

Xiaodong Hu  
Jie Wang (Eds.)

LNCS 5092

# Computing and Combinatorics

14th Annual International Conference, COCOON 2008  
Dalian, China, June 2008  
Proceedings

 Springer

*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

*University of Dortmund, Germany*

Madhu Sudan

*Massachusetts Institute of Technology, MA, USA*

Demetri Terzopoulos

*University of California, Los Angeles, CA, USA*

Doug Tygar

*University of California, Berkeley, CA, USA*

Gerhard Weikum

*Max-Planck Institute of Computer Science, Saarbruecken, Germany*

Xiaodong Hu Jie Wang (Eds.)

# Computing and Combinatorics

14th Annual International Conference, COCOON 2008  
Dalian, China, June 27-29, 2008  
Proceedings

Volume Editors

Xiaodong Hu  
Chinese Academy of Sciences  
Institute of Applied Mathematics  
Zhong Guan Cun Dong Lu 55  
Beijing 100190, China  
E-mail: xdhu@amss.ac.cn

Jie Wang  
University of Massachusetts–Lowell  
Department of Computer Science  
Center for Network and Information Security  
Lowell, MA 01854, USA  
E-mail: wang@cs.uml.edu

Library of Congress Control Number: 2008929349

CR Subject Classification (1998): F.2, G.2, I.3.5, C.2.3-4, E.1, E.5, E.4

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

ISSN 0302-9743  
ISBN-10 3-540-69732-2 Springer Berlin Heidelberg New York  
ISBN-13 978-3-540-69732-9 Springer Berlin Heidelberg New York

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.

Springer is a part of Springer Science+Business Media

[springer.com](http://springer.com)

© Springer-Verlag Berlin Heidelberg 2008  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India  
Printed on acid-free paper SPIN: 12279302 06/3180 5 4 3 2 1 0

# Preface

The 14th Annual International Computing and Combinatorics Conference, COCOON 2008, took place in Dalian, China, June 27–29, 2008. Past COCOON conferences were held in Xi’an (1995), Hong Kong (1996), Shanghai (1997), Taipei (1998), Tokyo (1999), Sydney (2000), Guilin (2001), Singapore (2002), Montana (2003), Jeju Island (2004), Kunming (2005), Taipei (2006), and Alberta (2007).

COCOON 2008 provided a forum for researchers working in the areas of algorithms, theory of computation, computational complexity, and combinatorics related to computing. The Program Committee received 172 submissions from 26 countries and regions: Canada, Australia, Austria, Brazil, China, Denmark, France, Germany, Hong Kong, Hungary, India, Iran, Israel, Japan, Korea, Mexico, Morocco, Netherlands, Pakistan, Singapore, Spain, Switzerland, Taiwan, Ukraine, the UK, and USA.

With the help of 116 external referees, each submission was reviewed by at least two Program Committee members or external referees. Of the 172 submissions, 66 papers were selected for presentation in the conference and are included in this volume. Some of these will be selected for publication in a special issue of *Journal of Computer Science and Technology* and a special issue of the *Journal of Supercomputing* under the standard refereeing procedure. In addition to the selected papers, the conference also included two invited presentations by Der-Tsai Lee (Academia Sinica, Taiwan) and Takao Nishizeki (Tohoku University, Japan).

The best paper awards were given for “Visual Cryptography on Graphs” to Lu, Manchala and Ostrovsky, and for “A Linear Programming Duality Approach to Analyzing Strictly Nonblocking  $d$ -ary Multilog Networks under General Crosstalk Constraints” to Ngo, Wang and Le.

We thank the authors for submitting their papers to the conference. We are grateful to the members of the Program Committee and the external referees for their work within demanding time constraints. We thank the Organizing Committee for their contribution to making the conference a success. We also thank Jin-rong Wu for helping us create conference Web pages, Andrei Voronkov for letting us use the Easychair conference system, and Dingzhu Du for offering guidance.

Finally, we thank the conference sponsors and supporting organizations for their support and assistance. COCOON 2008 was supported in part by the National Natural Science Foundation of China under Grant No. 70221001, 10531070, 10771209, 10721101, and was held at Mercure Teda Dalian Hotel, Dalian, China.

June 2008

Xiaodong Hu  
Jie Wang

# Organization

## Executive Committee

Conference Chair: Dingzhu Du (University of Texas at Dallas, USA)

