	D
XIII	Preface

xiv Acknowledgments

Session 1A

- 1 Region-Fault Tolerant Geometric Spanners
 M. A. Abam, M. de Berg, M. Farshi, and J. Gudmundsson
- 11 A PTAS for TSP with Neighborhoods among Fat Regions in the Plane Joseph S. B. Mitchell
- 19 Optimal Dynamic Vertical Ray Shooting in Rectilinear Planar Subdivisions Yoav Giyora and Haim Kaplan
- 29 Squarepants in a Tree: Sum of Subtree Clustering and Hyperbolic Pants Decomposition

 David Eppstein
- 39 A Near Linear Time Constant Factor Approximation for Euclidean Bichromatic Matching (Cost)

 Piotr Indyk

Session 1B

- 43 Compacting Cuts: A New Linear Formulation for Minimum Cut
 Robert D. Carr, Goran Konjevod, Greg Little, Venkatesh Natarajan, and Ojas
 Parekh
- 53 Linear Programming Relaxations of Maxcut
 Wenceslas Fernandez de la Vega and Claire Kenyon-Mathieu
- 62 Near-Optimal Algorithms for Maximum Constraint Satisfaction Problems Moses Charikar, Konstantin Makarychev, and Yury Makarychev
- 69 Improved Bounds for the Symmetric Rendezvous Value on the Line Qiaoming Han, Donglei Du, Juan Vera, and Luis F. Zuluaga
- 79 Efficient Solutions to Relaxations of Combinatorial Problems with Submodular Penalties via the Lovász Extension and Non-smooth Convex Optimization Fabián A. Chudak and Kiyohito Nagano

Session 1C

- 89 Multiple Source Shortest Paths in a Genus g Graph Sergio Cabello and Erin W. Chambers
- 98 Obnoxious Centers in Graphs Sergio Cabello and Günter Rote
- 108 Maximum Matching in Graphs with an Excluded Minor Raphael Yuster and Uri Zwick

