

Richard Ryan Williams

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EDUCATION

Carnegie Mellon University (Pittsburgh, PA)

Ph.D. in Computer Science, August 2007.
Thesis Title: Algorithms and Resource Requirements for Fundamental Problems
Advisor: Manuel Blum

Cornell University (Ithaca, NY)

Master of Engineering in Computer Science, 2002
Bachelor of Arts in Computer Science and Mathematics with Honors, 2001.

RESEARCH POSITIONS

IBM Almaden Research Center (San Jose, CA)

Raviv Postdoctoral Fellow, Sept. 2009 – present.
Managers: T. S. Jayram and Ken Clarkson.

Institute for Advanced Study (Princeton, NJ)

Member of the School of Mathematics, Sept. 2008 – Sept. 2009.
Mentors: Avi Wigderson and Russell Impagliazzo.

Carnegie Mellon University (Pittsburgh, PA)

Postdoctoral Research Fellow, Sept. 2007 – August 2008.
Mentor: Manuel Blum.

HONORS AND AWARDS

IBM Josef Raviv Postdoctoral Research Fellowship in Computer Science, 2009-2011.

Carnegie Mellon SCS Distinguished Dissertation Award (Honorable Mention), 2008.

Ron Book Prize for Best Student Paper from the IEEE Conf. on Computational Complexity:

- for “Time-Space Tradeoffs for Counting NP Solutions Modulo Integers,” 2007.
- for “Better Time-Space Lower Bounds for SAT and Related Problems,” 2005.

Best Student Paper Award from the European Association for Theoretical Computer Science:

- for “A New Algorithm For Optimal Constraint Satisfaction And Its Implications,” awarded at ICALP 2004.

Highest ranked paper at SPAA 2005: “Parallelizing Time With Polynomial Circuits”

NSF Graduate Research Fellowship, 2001-2004.

Cornell Computer Science Prize for Academic Excellence, 2001.

(Awarded annually to one graduating senior)

TEACHING EXPERIENCE

Lecturer (with V. Vassilevska Williams) for “Wonderful and Crazy Ideas in Theoretical Computer Science and Math”, NJ Governor’s School for Engineering and Technology, a summer program for high school students at Rutgers University, Summer 2009.

Primary Lecturer (with L. Blum) for “15-453 Formal Languages, Automata, and Computation”, Carnegie Mellon, Spring 2008.

Lecturer (with M. Blum and S. Rudich) for “15-859P Theoretical Cryptography”, Carnegie Mellon, Fall 2007.

TA (Teaching Assistant) for “15-503/15-859P Theoretical Cryptography”, Carnegie Mellon, Spring 2006. Professors: Manuel Blum and Steven Rudich.

TA for 15-855 Computational Complexity Theory, Carnegie Mellon, Fall 2004. Professors: Steven Rudich and Avrim Blum.

TA for 15-845 Graduate Algorithms, Carnegie Mellon, Spring 2003. Professor: Manuel Blum.

TA for COMS280 Discrete Structures, Cornell, Spring 2001. Professor: Sergei Artemov.

TA for COMS381 Theory of Computing, Cornell, Fall 2000. Professor: Sergei Artemov.

PROFESSIONAL ACTIVITIES

Program Committee Member: AAI 2006, IWPEC 2010, STOC 2011, FCT 2011.

Moderator on CSTheory.org, a Q & A site for questions on theoretical computer science; active participant on MathOverflow.net, a similar site for mathematics

Reviewer for: STOC, FOCS, SODA, AAI, IJCAI, LICS, ICALP, PODS, LATIN, FSTTCS, IPEC, ESA, CP, APPROX-RANDOM, Journal of the ACM, SIAM Journal on Computing, SIAM Journal on Discrete Mathematics, Journal of Computational Complexity, ACM Transactions on Algorithms, Electronic Journal of Combinatorics, Theoretical Computer Science, Annals of Mathematics and Artificial Intelligence, Information and Computation, Information Processing Letters, *Discussiones Mathematicae Graph Theory*, etc.

Ph.D. Thesis Committee for Serge Gaspers, University of Bergen, December 2008.

Co-Organizer for MSR-CMU MindSwap Workshop on Privacy, Fall 2007.

CMU Computer Science Department Speaker’s Club, 2006-2008.

Local Arrangements volunteer for FOCS 2005 (Pittsburgh, PA)

Member of DEC-5 and FreeCSD (CMU SCS Student Organizations) 2004-2006.

