Nima Anari

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https://nimaanari.com

Research Interests

Sampling algorithms and Markov chains
High-dimensional expanders
Geometry of polynomials
Combinatorial optimization

Academic Positions

Stanford University ......................................................... 9/2019 - present
Assistant Professor of Computer Science.
Robert N. Noyce Faculty Fellow.

Simons Institute for the Theory of Computing ....................... 1/2019 - 5/2019
Microsoft Research Fellow.

Stanford University ......................................................... 1/2018 - 8/2019
Research Engineer in Computer Science.

Simons Institute for the Theory of Computing ....................... 8/2017 - 12/2017
Research Fellow.

Stanford University ......................................................... 1/2016 - 8/2017
Postdoctoral Scholar in Management Science and Engineering, Hosted by Amin Saberi.

Education

University of California, Berkeley ....................................... 8/2010 - 12/2015
Ph.D. in Computer Science.
Advisor: Satish Rao.
Sharif University of Technology .................................................. 9/2006 - 7/2010
B.Sc. in Computer Engineering and B.Sc. in Pure Mathematics.

Honors and Awards

Sloan Research Fellowship .......................................................... 2021
Alfred P. Sloan Foundation.

NSF CAREER Award ................................................................. 2021
National Science Foundation.

STOC 2019 Best Paper Award .................................................... 2019
For the paper “Log-Concave Polynomials II: High-Dimensional Walks and an FPRAS for Counting Bases of a Matroid.”

Google Faculty Research Award ............................................... 2019
Google.

Microsoft Research Fellow ...................................................... 2019
Simons Institute for the Theory of Computing.

Simons-Berkeley Research Fellow ............................................. 2017
Simons Institute for the Theory of Computing

Berkeley Fellowship for Graduate Studies .................................. 2010 - 2012
University of California, Berkeley.

Ranked 14th Team ................................................................. ICPC 2009
ACM International Collegiate Programming Contest World Finals.

Ranked 13th Team ................................................................. ICPC 2008
ACM International Collegiate Programming Contest World Finals.

First Prize ........................................................................... IMC 2008
International Mathematics Competition.

First Prize ........................................................................... IMC 2007
International Mathematics Competition.

Outstanding Student Award .................................................... 2007, 2008, 2009
Sharif University of Technology

Silver Medal ............................................................................ IOI 2006
International Olympiad in Informatics.
Gold Medal ........................................................................................................... IMO 2006
International Mathematical Olympiad.

Silver Medal ........................................................................................................... IMO 2005
International Mathematical Olympiad.

Teaching

CS 263: Counting and Sampling ............................................................................ Autumn 2022
Stanford University.

CS 161: Design and Analysis of Algorithms ............................................................. Winter 2022
Stanford University.

CS 221: Artificial Intelligence: Principles and Techniques ....................................... Spring 2021
Stanford University.

CS 161: Design and Analysis of Algorithms ............................................................. Winter 2021
Stanford University.

CS 263: Counting and Sampling ............................................................................ Autumn 2020
Stanford University.

CS 221: Artificial Intelligence: Principles and Techniques ....................................... Spring 2020
Stanford University.

CS 260: Geometry of Polynomials in Algorithm Design ......................................... Winter 2020
Stanford University.

Mentoring

Misha Ivkov .................................................................................................................. Ph.D., 2022 - present
Co-advised with Tselil Schramm.

Brian Xu ..................................................................................................................... Undergrad, 2022
Summer CURIS Project.

Katherine Yu ............................................................................................................ Undergrad, 2022
Summer CURIS Project.
Yizhi Huang . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Undergrad, 2022
Summer UGVR Project.

Tianyu Liu . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Postdoc, 2022 - present
Computing Innovation Fellow.

Frederic Koehler . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Postdoc, 2022 - present
Motwani Postdoctoral Fellow. Co-hosted with Omer Reingold and Gregory Valiant.

Callum Burgess . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Undergrad, 2021
Summer CURIS Project.

Thuy-Duong (June) Vuong . . . . . . . . . . . . . . . . . . . . . . . . . . Ph.D., 2020 - present
Co-advised with Moses Charikar.

Nathan Hu . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Undergrad, 2020
Summer CURIS Project.

Armaun Sanayei . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Undergrad, 2020
Summer CURIS Project.

