

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

TU Dortmund University, Germany

Madhu Sudan

Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbruecken, Germany

A. Ridha Mahjoub Vangelis Markakis
Ioannis Milis Vangelis Th. Paschos (Eds.)

Combinatorial Optimization

Second International Symposium, ISCO 2012
Athens, Greece, April 19–21, 2012
Revised Selected Papers

Volume Editors

A. Ridha Mahjoub
LAMSADE, Université Paris-Dauphine
Place du Maréchal de Lattre de Tassigny
75775 Paris Cedex 16, France
E-mail: mahjoub@lamsade.dauphine.fr

Vangelis Markakis
Department of Informatics
Athens University of Economics and Business
76 Patission str., 10434 Athens, Greece
E-mail: markakis@aueb.gr

Ioannis Milis
Department of Informatics
Athens University of Economics and Business
76 Patission str., 10434 Athens, Greece
E-mail: milis@aueb.gr

Vangelis Th. Paschos
LAMSADE, Université Paris-Dauphine
Place du Maréchal de Lattre de Tassigny
75775 Paris Cedex 16, France
E-mail: paschos@lamsade.dauphine.fr

ISSN 0302-9743
ISBN 978-3-642-32146-7
DOI 10.1007/978-3-642-32147-4

e-ISSN 1611-3349
e-ISBN 978-3-642-32147-4

Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2012942593

CR Subject Classification (1998): F.2.2, G.2.2, F.2, G.2, G.1.6, I.2.8, G.1.2

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

© Springer-Verlag Berlin Heidelberg 2012

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, 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.

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

The Second International Symposium on Combinatorial Optimization (ISCO 2012) took place at the Athens University of Economics and Business (AUEB) during April 19–21, 2012. ISCO 2012 was preceded by the Spring School on “Mathematical Programming and Design of Approximation Algorithms” given by David Shmoys and David Williamson.

ISCO is a new biannual symposium with its first venue in Hammamet, Tunisia, in March 2010. The symposium aims to bring together researchers from all the communities related to combinatorial optimization, including algorithms and complexity, mathematical programming and operations research. It is intended to be a forum for presenting original research on all aspects of combinatorial optimization, ranging from mathematical foundations and theory of algorithms to computational studies and practical applications, and especially their intersections.

In response to the call for papers, ISCO 2012 received 94 regular and 30 short submissions. Each submission was reviewed by at least three Program Committee (PC) members with the assistance of external reviewers. The submissions were judged on their originality and technical quality and the PC had to discuss in length the reviews and make tough decisions. As a result, the PC selected 37 regular papers to be presented at the symposium (along with 31 short papers selected from both regular and short submissions). Four eminent invited speakers, Giorgio Ausiello (Università di Roma “La Sapienza”), George Nemhauser (Georgia Tech), Christos Papadimitriou (UC Berkeley) and Paolo Toth (Università di Bologna) also gave talks at the symposium. The revised versions of the accepted regular papers and extended abstracts of the invited talks are included in this volume.

We would like to thank all the authors who submitted their work to ISCO 2012, and the PC members and external reviewers for their excellent work. We would also like to thank our invited speakers as well as the speakers of the Spring School for their exciting lectures. They all contributed to the quality of the symposium and gave ISCO 2012 a new distinct character.

Finally, we would like to thank the Organizing Committee members, for their dedicated work in preparing this conference, and we gratefully acknowledge our sponsoring institutions for their assistance and support.

May 2012

A. Ridha Mahjoub
Vangelis Markakis
Ioannis Milis
Vangelis Paschos

Organization

ISCO 2012 was organized by the Department of Informatics, Athens University of Economics and Business, in cooperation with LAMSADE Laboratory of Université Paris-Dauphine.

