

# Xi Chen

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Department of Computer Science  
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Date of Preparation: November 7, 2015

## Research Interests

Theoretical Computer Science, including Algorithmic Game Theory and Economics, Complexity Theory, Graph Isomorphism Testing, and Property Testing.

## Academic Training

B.S. Physics / Mathematics, Tsinghua University, Sep 1999 – Jul 2003

Ph.D. Computer Science, Tsinghua University, Sep 2003 – Jul 2007

Advisor: Professor Bo Zhang, Tsinghua University

Thesis Title: The Complexity of Two-Player Nash Equilibria

## Academic Positions

Associate Professor (without tenure), Columbia University, Jul 2015 – Now

Assistant Professor, Columbia University, Jan 2011 – Jun 2015

Postdoctoral Researcher, Columbia University, Aug 2010 – Dec 2010

Postdoctoral Researcher, University of Southern California, Aug 2009 – Aug 2010

Postdoctoral Researcher, Princeton University, Aug 2008 – Aug 2009

Postdoctoral Researcher, Institute for Advanced Study, Sep 2007 – Aug 2008

## Honors and Awards

EATCS Presburger Award, 2015

Alfred P. Sloan Research Fellowship, 2012

NSF CAREER Award, 2012

Best Paper Award

The 4th International Frontiers of Algorithmics Workshop, 2010

Best Paper Award

The 20th International Symposium on Algorithms and Computation, 2009

Silver Prize, New World Mathematics Award (Ph.D. Thesis)

The 4th International Congress of Chinese Mathematicians, 2007

Best Paper Award

The 47th Annual IEEE Symposium on Foundations of Computer Science, 2006

## Grants

Submitted, Natural Science Foundation, Title: *New Frontiers in Boolean Function Property Testing*, Amount: \$1,176,926. Jointly with PI Rocco A. Servedio, Columbia University, Sep 2015.

Current, Natural Science Foundation, Title: *On the Complexity of Optimal Pricing and Mechanism Design*, Period: Aug 2014 – Jul 2017, Amount: \$449,985. Jointly with PI Mihalis Yannakakis, Columbia University. (CCF-1423100)

Current, Natural Science Foundation, Title: *CAREER: Bridging Game Theory, Economics and Computer Science: Equilibria, Fixed Points, and Beyond*, Period: Jul 2012 – Jun 2017, Amount: \$499,932. (CCF-1149257)

Past, Natural Science Foundation, Title: *EAGER: Social Information Dissemination: A Market Based Approach*, Period: Sep 2011 – Aug 2013, Amount: \$249,993. Jointly with PI Vishal Misra and co-PI Augustin Chaintreau, Columbia University. (CCF-1139915)

## Teaching

Analysis of Algorithms (CSOR 4231), S15

overall rating: 4.34, instructor score: 4.53, enrollment: 61 students

Introduction to Computational Complexity (COMS 4236), F14

overall rating: 4.14, instructor score: 4.14, enrollment: 19 students

Analysis of Algorithms (CSOR 4231), S14

overall rating: 4.41, instructor score: 4.46, enrollment: 95 students

Lower Bounds in Theoretical Computer Science (COMS 6998), F13

overall rating: 4.50, instructor score: 4.50, enrollment: 14 students

Introduction to Computational Complexity (COMS 4236), S13

overall rating: 3.89, instructor score: 4.17, enrollment: 22 students

Randomness in Computing (COMS 6998), F12

overall rating: 4.00, instructor score: 3.80, enrollment: 11 students

Analysis of Algorithms (CSOR 4231), S12

overall rating: 3.95, instructor score: 3.98, enrollment: 110 students

Introduction to Communication Complexity (COMS 4995), F11

overall rating: 5.00, instructor score: 4.75, enrollment: 4 students

Algorithmic Game Theory and Economics (COMS 6998), S11

overall rating: 4.50, instructor score: 4.50, enrollment: 13 students

## Advising

Current PhD Students:

Xiaorui Sun (5th year)

Jinyu Xie (3rd year)

Georgios Matikas (1st year), co-advised with Rocco A. Servedio and Mihalis Yannakakis

Erik Waingarten (1st year), co-advised with Rocco A. Servedio, Cliff Stein  
and Mihalis Yannakakis

PhD Thesis Committee Served:

