Daniel A. Spielman

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Academic Positions		
	YALE UNIVERSITY	July '05 - present
	Henry Ford II Professor of Computer Science, Mathematics and Applied Mathematics	
	MASSACHUSETTS INSTITUTE OF TECHNOLOGY	July '02 - July '05
	Associate Professor of Applied Mathematics (tenured '04)	
	MASSACHUSETTS INSTITUTE OF TECHNOLOGY	July '96 - July '02
	Assistant Professor of Applied Mathematics	
	U. C. BERKELEY, DIVISION OF COMPUTER SCIENCE	July '95–June '96
	N.S.F. Mathematical Sciences Postdoc	

Education

MASSACHUSETTS INSTITUTE OF TECHNOLOGY — Ph.D. June '95
Department of Mathematics, adviser: M. Sipser.
Thesis: "Computationally efficient error-correcting codes and holographic proofs"

YALE UNIVERSITY — B.A. May '92
Summa cum laude. Exceptional distinction in Computer Science.
Beckwith prize in Mathematics.

Awards and Honors

2014 Polya Prize, awarded by SIAM

2014 Invited speaker at International Congress of Mathematicians.

2013 Best Paper at the 54th Annual IEEE Symposium on Foundations of Computer Science (FOCS).

2013 Yale Science and Engineering Association Award for Advancement of Basic and Applied Science.

2012 MacArthur Fellowship.

2012 Simons Investigator.

2012 Best Paper at the 25th Conference on Learning Theory (COLT).

2012 Member Connecticut Academy of Science and Engineering.

2011 Best Paper at the 43rd ACM Symposium on Theory of Computing (STOC).

2010 Fellow of the Association for Computing Machinery.

2010 Rolf Nevanlinna Prize, awarded by the IMU.

2010 Invited speaker at International Congress of Mathematicians.

2009 Fulkerson Prize, awarded jointly by the AMS and MPS.

2008 Gödel Prize, awarded jointly by the ACM and EATCS.

2002 IEEE Information Theory Society Paper Award.

2002 Invited speaker at International Congress of Mathematicians.

1998 Alfred P. Sloan Foundation Research Fellowship.

1997 NSF CAREER Award.

1995 Association for Computing Machinery Doctoral Dissertation Award.

1995 MIT Laboratory for Computer Science Thesis Award.

1995 Best Student Paper at the 27th ACM Symposium on Theory of Computing.

1994 Best Student Paper at the 26th ACM Symposium on Theory of Computing.

Grants
MacArthur Fellowship. 1/1/13 - 12/31/17.

Simons Investigator. 9/1/12 - 8/31/17.

AFOSR FA9550-121-0175: "Discovering and Analyzing Network Function and Structure".

NSF CCF1111257: "AF:Large: Collaborative Research: Algebraic Graph Algorithms: The Laplacian and Beyond".

NSF CCF-0915487: "Spectral Graph Theory, Point Clouds, and Linear Equation Solvers". 8/1/09-7/31/12.

NSF CCF-0634957: "Collaborative Research: Spectral Graph Theory and Its Applications" 5/1/07–4/30/10. With Garry Miller, John Lafferty, Tai Sing Lee, Satish Rao, and Shang-Hua Teng .

NSF Medium ITR CCR-0324914: "Collaborative Research: Smoothed Analysis of Algorithms." 9/1/03–9/1/08. With Shang-Hua Teng.

NSF Small ITR/SY(CISE) CCR-0112487: "Why Algorithms Work Well In Practice: Perturbation-Based Average-Case Analysis of the Simplex Algorithm and Beyond." 7/1/01–6/31/04.

NSF CAREER Award CCR-9701304: "Computationally Efficient Error-Correcting Codes and Their Applications". 7/1/97–6/30/01.