iv Contents

118 Faster Dynamic Matchings and Vertex Connectivity

Piotr Sankowski

127 Efficient Algorithms for Computing All Low *s-t* Edge Connectivities and Related Problems

Ramesh Hariharan, Telikepalli Kavitha, and Debmalya Panigrahi

Session 2

137 Analytic Combinatorics—A Calculus of Discrete Structures

Philippe Flajolet

Session 3A

149 Equilibria in Online Games

Roee Engelberg and Joseph (Seffi) Naor

159 The Approximation Complexity of Win-Lose Games

Xi Chen, Shang-Hua Teng, and Paul Valiant

169 Convergence to Approximate Nash Equilibria in Congestion Games

Steve Chien and Alistair Sinclair

179 Efficient Contention Resolution Protocols for Selfish Agents

Amos Fiat, Yishay Mansour, and Uri Nadav

189 Strong Price of Anarchy

Nir Andelman, Michal Feldman, and Yishay Mansour

Session 3B

199 Better Online Buffer Management

Fei Li, Jay Sethuraman, and Clifford Stein

209 Considering Suppressed Packets Improves Buffer Management in QoS Switches

Matthias Englert and Matthias Westermann

219 Instability of FIFO in the Permanent Sessions Model at Arbitrarily Small Network Loads

Matthew Andrews

229 On the Separation and Equivalence of Paging Strategies

Spyros Angelopoulos, Reza Dorrigiv, and Alejandro López-Ortiz

238 Pull-Based Data Broadcast with Dependencies: Be Fair to Users, Not to Items

Julien Robert and Nicolas Schabanel

Improved Bounds for the Online Steiner Tree Problem in Graphs of Bounded

Edge-Asymmetry

Spyros Angelopoulos

Session	3C
258	Minimizing Movement Erik D. Demaine, MohammadTaghi Hajiaghayi, Hamid Mahini, Amin S. Sayedi- Roshkhar, Shayan Oveisgharan, and Morteza Zadimoghaddam
268	Optimization Problems in Multiple-Interval Graphs Ayelet Butman, Danny Hermelin, Moshe Lewenstein, and Dror Rawitz
278	Approximation Algorithms via Contraction Decomposition Erik D. Demaine, MohammadTaghi Hajiaghayi, and Bojan Mohar
288	A 1.875–Approximation Algorithm for the Stable Marriage Problem Kazuo Iwama, Shuichi Miyazaki, and Naoya Yamauchi
298	Improved Algorithms for Path, Matching, and Packing Problems Jianer Chen, Songjian Lu, Sing-Hoi Sze, and Fenghui Zhang
Session	14A
308	Model-Driven Optimization Using Adaptive Probes Sudipto Guha and Kamesh Munagala
318	Estimating the Sortedness of a Data Stream Parikshit Gopalan, T.S. Jayram, Robert Krauthgamer, and Ravi Kumar
328	A Near-Optimal Algorithm for Computing the Entropy of a Stream Amit Chakrabarti, Graham Cormode, and Andrew McGregor
336	The Communication and Streaming Complexity of Computing the Longest Common and Increasing Subsequences Xiaoming Sun and David P. Woodruff
346	Efficient Aggregation Algorithms for Probabilistic Data T.S. Jayram, Satyen Kale, and Erik Vee
Session	4B
356	An Unbiased Pointing Operator for Unlabeled Structures, with Applications to Counting and Sampling Manuel Bodirsky, Eric Fusy, Mihyun Kang, and Stefan Vigerske
366	Approximating Entropy from Sublinear Samples Mickey Brautbar and Alex Samorodnitsky
376	Torpid Mixing of Local Markov Chains on 3-Colorings of the Discrete Torus David Galvin and Dana Randall
385	Probabilistic Analysis of Linear Programming Decoding Constantinos Daskalakis, Alexandros G. Dimakis, Richard M. Karp, and Martin J. Wainwright

vi Contents

395 Scrambling Adversarial Errors Using Few Random Bits, Optimal Information Reconciliation, and Better Private Codes

Adam Smith

Session 4C

405 Deterministic Pivoting Algorithms for Constrained Ranking and Clustering Problems

Anke van Zuylen, Rajneesh Hegde, Kamal Jain, and David P. Williamson

415 Aggregation of Partial Rankings, *p*-Ratings and Top-*m* Lists Nir Ailon

425 Algorithms and Incentives for Robust Ranking

Rajat Bhattacharjee and Ashish Goel

Matroids, Secretary Problems, and Online Mechanisms *Moshe Babaioff, Nicole Immorlica, and Robert Kleinberg*

444 An Algebraic Algorithm for Weighted Linear Matroid Intersection Nicholas J. A. Harvey

Session 5A

454 An Elementary Construction of Constant-Degree Expanders

Noga Alon, Oded Schwartz, and Asaf Shapira

The k-Orientability Thresholds for $G_{n,p}$

Daniel Fernholz and Vijaya Ramachandran

The Random Graph Threshold for *k*-Orientiability and a Fast Algorithm for Optimal Multiple-Choice Allocation

Julie Anne Cain, Peter Sanders, and Nick Wormald

477 On Extremal Subgraphs of Random Graphs

Graham Brightwell, Konstantinos Panagiotou, and Angelika Steger

486 Online Vertex Colorings of Random Graphs without Monochromatic Subgraphs

Martin Marciniszyn and Reto Spöhel

494 On Testable Properties in Bounded Degree Graphs

Artur Czumaj and Christian Sohler

Session 5B

502 Embedding Metrics into Ultrametrics and Graphs into Spanning Trees with Constant Average Distortion

Ittai Abraham, Yair Bartal, and Ofer Neiman

Approximation Algorithms for Embedding General Metrics into Trees *Mihai Bădoiu, Piotr Indyk, and Anastasios Sidiropoulos*