Program Committee Co-chairs

A. Ridha Mahjoub	Université Paris-Dauphine, France
Ioannis Milis	Athens University of Economics and Business, Greece

Program Committee

Mourad Baïou	Université Blaise Pascal, Clermont-Ferrand, France
Evipidis Bampis	Université Pierre et Marie Curie, France
Francisco Barahona	IBM T.J. Watson Research Center, New York, USA
Walid Ben-Ameur	TELECOM SudParis, France
Jaroslaw Byrka	University of Wrocław, Poland
William Cook	Georgia Tech, USA
Gerard Cornuéjols	Carnegie Mellon, USA
Federico Della Croce	Politecnico di Torino, Italy
Josep Diaz	Universitat Politècnica de Catalunya, Spain
Bruno Escoffier	Université Paris-Dauphine, France
Satoru Fujishige	Kyoto University, Japan
Eric Gourdin	Orange Labs, Paris, France
Luis Gouveia	University of Lisbon, Portugal
Anupam Gupta	Carnegie Mellon, USA
Brahim Hnich	Izmir University of Economics, Turkey
Klaus Jansen	Christian-Albrechts-Universität, Kiel, Germany
Stavros Kolliopoulos	National and Kapodistrian University of Athens, Greece
Jochen Könemann	University of Waterloo, Canada
Andrea Lodi	Università di Bologna, Italy
Nelson Maculan	Universidade Federal do Rio de Janeiro, Brazil

Alberto Marchetti-Spaccamela	Università di Roma La Sapienza, Italy
Vangelis Markakis	Athens University of Economics and Business, Greece
Tom McCormick	University of British Columbia, Canada
Jérôme Monnot	Université Paris-Dauphine, France
Vangelis Paschos	Université Paris-Dauphine, France
Gerhard Reinelt	Universität Heidelberg, Germany
Giovanni Rinaldi	IASI-CNR, Rome, Italy
Amin Saberi	Stanford University, USA
François Vanderbeck	Université Bordeaux 1, France
Peter Widmayer	ETH, Zürich, Switzerland
Gerhard Woeginger	Eindhoven University of Technology, The Netherlands
Hande Yaman	Bilkent University, Ankara, Turkey
Vassilis Zissimopoulos	National and Kapodistrian University of Athens, Greece

Referees

Tatsuya Akutsu	Shayan Ehsani	Lukasz Jeż
Laurent Alfandari	Tinaz Ekim	Marcin Kaminski
Kazutoshi Ando	Dominique Feillet	Pegah Kamousi
Roberto Baldacci	Celina Figueiredo	Gregory Karagiorgos
Rida Bazzi	Samuel Fiorini	George Karakostas
Tolga Bektas	Matteo Fischetti	Eun J. Kim
Amal Benhamiche	Holger Flier	Tamas Kiraly
Cedric Bentz	Bernard Fortz	Tamas Kis
Marcin Bienkowski	Dimitris Fotakis	Ralf Klasing
Ben Birnbaum	Radoslav Fulek	Kim-M. Klein
Maria J. Blesa	Virginie Gabrel	Sulamita Klein
Nicolas Boria	Thierry Garaix	Yoshiharu Kohayakawa
Nicolas Bourgeois	Pawel Gawrychowski	Ekkehard Köhler
Andreas Brandstaedt	Konstantinos Georgiou	Ersin Korpeoglu
Tiziana Calamoneri	Shayan O. Gharan	Arie Koster
Roberto W. Calvo	Marco Ghirardi	Stefan Kraft
Ioannis Caragiannis	Aristotelis Giannakos	Felix Kumm
Giuliana Carello	Juan J.S. González	Mathieu Lacroix
Gerard J. Chang	Laurent Gourves	Kati Land
Panagiotis Cheilaris	Marcos Goycoolea	Monique Laurent
Lin Chen	Alexander Grigoriev	Pierre Leone
Denis Cornaz	Andrea Grosso	Dimitrios Letsios
Basile Couëtoux	Hakan Gultekin	Leo Liberti
Federico D. Croce	Christoph Helmberg	Giorgio Lucarelli
Francois Delbot	Han Hoogeveen	James Luedtke
Marc Demange	Cor Hurkens	Dimitrios Magos
Ibrahima Diarrassouba	Riko Jacob	Carlos Martinhon

