

CURRICULUM VITAE

MARIO SZEGEDY

Born October 23, 1960, Budapest
Married, two children

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PRESENT AND PREVIOUS ACADEMIC EXPERIENCE

Member of the Chair Professor Team of the Institute for Theoretical Computer Science, Tsinghua University;	2007-present.
UC Berkeley, Kyoto University, Tshinghua University, Visitor;	2007 Spring, sabbatical.
“Coach” of Quantum computing team at Rutgers	2004-present.
Orsay Institute, MIT, Harvard University, Visitor;	2003 fall, sabbatical
Rutgers, Computer Science Dept, Professor;	2002-present.
Member of various NSF panels;	N/A
Rutgers, Computer Science Dept, Associate Professor;	2000-2001.
Member of the Institute for Advanced Study, Princeton;	1999-2000.
AT&T Labs-Research (Formerly AT&T Bell Laboratories), MTS;	1992-1999.
AT&T, Bell Laboratories, Murray Hill, Postdoctoral Fellow;	1991-92.
The University of Chicago, Visiting Assistant Professor;	1990-1991.
The University of Bonn, Visiting Research Fellow;	August 1990.
Hebrew University, Jerusalem, Postdoctoral Fellow;	1989-1990.

EDUCATION

Ph.D: Computer Science, Dec 1989, The University of Chicago, Chicago, IL;
Thesis: *Algebraic Methods in Lower Bounds for Computational Models with Limited Communication*, Advisers: Prof. L. Babai, Prof. J. Simon.

M.S: Mathematics, Eötvös Lóránd University, Budapest, Hungary June 1985; Thesis:
On a Problem of R. L. Graham, Adviser: Prof. R. Freud.

HONORS AND AWARDS

Godel Prize.	Baltimore, 2005
Godel Prize.	Crete, 2001
Lady Davis Fellowship.	Hebrew University, Jerusalem, Israel, 1989-1990.
Rényi Kató Memorial Award.	1985. (awarded annually by the J. Bolyai Mathematical Society, Hungary for outstanding student paper).
M. Schweitzer Memorial Mathematical Contest, 2nd Prize.	1984. (Hungarian national contest for university students, organized by J. Bolyai Mathematical Society).
Scholarship of the Republic of Hungary.	Acad. Years 1983-84, 1984-85. (annually awarded by the Secretary of the Department of Education).
International Mathematical Olympiad, Bronze Medal.	London, 1979.

PUBLIC SERVICES

Member of Editorial board, AMS — Advances in Mathematics of Communications;
Member of Editorial board, ECCC — The Electronic Colloquium on Computational Complexity;
Member of Editorial board, Journal of Discrete Algorithms;
Program Committee member, CCC 2007;
Program Committee member, Advances in Computer Science and Technology 2006;
Program Committee member, Advances in Computer Science and Technology 2004;
Program Committee member, ISAAC 2003;
DIMACS representative of Rutgers University, 2002;
Member of steering committee for DIMACS 2001-2004;
Special Focus on Data Analysis and Mining;
Program Committee member, FOCS 2000;
Reviews of individual grant proposals for NSF, BSF;
Refereeing for journals, conferences;

INVITED LECTURES¹

Plenary Speaker, Workshop on Algorithms, Combinatorics and Geometry	University of North Texas, Nov 2007
Theory Seminar	IAS, Oct 2006
Theory Seminar	Technion, Dec 2005
Theory Seminar	Princeton, Dec 2005
Invited Speaker at IBM/NYU/Columbia Theory Day	NYU, November 2005
Invited speaker at QIP	MIT, January 2005
Distinguished Lecturer	University of Michigan, December 2004
BIRS workshop, Quantum Computation and Information Theory	Banff, September 2004
Advances in Complexity Theory	Banff, July 2004
Invited Speaker at CIAR meeting	Vancouver, May 2004
Invited speaker at Multiscale Optimization Methods and Applications	University of Florida, February, 2004
Distinguished Lecturer	Simon Frazer University, January 2004
MSRI's workshop on Quantum Algorithms and Complexity	Banff, September 2002

GRANTS

NSF grant, 260,000\$; Emerging Models and Technologies for Computation; Grant number: 0523866; Period: 2005-2008;

Internal grant, 60,000\$; Quantum Computing;

NSF grant, 270,000\$; Theory of computing; Grant number: 0105692; Period: 2001-present.