Professional Service

Program Committee Member . . . . . . . . . . . . . . . . . . . . . . . . . ITCS 2021

Program Committee Member . . . . . . . . . . . . . . . . . . . . . . . . . STOC 2020

Program Committee Member . . . . . . . . . . . . . . . . . . . . . . . . . RANDOM 2020

Workshop Organizer . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . STOC 2019
Co-organized workshop on “Nash Welfare, Market Equilibrium, and Stable Polynomials.”

Program Committee Member . . . . . . . . . . . . . . . . . . . . . . . . . APPROX 2019

Workshop Organizer . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . FOCS 2016
Co-organized workshop on “Approximating Traveling Salesman Problems using Algebraic Techniques.”

Miscellaneous Jobs

Microsoft Research, Redmond . . . . . . . . . . . . . . . . . . . . . . . . . . . 5/2015 - 8/2015
Intern in the Theory Group.
Google, New York ................................................................. 5/2014 - 8/2014
Intern in the Algorithms Research Group.

Jane Street, New York ......................................................... 5/2013 - 8/2013
Intern.

Facebook, Menlo Park ........................................................ 5/2012 - 8/2012
Intern.

D.E. Shaw & Co., New York ................................................... 6/2011 - 8/2011
Intern.

Invited Talks

University of Minnesota and Lehigh University ...................... 10/2022
Joint Probability Seminar.

University of California, Santa Barbara ................................ 8/2022
Summer School on "New Tools for Optimal Mixing of Markov Chains: Spectral Independence and Entropy Decay."

Center for Discrete Mathematics and Theoretical Computer Science (DIMACS) ........ 5/2022
Workshop on "Entropy and Optimization."

University of Cambridge ...................................................... 2/2022
Probability Seminar.

Oberwolfach Research Institute for Mathematics .................. 11/2021
Workshop on "Combinatorial Optimization."

Simons Foundation, New York ............................................. 11/2021
Workshop on "High-Dimensional Expanders."

University of Illinois, Urbana-Champaign ............................ 11/2021
Theory Seminar.

STOC 2021 .............................................................................. 6/2021
Invited Tutorial on "Log-Concave Polynomials."

Tata Institute of Fundamental Research ................................. 1/2021
Workshop on Uniqueness Methods in Statistical Mechanics .......... 12/2020
Institute for Advanced Studies (IAS) ................................. 10/2020
Computer Science and Discrete Math Seminar.

Highlights of Algorithms (HALG) ..................................... 8/2020

Purdue University .......................................................... 4/2020
Theory Seminar.

University of California, Berkeley ................................. 3/2020
Theory Seminar.

MIT ................................................................. 1/2020
Workshop on “Learning Under Complex Structure.”

University of California, Los Angeles ....................... 11/2019
Combinatorics Seminar.

Georgia Tech .......................................................... 11/2019
Invited Lectures.

Highlights of Algorithms (HALG) ................................. 6/2019

Banff International Research Station ....................... 5/2019
Workshop on “Geometry of Real Polynomials.”

Simons Institute for the Theory of Computing ................ 5/2019
Workshop on “Hyperbolic Polynomials and Hyperbolic Programming.”

Bay Area Discrete Math Workshop (BADMath) ............ 4/2019

University of California, Berkeley ......................... 4/2019
Probability Seminar.

Simons Institute for the Theory of Computing ............. 3/2019
Workshop on “Deterministic Counting, Probability, and Zeros of Partition Functions.”

Simons Institute for the Theory of Computing ............. 2/2019
Workshop on “Beyond Randomized Rounding and the Probabilistic Method.”

University of California, San Diego ......................... 1/2019
Theory Seminar.

Simons Institute for the Theory of Computing ............. 1/2019
Workshop on “Geometry of Polynomials Bootcamp.”
Stanford University ................................................................. 11/2018
Probability Seminar.

EPFL ................................................................. 11/2018
Workshop on “Applications of Partition Functions.”

MIT ................................................................. 10/2018
Algorithms and Complexity Seminar.

EPFL ................................................................. 10/2018
Workshop on “Theoretical Challenges in Partition Functions.”

Harvard University ................................................................. 9/2018
Theory of Computing Seminar.

Banff International Research Station ................................................................. 9/2018
Workshop on “The Traveling Salesman Problem: Algorithms & Optimization.”

Georgia Tech ................................................................. 4/2018
ARC Colloquium.