Dr. Igor C. Oliveira, Columbia University, 2015

Dr. Li-Yang Tan, Columbia University, 2014

Dr. Yun-Kuen Cheung, New York University, 2014

Dr. Imran Khan, Columbia University, 2011

## Service

**Program Committees:**

Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2013, 2008

ACM Symposium on the Theory of Computing (STOC), 2013

ACM Conference on Electronic Commerce (ACM EC), 2013, 2012

Conference on Theory & Applications of Models of Computation (TAMC), 2013, 2009

International Symposium on Algorithms and Computation (ISAAC), 2013

International Workshop on Internet and Network Economics (WINE), 2012, 2008, 2006

Conference on Algorithmic Aspects in Information and Management, 2012, 2011, 2008

International Symposium on Algorithmic Game Theory (SAGT), 2010

International Frontiers of Algorithmics Workshop (FAW), 2009

**Organizing Committees:**

Organizer of the Spring 2016 Program on Counting Complexity and Phase Transitions  
at Simons Institute for the Theory of Computing, Berkeley, Jan 2016 – May 2016

New York Area Theory Day, Fall 2012 and Spring 2013

New York Computer Science and Economics Day, 2011

**Tutorials:**

Mini-course on Algorithmic Game Theory

Princeton University, jointly with Alex Fabrikant, Fall 2008

Shanghai Jiao Tong University, jointly with Ning Chen, Summer 2012

**Proposal Review Panel:**

Natural Science Foundation, Spring 2008

**Editorial Board:**

Journal of Discrete Algorithms, Elsevier, Jan 2015 – Now

Algorithmica, Springer, Jan 2016 – Now

**Department Service:**

Organizer of Columbia theory group weekly seminar, Fall 2011 – Now

SEAS undergraduate advisor, Spring 2012 – Now

MS track advisor (Foundations of Computer Science), Fall 2013 – Now

PhD admission committee, Spring 2011 – Now

Visibility committee, Fall 2014 – Now

Department newsletter (chair), Spring 2013 – Now

**Talks and Presentations**

Invited Talk at ICALP for the EATCS Presburger Award, Jul 2015

New York Colloquium on Algorithms and Complexity, Nov 2014

Dagstuhl Seminar, Jan 2013, Aug 2014

DIMACS Theoretical Computer Science Seminar, Dec 2007, Nov 2008, Oct 2013

IBM Thomas J. Watson Research Center, Nov 2012

Shanghai Jiao Tong University, Jun 2012

Workshop on Counting, Inference, and Optimization on Graphs, Princeton, Nov 2011

Panel discussion, 13th Computing in the 21st Century Conference, Oct 2011

Tsinghua University, Oct 2011

University of Liverpool, Aug 2011

Institute for Advanced Study, Dec 2006, Nov 2007, Jan 2009, Mar 2011

University of Wisconsin-Madison, Apr 2009, Mar 2010

University of Rochester, Mar 2010

University of California, Merced, Mar 2010

Information Theory and Application Workshop, San Diego, Feb 2010

University of Southern California, Feb 2010

Microsoft Research Silicon Valley, Dec 2009

Georgia Institute of Technology, Nov 2009

Bell Labs (Theory Seminar), Jun 2009

California Institute of Technology, Mar 2009

University of Michigan (Theory Seminar), Oct 2008

The University of Hong Kong (Computer Science Seminars), Jan 2007

The Chinese University of Hong Kong (Seminar Series), Jan 2007

Boston University (Theory Seminar), Dec 2006

Northeastern University (CCIS Colloquia), Dec 2006

The Hong Kong University of Science and Technology (Theory Seminar), Mar 2005

## Publications: Conference Papers

\*Names of PhD and MS student authors mentored are underlined.

In Theoretical Computer Science, authors are listed alphabetically.

