USA*

Bernhard Steffen, *University of Dortmund, Germany*

Deng Xiaotie, *City University of Hong Kong*

Jeannette M. Wing, *Microsoft Research, Redmond, WA, USA*

Ron Lavi (Ed.)

# Algorithmic Game Theory

7th International Symposium, SAGT 2014  
Haifa, Israel, September 30 – October 2, 2014  
Proceedings



Springer

## Volume Editor

Ron Lavi  
Technion – Israel Institute of Science  
Faculty of Industrial Engineering and Management  
Technion City, Haifa 3200003, Israel  
E-mail: ronlavi@ie.technion.ac.il

ISSN 0302-9743  
ISBN 978-3-662-44802-1  
DOI 10.1007/978-3-662-44803-8  
Springer Heidelberg New York Dordrecht London

e-ISSN 1611-3349  
e-ISBN 978-3-662-44803-8

Library of Congress Control Number: 2014947966

LNCS Sublibrary: SL 3 - Information Systems and Applications,  
incl. Internet/Web and HCI

© Springer-Verlag Berlin Heidelberg 2014

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

*Typesetting:* Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

# Preface

This book contains the proceedings of the 7th International Symposium on Algorithmic Game Theory (SAGT) held in Haifa, Israel, in October 2014.

The program of SAGT 2014 consisted of five invited lectures and 29 presentations of refereed submissions. The Program Committee selected 29 out of 65 submissions after a careful reviewing process. The PC found that this year's submissions included many papers of high quality, more papers than a regular program can accommodate. The PC therefore decided to accept 26 regular papers, and to invite 3 additional submissions to be presented in the form of a brief announcement at the conference. The PC feels that these brief announcements added inspiration and novelty to the program.

The accepted submissions were invited to these proceedings. They cover various important aspects of algorithmic game theory that were grouped into 8 sessions: Matching Theory, Game Dynamics, Games of Coordination, Networks and Social Choice, Markets and Auctions, Price of Anarchy, Computational aspects of games, and Mechanism Design and Auctions.

I would like to thank all authors who submitted their research work and all Program Committee members and external reviewers for their effort in selecting the program for SAGT 2014.

July 2014

Ron Lavi

# Organization

## Program Committee

Itai Ashlagi	MIT, USA
Yang Cai	MIT, USA
Shahar Dobzinski	Weizmann Institute of Science, Israel
Arpita Ghosh	Cornell University, USA
Paul Goldberg	University of Oxford, UK
Bruce Hajek	University of Illinois at Urbana Champaign, USA
Martin Hoefer	Max-Planck-Institut für Informatik, Germany
Patrick Hummel	Google, USA
Ron Lavi	Technion – Israel Institute of Technology (chair), Israel
Stefano Leonardi	University of Rome “La Sapienza”, Italy
Brendan Lucier	MSR New England, USA
Mohammad Mahdian	Google, USA
Vangelis Markakis	Athens University of Economics and Business, Greece
Aranyak Mehta	Google, USA
Seffi Naor	Technion – Israel Institute of Technology, Israel
Ilan Newman	University of Haifa, Israel
Sigal Oren	Hebrew University and MSR Herzliya, Israel
Mallesh Pai	University of Pennsylvania, USA
Maria Polukarov	University of Southampton, UK
Chaitanya Swamy	University of Waterloo, Canada
Chris Wilkens	Yahoo! Labs, USA

## Steering Committee

Elias Koutsoupias	University of Athens, Greece
Marios Mavronicolas	University of Cyprus, Cyprus
Dov Monderer	Technion Haifa, Israel
Burkhard Monien	University of Paderborn, Germany
Christos Papadimitriou	UC Berkeley, USA
Giuseppe Persiano	University of Salerno, Italy
Paul Spirakis	University of Patras, Greece - Chair
Berthold Vöcking	RWTH Aachen University, Germany

## Organizing Team

Mili Harrari	Technion, Israel
Martin Hoefler	MPI, Germany - Publicity Chair
Ron Lavi	Technion, Israel - PC Chair
Dov Monderer	Technion, Israel - General Chair
Rann Smorodinsky	Technion, Israel - Chair of Econ track
Igal Shprincis	Technion, Israel

## Additional Reviewers

Bo An	Scott Jordan
Elliot Anshelevich	Vicki Knoblauch
Haris Aziz	Bojana Kodric
Riccardo Colini Baldeschi	Spyros Kontogiannis
Oren Ben-Zwi	Oded Lachish
Randall Berry	Silvio Lattanzi
Francis Bloch	Renato Paes Leme
Ulrik Brandes	Omer Lev
Ioannis Caragiannis	Jian Li
Shahar Chen	Yunan Li
George Christodoulou	Azarakhsh Malekian
Bart De Keijzer	Ruta Mehta
Mustafa Dogan	Emerson Melo
Yair Dombb	Chandra Nair
Paul Dütting	Nina Narodytska
Noa Elad	Thanh Nguyen
Gabor Erdelyi	Svetlana Obraztsova
Selman Erol	Joerg Rothe
John Fearnley	Aviad Rubinstein
Moran Feldman	Sujay Sanghavi
Diodato Ferraioli	Jan Christoph Schlegel
Felix Fischer	Roy Schwartz
Dimitris Fotakis	Balasubramanian Sivan
Hu Fu	Alexander Skopalik
Martin Gairing	Vijay Subramanian
Vasilis Gkatzelis	Xiaorui Sun
Nick Gravin	Siddharth Suri
Avinatan Hassidim	Vasilis Syrgkanis
Daniel Hauser	Bo Tang
Xinran He	Christos Tzamos
Zehao Hu	Bo Waggoner
Albert Xin Jiang	Lisa Wagner
Ramesh Johari	David Wajc