Institute for Pure & Applied Mathematics (IPAM) ................................................................. 4/2018
Workshop on “Expected Characteristic Polynomial Techniques and Applications.”

TCS+ ................................................................. 3/2018

Simons Institute for the Theory of Computing ................................................................. 9/2017
Workshop on “Discrete Optimization via Continuous Relaxation.”

Manuscripts and Working Papers

Entropic Independence II: Optimal Sampling and Concentration via Restricted Modified Log-
Sobolev Inequalities
Nima Anari, Vishesh Jain, Frederic Koehler, Huy Tuan Pham, Thuy-Duong Vuong
CoRR, abs/2111.03247
Extended abstract merged with the paper “Entropic Independence I: Modified Log-Sobolev Inequalities
for Fractionally Log-Concave Distributions and High-Temperature Ising Models.”
Entropic Independence I: Modified Log-Sobolev Inequalities for Fractionally Log-Concave Distributions and High-Temperature Ising Models
Nima Anari, Vishesh Jain, Frederic Koehler, Huy Tuan Pham, Thuy-Duong Vuong
CoRR, abs/2106.04105
Extended abstract merged with the paper "Entropic Independence II: Optimal Sampling and Concentration via Restricted Modified Log-Sobolev Inequalities".

Improved Sampling-to-Counting Reductions in High-Dimensional Expanders and Faster Parallel Determinantal Sampling
Nima Anari, Callum Burgess, Kevin Tian, Thuy-Duong Vuong
CoRR, abs/2203.11190

Batch Active Learning Using Determinantal Point Processes
Erdem Biyik, Kenneth Wang, Nima Anari, Dorsa Sadigh
CoRR, abs/1906.07975

Log-Concave Polynomials III: Mason’s Ultra-Log-Concavity Conjecture for Independent Sets of Matroids
Nima Anari, Kuikui Liu, Shayan Oveis Gharan, Cynthia Vinzant
CoRR, abs/1811.01600

The Kadison-Singer Problem for Strongly Rayleigh Measures and Applications to Asymmetric TSP
Nima Anari, Shayan Oveis Gharan
CoRR, abs/1412.1143

Publications

Optimal Sublinear Sampling of Spanning Trees and Determinantal Point Processes via Average-Case Entropic Independence
Nima Anari, Yang P. Liu, Thuy-Duong Vuong
Invited to special issue of SIAM Journal on Computing.

From Sampling to Optimization on Discrete Domains with Applications to Determinant Maximization
Nima Anari, Thuy-Duong Vuong
Conference on Learning Theory, 2-5 July 2022, London, UK, 178

Entropic independence: optimal mixing of down-up random walks
Nima Anari, Vishesh Jain, Frederic Koehler, Huy Tuan Pham, Thuy-Duong Vuong
STOC ’22: 54th Annual ACM SIGACT Symposium on Theory of Computing, Rome, Italy, June 20 - 24, 2022
50 Domain Sparsification of Discrete Distributions Using Entropic Independence ............... ITCS 2022
Nima Anari, Michal Derezinski, Thuy-Duong Vuong, Elizabeth Yang
13th Innovations in Theoretical Computer Science Conference, ITCS 2022, January 31 - February 3, 2022, Berkeley, CA, USA, 215

29 The Bethe and Sinkhorn Permanents of Low Rank Matrices and Implications for Profile ... COLT 2021
Maximum Likelihood
Nima Anari, Moses Charikar, Kirankumar Shiragur, Aaron Sidford
Conference on Learning Theory, COLT 2021, 15-19 August 2021, Boulder, Colorado, USA, 134

28 Sampling Arborescences in Parallel ................................................................. ITCS 2021
Nima Anari, Nathan Hu, Amin Saberi, Aaron Schild
12th Innovations in Theoretical Computer Science Conference, ITCS 2021, January 6-8, 2021, Virtual Conference, 185

27 Learning Multimodal Rewards from Rankings ..................................................... CoRL 2021
Vivek Myers, Erdem Biyik, Nima Anari, Dorsa Sadigh
Conference on Robot Learning, 8-11 November 2021, London, UK, 164

26 Fractionally log-concave and sector-stable polynomials: counting planar matchings ... STOC 2021
and more
Yeganeh Alimohammadi, Nima Anari, Kirankumar Shiragur, Thuy-Duong Vuong
STOC ’21: 53rd Annual ACM SIGACT Symposium on Theory of Computing, Virtual Event, Italy, June 21-25, 2021

