

# Table of Contents

|                               |    |
|-------------------------------|----|
| Conference Organization ..... | xi |
|-------------------------------|----|

|                |     |
|----------------|-----|
| Sponsors ..... | xii |
|----------------|-----|

## Friday, July 6

### Session 1A

Chair: Mihalis Yannakakis

- **Clustering to Minimize the Sum of Cluster Diameters** ..... 1  
Moses Charikar and Rina Panigrahy
- **Approximating Min-Sum  $k$ -Clustering in Metric Spaces**.....11  
Yair Bartal, Moses Charikar, and Danny Raz
- **Local Search Heuristics for  $k$ -median and Facility Location Problems**..... 21  
Vijay Arya, Naveen Garg, Rohit Khandekar, Adam Meyerson, Kamesh Munagala, and Vinayaka Pandit
- **Profit-Earning Facility Location**..... 30  
Adam Meyerson

### Session 1B

Chair: Noam Nisan

- **One-Dimensional Quantum Walks** ..... 37  
Andris Ambainis, Eric Bach, Ashwin Nayak, Ashvin Vishwanath, and John Watrous
- **Quantum Walks on Graphs**..... 50  
Dorit Aharonov, Andris Ambainis, Julia Kempe, and Umesh Vazirani
- **Quantum Algorithms for Solvable Groups** ..... 60  
John Watrous
- **Quantum Mechanical Algorithms for the Nonabelian Hidden Subgroup Problem** ..... 68  
Michelangelo Grigni, Leonard Schulman, Monica Vazirani, and Umesh Vazirani

### Session 2A

Chair: Paul Spirakis

- **Minimax Parametric Optimization Problems and Multi-dimensional Parametric Searching** ..... 75  
Takeshi Tokuyama
- **Algorithms for Minimizing Weighted Flow Time** ..... 84  
Chandra Chekuri, Sanjeev Khanna, and An Zhu
- **Non-Clairvoyant Scheduling to Minimize the Average Flow Time on Single and Parallel Machines** ..... 94  
Luca Becchetti and Stefano Leonardi
- **Stackelberg Scheduling Strategies**..... 104  
Tim Roughgarden

## Session 2B

Chair: Noam Nisan

- **Quantum Computers that Can be Simulated Classically in Polynomial Time**.....114  
Leslie G. Valiant
- **Interaction in Quantum Communication and the Complexity of Set Disjointness**..... 124  
Hartmut Klauck, Ashwin Nayak, Amnon Ta-Shma, and David Zuckerman
- **A New Protocol and Lower Bounds for Quantum Coin Flipping**..... 134  
Andris Ambainis
- **Loss-less Condensers, Unbalanced Expanders, and Extractors**..... 143  
Amnon Ta-Shma, Christopher Umans, and David Zuckerman

## Session 3A

Chair: Elias Koutsoupias

- **Conditions on Input Vectors for Consensus Solvability in Asynchronous Distributed Systems**..... 153  
Achour Mostefaoui, Sergio Rajsbaum, and Michel Raynal
- **Spatial Gossip and Resource Location Protocols**..... 163  
David Kempe, Jon Kleinberg, and Alan Demers
- **$(1+\epsilon, \beta)$ -Spanner Constructions for General Graphs**..... 173  
Michael Elkin and David Peleg
- **Approximate Distance Oracles**..... 183  
Mikkel Thorup and Uri Zwick

## Session 3B

Chair: Russell Impagliazzo

- **Extractor Codes**..... 193  
Amnon Ta-Shma and David Zuckerman
- **Excellent Nonlinear Codes from Modular Curves**..... 200  
Noam D. Elkies
- **Sparse Polynomial Approximation in Finite Fields**..... 209  
Igor E. Shparlinski
- **Randomness Efficient Identity Testing of Multivariate Polynomials**..... 216  
Adam R. Klivans and Daniel A. Spielman

## Session 4A

Chair: Elias Koutsoupias

- **Fully-Dynamic Min-Cut**..... 224  
Mikkel Thorup
- **Computing Crossing Numbers in Quadratic Time**..... 231  
Martin Grohe
- **Euler Paths in Series Parallel Graphs**..... 237  
S. Rao Kosaraju
- **Decidability of String Graphs**..... 241  
Marcus Schaefer and Daniel Štefankovič