BOOK CHAPTER

C. Gomes and R. Williams. Approximation Algorithms. In *Search Methodologies: Introductory Tutorials in Optimization and Decision Support Techniques*, E. Burke and G. Kendall (eds.), Springer, 2005.

JOURNAL PUBLICATIONS AND INVITED ARTICLES

R. Williams. Improving Exhaustive Search Implies Superpolynomial Lower Bounds. Invited to appear in a special issue of *SIAM Journal on Computing* for STOC 2010.

V. Vassilevska, R. Williams, and R. Yuster. Finding Heaviest H -Subgraphs in Real Weighted Graphs, With Applications. *ACM Transactions on Algorithms* 6(3), 2010.

S. Diehl, D. van Melkebeek, and R. Williams. An Improved Time-Space Lower Bound for Tautologies. *Journal of Combinatorial Optimization*, 2010.

URL: <http://dx.doi.org/10.1007/s10878-009-9286-x>

R. Williams. Parallelizing Time With Polynomial Circuits. *Theory of Computing Systems*, 2009. URL: <http://dx.doi.org/10.1007/s00224-009-9237-z>

V. Vassilevska, R. Williams, and R. Yuster. All Pairs Bottleneck Paths and Max-Min Matrix Products in Truly Subcubic Time. *Theory of Computing* 5(1):173–189, 2009.

R. Williams. Finding Paths of Length k in $O^*(2^k)$ Time. *Information Processing Letters* 109(6):315–318, 2009.

R. Williams. Applying Practice to Theory. Invited survey article in *SIGACT News*, December 2008.

R. Williams. Maximum 2-Satisfiability. Invited article in *Encyclopedia of Algorithms*, M.-Y. Kao (ed.), Springer, 2008.

R. Williams. Time-Space Lower Bounds for Counting NP Solutions Modulo Integers. *Computational Complexity* 17(2): 179–219, 2008.

R. Williams. Inductive Time-Space Lower Bounds for SAT and Related Problems. *Computational Complexity* 15(4):433–470, 2006.

R. Williams. A New Algorithm for Optimal 2-Constraint Satisfaction and Its Implications. *Theoretical Computer Science*, 348(2-3):357–365, 2005.

CONFERENCE PUBLICATIONS

V. Vassilevska Williams and R. Williams. Subcubic Equivalences Between Path, Matrix, and Triangle Problems. To appear in *IEEE Symposium on Foundations of Computer Science (FOCS)*, 2010.

J. Blocki and R. Williams. Resolving the Complexity of Some Data Privacy Problems. In *Intern'l Colloquium on Automata, Languages, and Programming (ICALP) Vol 2*, 393–404, 2010.

R. Impagliazzo and R. Williams. Communication Complexity With Synchronized Clocks. In *IEEE Conference on Computational Complexity (CCC)*, 259–269, 2010.

R. Williams. Improving Exhaustive Search Implies Superpolynomial Lower Bounds. In *ACM Symposium on Theory of Computing (STOC)*, 231–240, 2010.

R. Williams. Alternation-Trading Proofs, Linear Programming, and Lower Bounds. In *International Symposium on Theoretical Aspects of Computer Science (STACS)*, 669–680, 2010.

M. Patrascu and R. Williams. On the Possibility of Better SAT Algorithms. In *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 1065–1075, 2010.

N. Bansal and R. Williams. Regularity Lemmas and Combinatorial Algorithms. In *IEEE Symposium on Foundations of Computer Science (FOCS)*, 745–754, 2009.

S. Diehl, D. van Melkebeek, and R. Williams. An Improved Time-Space Lower Bound for Tautologies. *Computing and Combinatorics Conference (COCOON)*, Springer LNCS 5609, 429–438, 2009.

L. Fortnow, R. Santhanam, and R. Williams. Fixed-Polynomial Circuit Lower Bounds. In *IEEE Conference on Computational Complexity (CCC)*, 19–26, 2009.

I. Koutis and R. Williams. Limits and Applications of Group Algebra For Parameterized Problems. In *Intern'l Colloq. Automata, Languages, and Programming (ICALP) Vol. 1*: 653–664, 2009.