Colin Mcdiarmid	Lars Prädél	Olivier Spanjaard
Martin Milanic	Günther Raidl	Grzegorz Stachowiak
Ioannis Moisoglou	Ted Ralphs	Gautier Stauffer
Pedro Moura	Bernard Ries	Rüdiger Stephan
Ioannis Mourtos	Christina Robenek	Maxim Sviridenko
Cécile Murat	Jairo Rocha	Michal Szydelko
Kim T. Nguyen	Andrea Roli	Raouia Taktak
Viet H. Nguyen	Farnaz Ronaghi	Shin-Ichi Tanigawa
Yoshio Okamoto	Stefan Ropke	Orestis Telelis
James Ostrowski	Fabio Salassa	João Telhada
Adam Ourou	Laura Sanità	Torsten Tholey
Aris Pagourtzis	Danny Segev	Moshe Vardi
Katarzyna Paluch	Maria Serna	Antonios Varvitsiotis
Guido Perboli	Angelo Sifaleras	Jan Vondrak
Jordi Petit	Gilles Simonin	Tjark Vredeveld
Gerasimos Pollatos	Alexandre Skoda	Georgios Zois

Organizing Committee

Christos Amanatidis	Athens University of Economics and Business, Greece
Katerina Kinta	Université Paris-Dauphine, France
Anna Klouvatou	RC-Athens University of Economics and Business, Greece
Giorgio Lucarelli	Université Paris-Dauphine, France
A. Ridha Mahjoub	Université Paris-Dauphine, France
Vangelis Markakis	Athens University of Economics and Business, Greece
Ioannis Milis	Athens University of Economics and Business, Greece
Vangelis Paschos	Université Paris-Dauphine, France
Georgios Zois	Athens University of Economics and Business, Greece

Sponsoring Institutions

Athens University of Economics and Business (AUEB)
 LAMSADE, Université Paris-Dauphine
 Department of Informatics, AUEB
 Klidarithmos Publications, Athens, Greece

Table of Contents

Invited Talks

Structure Theorems for Optimum Hyperpaths in Directed Hypergraphs	1
<i>Giorgio Ausiello, Giuseppe F. Italiano, Luigi Laura, Umberto Nanni, and Fabiano Sarracco</i>	
Branch-and-Price Guided Search (Extended Abstract)	15
<i>Mike Hewitt, George L. Nemhauser, and Martin Savelsbergh</i>	
The New Faces of Combinatorial Optimization	19
<i>Christos H. Papadimitriou</i>	
Models and Algorithms for the Train Unit Assignment Problem	24
<i>Valentina Cacchiani, Alberto Caprara, and Paolo Toth</i>	

Contributed Talks

The Minimum Stabbing Triangulation Problem: IP Models and Computational Evaluation	36
<i>Breno Piva and Cid C. de Souza</i>	
Orbital Shrinking	48
<i>Matteo Fischetti and Leo Liberti</i>	
Using Symmetry to Optimize over the Sherali-Adams Relaxation	59
<i>James Ostrowski</i>	
A Second-Order Cone Programming Approximation to Joint Chance-Constrained Linear Programs	71
<i>Jianqiang Cheng, Céline Gicquel, and Abdel Lisser</i>	
Semidefinite Relaxations for Mixed 0-1 Second-Order Cone Program	81
<i>Agnès Gorge, Abdel Lisser, and Riadh Zorgati</i>	
The Non-Disjoint m -Ring-Star Problem : Polyhedral Results and SDH/SONET Network Design	93
<i>Pierre Foulhoux and Aurélien Questel</i>	
The Uncapacitated Asymmetric Traveling Salesman Problem with Multiple Stacks	105
<i>Sylvie Borne, Roland Grappe, and Mathieu Lacroix</i>	