¹By definition, reimbursed by the inviting institute; Not a complete list

SKILLS, INTERESTS, VISION

My fascination with mathematics goes back to the seventh grade, when I started to read the famous work of the Hungarian mathematician János Bolyai, who was the inventor, alongside with Gauss and Lobachevsky, of the then revolutionary hyperbolic geometry. First indirectly, later directly I became exposed to the flourishing “Budapest school of combinatorics,” with its satellite subjects: Algebra, Combinatorial Geometry and Combinatorial Number Theory.

My introduction to Theoretical Computer Science was through the memorable courses of László Babai, who was among the first to realize that Circuit Complexity, Communication Complexity, Interactive Proof Systems, can richly benefit from expertise in the above branches of mathematics. Many of my works in computer science including my involvement in the theory of probabilistically checkable proofs come from this inspiration, and explore the aforementioned topics.

In the nineties, working for ATT research I learned that only useful interplay in between theory and practice can lead to discoveries that are accepted by our larger community. The rigor that applicability imposes on a research is as compelling as the condition of mathematical elegance. With Alon and Matias I patented methods for data base statistics. I worked on KDD problems with M. Strauss and H. Kaplan. I have programmed in C, Tcl, Tk, yacc, lex, Perl, Java, Javascript, and wrote my own preprocessor language, for the expressive power of computer languages have always excited me.

Although not claiming any outstanding abilities to natural languages, I speak English and Hungarian fluently and can read German and Russian.

In the past two-three years I have become more and more involved into quantum computing. I see how the breadth of computer science gets ever wider, and like to stay abreast of the advances, but I also learned to resist temptation and stay on track. In particular, complexity theory will always remain a great challenge for me until major problems, such as P vs NP, get solved.

PATENT

Apparatus and Method for Approximating Frequency Moments, with Alon N. and Matias Y.

PUBLICATIONS

- 1984: “On the subdivision of a unit square into rectangles of equal area, finite and infinite sets”, *Colloq. Math. Soc. János Bolyai*, **37**, pp. 899–902, North-Holland, Amsterdam-New York.
- “The telephone problem for connected graph”, with Burosch, G., Gorlow, W. W. and Labahn, R., *Elektronische Informationsverarbeitung und Kybernetik* (10-11), pp. 557–573.
- “Une généralisation commune de théoremes de Fabry et de Paley-Zygmund”, *Comptes Rendus des Seances de L’Academie des Sciences Serie I-Mathematique* **299**(15), pp. 749–751.
- 1986: “The solution of Graham’s greatest common divisor problem”, *Combinatorica* **6**(1), pp. 67–71.
- 1987: “ $a \pmod{p} \leq b \pmod{p}$ for all primes implies $a = b$ ”, with Erdős, P. and Pálffy, P. P., *American Mathematical Monthly* **94**(2), pp. 169–170.
- “Threshold circuits of bounded depth”, with Hajnal, A., Maass, W., Pudlak, P. and Turán, G., *Proc. of the 28th FOCS*, pp. 111-140. Also in: *Journal of Computer and System Sciences* **46**(2), pp. 129-154.
- 1988: “On the decomposition of infinite series into monotone decreasing path”, with Tardos, G., *Studia Scientiarum Mathematicarum Hungarica* **23**(1–2), pp. 81–83.
- “A subset coloring algorithm and its applications to computer graphics”, with Rubinfeld, D. Shallit, J., *Communications of the ACM* **31**(10), pp. 1228–1232.
- 1989: “Multiparty protocols and logspace-hard pseudorandom sequences”, with Babai, L. Nisan, N., *Proc. of the 21st STOC*, pp. 1–11. Also in: *Journal of Computer and System Sciences* **45**(2), pp. 204-232.
- 1990: “Functions with bounded symmetric communication complexity and circuits with mod m gates”, *Proc. of the 22nd STOC*, pp. 278–286. Also in: *Journal of Computer and System Sciences* **47**(3), pp. 405-423.
- 1991: “Checking computations in polylogarithmic time”, with Babai, L. Fortnow, L. and Levin, L., *23rd STOC*, pp. 21–31.
- “Approximating clique is almost NP complete”, with Feige, U., Goldwasser, S., Lovász, L. and Safra, M., *32nd FOCS*, pp. 2–11.