Patents
Error-Correcting Codes: I have been granted four patents on the error-correcting codes presented in the papers, "Efficient Erasure Correcting Codes" and "Improved Low-Density Parity-Check Codes Using Irregular Graphs". These codes provide an efficient solution to the problem of packet-loss over the internet, and are particularly useful in multicast communications. They also provide one of the best-known coding techniques for minimizing the power consumption required to achieve reliable communication in the presence of white Gaussian noise. (U.S. pat. nos. 6163870, 6081918, 6073250 and 6081909)

Calling lines in Tennis: For my eleventh-grade physics project, I invented a device for calling lines in Tennis. (U.S. pat. no. 4,814,986)

Supervision   Huan Wang, Ph.D., Yale, Computer Science '13
"Dictionary Learning: Algorithms and Analysis"

Nikhil Srivastava, Ph.D., Yale, Computer Science '10
"Spectral Sparsification and Restricted Invertibility"

Samuel Daitch, Ph.D., Yale, Computer Science '09
"Efficient Graph-Based Algorithms for Linear Equations, Network Flows, and Machine Learning"

Amit Deshpande, Ph.D., M.I.T., Applied Math '07
"Sampling-Based Algorithms for Dimension Reduction"

Jonathan Kelner, Ph.D., M.I.T., EECS '06
"New Geometric Techniques for Linear Programming and Graph Partitioning"

Arvind Sankar, Ph.D., M.I.T., Applied Math '04,
"Smoothed Analysis of Gaussian Elimination"

Mohammad Mahdian, Ph.D., M.I.T., Applied Math '04
"Facility Location and the Analysis of Algorithms through Factor-Revealing Programs

Louay Bazzi, Ph.D., M.I.T., EECS '03, (co-Advised with Sanjoy Mitter)
"Minimum Distance of Error Correcting Codes versus Encoding Complexity, Symmetry, and Pseudorandomness"

Nodari Sitchinava, M.S., M.I.T., EECS '03
"Dynamic Scan Chains - A Novel Architecture to Lower the Cost of VLSI Test"

Adam Klivans, Ph.D., M.I.T., Applied Math '02
"A Complexity Theoretic Approach to Learning"

Joseph D. Kanapka, M.S., M.I.T., EECS '98
"Faster Eigenvector Computation for Laplacians of Well-Shaped Meshes"

Professional service

Organizer of MSRI "Hot Topics" workshop, 2015.

Organizer of Simon's Institute workshop, 2014.

Organizer of American Institute of Mathematics workshop, 2014.

Advisory Board of the Center of Mathematical Sciences and Applications at Harvard University.

Selection Committee for the ICM-2014 Travel Grants.

Organizing Committee for the SIAM 2014 Conference on Discrete Mathematics.

Gödel Prize Committee, 2012-2014.

NSF Panel in Mathematics, 2013.

Program Committee of the 44th ACM Symposium on Theory of Computing.

Associate Editor, SIAM Journal on Discrete Mathematics, 2009–2012.

Editorial Board, Theory of Computing.

Program Chair of the 50th Annual IEEE Symposium on Foundations of Computer Science, 2009 (FOCS '09).

Program Committee for the 2008 ACM-SIAM Symposium on Discrete Algorithms (SODA '08).

Program Committee for the 2007 SIAM Workshop on Combinatorial Scientific Computing.

Organizer of the 2nd Cowles Foundation Conference on Optimization, 2007.

NSF Panel in Computer Science, 2007.

Program Committee for the 47th Annual Symposium on Foundations of Computer Science, 2006.

Organizer of the 1st Cowles Foundation Conference on Optimization, 2006.

Program Committee for the 7th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, 2004.

NSF Panel in Mathematics, 2003.

Program Committee for the 2002 IEEE Symposium on Foundations of Computer Science (FOCS '02).

Program Committee for the 13th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA '02).

Organizer, DIMACS Workshop on Codes and Complexity, December 2001.

NSF Panel in Computer Science, 2001.

Guest Associate Editor for *IEEE Transactions on Information Theory* Special Issue on Codes and Graph and Iterative Algorithms. Volume 47 (2), Feb. 2001.

Program Committee for the Twelfth Annual ACM Symposium on Parallel Algorithms and Architectures (SPAA '00).

Program Committee for the Tenth Annual Symposium on Combinatorial Pattern Matching (CPM '99).

Program Committee for the 1998 IEEE Symposium on Foundations of Computer Science (FOCS '98).

Program Committee for the 9th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA '98).

Program Committee for the Thirteenth Annual IEEE Conference on Computational Complexity (Complexity '98).

2. Papers in Refereed Journals

"Interlacing Families I: Bipartite Ramanujan Graphs of All Degrees", *Annals of Mathematics*, to appear. With A. Marcus and N. Srivastava.