1. Xi Chen and Jinyu Xie, *Tight Bounds for the Distribution-Free Testing of Monotone Conjunctions*, In Proceedings of the 27th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2016.
2. Xi Chen, Ilias Diakonikolas, Anthi Orfanou, Dimitris Pappas, Xiaorui Sun and Mihalis Yannakakis, *On the Complexity of Optimal Lottery Pricing and Randomized Mechanisms*, In Proceedings of the 56th Annual Symposium on Foundations of Computer Science (FOCS), 2015.
3. Xi Chen, Anindya De, Rocco A. Servedio and Li-Yang Tan, *Boolean Function Monotonicity Testing Requires (Almost)  $n^{1/2}$  Non-Adaptive Queries*, In Proceedings of the 47th ACM Symposium on Theory of Computing (STOC), 2015.
4. Xi Chen, David Durfee and Anthi Orfanou, *On the Complexity of Nash Equilibria in Anonymous Games*, In Proceedings of the 47th ACM Symposium on Theory of Computing (STOC), 2015.
5. Xi Chen, Rocco A. Servedio and Li-Yang Tan, *New Algorithms and Lower Bounds for Monotonicity Testing*, In Proceedings of the 55th Annual Symposium on Foundations of Computer Science (FOCS), 2014.
6. Xi Chen, Ilias Diakonikolas, Dimitris Pappas, Xiaorui Sun and Mihalis Yannakakis, *The Complexity of Optimal Multidimensional Pricing*, In Proceedings of the 25th ACM-SIAM Symposium on Discrete Algorithms (SODA), 2014.
7. László Babai, Xi Chen, Xiaorui Sun, Shang-Hua Teng and John Wilmes, *Faster Canonical Forms for Strongly Regular Graphs*, In Proceedings of the 54th Annual Symposium on Foundations of Computer Science (FOCS), 2013.
8. Xi Chen, Xiaorui Sun and Shang-Hua Teng, *Multi-Stage Propagation and Quasipolynomial-Time Isomorphism Testing of Steiner 2-Systems*, In Proceedings of the 45th ACM Symposium on Theory of Computing (STOC), 2013.
9. Xi Chen, Dimitris Pappas and Mihalis Yannakakis, *The Complexity of Non-Monotone Markets*, In Proceedings of the 45th ACM Symposium on Theory of Computing (STOC), 2013.
10. Xi Chen, Martin Dyer, Leslie Ann Goldberg, Mark Jerrum, Pinyan Lu, Colin McQuillan and David Richerby, *The Complexity of Approximating Conservative Counting CSPs*, In Proceedings of the 30th Symposium on Theoretical Aspects of Computer Science (STACS), 2013.

11. Jin-Yi Cai and Xi Chen, *Complexity of Counting CSP with Complex Weights*, In Proceedings of the 44th ACM Symposium on Theory of Computing (STOC), 2012.
12. Jin-Yi Cai, Xi Chen, Heng Guo and Pinyan Lu, *Inapproximability after Uniqueness Phase Transition in Two-Spin Systems*, In Proceedings of the 6th International Conference on Combinatorial Optimization and Applications (COCOA), 2012.
13. Jin-Yi Cai, Xi Chen and Pinyan Lu, *Non-negatively Weighted #CSP: An Effective Complexity Dichotomy*, In Proceedings of the 26th Conference on Computational Complexity (CCC), 2011.
14. Xi Chen and Shang-Hua Teng, *A Complexity View of Markets with Social Influence*, In Proceedings of the 2nd Symposium on Innovations in Computer Science, 2011.
15. Jin-Yi Cai, Xi Chen and Pinyan Lu, *Graph Homomorphisms with Complex Values: A Dichotomy Theorem*, In Proceedings of the 37th International Colloquium on Automata, Languages and Programming (ICALP), 2010.
16. Jin-Yi Cai and Xi Chen, *A Decidable Dichotomy Theorem on Directed Graph Homomorphisms with Non-negative Weights*, In Proceedings of the 51st Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2010.
17. Boaz Barak, Mark Braverman, Xi Chen and Anup Rao, *How to Compress Interactive Communication*, In Proceedings of the 42th ACM Symposium on Theory of Computing (STOC), 2010.
18. Jin-Yi Cai, Xi Chen, Richard Lipton and Pinyan Lu, *On Tractable Exponential Sums*, In Proceedings of the 4th International Frontiers of Algorithmics Workshop (FAW), 2010, Best paper award.
19. Xi Chen and Shang-Hua Teng, *Spending is Not Easier than Trading: On the Computational Equivalence of Fisher and Arrow-Debreu Equilibria*, In Proceedings of the 20th Symposium on Algorithms and Computation, 2009, Best Paper Award.
20. Xi Chen, Decheng Dai, Ye Du and Shang-Hua Teng, *Settling the Complexity of Arrow-Debreu Equilibria in Markets with Additively Separable Utilities*, In Proceedings of the 50th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2009.
21. Jin-Yi Cai, Xi Chen and Dong Li, *A Quadratic Lower Bound for the Permanent and Determinant Problem over any Characteristic  $\neq 2$* , In Proceedings of the 40th ACM Symposium on Theory of Computing (STOC), 2008.
22. Xi Chen, Xiaoming Sun and Shang-Hua Teng, *Quantum Separation of Local Search and Fixed Point Computation*, In Proceedings of the 14th Annual International Computing and Combinatorics Conference (COCOON), 2008.