- “Two oracle instance hiding schemes”, with Fortnow, L., *ASIACRYPT '91*. Also in: *Information Processing Letters* **44**(6), pp. 303-306. (with the title “On the power of two-local random reductions”).
- “Lower bound techniques for read once only branching programs”, Simon, J., Accepted by DIMACS series on Discrete Math. and Theo. Comp. Science – Volume on Special Year 1990/91, Amer. Math. Soc., J. Y. Cai.
- 1992: “On packing bipartite graphs”, with Hajnal, P., *Combinatorica* **12**(3), pp. 295–301.
- “Lower bounds for on line graph coloring”, with Halldórsson, M. M., *Third annual symposium on discrete algorithms*, pp. 211–216. Also in: *Theoretical Computer Science* **130**(1), pp. 163-174.
- “On the degree of Boolean functions as real polynomials”, with Nisan, N., *Proc. of the 24th STOC*, pp. 462–467.
- “On the complexity of RAM with various operation sets”, with Simon, J., *Proc. of the 24th STOC*, pp. 624–631.
- “Notes on the expansion property of symmetric graphs”, with Babai, L., *Combinatorics Probability and Computing* **1**, pp. 1–11.
- “On the intractability of approximation problems”, with Arora, S., Lund, C., Motwani, R. and Sudan, M., *33rd FOCS*, pp. 14–23.
- 1993: “Locality based graph coloring”, with Vishwanathan, S., *Proc. of the 25th STOC*, pp. 201–207.
- 1994: “Applications of the crossing number”, with Pach, J. and Shakhrokhi, F., *10th ACM Symposium on Computational Geometry*, pp. 198-202. Also in: *Algorithmica* **16**, pp. 111-117.
- “A note on the θ number of Lovász and the generalized Delsarte bound”, *35th FOCS*.
- 1995: “On Conway’s thrackle conjecture”, with Lovász, L. and Pach J. *11th ACM Symposium on Computational Geometry*, pp. 147-151.
- “Fault tolerant circuits and probabilistically checkable proofs”, with Gal, A., *Proc. of 10th Annual Conf. on Structure in Complexity Theory*, pp. 65-73.
- “Large sets of nearly orthogonal vectors”, with Alon, N. (in preparation)

1996: “Public vs. private coin flips in one round communication games”, with Newman I., *Proc. of the 28th STOC*, pp. 561-570.

“The space complexity of approximating the frequency moments”, with Alon N. and Matias Y., *Proc. of the 28th STOC*, pp. 20-29.

“Interactive proofs and the hardness of approximating cliques”, with Feige, U.; Goldwasser, S.; Lovász, L. and Safra S., *Journal of the ACM* **43**, pp. 268-292.

1998: “Discovering the Geographical Regions with High Facsimile Capability,” with Haim Kaplan, Martin Strauss, *ATT Technical Report*

“Algorithms to Tile the Infinite Grid with Finite Clusters” *39th FOCS, 1998*

1999: “The Bipartite Graph Method: A Clique Size Bounding Technique with Application to Non-linear Codes,” *SODA 1999*

What are the least tractable instances of Max Clique? with David S. Johnson, *SODA 1999*

“On-line Complexity of Monotone Set Systems” with Haim Kaplan, *SODA 1999*.

“Just the Fax–Differentiating Voice and Fax Phone Lines Using Call Billing Data” with Haim Kaplan and Martin Strauss, *SODA 99*

“Exponential Lower bounds for the Towers of Hanoi problem with more than Three Pegs” *STACS, 1999*

“Regularity Testing” with N. Alon, M. Krivelevich and I. Newman *FOCS 1999*

“Logical Property Testing” with N. Alon, E. Fischer and M. Krivelevich *FOCS 1999*

“Many-Valued Logic and Proof Checking” *ICALP’99*

“Tracking Join and Self-Join Sizes in Limited Storage” with Noga Alon, Phillip B. Gibbons, Yossi Matias *PODS’99*

2000:

“Efficient Testing of Large Graphs,” with Noga Alon, Eldar Fischer and Michael Krivelevich, *Combinatorica* *20(4): 451-476 (2000)*

“Regular Languages are Testable with a Constant Number of Queries,” with Noga Alon, Michael Krivelevich and Ilan Newman, *SIAM J. Comput.* *30(6): 1842-1862 (2000)*

“The PCP Theory and Non-Approximability Results for NP Optimization Problems” to appear in *Handbook of Combinatorial Optimization D.-Z. Du and P.M. Pardalos (Eds.), Kluwer Academic Publishers*