"Interlacing Families II: Mixed Characteristic Polynomials and the Kadison-Singer Problem", *Annals of Mathematics*, to appear. With A. Marcus and N. Srivastava.

"Nearly-Linear Time Algorithms for Preconditioning and Solving Symmetric, Diagonally Dominant Linear Systems". *SIAM Journal on Matrix Analysis and Applications*, 35 (3), 835-885, 2014. With S.-H. Teng.

"Twice-Ramanujan Sparsifiers (Sigest)", *SIAM Review*, 56 (2), 315-334, 2014. With J. Batson and N. Srivastava.

"A Cheeger inequality for the graph connection Laplacian". *SIAM Journal on Matrix Analysis and Applications*, 34 (4), 1611-1630, 2013. With A. S. Bandiera and A. Singer.

"A Local Clustering Algorithm for Massive Graphs and its Application to Nearly-Linear Time Graph Partitioning". *SIAM Journal on Computing*, vol 42 (1), pp. 1-26, 2013. With S.-H. Teng

"Spectral sparsification of graphs: theory and algorithms" *Communications of the ACM*, vol 56 (8), pp. 87-94, 2013. With J. Baston, N. Srivastava, and S.-H. Teng.

"Twice-Ramanujan Sparsifiers", *SIAM Journal on Computing*, 41 (6), 1704-1721, 2012. With J. Batson and N. Srivastava.

"An Elementary Proof of the Restricted Invertibility Theorem". Israel Journal of Mathematics, 2011, (DOI) 10.1007/s11856-011-0194-2. With N. Srivastava.

"Graph Sparsification by Effective Resistances," *SIAM Journal on Computing,* vol 40 (6), pp. 1913-1926, 2011. With N. Srivastava.

"Spectral Sparsification of Graphs". *SIAM Journal on Computing,* vol 40 (4), pp. 981-1025, 2011. With S.-H. Teng

"Smoothed analysis of condition numbers and complexity implications for linear programming," *Mathematical Programming, Series A.*, Vol 126 (2), pp. 315-350, 2011. With S.-H. Teng and J. Dunagan.

"The Minimum Distance of Turbo-Like Codes," *IEEE Transactions on Information Theory*, Vol 55 (1), pages 6-15, Jan 2009. With L. Bazzi and M. Mahdian.

"Lower-Stretch Spanning Trees", *SIAM Journal on Computing*, Vol 32 (2), pp. 608–628, 2008. With M. Elkin, Y. Emek, and S.-H. Teng.

"Spectral Partitioning Works: Planar graphs and finite element meshes", *Linear Algebra and its Applications*, Vol 421 (2–3), pp. 284–305, 2007. With S.-H. Teng.

"Parallel Delaunay Refinement: Algorithms and Analyses", *International Journal of Computational Geometry & Applications*, Vol 17 (1), pp. 1–30, 2007. With S.-H. Teng and A. Ungor.

"Smoothed Analysis of the Condition Numbers and Growth Factors of Matrices", *SIAM. J. Matrix Anal. & Appl*, Vol 28, pp. 446–476, 2006. With A. Sankar and S.-H. Teng.

"Smoothed Analysis of Algorithms: Why The Simplex Algorithm Usually Takes Polynomial Time," *Journal of the ACM*, Vol 51 (3), pp. 385 - 463, 2004.

"Smoothed Analysis of Termination of Linear Programming Algorithms", *Mathematical Programming, Series B*, Vol 97, pp. 375-404, 2003. With S.-H. Teng.

"Efficient Erasure Correcting Codes," *IEEE Transactions on Information Theory*, 47(2), pp. 569-584, Feb. 2001. With M. G. Luby, M. Mitzenmacher and M. A. Shokrollahi.

"Improved Low-Density Parity-Check Codes Using Irregular Graphs," *IEEE Transactions on Information Theory*, 47(2), pp. 585-598, Feb. 2001. With M. G. Luby, M. Mitzenmacher and M. A. Shokrollahi. (Received Information Theory Society Paper Prize)

"Min-Max Boundary Domian Decomposition," *Theoretical Computer Science*, pp. 253-266, Volume 261, Issue 2, 2001. With M. Kiwi and S.-H. Teng.