23. Xi Chen and Shang-Hua Teng, *Paths Beyond Local Search: A Tight Bound for Randomized Fixed-Point Computation*, In Proceedings of the 48th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2007.
24. Xi Chen, Shang-Hua Teng and Paul Valiant, *The Approximation Complexity of Win-Lose Games*, In Proceedings of the 18th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2007.
25. Jing Zhang, Xi Chen and Ming Li, *Computing Exact  $p$ -Value for Structured Motif*, In Proceedings of the 18th Annual Symposium on Combinatorial Pattern Matching (CPM), 2007.
26. Xi Chen and Xiaotie Deng, *Settling the Complexity of 2-Player Nash-Equilibrium*, In Proceedings of the 47th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2006, Best Paper Award.
27. Xi Chen, Xiaotie Deng and Shang-Hua Teng, *Computing Nash Equilibria: Approximation and Smoothed Complexity*, In Proceedings of the 47th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2006.
28. Xi Chen, Xiaotie Deng and Shang-Hua Teng, *Sparse Games are Hard*, In Proceedings of the 2nd Workshop on Internet and Network Economics, 2006.
29. Xi Chen, Li-Sha Huang and Shang-Hua Teng, *Market Equilibria with Hybrid Linear-Leontief Utilities*, In Proceedings of the 2nd Workshop on Internet and Network Economics (WINE), 2006.
30. Xi Chen and Xiaotie Deng, *A Simplicial Approach for Discrete Fixed Point Theorems*, *Algorithmica*, 53(2): 250–262, 2009. In Proceedings of the 12th Annual International Computing and Combinatorics Conference (COCOON), 2006.
31. Xi Chen, Xiaotie Deng and Becky Jie Liu, *On Incentive Compatible Competitive Selection Protocols*, In Proceedings of the 12th Annual International Computing and Combinatorics Conference (COCOON), 2006.
32. Xi Chen and Xiaotie Deng, *On the Complexity of 2D Discrete Fixed Point Problem*, In Proceedings of the 33rd International Colloquium on Automata, Languages and Programming (ICALP), 2006.
33. Xi Chen and Xiaotie Deng, *Lattice Embedding of Direction-Preserving Correspondence Over Integrally Convex Set*, In Proceedings of the 2nd International Conference on Algorithmic Aspects in Information and Management (AAIM), 2006.
34. Lan Liu, Xi Chen, Jing Xiao and Tao Jiang, *Complexity and Approximation of the Minimum Recombination Haplotype Configuration Problem*, In Proceedings of the 16th Annual Symposium on Algorithms and Computation (ISAAC), 2005.

35. Xi Chen and Xiaotie Deng, *Matching Algorithmic Bounds for Finding a Brouwer Fixed Point*, In Proceedings of the 37th Symposium on Theory of Computing (STOC), 2005.

## Publications: Journal Papers

### Under Submission:

1. Jin-Yi Cai, Xi Chen and Pinyan Lu, *Non-negative Weighted #CSP: An Effective Complexity Dichotomy*, submitted to SIAM Journal on Computing.
2. Jin-Yi Cai and Xi Chen, *A Decidable Dichotomy Theorem on Directed Graph Homomorphisms with Non-negative Weights*, submitted to Computational Complexity.
3. Xi Chen, Ilias Diakonikolas, Dimitris Paparas, [Xiaorui Sun](#) and Mihalis Yannakakis, *The Complexity of Optimal Multidimensional Pricing*, submitted to Games and Economic Behavior.
4. László Babai, Xi Chen, [Xiaorui Sun](#), Shang-Hua Teng and John Wilmes, *Faster Canonical Forms for Strongly Regular Graphs*, invited to the FOCS 2013 special issue of SIAM Journal on Computing.
5. Xi Chen, Dimitris Paparas and Mihalis Yannakakis, *The Complexity of Non-Monotone Markets*, submitted to Journal of the ACM.