“CKit: A Preprocessor for Algorithmic Experiments,” *has appeared in the volume of Workshop on Algorithm Engineering as a New Paradigm, 2000 RIMS, Kyoto University, Kyoto, Japan*

2001:

“Parent-identifying codes,” with N. Alon and E. Fischer, *Journal of Combinatorial Theory Series A 95 (2001), 349-359.*

2002:

“Computing Boolean Functions from Multiple Faulty Copies of Input Bits,” with Xiaomin Chen, *LATIN 2002, 539-553*

“Tracking Join and Self-Join Sizes in Limited Storage,” with Noga Alon, Phillip B. Gibbons and Yossi Matias, *JCSS 64(3): 719-747 (2002)*

2003

“Quantum query complexity and semi-definite programming,” with Howard Barnum and Mike Saks *IEEE Conference on Computational Complexity 2003: 179-193*

“Long monotone paths in line arrangements,” with József Balogh, Oded Regev, Clifford Smyth and William Steiger, *Symposium on Computational Geometry 2003: 124-128*

“On the quantum query complexity of detecting triangles in graphs,” *Technical Report quant-ph/0310107, arXiv archive, 2003.*

2004

“Spectra of Quantized Walks and a $\sqrt{\delta\epsilon}$ rule,” *quant-ph/0401053.*

“Quantum Speed-Up of Markov Chain Based Algorithms,” *FOCS 2004: 32-41*

“Quantum and classical query complexities of local search are polynomially related,” with Miklos Santha, *STOC 2004: 494-501*

“Long Monotone Paths in Line Arrangements,” with József Balogh, Oded Regev, Clifford Smyth and William Steiger, *Discrete and Computational Geometry 32(2): 167-176 (2004)*

“Computing Boolean functions from multiple faulty copies of input bits,” with Xiaomin Chen, *Theor. Comput. Sci.* 321(1): 149-170 (2004)

2005

“Near optimality of the priority sampling procedure.” *ECCC 2005*, <http://eccc.univ-trier.de/eccc-reports/2005/TR05-001/index.html>

“Quantum Algorithms for the Triangle Problem” with Frédéric Magniez and Miklos Santha, *Proceedings of 16th ACM-SIAM Symposium on Discrete Algorithms*, pages 1109-1117, 2005.

“The quantum adversary method and formula size lower bounds” with Sophie Laplante and Troy Lee, *quant-ph Technical Report number 0501057*; *IEEE Conference on Computational Complexity 2005*: 76-90.

“All Quantum Adversary Methods are Equivalent” with Robert Spalek, *ICALP 2005*; journal version: *Theory of Computing*

“Optimally Balanced Forward Degree Sequence” with Xiaomin Chen and Lei Wang, *COCOON 2005*.

2006

“The Quantum Adversary Method and Classical Formula Size Lower Bounds” with Sophie Laplante, Troy Lee, Mario Szegedy, *Computational Complexity* 15(2): 163-196 (2006)

“A Dichotomy Theorem for Constraint Satisfaction over Disjoint Boolean Domains” with Su Chen, Tomasz Imielinski, Karin Johnsgard, Donald Smith. *SAT 2006*: 226-239.

“The DLT Priority Sampling is Essentially Optimal.” *STOC 2006*: 150-158

2007

“Languages with bounded multiparty complexity” with Arkadev Chattopadhyay, Andreas Krebs, Michal Koucky, Pascal Tesson, Denis Therien, *STACS 2007*: 500-511

“Quantum Algorithms for the Triangle Problem” with Frederic Magniez and Miklos Santha, *SIAM J. Comput.* 37(2): 413-424 (2007)

“Product Rules in Semidefinite Programming” with Rajat Mittal, *FCT 2007*: 435-445

“On the Variance of Subset Sum Estimation” with Mikkel Thorup, ESA 2007: 75-86

“Hardness of Approximation.” A chapter in a Handbook for Combinatorial Optimization

2008

“Delaunay graphs of point sets in the plane with respect to axis-parallel rectangles” with Xiaomin Chen, János Pach and Gábor Tardos, SODA 2008

“Parallel Repetition of the Odd Cycle Game” with Kooshir Azimian, LATIN 2008

“Every connected cubic graph has a geometric representation with four slopes” with Padmini Mukkamala, Submitted

“A New Line of Attack On the Dichotomy Conjecture” with Gabor Kun, submitted

In preparation:

“Communication Complexity of Distributions” with Jeremie Roland, in preparation