Sharat Ibrahimpur

i-sharat.github.io

Contact Information

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Research Interests

Combinatorial Optimization, Stochastic Optimization, Approximation Algorithms, Randomized Algorithms, Online Algorithms, Network Design, Scheduling, Load Balancing, Caching.

Academic Employment

Research Officer in Algorithms and Optimisation Sept 2022 - Sept 2024
Dept of Mathematics, London School of Economics

Hosts: László Végh and Neil Olver
Postdoctoral Researcher in the Operations Research Group with focus on stochastic scheduling, asymmetric Nash social welfare, and online bipartite matching problems.

Education

Ph.D. in Combinatorics and Optimization Sep 2016 - Jul 2022

Dept of Combinatorics and Optimization, University of Waterloo
Thesis: Stochastic Minimum Norm Combinatorial Optimization
Advisor: Prof. Chaitanya Swamy
Research Areas: Stochastic Optimization, Approximation Algorithms, Combinatorial Optimization, Randomized Algorithms
GPA: 94.88 / 100

M.Math. in Combinatorics and Optimization Sep 2015 - Sep 2016

Dept of Combinatorics and Optimization, University of Waterloo
Thesis: Packing and Covering Odd (u, v)-trails in a Graph
Advisor: Prof. Chaitanya Swamy
Research Area: Combinatorial Optimization, Approximation Algorithms
GPA: 90.75 / 100

Integrated B.Sc & M.Sc. in Applied Mathematics Aug 2008 - May 2013

Dept of Mathematics, Indian Institute of Technology Roorkee
GPA: 7.80 / 10

Research Internship

Research Intern May 2021 - Oct 2021
Google Research (North America, Virtual)

Host: Manish Purohit
Research Intern in the Discrete Algorithms Group. Introduced and studied the caching with reserves problem. Implemented a greedy heuristic for improving memory space assignment on accelerators.

Industry Employment

Senior Analyst Jun 2013 - Jul 2015
Goldman Sachs, Bangalore, India

Worked on risk models used by Global Securities Services, Prime Brokerage, and Clearing businesses undertaken by Goldman Sachs. Developed fast and robust risk monitoring systems, which compute margin requirements every few minutes across thousands of accounts involving over half a million unique products using distributed computing.

Publications

ARTICLES IN REFEREED CONFERENCE AND JOURNALS

Efficient Caching with Reserves via Marking
With Manish Purohit, Zoya Svitkina, Erik Vee, and Joshua R. Wang
Appeared in ICALP 2023
Links: ICALP23, arXiv

Improved Approximation Algorithms by Generalizing the Primal-Dual Method Beyond Uncrossable Functions
With Ishan Bansal, Joseph Cheriyan, and Logan Grout
Appeared in ICALP 2023
Links: ICALP23, arXiv

Approximation Algorithms for Flexible Graph Connectivity
With Sylvia Boyd, Joseph Cheriyan, and Arash Haddadan
Appeared in Mathematical Programming, 2023
Conference version appeared in FSTTCS 2021
Links: MathProg23, FSTTCS21, arXiv, Short Talk, Long Talk

Caching with Reserves
With Manish Purohit, Zoya Svitkina, Erik Vee, and Joshua R. Wang
Appeared in APPROX 2022
Links: APPROX22, arXiv, Long Talk

A 4/3-Approximation Algorithm for the Minimum 2-Edge Connected Multisubgraph Problem in the Half-Integral Case
With Sylvia Boyd, Joseph Cheriyan, Robert Cummings, Logan Grout, Zoltán Szigeti, and Lu Wang
Appeared in SIAM Journal on Discrete Mathematics, Volume 36, Issue 3, 2022.
Conference version appeared in APPROX 2020
Links: SIDMA22, APPROX20, arXiv, Short Talk, Long Talk

A Simple Approximation Algorithm for Vector Scheduling and Applications to Stochastic Min-Norm Load Balancing
With Chaitanya Swamy
Appeared in SOSA 2022
Links: SOSA22, arXiv

Minimum-Norm Load Balancing Is (Almost) as Easy as Minimizing Makespan
With Chaitanya Swamy
Appeared in ICALP 2021
Links: ICALP21, Long Talk

Approximation Algorithms for Stochastic Minimum Norm Combinatorial Optimization
With Chaitanya Swamy
Appeared in FOCS 2020
Invited talk at CanaDAM 2021
Links: FOCS20, arXiv, Long Talk

Min-Max Theorems for Packing and Covering Odd (u, v)-trails
With Chaitanya Swamy
Appeared in IPCO 2017
Contributed Talk at ISMP 2018
Links: IPCO17, arXiv

ARTICLES ACCEPTED TO REFEREED CONFERENCE AND JOURNALS

Algorithms for 2-connected network design and flexible Steiner trees with a constant number of terminals
With Ishan Bansal, Joseph Cheriyan, and Logan Grout
To appear in APPROX 2023 [arXiv]

