# Lecture Notes in Computer Science

8289

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

#### **Editorial Board**

David Hutchison, UK Takeo Kanade, USA Josef Kittler, UK Jon M. Kleinberg, USA

Alfred Kobsa, USA Friedemann Mattern, Switzerland

John C. Mitchell, USA Moni Naor, Israel

Oscar Nierstrasz, Switzerland C. Pandu Rangan, India Bernhard Steffen, Germany Madhu Sudan, USA Demetri Terzopoulos, USA Doug Tygar, USA

Gerhard Weikum, Germany

# 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*Madhu Sudan, *Microsoft Research, Cambridge, MA, USA*Deng Xiaotie, *City University of Hong Kong*Jeannette M. Wing, *Microsoft Research, Redmond, WA, USA* 

# Web and Internet Economics

9th International Conference, WINE 2013 Cambridge, MA, USA, December 11-14, 2013 Proceedings



Volume Editors

Yiling Chen Cambridge, MA, USA

E-mail: yiling@eecs.harvard.edu

Nicole Immorlica Cambridge, MA, USA

E-mail: nicimm@microsoft.com

ISSN 0302-9743 e-ISSN 1611-3349 ISBN 978-3-642-45045-7 e-ISBN 978-3-642-45046-4 DOI 10.1007/978-3-642-45046-4 Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2013952968

CR Subject Classification (1998): H.3, F.2, G.1, C.2, K.4.4, F.1, J.4

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

© Springer-Verlag Berlin Heidelberg 2013

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 ist 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 volume contains the papers and extended abstracts for work presented at WINE 2013: The 9th Conference on Web and Internet Economics held during December 11–14, 2013, at Harvard University, Cambridge, Massachusetts, USA.

Over the past decade, researchers in theoretical computer science, artificial intelligence, and microeconomics have joined forces to tackle problems involving incentives and computation. These problems are of particular importance in application areas like the Web and the Internet that involve large and diverse populations. The Conference on Web and Internet Economics (WINE) is an interdisciplinary forum for the exchange of ideas and results on incentives and computation arising from these various fields.

WINE 2013 built on the success of the Workshop on Internet and Network Economics, which had the same acronym, WINE. The workshop was held annually from 2005 to 2012 and published archival proceedings. To accommodate the growing research interests and emphasize its archival nature, WINE was renamed a conference with the same acronym in 2013.

WINE 2013 received 150 submissions. All submissions were rigorously peer-reviewed and evaluated on the basis of originality, soundness, significance, and exposition. The committee decided to accept 36 papers. The program also included four invited talks by Dirk Bergemann (Yale University), Joe Halpern (Cornell University), Ehud Kalai (Microsoft Research and Northwestern University), and Eva Tardos (Cornell University). In addition, WINE 2013 featured four tutorials on December 11: Price of Anarchy in Auctions, by Jason Hartline (Northwestern University), Online Behavioral Experiments, by Andrew Mao (Harvard University) and Siddharth Suri (Microsoft Research), Budget Feasible Mechanisms, by Nick Gravin (Microsoft Research) and Yaron Singer (Harvard University), and Computational Social Choice, by Lirong Xia (Rensselaer Polytechnic Institute).

We would like to thank Microsoft Research, Facebook, and Google Research for their generous financial support to WINE 2013 and Harvard University for hosting the event. We thank David Parkes, the general chair of the conference, and Ann Marie King for their excellent local arrangements work and Andrew Mao for his help with the conference website.

We also acknowledge the work of the Program Committee, Anna Kramer at Springer for helping with the proceedings, and the EasyChair paper management system.

October 2013 Yiling Chen
Nicole Immorlica

## Conference Organization

### General Chair

David C. Parkes Harvard University, USA

## **Program Committee Chairs**

Yiling Chen Harvard University, USA Nicole Immorlica Microsoft Research

## **Program Committee**

Saeed Alaei Cornell University, USA

Itai Ashlagi Massachusetts Institute of Technology, USA

Moshe Babaioff Microsoft Research

Richard Cole New York University, USA

Nikhil Devanur Microsoft Research

Shaddin Dughmi University of Southern California, USA

Michal Feldman Tel Aviv University, Israel
Amos Fiat Tel Aviv University, Israel
Felix Fischer University of Cambridge, UK

Hu Fu Microsoft Research Gagan Goel Google Research

Mingyu Guo University of Liverpool, UK

Ian Kash Microsoft Research

David Kempe University of Southern California, USA

Robert Kleinberg Cornell University, USA

Jochen Koenemann University of Waterloo, Canada

Scott Duke Kominers Harvard University, USA

Sébastien Lahaie Microsoft Research

Stefano Leonardi Sapienza University of Rome, Italy
Katrina Ligett California Institute of Technology, USA

Brendan Lucier Microsoft Research Mohammad Mahdian Google Research

David Malec University of Wisconsin - Madison, USA

Yishav Mansour Tel Aviv University, Israel

Evangelos Markakis Athens University of Economics and Business,

Greece

Reshef Meir The Hebrew University of Jerusalem, Israel

Vahab Mirrokni Google Research

#### VIII Conference Organization

Thanh Nguyen Northwestern University, USA

Renato Paes Leme Microsoft Research

Mallesh Pai University of Pennsylvania, USA Aaron Roth University of Pennsylvania, USA

Tim Roughgarden Stanford University, USA

Michael Schapira The Hebrew University of Jerusalem, Israel

Yaron Singer Harvard University, USA

Rakesh Vohra University of Pennsylvania, USA Michael Wellman University of Michigan, USA

