

MAKRAND SINHA

Contact Information

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Research Interests

- Quantum Computing, Computational Complexity, Optimization, Stochastic Processes

Employment

NOV 2018-PRESENT **Centrum Wiskunde & Informatica (CWI)**, Amsterdam
Postdoctoral Researcher in the *Networks & Optimization* group
Advisors: Nikhil Bansal, Ronald de Wolf, Monique Laurent

Education

AUG 2018 **University of Washington**, Seattle
Ph.D. in *Computer Science and Engineering*
Advisor: Anup Rao
Dissertation: Lower Bounds for Interactive Compression and Linear Programs

MAY 2011 **ETH Zürich**, Switzerland
M. Sc. in *Computer Science*
Advisor: Thomas Holenstein

MAY 2009 **Indian Institute of Technology Kanpur**, India
Bachelor of Technology in *Computer Science and Engineering*

Publications

1. ***k*-Forrelation Optimally Separates Quantum and Classical Query Complexity** [\[arXiv\]](#)
Nikhil Bansal and Makrand Sinha
Manuscript.
2. **Majorizing Measures for the Optimizer** [\[arXiv\]](#)
Sander Borst, Daniel Dadush, Neil Olver and Makrand Sinha
To appear in the 12th Innovations in Theoretical Computer Science (**ITCS '21**)
3. **Online Discrepancy Minimization for Stochastic Arrivals** [\[arXiv\]](#)
Nikhil Bansal, Haotian Jiang, Raghu Meka, Sahil Singla and Makrand Sinha
To appear in the 32nd Symposium on Discrete Algorithms (**SODA '21**).
4. **Online Vector Balancing and Geometric Discrepancy** [\[arXiv\]](#)
Nikhil Bansal, Haotian Jiang, Sahil Singla and Makrand Sinha
Appeared in the 52nd Symposium on Theory of Computing (**STOC '20**). Invited talk at **TCS+**.
5. **Exponential Separation between Quantum Communication and Logarithm of Approximate Rank** [\[arXiv\]](#)
Makrand Sinha and Ronald de Wolf
Appeared in IEEE 60th Annual Symposium on Foundations of Computer Science, (**FOCS '19**).
Invited talk at Quantum Information Processing (**QIP '20**) as part of a joint submission.

6. **Simplified Separation of Information and Communication** [\[ECCC\]](#)

Anup Rao and Makrand Sinha

Appeared in **Theory of Computing**, December 2018.

7. **Edge Estimation with Independent Set Oracles** [\[arXiv\]](#)

Paul Beame, Sarel Har-Peled, Sivaramakrishnan Natarajan Ramamoorthy, Cyrus Rashtchian and Makrand Sinha

Appeared in the 9th Innovations in Theoretical Computer Science (**ITCS '18**).

Full version in ACM **Transactions on Algorithms**.

8. **Lower Bounds for Approximating the Matching Polytope** [\[arXiv\]](#)[\[ECCC\]](#)

Makrand Sinha

Appeared in the 29th Annual ACM-SIAM Symposium on Discrete Algorithms (**SODA '18**).

Invited talk at the International Symposium on Mathematical Programming (**ISMP '18**).

9. **A Direct-sum Theorem for Read-Once Branching Programs** [\[pdf\]](#)

Anup Rao and Makrand Sinha

Appeared in the 20th International Workshop on Randomization and Computation (**RANDOM '16**)

10. **Fooling Pairs in Randomized Communication Complexity** [\[ECCC\]](#)

Shay Moran, Makrand Sinha and Amir Yehudayoff

Appeared in the 23rd International Colloquium on Structural Information and Communication Complexity (**SIROCCO '16**)

11. **On the Communication Complexity of Greater-Than** [\[pdf\]](#)

Sivaramakrishnan Natarajan Ramamoorthy and Makrand Sinha

Appeared in the 53rd Annual Allerton Conference on Communication, Control and Computing (**Allerton '15**)

12. **Constructing a Pseudorandom Generator Requires an Almost Linear Number of Calls** [\[arXiv\]](#)

Thomas Holenstein and Makrand Sinha

Appeared in the 53rd Annual Symposium on Foundations of Computer Science (**FOCS' 12**)

13. **Vertices of Degree k in Random Unlabeled Trees** [\[pdf\]](#)