### Accepted:

1. Jin-Yi Cai and Xi Chen, *Complexity of Counting CSP with Complex Weights*, Journal of the ACM.

### Published:

1. Xi Chen, Martin Dyer, Leslie Ann Goldberg, Mark Jerrum, Pinyan Lu, Colin McQuillan and David Richerby, *The Complexity of Approximating Conservative Counting CSPs*, Journal of Computer and System Sciences 81(1): 311–329, 2015.
2. Jin-Yi Cai, Xi Chen and Pinyan Lu, *Graph Homomorphisms with Complex Values: A Dichotomy Theorem*, SIAM Journal on Computing, 42(3), 924–1029, 2013.
3. Boaz Barak, Mark Braverman, Xi Chen and Anup Rao, *How to Compress Interactive Communication*, SIAM Journal on Computing 42(3): 1327-1363, 2013.
4. Xi Chen, Neeraj Kayal and Avi Wigderson, *Partial Derivatives in Arithmetic Complexity and Beyond*, Foundations and Trends in Theoretical Computer Science 6(1-2): 1–158, 2011.



5. Xi Chen, *Complexity Dichotomies of Counting Problems*, ACM SIGACT News, Complexity Theory Column 72, 42(4): 54–76, December 2011.
6. Xi Chen, Xiaotie Deng and Becky Jie Liu, *On Incentive Compatible Competitive Selection Protocols*, Algorithmica 61(2): 447–462, 2011.
7. Jin-Yi Cai, Xi Chen and Dong Li, *A Quadratic Lower Bound for the Permanent and Determinant Problem over any Characteristic  $\neq 2$* , Computational Complexity 19(1): 37–56, 2010.
8. Xi Chen, Xiaoming Sun, Shang-Hua Teng, *Quantum Separation of Local Search and Fixed Point Computation*, Algorithmica 56(3): 364–382, 2010.
9. Xi Chen, Xiaotie Deng and Shang-Hua Teng, *Settling the Complexity of Computing Two-Player Nash Equilibria*, Journal of the ACM, 56(3): 1–57, 2009.
10. Xi Chen, Li-Sha Huang and Shang-Hua Teng, *Market Equilibria with Hybrid Linear-Leontief Utilities*, Theoretical Computer Science, 410(17): 1573–1580, 2009.
11. Xi Chen and Xiaotie Deng, *On the Complexity of 2D Discrete Fixed Point Problem*, Theoretical Computer Science, 410(44): 4448–4456, 2009.
12. Xi Chen and Xiaotie Deng, *A Simplicial Approach for Discrete Fixed Point Theorems*, Algorithmica, 53(2): 250–262, 2009.
13. Xi Chen and Xiaotie Deng, *Matching Algorithmic Bounds for Finding a Brouwer Fixed Point*, Journal of the ACM, 55(3): 1–26, 2008.
14. Xiaotie Deng and Xi Chen, *Recent Development in Computational Complexity Characterization of Nash equilibrium*, Computer Science Review 1(2): 88–99, 2007.
15. Lan Liu, Xi Chen, Jing Xiao and Tao Jiang, *Complexity and Approximation of the Minimum Recombination Haplotype Configuration Problem*, Theoretical Computer Science, 378(3): 316–330, 2007.
16. Yongxi Cheng, Xi Chen and Yiqun L. Yin, *On Searching a Table Consistent with Division Poset*, Theoretical Computer Science, 370(1–3): 240–253, 2007.

## Manuscripts

1. Xi Chen, Yu Cheng and Bo Tang, *Well-Supported versus Approximate Nash Equilibria: Query Complexity of Large Games*, arXiv Report, 2015.
2. Xi Chen, Igor C. Oliveira and Rocco A. Servedio, *Addition is Exponentially Harder than Counting for Shallow Monotone Circuits*, ECCO Report, 2015.
3. Xi Chen, Igor C. Oliveira, Rocco A. Servedio and Li-Yang Tan, *Near-Optimal Small-Depth Lower Bounds for Small Distance Connectivity*, arXiv Report, 2015.