

# Nicholas Harvey

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## Education

- Massachusetts Institute of Technology** Ph.D in Computer Science 2005 - 2008  
• Advisor: Professor Michel Goemans (Dept. of Mathematics)
- Massachusetts Institute of Technology** MSc in Computer Science 2003 - 2005  
• Advisors: Professors David Karger and Erik Demaine
- University of Waterloo** Bachelor of Mathematics 1995 - 1999  
• Major: Double Honors Combinatorics & Optimization and Computer Science

## Selected Honors

- Machtey Award, 2006.**  
Awarded annually to the best paper authored by a student at IEEE Symposium on Foundations of Computer Science.
- USITS Best Paper Award, 2003.**  
Awarded annually to the best paper at the USENIX Symposium on Internet Technologies and Systems.
- Canada Graduate Scholarship, 2005.**  
Awarded by the Natural Sciences and Engineering Research Council of Canada to the most outstanding students pursuing masters or doctoral studies.
- MIT Presidential Fellowship, 2003.**  
Awarded annually to 150 new graduate students at the Massachusetts Institute of Technology.
- Combinatorics and Optimization Book Prize, 2000.**  
Awarded annually to an outstanding undergraduate student of Combinatorics and Optimization at the University of Waterloo.

## Work Experience

- Microsoft Research** Redmond, WA  
Intern May 2006 – Aug 2006  
Jointly affiliated with the Theory Group and Communication and Collaboration Systems Group. Mentored by Dr. Kamal Jain and Dr. Yunnan Wu.
- Microsoft Research** Redmond, WA  
Research Software Design Engineer May 2002 – Aug 2003  
Research and development of peer-to-peer systems in the Systems and Networking group.
- Microsoft Corporation** Redmond, WA  
Software Design Engineer March 2000 – May 2002  
Developer for the Windows .NET Server and Windows XP products.

## Teaching Experience

- Teaching Assistant** Massachusetts Institute of Technology  
Sept 2004 – Dec 2004 Cambridge, MA  
Teaching Assistant for the class “6.042: Mathematics for Computer Science”, taught by Professor Tom Leighton and Dr. Eric Lehman.

## Publications

### Optimization Algorithms

- Nicholas J. A. Harvey. *Algebraic Structures and Algorithms for Matroid and Matching Problems*. In Proceedings of the 47<sup>th</sup> Annual IEEE Symposium on Foundations of Computer Science (FOCS), October 2006. Received the **Best Student Paper (Machtey) Award**. Invited to the SIAM Journal of Computing, Special Issue for FOCS 2006.
- John Dunagan and Nicholas J. A. Harvey. *Iteratively Constructing Preconditioners via the Conjugate Gradient Method*. In Proceedings of the 39<sup>th</sup> Annual ACM Symposium on Theory of Computing (STOC), June 2007.
- Nicholas J. A. Harvey. *An Algebraic Algorithm for Weighted Linear Matroid Intersection*. In Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2007.
- Nicholas J. A. Harvey, Laszlo Lovasz, Richard Ladner and Tami Tamir. *Semi-Matchings for Bipartite Graphs and Load Balancing*. Journal of Algorithms 59(1):53-78, 2006. Preliminary version appeared in the Workshop on Algorithms and Data Structures (WADS), July 2003.

### Lower Bounds and Complexity

- Nicholas J. A. Harvey. *Matroid Intersection, Pointer Chasing, and Young's Seminormal Representation of  $S_n$* . In Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2008.
- Micah Adler, Erik D. Demaine, Nicholas J. A. Harvey, Mihai Patrascu. *Lower Bounds for Asymmetric Communication Channels and Distributed Source Coding*. In Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2006.
- Nicholas J. A. Harvey, David R. Karger and Sergey Yekhanin. *The Complexity of Matrix Completion*. In Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2006.

### Information Theory & Network Coding

- Micah Adler, Nicholas J. A. Harvey, Kamal Jain, Robert D. Kleinberg and April R. Lehman. *On the Capacity of Information Networks*. IEEE Transactions on Information Theory 52(6):2345-2364, 2006. Preliminary version appeared in the ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2006.
- Nicholas J. A. Harvey, Robert D. Kleinberg, Chandra Nair and Yunnan Wu. *A "Chicken & Egg" Network Coding Problem*. In Proceedings of the 2007 IEEE International Symposium on Information Theory (ISIT), June 2007.
- Petar Maymounkov, Nicholas J. A. Harvey and Desmond Lun. *Methods for Efficient Network Coding*. In Proceedings of the 44<sup>th</sup> Annual Allerton Conference on Communication, Control, and Computing, September 2006.
- Nicholas J. A. Harvey, David R. Karger and Kazuo Murota. *Deterministic Network Coding by Matrix Completion*. In Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2005.
- Nicholas J. A. Harvey and Robert Kleinberg. *Tighter Cut-based Bounds for  $k$ -pairs Communication Problems*. In Proceedings of the 43<sup>rd</sup> Annual Allerton Conference on Communication, Control, and Computing, September 2005.
- Nicholas J. A. Harvey, Kamal Jain, Lap Chi Lau, Chandra Nair, Yunnan Wu. *Conservative Network Coding*. In Proceedings of the 44<sup>th</sup> Annual Allerton Conference on Communication, Control, and Computing, September 2006.
- Nicholas J. A. Harvey, Robert D. Kleinberg and April R. Lehman. *Comparing Network Coding with Multicommodity Flow for the  $k$ -pairs Communication Problem*. Technical Report MIT-LCS-TR-964, September 2004.