25 Log-concave polynomials IV: approximate exchange, tight mixing times, and near-... STOC 2021
optimal sampling of forests
Nima Anari, Kuikui Liu, Shayan Oveis Gharan, Cynthia Vinzant, Thuy-Duong Vuong
STOC ’21: 53rd Annual ACM SIGACT Symposium on Theory of Computing, Virtual Event, Italy, June 21-25, 2021

24 Matching Is as Easy as the Decision Problem, in the NC Model ................. ITCS 2020
Nima Anari, Vijay V. Vazirani
11th Innovations in Theoretical Computer Science Conference, ITCS 2020, January 12-14, 2020, Seattle, Washington, USA, 151

23 An Extension of Plücker Relations with Applications to Subdeterminant Maximization ... APPROX 2020
Nima Anari, Thuy-Duong Vuong
Approximation, Randomization, and Combinatorial Optimization. Algorithms and Techniques, APPROX/RAN-
DOM 2020, August 17-19, 2020, Virtual Conference, 176
22 Isotropy and Log-Concave Polynomials: Accelerated Sampling and High-Precision Counting of Matroid Bases
Nima Anari, Michal Derezinski
61st IEEE Annual Symposium on Foundations of Computer Science, FOCS 2020, Durham, NC, USA, November 16-19, 2020

21 Spectral Independence in High-Dimensional Expanders and Applications to the Hard-core Model
Nima Anari, Kuikui Liu, Shayan Oveis Gharan
61st IEEE Annual Symposium on Foundations of Computer Science, FOCS 2020, Durham, NC, USA, November 16-19, 2020
Invited to special issue of SIAM Journal on Computing.

20 Instance Based Approximations to Profile Maximum Likelihood
Nima Anari, Moses Charikar, Kirankumar Shiragur, Aaron Sidford
Advances in Neural Information Processing Systems 33: Annual Conference on Neural Information Processing Systems 2020, NeurIPS 2020, December 6-12, 2020, virtual

19 Nearly Optimal Pricing Algorithms for Production Constrained and Laminar Bayesian Selection
Nima Anari, Rad Niazadeh, Amin Saberi, Ali Shameli
Proceedings of the 2019 ACM Conference on Economics and Computation, EC 2019, Phoenix, AZ, USA, June 24-28, 2019

18 Log-concave polynomials II: high-dimensional walks and an FPRAS for counting bases of a matroid
Nima Anari, Kuikui Liu, Shayan Oveis Gharan, Cynthia Vinzant
Proceedings of the 51st Annual ACM SIGACT Symposium on Theory of Computing, STOC 2019, Phoenix, AZ, USA, June 23-26, 2019
Invited to Theory of Computing. Awarded Best Paper of STOC 2019.

17 Structured Robust Submodular Maximization: Offline and Online Algorithms
Nima Anari, Nika Haghtalab, Seffi Naor, Sebastian Pokutta, Mohit Singh, Alfredo Torrico
The 22nd International Conference on Artificial Intelligence and Statistics, AISTATS 2019, 16-18 April 2019, Naha, Okinawa, Japan, 89
INFORMS J. Comput., 33

16 A Tight Analysis of Bethe Approximation for Permanent
Nima Anari, Alireza Rezaei
60th IEEE Annual Symposium on Foundations of Computer Science, FOCS 2019, Baltimore, Maryland, USA, November 9-12, 2019
Invited to special issue of SIAM Journal on Computing.
Log-Concave Polynomials I: Entropy and a Deterministic Approximation Algorithm for Counting Bases of Matroids
Nima Anari, Shayan Oveis Gharan, Cynthia Vinzant
59th IEEE Annual Symposium on Foundations of Computer Science, FOCS 2018, Paris, France, October 7-9, 2018

Planar Graph Perfect Matching Is in NC
Nima Anari, Vijay V. Vazirani
59th IEEE Annual Symposium on Foundations of Computer Science, FOCS 2018, Paris, France, October 7-9, 2018
J. ACM, 67
Invited to special issue of SIAM Journal on Computing.