"Alternation in Interaction," *Computational Complexity* 9(3-4):202-246, 2000. With M. Kiwi, C. Lund, A. Russell, and R. Sundaram.

"A Remark on Matrix rigidity," *Information Processing Letters*, 64(6), pp. 283–285, Dec. 1997. With M. A. Shokrollahi and V. Stemann

"Linear-Time Encodable and Decodable Error-Correcting Codes," *IEEE Transactions on Information Theory*, 42(6), pp. 1723-1731, Nov. 1996.

"Expander Codes," *IEEE Transactions on Information Theory*, 42(6), pp. 1710-1722, Nov. 1996. With M. Sipser.

"PP is closed under intersection," *Journal of Computer and System Sciences*, 50(2), pp. 191-202, 1995. With R. Beigel and N. Reingold.

"The Power of Adaptiveness and Additional Queries in Random-Self-Reductions," *Computational Complexity*, vol. 4, pp. 158-174, 1994. With J. Feigenbaum, L. Fortnow and C. Lund.

3. Proceedings of Refereed Conferences

"An Efficient Parallel Solver for SDD Linear Systems", *Proceedings of the 46th annual ACM symposium on Theory of computing*, pp. 333-342, 2014. With R. Peng.

"Interlacing Families I: Bipartite Ramanujan Graphs of All Degrees", *Proceedings of the 54th Annual IEEE Symposium on Foundations of Computer Science*, pp. 529-537, 2013. With A. Marcus and N. Srivastava.

"Exact Recovery of Sparsely-Used Dictionaries", *Proceedings of the 25th Annual Conference on Learning Theory.* Journal of Machine Learning Research, vol 23 (2012) 37.137.18. 2012. With H. Wang and J. Wright.

"Electrical Flows, Laplacian Systems, and Faster Approximation of Maximum Flow in Undirected Graphs", *Proceedings of the 43rd ACM Symposium on Theory of Computing*, pp. 273–281, 2011. With P. Christiano, J. Kelner, A. Madry, and S.-H. Teng.

"Fitting a Graph to Vector Data", *Proceedings of the 26th Annual International Conference on Machine Learning*, pp. 201–208, 2009. With S. Daitch and J. Kelner.

"Twice-Ramanujan Sparsifiers", *Proceedings of the 41st annual ACM symposium on Theory of computing*, pp. 255–262, 2009. With J. Batson and N. Srivastava.

"Faster Approximate Lossy Generalized Flow via Interior Point Algorithms", *Proceedings of the 40th annual ACM symposium on Theory of computing*, pp. 451–460, 2008. With Samuel I. Daitch.

"Graph Sparsification by Effective Resistances," *Proceedings of the 40th Annual ACM Symposium on Theory of Computing*, pp. 563–568, 2008. With N. Srivastava.

"A Randomized Polynomial-Time Simplex Algorithm for Linear Programming", *Proceedings of the 38th annual ACM symposium on Theory of computing*, 2006. With Jonathan A. Kelner

"Accelerated Gossip Algorithms for Distributed Computation" *44th Annual Allerton Conference on Communication, Control, and Computation*, 2006. With Ming Cao and Edmund Yeh

"Lower-Stretch Spanning Trees", *Proceedings of the 37th Annual ACM Symposium on Theory of Computing*, 2005. With M. Elkin, Y. Emek, and S.-H. Teng.

"Nearly-Linear Time Algorithms for Graph Partitioning, Graph Sparsification, and Solving Linear Systems," *Proceedings of the 36th Annual ACM Symposium on Theory of Computing*, pp. 81–90, 2004.

"Parallel Delaunay Refinement with Off-Centers" *10th International EURO-PAR Conference*, pp. 812–819, 2004. With S.-H. Teng and A. Ungor.

"Solving Sparse, Symmetric, Diagonally-Dominant Linear Systems in Time $O(m^{1.31})$," *Proceedings of the 44th Annual IEEE Symposium on Foundations of Computer Science*, pp. 416–427, 2003. With S.-H. Teng.

"Exponential algorithmic speedup by a quantum walk," *Proceedings of the 35th Annual ACM Symposium on Theory of Computing*, pp. 59–68, 2003. With A. M. Childs, R. Cleve, E. Deotto, E. Farhi and S. Gutmann.