## Session 4B

Chair: Sampath Kannan

- **Learning Mixtures of Arbitrary Gaussians** ..... 247  
Sanjeev Arora and Ravi Kannan
- **Learning DNF in Time  $2^{\tilde{O}(n^{1/3})}$**  ..... 258  
Adam R. Klivans and Rocco A. Servedio
- **Sampling Algorithms: Lower Bounds and Applications** ..... 266  
Ziv Bar-Yossef, Ravi Kumar, and D. Sivakumar
- **Testing Metric Properties** ..... 276  
Michal Parnas and Dana Ron
- **Testing of Matrix Properties** ..... 286  
Eldar Fischer and Ilan Newman

## Saturday, July 7

### Session 5A

Chair: Kurt Melhorn

- **Smoothed Analysis of Algorithms: Why the Simplex Algorithm Usually Takes Polynomial Time** ..... 296  
Daniel A. Spielman and Shang-Hua Teng
- **One Line and  $n$  Points** ..... 306  
Bernd Gärtner, József Solymosi, Falk Tschirschnitz, Emo Welzl, and Pavel Valtr
- **A Tight Bound for the Complexity of Voronoi Diagrams under Polyhedral Convex Distance Functions in 3D** ..... 316  
Christian Icking and Lihong Ma
- **Lower Bounds for Intersection Searching and Fractional Cascading in Higher Dimension** ..... 322  
Bernard Chazelle and Ding Liu

### Session 5B

Chair: Russell Impagliazzo

- **Sharp Threshold and Scaling Window for the Integer Partitioning Problem** ..... 330  
Christian Borgs, Jennifer T. Chayes, and Boris Pittel
- **A Sharp Threshold in Proof Complexity** ..... 337  
Dimitris Achlioptas, Paul Beame, and Michael Molloy
- **Regular Resolution Lower Bounds for the Weak Pigeonhole Principle** ..... 347  
Toniann Pitassi and Ran Raz
- **The Complexity of Analytic Tableaux** ..... 356  
Noriko H. Arai, Toniann Pitassi, and Alasdair Urquhart

### Session 6A

Chair: Kurt Melhorn

- **Applications of Approximation Algorithms to Cooperative Games** ..... 364  
Kamal Jain and Vijay V. Vazirani
- **Approximation Algorithms for Constrained Node Weighted Steiner Tree Problems** ..... 373  
Anna Moss and Yuval Rabani

- **A Constant Factor Approximation for the Single Sink Edge Installation Problem**..... 383  
Sudipto Guha, Adam Meyerson, and Kamesh Munagala
- **Provisioning a Virtual Private Network: A Network Design Problem for Multicommodity Flow**.. 389  
Anupam Gupta, Jon Kleinberg, Amit Kumar, Rajeev Rastogi, and Bulent Yener

## Session 6B

Chair: Russell Impagliazzo

- **Explicit Lower Bound of  $4.5n - o(n)$  for Boolean Circuits**..... 399  
Oded Lachish and Ran Raz
- **Lower Bounds for Matrix Product, in Bounded Depth Circuits with Arbitrary Gates** ..... 409  
Ran Raz and Amir Shpilka
- **A Read-Once Branching Program Lower Bound of  $\Omega(2^{n/4})$  for Integer Multiplication Using Universal Hashing**..... 419  
Beate Bollig and Philipp Woelfel
- **On the Cell Probe Complexity of Membership and Perfect Hashing**..... 425  
Rasmus Pagh

## Session 7A

Chair: Chandra Chekuri

- **On the Integrality Ratio of Semidefinite Relaxations of MAX CUT**..... 433  
Uriel Feige and Gideon Schechtman
- **Approximation Algorithms for MAX-3-CUT and Other Problems via Complex Semidefinite Programming**..... 443  
Michel X. Goemans and David P. Williamson
- **Non-approximability Results for Optimization Problems on Bounded Degree Instances**..... 453  
Luca Trevisan
- **Colouring Graphs When the Number of Colours is Nearly the Maximum Degree** ..... 462  
Michael Molloy and Bruce Reed

## Session 7B

Chair: S. Muthukrishnan

- **Data-Streams and Histograms**..... 471  
Sudipto Guha, Nick Koudas, and Kyuseok Shim
- **Optimal Static Range Reporting in One Dimension**..... 476  
Stephen Alstrup, Gerth Stølting Brodal, and Theis Rauhe
- **Biased Dictionaries with Fast Insert/Deletes** ..... 483  
Funda Ergun, S. Cenk Şahinalp, Jonathan Sharp, and Rakesh K. Sinha
- **Anti-persistence: History Independent Data Structures**..... 492  
Moni Naor and Vanessa Teague

## Session 8A

Chair: Christos Papadimitriou

- **Dynamic TCP Acknowledgement and Other Stories About  $e/(e-1)$** ..... 502  
Anna R. Karlin, Claire Kenyon, and Dana Randall
- **The Price of Selfish Routing**..... 510  
Marios Mavronicolas and Paul Spirakis