Konstantinos Panagiotou and Makrand Sinha

Appeared in the proceedings of **EuroComb '09**. Full version appeared in **Journal of Graph Theory**, 2012

Research Visits

AUG 18-SEP 18	Simons Institute , <i>Lower Bounds in Computational Complexity</i> program Visiting Researcher
SEP 14-OCT 14	Technion-Israel Institute of Technology Visiting Researcher
JUL 13-OCT 13	Microsoft Research India , <i>Theory Group</i> Research Internship
JUN 13-JUL 13	Technion-Israel Institute of Technology Visiting Researcher
MAY 08-JUL 08	ETH Zürich Research Internship

Organized Workshops

- Organized the post-conference workshop '*Extension Complexity and Lifting Theorems*' at **FSTTCS '19**.

Talks

- k -Forrelation Optimally Separates Quantum and Classical Query Complexity**
SEP 2020 QuSoft Seminar, CWI (Virtual)
SEP 2020 Quantum Information Seminar, UT Austin (Virtual)
- Online Vector Balancing and Geometric Discrepancy**
SEP 2020 HALG '20, Virtual
JUN 2020 STOC '20, Virtual
MAY 2020 N&O Seminar, CWI
- Tutorial: Lower Bounds for Extension Complexity**
DEC 2019 FSTTCS '19 Workshop, IIT Bombay
- Exponential Separation between Quantum Communication and Logarithm of Approximate Rank**
NOV 2019 FOCS '19, Baltimore
OCT 2018 Seminar, ENS Lyon
JUN 2019 Seminar, Institute of Mathematics, Czech Academy of Sciences
SEP 2019 QuantAlgo Workshop, CWI
SEP 2019 Seminar, Université de Libre Bruxelles
APR 2019 QuSoft Seminar, CWI
- Lower Bounds for Approximating the Matching Polytope**
SEP 2018 Simons Institute, Berkeley
JUL 2018 ISMP 2018, Bordeaux
MAR 2018 Seminar, CWI Amsterdam
JAN 2018 SODA 2018, New Orleans
NOV 2017 UW Theory Seminar, University of Washington
- A Direct-sum Theorem for Read-Once Branching Programs**
SEP 2016 APPROX-RANDOM 2016, IHP Paris
- Simplified Separation of Information and Communication**
MAR 2018 Theory Seminar, KTH Stockholm
DEC 2015 UW Theory Seminar, University of Washington
- On Parallelizing Streaming Computation**
APR 2015 Workshop on Information Theory in Complexity Theory and Combinatorics, Simons Institute
- Direct Sums and Compression for Parallel Streaming Computation**
FEB 2014 UW Theory Seminar, University of Washington
- Constructing a Pseudorandom Generator Requires an Almost Linear Number of Calls**
OCT 2012 FOCS 2012, New Brunswick
APR 2012 UW Theory Seminar, University of Washington

Teaching Experience

CWI

- Organized a reading group on *Random Matrices, Matrix Concentration and connections to Quantum Information Theory* (Fall 2019)

University of Washington

- Guest lecturer for several lectures in a graduate course on *Communication Complexity* (Autumn 2015).
- Teaching Assistant for graduate *Randomized Algorithms* (Winter 2015), undergraduate *Algorithms* (Summer 2014, Spring 2014), undergraduate *Complexity Theory* (Spring 2013).

- Organized and lectured in student reading groups: *Fourier Analysis* (Summer 2012, Organizer), *Recent developments in Theory* (Spring 2013, Organizer), *Incidence Geometry* (Winter 2014), *Recent developments in Theory* (Winter 2015), *Additive Combinatorics* (Spring 2016).
- Gave a popular science talk at Town Hall Seattle:
P vs NP: The Limits of Computers (May 2013), UW Science Now, *Town Hall Seattle*.

Academic Awards

- *Computer Science and Engineering Research Fellowship* at University of Washington for the year 2011-2012
- *Excellence Scholarship* at ETH Zürich from 2009-2011
- *Academic Excellence Award* for the year 2005-06 at IIT Kanpur
- *All India Rank 82* (among top 0.05% candidates) in IIT-Joint Entrance Examination 2005

Other Professional Activities

1. Conference Reviewer for RANDOM, STOC, FOCS, CCC, ITCS, ICALP, QIP, SODA
2. Journal Reviewer for Random Structures & Algorithms, Theoretical Computer Science, JACM, SICOMP, Information and Computation