## Program Committee

Eric Allender (Rutgers University, USA)  
Dan Brown (University of Waterloo, Canada)  
Danny Z. Chen (University of Notre Dame, USA)  
John Crossley (Monash University, Australia)  
Karen Daniels (University of Massachusetts, USA)  
Lane Hemaspaandra (University of Rochester, USA)  
Steven Homer (Boston University, USA)  
Xiaodong Hu (Chinese Academy of Sciences, China) (Co-chair)  
Toshihide Ibaraki (Kwansei Gakuin University, Japan)  
Sanjay Jain (University of Singapore, Singapore)  
Hiro Ito (Kyoto University, Japan)  
Ming-Yang Kao (Northwestern University, USA)  
Valentine Kabanets (Simon Fraser University, Canada)  
Ker-I Ko (State University of New York at Stony Brook, USA)  
Xiangyang Li (Illinois Institute of Technology, USA)  
Chi-Jen Lu (Academia Sinica, Taiwan)  
Shueh-I Lu (National Taiwan University, Taiwan)  
Shinichi Nakano (Gunma University, Japan)  
Rudiger Reischuk (University of Luebeck, Germany)  
Georg Schnitger (University of Frankfurt, Germany)  
Krishnaiyan Thulasiraman (University of Oklahoma, USA)  
Biing-Feng Wang (National Tsing Hua University, Taiwan)  
Jie Wang (University of Massachusetts, USA) (Co-chair)  
Yinfeng Xu (Xi'an Jiaotong University, China)  
Wenan Zang (Hong Kong University, Hong Kong)  
Guochuan Zhang (Zhejiang University, China)  
Xiao Zhou (Tohoku University, Japan)

## Organization Committee

Xujin Chen (Chinese Academy of Sciences, China)  
Jie Hu (Operations Research Society of China, China)  
Xudong Hu (Chinese Academy of Sciences, China) (Chair)  
Aimin Jiang (Chinese Academy of Sciences, China)  
Degang Liu (Operations Research Society of China, China)  
Yunbin Zhao (Chinese Academy of Sciences, China)

## Referees

Akihiro Matsuura	Jin-Yi Cai	Shin-ichi Nakayama
Akihiro Uejima	Johannes Textor	Stasys Jukna
Alexander K. Hudek	Johannes Uhlmann	Stefan Langerman
Alexander Russell	Jun Tarui	Steven Skiena
Amitabh Chaudhary	Kazuyuki Miura	Sun-Yuan Hsieh
Andreas Jakoby	Ken-ichi Kawarabayashi	Takaaki Mizuki
Benjamin Hescott	Kiyoshi Yoshimoto	Takeaki Uno
Bing Su	Klaus Jansen	Takehiro Ito
Binhai Zhu	Koichi Yamazaki	Takeyuki Tamura
Bodo Manthey	Lance Fortnow	Takuro Fukunaga
Boting Yang	Liang Zhao	Takuya Yoshihiro
Chang-Biau Yang	Lin Lin	Thanh Minh Hoang
Chih-Jen Lin	Magnus Halldorsson	Tibor Jordan
Christian Hundt	Maik Weinard	Till Tantau
Craig Kaplan	Mario Szegedy	Timothy Chan
Cyril Allauzen	Mark Braverman	Toru Araki
Dan Gusfield	Markus Hinkelmann	Toru Hasunuma
Debajyoti Bera	Masashi Kiyomi	Toshimasa Ishii
Decheng Dai	Maw-Shang Chang	Toshinori Yamada
Deshi Ye	Max Alekseyev	Toshiya Mashima
Dingzhu Du	Maxim Sviridenko	Troy Lee
Edith Elkind	Min Xu	Uri Zwick
Eng Wee Chionh	Ming Zhong	Victor Milenkovic
Evanthia Papadopoulou	Mirela Damian	Werner Kuich
Feifeng Zheng	Mitsuo Motoki	Wing Kai Hon
Frank Balbach	Nirmalya Roy	Xiaohua Xu
Frank Stephan	Pangfeng Liu	Xuli Han
Frank Stephan	Paul Goldberg	Yajun Wang
Fukuhito Ooshita	Petros Drineas	Yasuhito Asano
Gruia Calinescu	Ping Xu	Yaw-Ling Lin
Haitao Wang	Roger Grinde	Yijie Han
Heribert Vollmer	Rolf Harren	Ying Xiao
Hiroshi Hirai	Rupert Hartung	Yoshio Okamoto
Hiroataka Ono	Ryuhei Uehara	Yoshiyuki Kusakari
Hsu-Chun Yen	Ryuhei Uehara	Yucheng Dong
Hu Zhang	Sergey Bereg	Yufeng Wu
Jeremy Avigad	Shang-Ju Liu	Yuichi Asahiro
Jesper Jansson	Sheung-Hung Poon	Zhou Xu
Jian Xia	Shietung Peng	

## Sponsoring Institutions

Academy of Mathematics and System Science, Chinese Academy of Sciences  
Operations Research Society of China

# Table of Contents

## Algorithms and Data Structures

Efficient Compression of Web Graphs .....	1
Damaged BZip Files Are Difficult to Repair .....	12
Isoperimetric Problem and Meta-fibonacci Sequences .....	22

## Algorithmic Game Theory and Online Algorithms

On the Complexity of Equilibria Problems in Angel-Daemon Games .....	31
Average-Case Competitive Analyses for One-Way Trading .....	41
On the Monotonicity of Weak Searching .....	52

## Automata, Languages, Logic, and Computability

VC Dimension Bounds for Analytic Algebraic Computations .....	62
Resource Bounded Frequency Computations with Three Errors .....	72
A Sublinear Time Randomized Algorithm for Coset Enumeration in the Black Box Model .....	82
Smallest Formulas for Parity of $2^k$ Variables Are Essentially Unique .....	92