- V. Vassilevska and R. Williams. Finding, Minimizing, and Counting Weighted Subgraphs. In *ACM Symposium on Theory of Computing (STOC)*, 455–464, 2009.
- G. Blelloch, V. Vassilevska, and R. Williams. A New Combinatorial Approach to Sparse Graph Problems. In *Intern'l Colloq. Automata, Languages, and Programming (ICALP)* Vol. 1, 108–120, 2008.
- V. Vassilevska, R. Williams, and R. Yuster. All-Pairs Bottleneck Paths for General Graphs in Truly Sub-Cubic Time. In *ACM Symposium on Theory of Computing (STOC)*, 585–589, 2007.
- R. Williams. Time-Space Lower Bounds for Counting NP Solutions Modulo Integers. In *IEEE Conference on Computational Complexity (CCC)*, 70–82, 2007.
- R. Williams. Matrix-Vector Multiplication in Sub-Quadratic Time (Some Preprocessing Required). In *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 995–1001, 2007.
- V. Vassilevska, R. Williams, and R. Yuster. Finding the Smallest H-Subgraph in Real Weighted Graphs and Related Problems. In *International Colloquium on Automata, Languages, and Programming (ICALP)* Vol. 1, 262–273, 2006.
- V. Vassilevska and R. Williams. Finding a Minimum Weight Triangle in $n^{3-\delta}$ Time, With Applications. In *ACM Symposium on Theory of Computing (STOC)*, 225–231, 2006.
- V. Vassilevska, R. Williams, and S. L. M. Woo. Confronting Hardness Using a Hybrid Approach. In *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 1–10, 2006.
- R. Williams. Parallelizing Time With Polynomial Circuits. In *ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)*, 171–175, 2005.
- R. Williams. Better Time-Space Lower Bounds for SAT and Related Problems. In *IEEE Conference on Computational Complexity (CCC)*, 40–49, 2005.
- R. Williams. A New Algorithm for Optimal 2-Constraint Satisfaction and its Implications. In *International Colloquium on Automata, Languages, and Programming (ICALP)*, Springer LNCS Vol. 3142, 1227–1237, 2004.
- A. Meyerson and R. Williams. On The Complexity of Optimal K-Anonymity. In *ACM Symposium on Principles of Database Systems (PODS)*, 223–228, 2004.
- R. Williams. On Computing k -CNF Formula Properties. In *Theory and Applications of Satisfiability Testing*, Springer LNCS Vol. 2919, 330–340, 2004.
- R. Williams, C. Gomes, and B. Selman. Backdoors To Typical Case Complexity. In *International Joint Conference on Artificial Intelligence (IJCAI)*, 1173–1178, 2003.
- R. Williams. Algorithms for Quantified Boolean Formulas. In *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 299–307, 2002.

INVITED TALKS

Improving Exhaustive Search Implies Superpolynomial Lower Bounds

IBM Almaden, February 2010; Microsoft Research (Silicon Valley), April 2010; Georgia Tech, May 2010.

Communication Complexity With Clocks

U.C. Berkeley Theory Seminar, March 2010.

Time-Space Lower Bounds for NP-Hard Problems

North American Annual Meeting of the Association for Symbolic Logic, Washington, D.C., March 2010; U.C. San Diego, May 2009.

Graph Algorithms From Group Algebra

IBM T.J. Watson (Yorktown), February 2009.

Triangles and Matrix Multiplication

Center for Computational Intractability (Princeton), May 2009.

Applying Practice to Theory: Time Lower Bounds for Fundamental Problems

University of Toronto, February 2009; DIMACS, November 2008; Toyota Technological Institute at Chicago, March 2008.

Finding a k -Path in $O^(2^k)$ Time*

Schloss Dagstuhl, Germany, October 2008.

A Survey of Time Lower Bounds by Algorithmic Arguments

Institute for Advanced Study, September 2008.

Clique Problems and Applications

University of Rochester, February 2008.

Automated Proofs of Time Lower Bounds

China Theory Week, Tsinghua University, September 2007.

A Hybrid Approach to Coping With Hard Problems

Georgia Tech, April 2007; Schloss Dagstuhl, July 2005.

Exact 2-CSP Optimization Using Matrix Multiplication

Microsoft Research (Redmond), June 2005.

On the Complexity of Optimal K -Anonymity

Privacy in D.A.T.A. Workshop, Carnegie Mellon, March 2003.

REFERENCES

Miklos Ajtai, Research Scientist, IBM Almaden Research Center.

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Noga Alon, Baumritter Professor of Mathematics and Computer Science, Tel Aviv University, Israel, and Institute for Advanced Study, Princeton, NJ.

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