522 Embedding into I² Is Easy, Embedding into I³ Is NP-Complete Jeff Edmonds

532	Efficient Subspace Approximation Algorithms Nariankadu D. Shyamalkumar and Kasturi Varadarajan
541	A Divide and Conquer Algorithm for d-Dimensional Arrangement Moses Charikar, Konstantin Makarychev, and Yury Makarychev
Session	5C
547	Resilient Search Trees Irene Finocchi, Fabrizio Grandoni, and Giuseppe F. Italiano
555	Randomization Does Not Help Searching Predecessors Mihai Pătrașcu and Mikkel Thorup
565	Dynamic Weighted Ancestors Tsvi Kopelowitz and Moshe Lewenstein
575	Ultra-succinct Representation of Ordered Trees Jesper Jansson, Kunihiko Sadakane, and Wing-Kin Sung
585	Tree Exploration with Logarithmic Memory Leszek Gąsieniec, Andrzej Pelc, Tomasz Radzik, and Xiaohui Zhang
Session 6	
595	Testing for a Theta Maria Chudnovsky and Paul Seymour
Session	7A
599	Deterministic Rendezvous, Treasure Hunts and Strongly Universal Exploration Sequences Amnon Ta-Shma and Uri Zwick
609	Planar Graphs Are in 1-STRING J. Chalopin, D. Gonçalves, and P. Ochem
618	On the Bandwidth Conjecture for 3-Colourable Graphs Julia Böttcher, Mathias Schacht, and Anusch Taraz
627	Sandpile Transience on the Grid Is Polynomially Bounded László Babai and Igor Gorodezky
637	Digraph Measures: Kelly Decompositions, Games, and Orderings Paul Hunter and Stephan Kreutzer

Session 7B

Approximating the Spanning Star Forest Problem and Its Applications to Genomic Sequence Alignment
C. Thach Nguyen, Jian Shen, Minmei Hou, Li Sheng, Webb Miller, and Louxin Zhang 645

viii Contents

Fast Elimination of Redundant Linear Equations and Reconstruction of Recombination-Free Mendelian Inheritance on a Pedigree Jing Xiao, Lan Liu, Lirong Xia, and Tao Jiang

Whole Genome Duplications, Multi-break Rearrangements, and Genome Halvina Problem

Max A. Alekseyev and Pavel A. Pevzner

Succinct Indexes for Strings, Binary Relations and Multi-labeled Trees Jérémy Barbay, Meng He, J. Ian Munro, and S. Srinivasa Rao

690 A Simple Storage Scheme for Strings Achieving Entropy Bounds Paolo Ferragina and Rossano Venturini

Session 7C

697 A Network Formation Game for Bipartite Exchange Economies Eyal Even-Dar, Michael Kerans, and Siddharth Suri

707 Cheap Labor Can Be Expensive Ning Chen and Anna R. Karlin

716 Buying Cheap Is Expensive: Hardness of Non-parametric Multi-product Pricing Patrick Briest and Piotr Krysta

726 Dynamic Pricing for Impatient Bidders

Nikhil Bansal, Ning Chen, Neva Cherniavsky, Atri Rudra, Baruch Schieber, and Maxim Sviridenko

736 Designing and Learning Optimal Finite Support Auctions Edith Elkind

Session 8A

746 On Bregman Voronoi Diagrams

Frank Nielsen, Jean-Daniel Boissonnat, and Richard Nock

756 Zone Diagrams: Existence, Uniqueness, and Algorithmic Challenge Tetsuo Asano, Jiří Matoušek, and Takeshi Tokuyama

766 Approximate Shortest Paths in Anisotropic Regions Siu-Wing Cheng, Hyeon-Suk Na, Antoine Vigneron, and Yajun Wang

775 On Bounded Leg Shortest Paths Problems

Liam Roditty and Michael Segal

785 Counting Colors in Boxes

Haim Kaplan, Natan Rubin, Micha Sharir, and Elad Verbin

Session 8B

795 Energy Efficient Online Deadline Scheduling

Ho-Leung Chan, Wun-Tat Chan, Tak-Wah Lam, Lap-Kei Lee, Kin-Sum Mak, and Prudence W. H. Wong