Scholarships & Academic Achievements

Second place in the Mathematics Doctoral Prize competition	2023
Finalist for the Alumni Gold Medal at doctoral level	2022
Doctoral Thesis Completion Award	Winter 2022
William Tutte Postgraduate Scholarship	Fall 2018
Susan and Janos Aczel Graduate Scholarship	Winter 2017
Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship, India	2009 - 2013
National Board for Higher Mathematics Fellowship, India	2011 - 2013
Ranked 7th (India) in Graduate Aptitude Test in Engineering (Math)	2012
Ranked 5th (India) in National Eligibility Test (Math)	2012
Qualified for Karnataka Regional Mathematical Olympiad	2007
Qualified for Indian National Astronomy Olympiad	2006

Relevant Academic Training

Graduate Coursework

Combinatorial Optimization, Approximation Algorithms, Graph Theory, Convexity and Optimization, Semidefinite Optimization, Information Theory and Applications, Concentration Inequalities, Algorithm Design and Analysis, Randomized Algorithms.

Workshops

The Traveling Salesman Problem: Algorithms & Optimization — Sept 23-28, 2018
Banff International Research Station, Banff, Canada

STOC 2017 Theory Fest — June 23, 2017
Montreal, Canada

Summer Schools

IPCO 2020 Summer School (Virtual) — June 6-7, 2020
London School of Economics, London, UK

IPCO 2019 Summer School — May 20-21, 2019
University of Michigan, Ann Arbor, USA

Hausdorff School on Combinatorial Optimization — August 20-24, 2018
Hausdorff Centre for Mathematics, Bonn, Germany

IPCO 2017 Summer School — June 24-25, 2017
University of Waterloo, Waterloo, Canada

Programming Skills

Proficient in C++ and Python

Competitive Programming Experience

ACM-ICPC World Finals, St. Petersburg, Russia — July 2013

One of 5 teams to represent India, Ranked 61 / 120

Ranked 3rd in qualifier Amritapuri Regional Contest held in Bangalore, India

Parameterized Algorithms & Computational Experiments Challenge [PACE18]

Implemented exact (Track A) and approximation algorithms (Track C) for the Steiner Tree problem in C++ [GitHub]

Regular Participant in Google Code Jam, Google Kick Start, Facebook Hacker Cup

Ranked Top 500 in Facebook Hacker Cup Round 2 — 2016

Ranked Top 1000 in Google Code Jam Round 2 — 2016

Academic Projects

Course Project for *The Mathematics of Public-Key Cryptography* — Fall 2016

Used Python to implement a lattice-based attack on the Digital Signature Algorithm when partial information about the nonce is known.

Course Project for *Lattice-based Cryptography* — Fall 2015

Used Python to implement LLL and Block Korkine Zolotarev (BKZ) algorithm for lattice basis reduction.

Master's Dissertation on *Approximation Algorithms for Multicommodity Flow problems* — Jan - May 2013

Supervisor: Prof. T. R. Gulati, IIT Roorkee

Investigated the work of Garg and Konemann on approximation algorithms for maximum multicommodity flow and maximum concurrent flow.

Course Project on the *Quadratic Sieve Algorithm* — Jan - May 2013

Supervisor: Prof. Maheshanand, IIT Roorkee

Used Python to implement the quadratic sieve algorithm for factorizing 40-digit integers in under a few minutes.

Bachelor's Dissertation on *Construction of Primitive Polynomials over Finite Fields* — Jan - May 2011

Supervisor: Prof. Sugata Gangopadhyay, IIT Roorkee

Used C++ to implement finite field arithmetic over $\mathbb{Z}_p$ for verifying polynomial irreducibility and primitivity.

Teaching Assistantship

University of Waterloo (W: Winter, S: Spring, F: Fall)

CO 454	Scheduling	S18, S19, S22
CO 372	Portfolio Optimization Models	F20, W21
CO 380	Mathematical Discovery and Invention	S20
CO 353	Computational Discrete Optimization	W19, W20, W21
CO 450/650	Combinatorial Optimization	F17, F19
CO 351	Network Flow Theory	S17, F18
MMT 674.3	Cryptography	W18
CO 327	Deterministic OR Models	W17
CO 250	Introduction to Optimization	F15, W16, F16
MATH 119	Calculus 2 for Engineering	S16

Service

Peer reviewer for SODA (2024, 2019, 2018), Mathematics of Operations Research (2023), STACS (2023), IPCO (2022), ESA (2021, 2020), Discrete Optimization (2021), ISAAC (2020), APPROX (2020), WADS (2019), FOCS (2017), STOC (2017).

Co-organizer of Combinatorial Optimization Reading Group at the University of Waterloo from Fall 2018 to Spring 2020.

References

Prof Chaitanya Swamy
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University of Waterloo, Canada
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Department of Mathematics
London School of Economics, United Kingdom
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Prof Neil Olver
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Prof Joseph Cheriyan
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Prof Jochen Koenemann
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