

Nima Anari

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Gates Computer Science #168A
353 Jane Stanford Way
Stanford, CA 94305

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 Technology9/2006 - 7/2010
B.Sc. in Computer Engineering and B.Sc. in Pure Mathematics.

Honors and Awards

Frontiers of Science Award 2023
International Congress of Basic Science.

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 2023
Stanford University.

CS 161: Design and Analysis of Algorithms Winter 2023
Stanford University.

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

Chloë Blake Undergrad, 2023
LINXS Program (Summer Research).

Thanawat Sornwanee Undergrad, 2023
CURIS Program (Summer Research).

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

Brian Xu Undergrad, 2022
CURIS Program (Summer Research).

Katherine Yu Undergrad, 2022
CURIS Program (Summer Research).

Yizhi Huang Undergrad, 2022
UGVR Program (Summer Research).

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
CURIS Program (Summer Research).

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

Nathan Hu Undergrad, 2020
CURIS Program (Summer Research).

Armaun Sanayei Undergrad, 2020
CURIS Program (Summer Research).

Professional Service

Program Committee Member STOC 2023

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

- International Congress of Basic Science** 7/2023
- Simons Institute for the Theory of Computing** 6/2023
Workshop on “Beyond the Boolean Cube.”
- CanadAM 2023** 6/2023
Plenary Speaker.
- Harvard University** 5/2023
Theory Seminar.
- Oberwolfach Research Institute for Mathematics** 3/2023
Workshop on “New Directions in Real Algebraic Geometry.”

Banff International Research Station	3/2023
Workshop on “Algebraic Aspects of Matroid Theory.”	
Stanford University	1/2023
Combinatorics Seminar.	
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

- 43** **Universality of Spectral Independence with Applications to Fast Mixing in Spin Glasses**

Nima Anari, Vishesh Jain, Frederic Koehler, Huy Tuan Pham, Thuy-Duong Vuong

CoRR, abs/2307.10466
- 42** **Parallel Sampling of Diffusion Models**

Andy Shih, Suneel Belkhole, Stefano Ermon, Dorsa Sadigh, Nima Anari

CoRR, abs/2305.16317
- 41** **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”.
- 40** **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”.

- 39) **Batch Active Learning Using Determinantal Point Processes**
 Erdem Biyik, Kenneth Wang, Nima Anari, Dorsa Sadigh
 CoRR, abs/1906.07975
- 38) **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
- 37) **The Kadison-Singer Problem for Strongly Rayleigh Measures and Applications to Asymmetric TSP ...**
 Nima Anari, Shayan Oveis Gharan
 CoRR, abs/1412.1143

Publications

- 36) **Distortion in metric matching with ordinal preferences** EC 2023
 Nima Anari, Moses Charikar, Prasanna Ramakrishnan
 Proceedings of the 24th ACM Conference on Economics and Computation, EC 2023, London, United Kingdom, July 9-12, 2023
- 35) **Quadratic Speedups in Parallel Sampling from Determinantal Distributions** SPAA 2023
 Nima Anari, Callum Burgess, Kevin Tian, Thuy-Duong Vuong
 Proceedings of the 35th ACM Symposium on Parallelism in Algorithms and Architectures, SPAA 2023, Orlando, FL, USA, June 17-19, 2023
- 34) **Parallel Discrete Sampling via Continuous Walks** STOC 2023
 Nima Anari, Yizhi Huang, Tianyu Liu, Thuy-Duong Vuong, Brian Xu, Katherine Yu
 Proceedings of the 55th Annual ACM Symposium on Theory of Computing, STOC 2023, Orlando, FL, USA, June 20-23, 2023
- 33) **Optimal Sublinear Sampling of Spanning Trees and Determinantal Point Processes via ... Average-Case Entropic Independence** FOCS 2022
 Nima Anari, Yang P. Liu, Thuy-Duong Vuong
 63rd IEEE Annual Symposium on Foundations of Computer Science, FOCS 2022, Denver, CO, USA, October 31 - November 3, 2022
 Invited to special issue of SIAM Journal on Computing.
- 32) **From Sampling to Optimization on Discrete Domains with Applications to Determinant ... Maximization** COLT 2022
 Nima Anari, Thuy-Duong Vuong
 Conference on Learning Theory, 2-5 July 2022, London, UK, 178

- 31 **Entropic independence: optimal mixing of down-up random walks** STOC 2022
 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
 Merged extended abstract of the two papers Entropic Independence II: Optimal Sampling and Concentration via Restricted Modified Log-Sobolev Inequalities”.
- 30 **Domain Sparsification of Discrete Distributions Using Entropic Independence** ITCS 2022
 Nima Anari, Michal Derezhinski, 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 Maximum Likelihood** COLT 2021
 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 and more** STOC 2021
 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-optimal sampling of forests** STOC 2021
 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/RANDOM 2020, August 17-19, 2020, Virtual Conference, 176
- 22) **Isotropy and Log-Concave Polynomials: Accelerated Sampling and High-Precision FOCS 2020 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- FOCS 2020 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 NeurIPS 2020**
 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 EC 2019 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 STOC 2019 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 AISTATS 2019**
 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**FOCS 2019
 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.
- 15 **Log-Concave Polynomials I: Entropy and a Deterministic Approximation Algorithm for Counting Bases of Matroids** FOCS 2018
 Nima Anari, Shayan Oveis Gharan, Cynthia Vinzant
 59th IEEE Annual Symposium on Foundations of Computer Science, FOCS 2018, Paris, France, October 7-9, 2018
- 14 **Planar Graph Perfect Matching Is in NC** FOCS 2018
 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.
- 13 **Graph Clustering using Effective Resistance** ITCS 2018
 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
- 12 **Smoothed Analysis of Discrete Tensor Decomposition and Assemblies of Neurons** NeurIPS 2018
 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
- 11 **Budget Feasible Procurement Auctions** Oper. Res.
 Nima Anari, Gagan Goel, Afshin Nikzad
 Oper. Res., 66
 Invited to GEB special issue on Algorithmic Game Theory.
- 10 **Approximating the Largest Root and Applications to Interlacing Families** SODA 2018
 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

- 9 **Nash Social Welfare for Indivisible Items under Separable, Piecewise-Linear Concave Utilities** SODA 2018
 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
- 8 **Simply Exponential Approximation of the Permanent of Positive Semidefinite Matrices** FOCS 2017
 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
- 7 **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.
- 6 **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
- 5 **Monte Carlo Markov Chain Algorithms for Sampling Strongly Rayleigh Distributions and Determinantal Point Processes** COLT 2016
 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.
- 3 **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

- ② **Euclidean Movement Minimization** CCG 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
- ① **Equilibrium Pricing with Positive Externalities** WINE 2010
 Nima Anari, Shayan Ehsani, Mohammad Ghodsi, Nima Haghpahan, 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