805	Speed Scaling for Weighted Flow Time Nikhil Bansal, Kirk Pruhs, and Cliff Stein
814	Path-Independent Load Balancing with Unreliable Machines James Aspnes, Yang Richard Yang, and Yitong Yin
824	Layered Multicast Scheduling for the L_{∞} Objective Qingbo Cai and Vincenzo Liberatore
834	Lower Bounds on Average-Case Delay for Video-on-Demand Broadcast Protocols Wei-Lung Dustin Tseng and David Kirkpatrick
Session	8C
843	Maximum s - t -Flow with k Crossings in $O(k^3 n \log n)$ Time Jan M . Hochstein and Karsten Weihe
848	Matrix Scaling by Network Flow Günter Rote and Martin Zachariasen
855	Single Source Multiroute Flows and Cuts on Uniform Capacity Networks Henning Bruhn, Jakub Černý, Alexander Hall, and Petr Kolman
864	Island Hopping and Path Colouring with Applications to WDM Network Design Andrew McGregor and Bruce Shepherd
874	Maximum Independent Sets in Graphs of Low Degree Vadim Lozin and Martin Milanič
Session	9A
881	Noisy Binary Search and Its Applications Richard M. Karp and Robert Kleinberg
891	Multiple Choice Tries and Distributed Hash Tables Luc Devroye, Gabor Lugosi, Gahyun Park, and Wojciech Szpankowski
900	Making Deterministic Signatures Quickly Milan Ružić
910	A Faster Cache-Oblivious Shortest-Path Algorithm for Undirected Graphs with Bounded Edge Lengths Luca Allulli, Peter Lichodzijewski, and Norbert Zeh
920	On the k-Simple Shortest Paths Problem in Weighted Directed Graphs Liam Roditty

Session 9B

929 Semi-oblivious Routing: Lower Bounds
MohammadTaghi Hajiaghayi, Robert Kleinberg, and Tom Leighton

x Contents

Ke Yi

939	Optimal Scale-free Compact Routing Schemes in Networks of Low Doubling Dimension Goran Konjevod, Andréa W. Richa, and Donglin Xia
949	Distributed Algorithms for Multicommodity Flow Problems via Approximate Steepest Descent Framework Baruch Awerbuch, Rohit Khandekar, and Satish Rao
958	Network Sketching or: "How Much Geometry Hides in Connectivity? – Part II" Stefan Funke and Nikola Milosavljevic
968	Line-of-Sight Networks Alan Frieze, Jon Kleinberg, R. Ravi, and Warren Debany
Session	9C
978	All-Pairs Bottleneck Paths in Vertex Weighted Graphs Asaf Shapira, Raphael Yuster, and Uri Zwick
986	Finding a Heaviest Triangle Is Not Harder than Matrix Multiplication Artur Czumaj and Andrzej Lingas
995	Matrix-Vector Multiplication in Sub-quadratic Time (Some Preprocessing Required) Ryan Williams
1002	A Linear Work, $O(n^{1/6})$ Time, Parallel Algorithm for Solving Planar Laplacians loannis Koutis and Gary L. Miller
1012	Fast Computation of Power Series Solutions of Systems of Differential Equations A. Bostan, F. Chyzak, F. Ollivier, B. Salvy, É. Schost, and A. Sedoglavic
Session	10
1022	Combinatorial Algorithms for Web Search Engines—Three Success Stories Monika Henzinger
Session	11A
1027	k-means++: The Advantages of Careful Seeding David Arthur and Sergei Vassilvitskii
1036	Spectral Clustering with Limited Independence Anirban Dasgupta, John Hopcroft, Ravi Kannan, and Pradipta Mitra
1046	A Rigorous Analysis of Population Stratification with Limited Data Kamalika Chaudhuri, Eran Halperin, Satish Rao, and Shuheng Zhou
1056	Restricted Strip Covering and the Sensor Cover Problem Adam L. Buchsbaum, Alon Efrat, Shaili Jain, Suresh Venkatasubramanian, and