Graph Clustering using Effective Resistance
Vedat Levi Alev, Nima Anari, Lap Chi Lau, Shayan Oveis Gharan
9th Innovations in Theoretical Computer Science Conference, ITCS 2018, January 11-14, 2018, Cambridge, MA, USA, 94

Smoothed Analysis of Discrete Tensor Decomposition and Assemblies of Neurons
Nima Anari, Constantinos Daskalakis, Wolfgang Maass, Christos H. Papadimitriou, Amin Saberi, Santosh S. Vempala
Advances in Neural Information Processing Systems 31: Annual Conference on Neural Information Processing Systems 2018, NeurIPS 2018, December 3-8, 2018, Montréal, Canada

Budget Feasible Procurement Auctions
Nima Anari, Gagan Goel, Afshin Nikzad
Oper. Res., 66
Invited to GEB special issue on Algorithmic Game Theory.

Approximating the Largest Root and Applications to Interlacing Families
Nima Anari, Shayan Oveis Gharan, Amin Saberi, Nikhil Srivastava
Proceedings of the Twenty-Ninth Annual ACM-SIAM Symposium on Discrete Algorithms, SODA 2018, New Orleans, LA, USA, January 7-10, 2018

Nash Social Welfare for Indivisible Items under Separable, Piecewise-Linear Concave Utilities
Nima Anari, Tung Mai, Shayan Oveis Gharan, Vijay V. Vazirani
Proceedings of the Twenty-Ninth Annual ACM-SIAM Symposium on Discrete Algorithms, SODA 2018, New Orleans, LA, USA, January 7-10, 2018

Simply Exponential Approximation of the Permanent of Positive Semidefinite Matrices
Nima Anari, Leonid Gurvits, Shayan Oveis Gharan, Amin Saberi
58th IEEE Annual Symposium on Foundations of Computer Science, FOCS 2017, Berkeley, CA, USA, October 15-17, 2017
1. Nash Social Welfare, Matrix Permanent, and Stable Polynomials ....................... ITCS 2017
   Nima Anari, Shayan Oveis Gharan, Amin Saberi, Mohit Singh
   8th Innovations in Theoretical Computer Science Conference, ITCS 2017, January 9-11, 2017, Berkeley, CA, USA, 67
   Elevated to invited paper.

2. A generalization of permanent inequalities and applications in counting and optimization ...... STOC 2017
   Nima Anari, Shayan Oveis Gharan
   Proceedings of the 49th Annual ACM SIGACT Symposium on Theory of Computing, STOC 2017, Montreal, QC, Canada, June 19-23, 2017
   Advances in Mathematics, 383

3. Monte Carlo Markov Chain Algorithms for Sampling Strongly Rayleigh Distributions .... COLT 2016
   and Determinantal Point Processes
   Nima Anari, Shayan Oveis Gharan, Alireza Rezaei
   Proceedings of the 29th Conference on Learning Theory, COLT 2016, New York, USA, June 23-26, 2016, 49

4. Effective-Resistance-Reducing Flows, Spectrally Thin Trees, and Asymmetric TSP ........ FOCS 2015
   Nima Anari, Shayan Oveis Gharan
   IEEE 56th Annual Symposium on Foundations of Computer Science, FOCS 2015, Berkeley, CA, USA, 17-20 October, 2015
   Invited to special issue of SIAM Journal on Computing.

5. Mechanism Design for Crowdsourcing: An Optimal 1-1/e Competitive Budget-Feasible Mechanism for Large Markets ........ FOCS 2014
   Nima Anari, Gagan Goel, Afshin Nikzad
   55th IEEE Annual Symposium on Foundations of Computer Science, FOCS 2014, Philadelphia, PA, USA, October 18-21, 2014

6. Euclidean Movement Minimization ................................................................. CCCG 2011
   MohammadAmin Fazli, MohammadAli Safari, Nima Anari, Pooya Jalaly Khalilabadi, Mohammad Ghodsi
   Proceedings of the 23rd Annual Canadian Conference on Computational Geometry, Toronto, Ontario, Canada, August 10-12, 2011
   J. Comb. Optim., 32

7. Equilibrium Pricing with Positive Externalities ............................................. WINE 2010
   Nima Anari, Shayan Ehsani, Mohammad Ghodsi, Nima Haghpanah, Nicole Immorlica, Hamid Mahini, Vahab S. Mirrokni
   Internet and Network Economics - 6th International Workshop, WINE 2010, Stanford, CA, USA, December 13-17, 2010. Proceedings, 6484
   Theor. Comput. Sci., 476