## Combinatorics Related to Algorithms and Complexity

Counting Polycubes without the Dimensionality Curse .....	100
Polychromatic Colorings of $n$ -Dimensional Guillotine-Partitions .....	110



The Computational Complexity of Link Building..... 119

Improved Parameterized Algorithms for Weighted 3-Set Packing ..... 130

Structural Identifiability in Low-Rank Matrix Factorization ..... 140

Complexity of Counting the Optimal Solutions ..... 149

**Complexity Theory**

The Orbit Problem Is in the GapL Hierarchy ..... 160

Quantum Separation of Local Search and Fixed Point Computation .... 170

Multi-party Quantum Communication Complexity with Routed Messages..... 180

Monotone DNF Formula That Has a Minimal or Maximal Number of Satisfying Assignments ..... 191

Approximating Alternative Solutions ..... 204

Dimensions of Points in Self-similar Fractals ..... 215

**Cryptography, Reliability and Security, and Database Theory**

Visual Cryptography on Graphs ..... 225

Algebraic Cryptanalysis of CTRU Cryptosystem ..... 235

**Computational Biology and Bioinformatics – Model**

Detecting Community Structure by Network Vectorization ..... 245

Quasi-bicliques: Complexity and Binding Pairs.....	255
Complexity of a Collision-Aware String Partition Problem and Its Relation to Oligo Design for Gene Synthesis .....	265
Genome Halving under DCJ Revisited .....	276
Haplotype Inferring Via Galled-Tree Networks Is NP-Complete .....	287
<b>Computational Biology and Bioinformatics – Algorithms</b>	
Adjacent Swaps on Strings .....	299
Efficient Algorithms for SNP Haplotype Block Selection Problems.....	309
Sequence Alignment Algorithms for Run-Length-Encoded Strings .....	319
A 2.25-Approximation Algorithm for Cut-and-Paste Sorting of Unsigned Circular Permutations .....	331
A Practical Exact Algorithm for the Individual Haplotyping Problem MEC/GI .....	342
<b>Computational Algebra, Geometry, and Number Theory</b>	
Voronoi Diagram of Polygonal Chains under the Discrete Fréchet Distance .....	352
On Center Regions and Balls Containing Many Points .....	363
On Unfolding 3D Lattice Polygons and 2D Orthogonal Trees .....	374

New Algorithms for Online Rectangle Filling with  $k$ -Lookahead ..... 385

Geometric Spanner of Objects under  $L_1$  Distance ..... 395

**Graph Drawing and Information Visualization**

Star-Shaped Drawings of Graphs with Fixed Embedding and Concave  
Corner Constraints ..... 405

**Graph Theory and Algorithms**

A New Characterization of  $P_6$ -Free Graphs ..... 415

Maximum Connected Domatic Partition of Directed Path Graphs with  
Single Junction ..... 425

Efficient Algorithms for the  $k$  Smallest Cuts Enumeration ..... 434

Covering Directed Graphs by In-Trees ..... 444

On Listing, Sampling, and Counting the Chordal Graphs with Edge  
Constraints ..... 458

Probe Ptolemaic Graphs ..... 468

**Communication Networks and Optimization**

Diagnosability of Two-Matching Composition Networks ..... 478

The Iterated Restricted Immediate Snapshot Model ..... 487

Finding Frequent Items in a Turnstile Data Stream ..... 498

A Linear Programming Duality Approach to Analyzing Strictly Nonblocking $d$ -ary Multilog Networks under General Crosstalk Constraints .....	510
--	-----

Optimal Tree Structures for Group Key Tree Management Considering Insertion and Deletion Cost .....	521
---	-----

## Wireless Network

Throughput Maximization with Traffic Profile in Wireless Mesh Network .....	531
---	-----

Joint Topology Control and Power Conservation for Wireless Sensor Networks Using Transmit Power Adjustment .....	541
--	-----

$(6 + \varepsilon)$ -Approximation for Minimum Weight Dominating Set in Unit Disk Graphs .....	551
--	-----

Spectrum Bidding in Wireless Networks and Related .....	558
---	-----

## Network Optimization

$(1 + \rho)$ -Approximation for Selected-Internal Steiner Minimum Tree .....	568
--	-----

Computing Maximum Flows in Undirected Planar Networks with Both Edge and Vertex Capacities .....	577
--	-----

Spreading Messages .....	587
--------------------------	-----

On Some City Guarding Problems .....	600
--------------------------------------	-----

Optimal Insertion of a Segment Highway in a City Metric .....	611
---	-----

Approximating the Generalized Capacitated Tree-Routing Problem .....	621
--	-----

Column Generation Algorithms for the Capacitated  $m$ -Ring-Star Problem ..... 631

**Scheduling Problem**

Two-Agent Scheduling with Linear Deteriorating Jobs on a Single Machine ..... 642

A Two-Stage Flexible Flowshop Problem with Deterioration ..... 651

A Lower Bound for the On-Line Preemptive Machine Scheduling with  $\ell_p$  Norm ..... 661

The Coordination of Two Parallel Machines Scheduling and Batch Deliveries ..... 670

**Author Index** ..... 679