Polyhedral Analysis and Branch-and-Cut for the Structural Analysis Problem	117
<i>Mathieu Lacroix, A. Ridha Mahjoub, and Sébastien Martin</i>	
Extended Formulations, Nonnegative Factorizations, and Randomized Communication Protocols	129
<i>Yuri Faenza, Samuel Fiorini, Roland Grappe, and Hans Raj Tiwary</i>	
An Algebraic Approach to Symmetric Extended Formulations	141
<i>Gábor Braun and Sebastian Pokutta</i>	
Dual Consistent Systems of Linear Inequalities and Cardinality Constrained Polytopes	153
<i>Satoru Fujishige and Jens Maßberg</i>	
Minimum Ratio Cover of Matrix Columns by Extreme Rays of Its Induced Cone	165
<i>A.S. Freire, V. Acuña, P. Crescenzi, C.E. Ferreira, V. Lacroix, P.V. Milreu, E. Moreno, and M.-F. Sagot</i>	
Gap Inequalities for the Max-Cut Problem: A Cutting-Plane Algorithm	178
<i>Laura Galli, Konstantinos Kaparis, and Adam N. Letchford</i>	
Fast Separation Algorithms for Three-Index Assignment Problems	189
<i>Trivikram Dokka, Ioannis Mourtos, and Frits C.R. Spiessma</i>	
On the Hop Constrained Steiner Tree Problem with Multiple Root Nodes	201
<i>Luis Gouveia, Markus Leitner, and Ivana Ljubić</i>	
Theoretical Investigation of Aggregation in Pseudo-polynomial Network-Flow Models	213
<i>Marie-Emilie Vogé and François Clautiaux</i>	
On Solving the Rooted Delay- and Delay-Variation-Constrained Steiner Tree Problem	225
<i>Mario Ruthmair and Günther R. Raidl</i>	
A Parallel Lagrangian Relaxation Algorithm for the Min-Degree Constrained Minimum Spanning Tree Problem	237
<i>Leonardo Conegundes Martinez and Alexandre Salles da Cunha</i>	
Layered Formulation for the Robust Vehicle Routing Problem with Time Windows	249
<i>Agostinho Agra, Marielle Christiansen, Rosa Figueiredo, Lars Magnus Hvattum, Michael Poss, and Cristina Requejo</i>	

Models and Algorithms for Robust Network Design with Several Traffic Scenarios	261
<i>Eduardo Álvarez-Miranda, Valentina Cacchiani, Tim Dorneth, Michael Jünger, Frauke Liers, Andrea Lodi, Tiziano Parriani, and Daniel R. Schmidt</i>	
Aircraft Sequencing Problems via a Rolling Horizon Algorithm	273
<i>Fabio Furini, Carlo Alfredo Persiani, and Paolo Toth</i>	
On the Solution of a Graph Partitioning Problem under Capacity Constraints	285
<i>Pierre Bonami, Viet Hung Nguyen, Michel Klein, and Michel Minoux</i>	
Sum-Max Graph Partitioning Problem	297
<i>R. Watrigant, M. Bougeret, R. Giroudeau, and J.-C. König</i>	
The Packing Coloring Problem for $(q, q-4)$ Graphs	309
<i>G. Argiroffo, G. Nasini, and P. Torres</i>	
Selective Graph Coloring in Some Special Classes of Graphs	320
<i>Marc Demange, Jérôme Monnot, Petrica Pop, and Bernard Ries</i>	
Graph Orientations Optimizing the Number of Light or Heavy Vertices	332
<i>Ywichi Asahiro, Jesper Jansson, Eiji Miyano, and Hirotaka Ono</i>	
Constrained Matching Problems in Bipartite Graphs	344
<i>Monaldo Mastrolilli and Georgios Stamoulis</i>	
The Gram Dimension of a Graph	356
<i>Monique Laurent and Antonios Varvitsiotis</i>	
Exploiting a Hypergraph Model for Finding Golomb Rulers	368
<i>Manuel Sorge, Hannes Moser, Rolf Niedermeier, and Mathias Weller</i>	
Counting Homomorphisms via Hypergraph-Based Structural Restrictions	380
<i>Tommy Färnqvist</i>	
Hardness Results for the Probabilistic Traveling Salesman Problem with Deadlines	392
<i>Dennis Weyland, Roberto Montemanni, and Luca Maria Gambardella</i>	
Differential Approximation of the Multiple Stacks TSP	404
<i>Sophie Toulouse</i>	
Completion Time Scheduling and the WSRPT Algorithm	416
<i>Bo Xiong and Christine Chung</i>	

Two-Agent Scheduling on an Unbounded Serial Batching Machine	427
<i>Mikhail Y. Kovalyov, Ammar Oulamara, and Ameer Soukhal</i>	
Second-Price Ad Auctions with Binary Bids and Markets with Good Competition	439
<i>Cristina G. Fernandes and Rafael C.S. Schouery</i>	
Towards Minimizing k -Submodular Functions	451
<i>Anna Huber and Vladimir Kolmogorov</i>	
Recognition Algorithms for Binary Signed-Graphic Matroids	463
<i>Konstantinos Papalamprou and Leonidas Pitsoulis</i>	
Author Index	475