- **Buffer Overflow Management in QoS Switches** ..... 520  
Alexander Kesselman, Zvi Lotker, Yishay Mansour, Boaz Patt-Shamir, Baruch Schieber,  
and Maxim Sviridenko
- **Almost Optimal Permutation Routing on Hypercubes**..... 530  
Berthold Vöcking
- **Online Server Allocation in a Server Farm via Benefit Task Systems**..... 540  
T. S. Jayram, Tracy Kimbrel, Robert Krauthgamer, Baruch Schieber, and Maxim Sviridenko

## Session 8B

Chair: Joan Feigenbaum

- **Private Approximation of NP-hard Functions** ..... 550  
Shai Halevi, Robert Krauthgamer, Eyal Kushilevitz, and Kobbi Nissim
- **Concurrent and Resettable Zero-Knowledge in Poly-logarithmic Rounds** ..... 560  
Joe Kilian and Erez Petrank
- **Black-Box Concurrent Zero-Knowledge Requires  $\Omega(\log n)$  Rounds**..... 570  
Ran Canetti, Joe Kilian, Erez Petrank, and Alon Rosen
- **The Round Complexity of Verifiable Secret Sharing and Secure Multicast** ..... 580  
Rosario Gennaro, Yuval Ishai, Eyal Kushilevitz, and Tal Rabin
- **Communication Preserving Protocols for Secure Function Evaluation** ..... 590  
Moni Naor and Kobbi Nissim

## Sunday, July 8

### Session 9: Plenary Invited Talk: Turing Award Lecture

Chair: Mihalis Yannakakis

- **Some Perspectives on Computational Complexity**..... 600  
Andrew Chi-Chih Yao

## Session 10A

Chair: Prabhakar Raghavan

- **A Sieve Algorithm for the Shortest Lattice Vector Problem** ..... 601  
Miklós Ajtai, Ravi Kumar, and D. Sivakumar
- **Fast Computation of Low Rank Matrix Approximations** ..... 611  
Dimitris Achlioptas and Frank McSherry
- **Spectral Analysis of Data** ..... 619  
Yossi Azar, Amos Fiat, Anna R. Karlin, Frank McSherry, and Jared Saia
- **Optimal Outlier Removal in High-Dimensional Spaces** ..... 627  
John Dunagan and Santosh Vempala
- **Estimating True Evolutionary Distances Between Genomes** ..... 637  
Li-San Wang and Tandy Warnow

## Session 10B

Chair: Sampath Kannan

- **On Optimal Slicing of Parallel Programs**..... 647  
Markus Müller-Olm and Helmut Seidl
- **When is the Evaluation of Conjunctive Queries Tractable?** ..... 657  
Martin Grohe, Thomas Schwentick, and Luc Segoufin

- **The Complexity of Maximal Constraint Languages** ..... 667  
Andrei A. Bulatov, Andrei A. Krokhin, and Peter G. Jeavons
- **Quantitative Solution of Omega-Regular Games** ..... 675  
Luca de Alfaro and Rupak Majumdar
- **Distribution Functions of Probabilistic Automata** ..... 684  
Farrokh Vatan

## Session 11A

Chair: Prabhakar Raghavan

- **Compatible Sequences and a Slow Winkler Percolation** ..... 694  
Peter Gács
- **Edge Isoperimetry and Rapid Mixing on Matroids and Geometric Markov Chains** ..... 704  
Ravi Montenegro and Jun-Bae Son
- **A Polynomial-Time Approximation Algorithm for the Permanent of a Matrix with Non-Negative Entries** ..... 712  
Mark Jerrum, Alistair Sinclair, and Eric Vigoda

## Session 11B

Chair: S. Muthukrishnan

- **Computing with Continuous-Time Liapunov Systems** ..... 722  
Jiř Šima and Pekka Orponen
- **Complex Tilings** ..... 732  
Bruno Durand, Leonid A. Levin, and Alexander Shen
- **Running Time and Program Size for Self-assembled Squares** ..... 740  
Leonard Adleman, Qi Cheng, Ashish Goel, and Ming-Deh Huang

## Session 12 : STOC-ICALP Plenary Invited Talks

Chair: Paul Spirakis

- **Algorithms, Games, and the Internet** ..... 749  
Christos H. Papadimitriou
- **Automata, Circuits and Hybrids: Facets of Continuous Time** ..... 754  
Boris A. Trakhtenbrot

**Author Index** ..... 756