"Parallel Delaunay Refinement: Algorithms and Analyses" Proceedings of the *11th International Meshing Roundtable*, pp. 205-217, 2002. With S.-H. Teng and A. Ungor. Submitted to the *International Journal of Computational Geometry & Applications*.

"Smoothed Analysis of Algorithms: Why The Simplex Algorithm Usually Takes Polynomial Time," *Proceedings of the 33rd Annual ACM Symposium on Theory of Computing*, pp. 296-305, 2001. With S.-H. Teng.

"Randomness Efficient Identity Testing of Multivariate Polynomials", *Proceedings of the 33rd Annual ACM Symposium on Theory of Computing*, pp. 216-223, 2001. With A. R. Klivans.

"Finding Good LDPC Codes," *Proceedings of the Thirty-Sixth Allerton Conference on Communications, Control, and Computing,* pp. 211–219, 1998.

"Analysis of Low Density Codes and Improved Designs Using Irregular Graphs" *Proceedings of the 30th Annual ACM Symposium on Theory of Computing*, pp. 249–258, 1998. With M. G. Luby, M. Mitzenmacher and M. A. Shokrollahi.

"Improved Low-Density Parity-Check Codes Using Irregular Graphs and Belief Propagation" *1998 IEEE International Symposium on Information Theory,* p. 117, 1998. With M. G. Luby, M. Mitzenmacher and M. A. Shokrollahi.

"Min-Max Boundary Domian Decomposition," *Proceedings of The Fourth Annual International Computing and Combinatorics Conference*, 1998. With M. Kiwi and S.-H. Teng.

"Practical Loss-Resilient Codes" *Proceedings of the Twenty-Ninth Annual ACM Symposium on Theory of Computing,* pp. 150-159, 1997. With M. G. Luby, M. Mitzenmacher, M. A. Shokrollahi and V. Stemann.

"Highly Fault-Tolerant Parallel Computation," in *Proceedings of the 35th Annual IEEE Symposium on Foundations of Computer Science,* pp. 154–163, 1996.

"Spectral Partitioning Works: Planar Graphs and Finite-Element Meshes," *Proceedings of the 35th Annual IEEE Symposium on Foundations of Computer Science,* pp. 96–105, 1996. With S.-H. Teng.

"Faster Isomorphism Testing of Strongly Regular Graphs," *Proccedings of the Twenty-eighth ACM Symposium on the Theory of Computing,* pp. 576-584, 1996.

"Disk Packings and Planar Separators," *Proceedings of the 12th Annual ACM Symposium on Computational Geometry,* pp. 349-358, 1996. With S.-H. Teng.

"Linear-Time Encodable and Decodable Error-Correcting Codes," *Proccedings of the Twenty-seventh ACM Symposium on the Theory of Computing,* 1995, pp. 388–397.

"Expander Codes," *Proceedings of the 35th Annual IEEE Symposium on Foundations of Computer Science,* 1994, pp. 566-576. With M. Sipser.

"Nearly Linear-Size Holographic Proofs," *Proceedings of the 26th Annual ACM Symposium on the Theory of Computing,* pp. 194-203, 1994. With A. Polishchuk.

"Fault Diagnosis in a Small Constant Number of Parallel Testing Rounds," *Proceedings of the 5th Annual ACM Symposium on Parallel Algorithms and Architectures,* 1993. With R. Beigel and G. Margulis.

"The Power of Adaptiveness and Additional Queries in Random-Self-Reductions," *Proceedings of the 7th Annual IEEE Conference on Structure in Complexity Theory,* 1992, pp. 338-346. With J. Feigenbaum, L. Fortnow and C. Lund.

"The Perceptron Strikes Back," *Proceedings of the 6th Annual IEEE Conference on Structure in Complexity Theory,* 1991, pp. 286-291. With R. Beigel and N. Reingold.

"PP is closed under intersection," *Proceedings of the 23rd Annual ACM Symposium on the Theory of Computing,* 1991, pp. 1-9. With R. Beigel and N. Reingold.

4. Other Major Publications

"Ramanujan Graphs and the Solution of the Kadison-Singer Problem" *Proceedings of the International Congress of Mathematicians*, 2014.

"Algorithms, Graph Theory, and Linear Equations in Laplacian Matrices" *Proceedings of the International Congress of Mathematicians*, vol IV, pp. 2698–2722, 2010.