1066 Compressing Rectilinear Pictures and Minimizing Access Control Lists David A. Applegate, Gruia Calinescu, David S. Johnson, Howard Karloff, Katrina

Ligett, and Jia Wang

Session 11B

1076 Reconstruction Using Witness Complexes

Leonidas J. Guibas and Steve Y. Oudot

1086 Geometric and Topological Guarantees for the WRAP Reconstruction Algorithm Edgar A. Ramos and Bardia Sadri

1096 Delaunay Refinement for Piecewise Smooth Complexes

Siu-Wing Cheng, Tamal K. Dey, and Edgar A. Ramos

1106 Complexity of Delaunay Triangulation for Points on Lower-Dimensional Polyhedra

Nina Amenta, Dominique Attali, and Olivier Devillers

1114 On the Number of Tetrahedra with Minimum, Unit, and Distinct Volumes in Three-Space

Adrian Dumitrescu and Csaba D. Tóth

Session 11C

1124 Games of Fixed Rank: A Hierarchy of Bimatrix Games

Ravi Kannan and Thorsten Theobald

1133 The Effectiveness of Stackelberg Strategies and Tolls for Network Congestion Games

Chaitanya Swamy

1143 Setting Lower Bounds on Truthfulness

Ahuva Mu'alem and Michael Schapira

1153 An Efficient Cost-Sharing Mechanism for the Prize-Collecting Steiner Forest Problem

A. Gupta, J. Könemann, S. Leonardi, R. Ravi, and G. Schäfer

1163 A Lower Bound for Scheduling Mechanisms

George Christodoulou, Elias Koutsoupias, and Angelina Vidali

Session 12A

1171 The Independent Even Factor Problem

Satoru Iwata and Kenjiro Takazawa

1181 Fractional Packing in Ideal Clutters

Yuji Matsuoka

1187 Half Integral Packing, Erdös-Posá-Property and Graph Minors

Ken-ichi Kawarabayashi

1197	Harmonic Algorithm for 3-Dimensional Strip Packing Problem Nikhil Bansal, Xin Han, Kazuo Iwama, Maxim Sviridenko, and Guochuan Zhang	
1207	Polynomial Approximation Schemes for Smoothed and Random Instances of Multidimensional Packing Problems David Karger and Krzysztof Onak	
Session	12B	
1217	Quantum Algorithms for Simon's Problem over General Groups Gorjan Alagic, Cristopher Moore, and Alexander Russell	
1225	Quantum Algorithm for a Generalized Hidden Shift Problem Andrew M. Childs and Wim van Dam	
1235	The Quantum Schur and Clebsch-Gordan Transforms: I. Efficient Qudit Circuits Dave Bacon, Isaac L. Chuang, and Aram W. Harrow	
1245	Correlation Decay and Deterministic FPTAS for Counting List-Colorings of a Graph David Gamarnik and Dmitriy Katz	
1255	Counting Good Truth Assignments of Random k-SAT Formulae Andrea Montanari and Devavrat Shah	
Section 12C		
1265	Approximation Algorithms for Node-Weighted Buy-at-Bulk Network Design C. Chekuri, M. T. Hajiaghayi, G. Kortsarz, and M. R. Salavatipour	
1275	Approximation Algorithms for Prize Collecting Forest Problems with Submodular Penalty Functions Yogeshwer Sharma, Chaitanya Swamy, and David P. Williamson	
1285	A Polynomial-Time Approximation Scheme for Steiner Tree in Planar Graphs Glencora Borradaile, Claire Kenyon-Mathieu, and Philip Klein	
1295	Worst Case and Probabilistic Analysis of the 2-Opt Algorithm for the TSP Matthias Englert, Heiko Röglin, and Berthold Vöcking	
1305	Approximation Algorithms for Stochastic and Risk-Averse Optimization Aravind Srinivasan	
1315	Author Index	