S. Matthew Weinberg  
Steven R. Williams  
Gerhard J. Woeginger  
Jonathan Yaniv

Serdar Yuksel  
Qiang Zhang  
Jie Zhang

# Table of Contents

## Matching Theory

Social Welfare in One-Sided Matchings: Random Priority and Beyond . . . . .	1
<i>Aris Filos-Ratsikas, Søren Kristoffer Stiil Frederiksen, and Jie Zhang</i>	
Efficiency of Truthful and Symmetric Mechanisms in One-Sided Matching . . . . .	13
<i>Marek Adamczyk, Piotr Sankowski, and Qiang Zhang</i>	
Stable Marriage with General Preferences (Extended Abstract) . . . . .	25
<i>Linda Farczadi, Konstantinos Georgiou, and Jochen Könemann</i>	

## Game Dynamics

The Convergence Time for Selfish Bin Packing . . . . .	37
<i>György Dósa and Leah Epstein</i>	
Short Sequences of Improvement Moves Lead to Approximate Equilibria in Constraint Satisfaction Games . . . . .	49
<i>Ioannis Caragiannis, Angelo Fanelli, and Nick Gravin</i>	
Paths to Stable Allocations . . . . .	61
<i>Ágnes Cseh and Martin Skutella</i>	
Self-stabilizing Uncoupled Dynamics . . . . .	74
<i>Aaron D. Jaggard, Neil Lutz, Michael Schapira, and Rebecca N. Wright</i>	

## Games of Coordination

Profit Sharing with Thresholds and Non-monotone Player Utilities . . . . .	86
<i>Elliot Anshelevich and John Postl</i>	
Shared Resource Management via Reward Schemes . . . . .	98
<i>Shahar Dobzinski and Amir Ronen</i>	
Budget-Restricted Utility Games with Ordered Strategic Decisions . . . . .	110
<i>Maximilian Drees, Sören Riechers, and Alexander Skopalik</i>	



## Networks/Social Choice

Influence Maximization in Switching-Selection Threshold Models . . . . .	122
<i>Dimitris Fotakis, Thodoris Lykouris, Evangelos Markakis, and Svetlana Obraztsova</i>	
Network Cost-Sharing without Anonymity . . . . .	134
<i>Tim Roughgarden and Okke Schrijvers</i>	
Recognizing 1-Euclidean Preferences: An Alternative Approach . . . . .	146
<i>Edith Elkind and Piotr Faliszewski</i>	

## Markets and Auctions

Clearing Markets via Bundles . . . . .	158
<i>Michal Feldman and Brendan Lucier</i>	
Walrasian Equilibrium with Few Buyers . . . . .	170
<i>Reshef Meir and Moshe Tennenholtz</i>	
Multimarket Oligopolies with Restricted Market Access . . . . .	182
<i>Tobias Harks and Max Klimm</i>	
Value of Targeting . . . . .	194
<i>Kshipra Bhawalkar, Patrick Hummel, and Sergei Vassilvitskii</i>	

## Price of Anarchy

Welfare Guarantees for Proportional Allocations . . . . .	206
<i>Ioannis Caragiannis and Alexandros A. Voudouris</i>	
Strong Price of Anarchy, Utility Games and Coalitional Dynamics . . . . .	218
<i>Yoram Bachrach, Vasilis Syrgkanis, Éva Tardos, and Milan Vojnović</i>	

## Computational Aspects of Games

The Complexity of Approximating a Trembling Hand Perfect Equilibrium of a Multi-player Game in Strategic Form . . . . .	231
<i>Kousha Etessami, Kristoffer Arnsfelt Hansen, Peter Bro Miltersen, and Troels Bjerre Sørensen</i>	
Approximate Well-Supported Nash Equilibria in Symmetric Bimatrix Games . . . . .	244
<i>Artur Czumaj, Michail Fasoulakis, and Marcin Jurdziński</i>	

## Mechanism Design and Auctions

Mechanisms for Hiring a Matroid Base without Money . . . . .	255
<i>Emmanouil Pountourakis and Guido Schäfer</i>	
Prediction and Welfare in Ad Auctions . . . . .	267
<i>Mukund Sundararajan and Inbal Talgam-Cohen</i>	
On the Impossibility of Black-Box Transformations in Mechanism Design . . . . .	279
<i>Rafael Pass and Karn Seth</i>	

## Abstracts and Brief Announcements

Designing Matching Mechanisms under Constraints: An Approach from Discrete Convex Analysis (Extended Abstract) . . . . .	291
<i>Fuhito Kojima, Akihisa Tamura, and Makoto Yokoo</i>	
Monotonicity, Revenue Equivalence and Budgets . . . . .	292
<i>Ahuva Mu'alem</i>	
The Price of Spite in Spot-Checking Games (Brief Announcement) . . . . .	293
<i>Guillaume Sagnol, Ralf Borndörfer, Thomas Schlechte, and Elmar Swarat</i>	
Brief Announcement: A Model for Multilevel Network Games . . . . .	294
<i>Sebastian Abshoff, Andreas Cord-Landwehr, Daniel Jung, and Alexander Skopalik</i>	
Complexity of Optimal Lobbying in Threshold Aggregation (Brief Announcement) . . . . .	295
<i>Ilan Nehama</i>	
<b>Author Index</b> . . . . .	297