"Smoothed Analysis: Motivation and Discrete Models" *Proceedings of WADS 2003, Lecture Notes in Computer Science 2748*, pp. 256-270, 2003. With S.-H. Teng

"Smoothed Analysis of Algorithms", *Proceedings of the International Congress of Mathematicians*, vol I, pp. 597-606, 2002. With S.-H. Teng

"Constructing Error-Correcting Codes from Expander Graphs," in Emerging Applications of Number Theory, pp. 591-600, IMA volumes in mathematics and its applications, vol 109, 1999.

"The Complexity of Error-Correcting Codes," in the Proceedings of the 11th International Symposium on Fundamentals of Computation Theory, Krakow, Poland, September 1997. Published as Lecture Notes in Computer Science no. 1279, pp. 67–84, 1997.

6. Selected Talks

Paris Kanellakis Distinguished Lecture in Computer Science. Brown University. December 2014.

Weyl Lectures at the Institute for Advanced Study. November 2014.

Erdös Lectures at Hebrew University. May 2014

Simons Lectures in Applied Mathematics, MIT. March 2014.

Plenary speaker at the 25th ACM-SIAM Symposium on Discrete Algorithms. Portland, OR. January 2014.

Plenary Speaker at 18th Conference of the International Linear Algebra Society. Providence, RI. June 2013.

Gilles Lecturer in Computer Science. University of Illinios at Urbana Champaign. March 2013.

Distinguished Lecture in Computer Science. Princeton. November 2012.

Distinguished Lecture in Computer Science. University of Massachusetts at Amherst. October 2012.

Plenary Lecture at the 39th International Colloquium on Automata, Languages and Programming (ICALP 2012). Warwick, United Kingdom. July 2012.

Plenary Lecture at the 2012 SIAM Conference on Discrete Mathematics. Halifax, Canada. June 2012.

Triangle Computer Science Distinguished Lecture. Duke University. April 2012.

The Courant Lectures. New York University. March 2012.

Distinguished Lecture in Computer Science. University of Wisconsin-Madison. March 2012.

Rajeev Motwani Distinguished Lecture. Stanford University. December 2011.

Distinguished Lecture in Computer Science. Rutgers University. December 2011.

CISE Distinguished Lecture. National Science Foundation. November 2011.

R. A. Blyth Lectures in Mathematics. University of Toronto, Canada. September 2011.

Distinguished Lecture in Computer Science. Brown University. September 2011.

AT&T Labs Distinguished Speaker. August 2011.

Rothschild Distinguished Lectures in Mathematics and Computer Science. Haifa, Israel. May 2011.

Berlin Mathematical School Colloquium. Berlin, Germany. May, 2011.

Toyota Technological Institute Spring 2011 Distinguished Lecture, March 2011.

Invited plenary talk at 51st Annual IEEE Symposium on Foundations of Computer Science, October, 2010.

Invited speaker at the International Congress of Mathematicians, Hyderabad, India. August, 2010.

Plenary talk at the 2009 SIAM Conference on Applied Linear Algebra. Monterey, California. October, 2009.

Tutorial speaker at the Twenty-Second Annual Conference on Neural Information Processing Systems, Vancouver, Canada. December, 2008.

Distinguished Lecture in Computer Science and Engineering, University of Michigan, Ann Arbor. November, 2007.

Tutorial speaker at the 48th Annual IEEE Symposium on Foundations of Computer Science, Providence, RI. October, 2007.

Plenary talk at the 15th International Symposium on Fundamentals of Computation Theory, Luebeck, Germany. August, 2005.

Tutorial at the 11th Conference on Integer Programming and Combinatorial Optimization, Berlin, Germany. June, 2005.

Invited talk at the IBM Research—NYU—Columbia Theory Day Conference, April, 2005.

Semi-plenary talk at the 18th International Symposium on Mathematical Programming, Copenhagen, Denmark. August, 2003.

Invited speaker at the International Congress of Mathematicians, Beijing, China. August, 2002.

Tutorial speaker at 13th Annual IEEE Conference on Computational Complexity. June, 1998.

Plenary speaker at the 11th International Symposium on Fundamentals of Computation Theory, Krakow, Poland. September, 1997.