### Data Structures

- Kevin Zatloukal and Nicholas J. A. Harvey. *Family Trees: An ordered dictionary with optimal congestion, locality, degree, and search time*. In Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA), January 2004.
- Nicholas J. A. Harvey and Kevin Zatloukal. *The Post-Order Heap*. In Proceedings of the Third International Conference on Fun with Algorithms (FUN), May 2004.

### Networking and Peer to Peer Systems

- Nicholas J. A. Harvey, Michael B. Jones, Stefan Saroiu, Marvin Theimer and Alec Wolman. *SkipNet: A Scalable Overlay Network with Practical Locality Properties*. In Proceedings of the Fourth USENIX Symposium on Internet Technologies and Systems (USITS), March 2003. Received the **Best Paper Award**. Extended version available as Microsoft Technical Report MSR-TR-2002-92.
- John Dunagan, Nicholas J. A. Harvey, Michael B. Jones, Dejan Kostic, Marvin Theimer and Alec Wolman. *FUSE: Lightweight Guaranteed Distributed Failure Notification*. In Proceedings of the Sixth Symposium on Operating System Design and Implementation (OSDI), December 2004.
- Nicholas J. A. Harvey, Mihai Patrascu, Yonggang Wen, Sergey Yekhanin and Vincent W. S. Chan. *Non-Adaptive Fault Diagnosis for All-Optical Networks via Combinatorial Group Testing on Graphs*. In Proceedings of the 26<sup>th</sup> Annual IEEE Conference on Computer Communications (INFOCOM), May 2007.
- Nicholas J. A. Harvey and J. Ian Munro. *Deterministic SkipNet*. Information Processing Letters 90(4):205-208, May 2004. Preliminary version appeared in the ACM Symposium on Principles of Distributed Computing (PODC), July 2003.
- Nicholas J. A. Harvey, Michael B. Jones, Marvin Theimer and Alec Wolman. *Efficient Recovery From Organizational Disconnects in SkipNet*. In Proceedings of the Second International Workshop on Peer-To-Peer Systems (IPTPS), February 2003.

### Manuscripts in Preparation

- Nicholas J. A. Harvey and Mohit Singh. *A Swap-Relabel Algorithm for Matroid Intersection*.
- Michel X. Goemans, Nicholas J. A. Harvey, Robert Kleinberg and Vahab Mirrokni. *On Learning Submodular Functions*.

### Invited Talks

Network Coding: A Theoretical Computer Science Perspective

- **IEEE Information Theory Workshop**, May 2008.

Query Lower Bounds for Matroids via Group Representations

- **Georgia Institute of Technology**, ACO Seminar, December 2007.
- **Carnegie Mellon University**, Theory/Operations Research Seminar, October 2007.
- **Tsinghua University**, China Theory Week, September 2007.

Iteratively Constructing Preconditioners via the Conjugate Gradient Method

- **Brown University**, CS Seminar, February 2007.
- **Dartmouth University**, Theory Seminar. November 2006.
- **Stanford University**, Algorithms Seminar. October 2006.
- **Lucent Bell Labs**, Mathematical and Algorithmic Sciences Research Center. 2006.

Algebraic Algorithms for Matching and Matroid Problems

- **Georgia Institute of Technology**, Guest Lecturer for MATH 4022, December 2007.
- **Yale University**, Cowles Foundation Workshop on Optimization. March 2007.
- **Princeton University**, Department of Computer Science. October 2006.
- **International Symposium on Mathematical Programming**, August 2006.
- **Amazon.com**, July 2006.
- **University of Waterloo**, Dept. of Combinatorics and Optimization. May 2006.
- **IBM T.J. Watson Research Center**, Algorithms and Theory Group. February 2006.

On the Capacity of Information Networks

- **Princeton University**, Workshop on Flexible Network Design. November 2005.
- **Tokyo University**, Department of Mathematical Engineering. August 2005.

Tighter Cut-based Bounds for k-pairs Communication Problems

- **Allerton Conference on Communication, Control, and Computing**. September 2005.

Semi-Matchings for Bipartite Graphs and Load Balancing

- **University of Washington**, Dept. of Computer Science and Engineering. May 2003.

SkipNet: A Scalable Overlay Network with Practical Locality Properties

- **ICSI Center for Internet Research (ICIR)**. Berkeley, CA. February 2003.

## Professional Activities

- Reviewing for: ACM Symposium on Theory of Computation, ACM-SIAM Symposium on Discrete Algorithms, ACM SIGACT-SIGOPS Symposium on Principles of Distributed Computing, Data Compression Conference, European Symposium on Algorithms, Foundations and Trends in Theoretical Computer Science, IEEE Communication Letters, IEEE International Symposium on Information Theory, IEEE International Parallel & Distributed Processing Symposium, IEEE Symposium on Foundations of Computer Science, IEEE Transactions on Information Theory, IEEE/ACM Transactions on Networking, International Symposium on Mathematical Foundations of Computer Science, Latin American Theoretical Informatics Symposium, Journal of Algorithms, Theoretical Computer Science.
- Organized the MIT Theory of Computing Colloquium, 2004-2005.
- Organized the MIT Algorithms & Complexity Seminar, 2007-2008.
- Organized the MIT Algorithms & Complexity Reading Group, 2007-2008.

## Citizenships

Canada and United Kingdom

## References

### Michel Goemans

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### Madhu Sudan

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### Harold Gabow

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### David Karger

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### Satoru Iwata

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### Alexander Postnikov

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