Aviv Zohar The Hebrew University of Jerusalem, Israel

#### External Reviewers

Bruno Abrahao David Gleich Shipra Agrawal Renato Gomes

Kareem Amin Ragavendran Gopalakrishnan

Haris Aziz Nick Gravin
Yoram Bachrach Nima Haghpanah
Ashwinkumar Badanidiyuru Paul Harrenstein

Xinran He Evtan Bakshy Anand Bhalgat Hoda Heidari Umang Bhaskar Chien-Ju Ho Kshipra Bhawalkar Martin Hoefer Davide Bilò Justin Hsu Michael Brautbar Zhivi Huang Simina Brânzei Patrick Hummel Ozan Candogan Atsushi Iwasaki Shaili Jain

Jing Chen Shaili Jain Giorgos Christo Max Klimm

Riccardo Colini-Baldeschi Spyros Kontogiannis Rachel Cummings Nitish Korula Bart De Keijzer Janardhan Kulkarni Alan Deckelbaum Silvio Lattanzi

Alan Deckelbaum
Argyrios Deligkas
Omer Lev
Miroslav Dudík
Paul Dütting
Lili Dworkin
Yuval Emek
Piotr Faliszewski
Silvio Lattanzi
Omer Lev
Vahid Liaghat
Hamid Mahini
Ruta Mehta
Debasis Mishra

Fei Fang Hamid Nazerzadeh Linda Farczadi Ilan Nehama

Joel Oren

Andreas Emil Feldmann
Augal Garg
Konstantinos Georgiou
Rad Niazadeh
Afshin Nikzad
Lev Omer

Vasilis Gkatzelis

Sigal Oren Michael Ostrovsky Georgios Piliouras

Emmanouil Pountourakis

Ariel Procaccia
Heiko Röglin
Daniela Saban
Anshul Sawant
Guido Schaefer
Lior Seeman
Nisarg Shah
Ankit Sharma
Peng Shi
Adish Singla

Balasubramanian Sivan Alexander Skopalik Greg Stoddard Vasilis Syrgkanis Inbal Talgam-Cohen

Omer Tamuz Orestis Telelis Nithum Thain Dave Thompson Pushkar Tripathi Christos Tzamos

Laci Vegh

Carmine Ventre

S. Matthew Weinberg

Omri Weinstein Zhiwei Wu Qiqi Yan Jinshan Zhang Yair Zick

# **Table of Contents**

The Asymmetric Matrix Partition Problem
Polylogarithmic Supports Are Required for Approximate Well-Supported Nash Equilibria below 2/3
The Computational Complexity of Random Serial Dictatorship
Incentives and Efficiency in Uncertain Collaborative Environments Yoram Bachrach, Vasilis Syrgkanis, and Milan Vojnović
Revenue Maximization with Nonexcludable Goods
On Lookahead Equilibria in Congestion Games
Trading Agent Kills Market Information: Evidence from Online Social Lending
Designing Markets for Daily Deals
The Exact Computational Complexity of Evolutionarily Stable Strategies
The Price of Anarchy of the Proportional Allocation Mechanism Revisited
Can Credit Increase Revenue?
Mechanism Design for Aggregating Energy Consumption and Quality of Service in Speed Scaling Scheduling

Valuation Compressions in VCG-Based Combinatorial Auctions  Paul Dütting, Monika Henzinger, and Martin Starnberger	146
Limits of Efficiency in Sequential Auctions	160
Competition in the Presence of Social Networks: How Many Service Providers Maximize Welfare?	174
Resolving Braess's Paradox in Random Networks	188
Truthfulness Flooded Domains and the Power of Verification for Mechanism Design	202
A Protocol for Cutting Matroids Like Cakes	216
Quantitative Comparative Statics for a Multimarket Paradox	230
Price of Anarchy for the N-Player Competitive Cascade Game with Submodular Activation Functions	232
Designing Profit Shares in Matching and Coalition Formation Games Martin Hoefer and Lisa Wagner	249
Jealousy Graphs: Structure and Complexity of Decentralized Stable	
Matching	263
Linear Regression as a Non-cooperative Game	277
Optimal Allocation for Chunked-Reward Advertising	291
Bicriteria Online Matching: Maximizing Weight and Cardinality Nitish Korula, Vahab S. Mirrokni, and Morteza Zadimoghaddam	305
Mitigating Covert Compromises: A Game-Theoretic Model of Targeted and Non-Targeted Covert Attacks	319
Characterization of Truthful Mechanisms for One-Dimensional Single Facility Location Game with Payments	333

Table of Contents	XIII
Equilibrium in Combinatorial Public Projects	347
Exchange Markets: Strategy Meets Supply-Awareness (Abstract)  Ruta Mehta and Milind Sohoni	361
A Lemke-Like Algorithm for the Multiclass Network Equilibrium  Problem	363
Near-Optimal and Robust Mechanism Design for Covering Problems with Correlated Players	377
Bounding the Inefficiency of Altruism through Social Contribution  Games	391
Welfare-Improving Cascades and the Effect of Noisy Reviews	405
The Complexity of Computing the Random Priority Allocation Matrix  Daniela Saban and Jay Sethuraman	421
Vickrey Auctions for Irregular Distributions	422
Strategy-Proof and Efficient Offline Interval Scheduling and Cake Cutting	436
Author Index	439