Curriculum Vitae, Joshua Brakensiek

JOSHUA D. BRAKENSIEK

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Curriculum Vitae

Education

STANFORD UNIVERSITY 2018 – 2023 (expected)
Toward Doctor of Philosophy in Computer Science
Co-advised by Aviad Rubinstein and Moses Charikar
Thesis (working title): “Higher Order MDS Codes”

STANFORD UNIVERSITY 2018 – 2021
Master’s of Science in Computer Science
Qualification Exam Topic: “Automated Design of Error-Correcting Codes”

CARNEGIE MELLON UNIVERSITY 2016 – 2018
Master’s of Science in Mathematical Sciences
Thesis: “Polymorphic Inquiries: Promise Constraint Satisfaction and Beyond”
Advisor: Venkatesan Guruswami

CARNEGIE MELLON UNIVERSITY 2014 – 2018
Bachelor’s of Science in Mathematical Sciences
Minor in Science, Technology, and Society
University and Mellon College of Science Honors
GPA: 4.00/4.00

Publications

SEPARATING MAX 2-AND, MAX DI-CUT AND MAX CUT
Brakensiek, J., Huang, N., Potechin, A., and Zwick, U.
Symposium on Foundations of Computer Science (FOCS) 2023. arXiv:2212.11191

A Dictatorship Test with Perfect Completeness for 2–to–2 Label Cover
Brakensiek, J. and Guruswami, V.
Chicago Journal of Theoretical Computer Science (CJTCS) 2023. ECCC TR17-141

IMPROVED FIELD SIZE BOUNDS FOR HIGHER ORDER MDS CODES
Brakensiek, J., Dhar, M., and Gopi, S.
IEEE International Symposium on Information Theory (ISIT) 2023. arXiv:2212.11262

GENERIC REED-SOLOMON CODES ACHIEVE LIST-DECODING CAPACITY
Brakensiek, J., Gopi, S., and Makam, V.
Symposium on Theory of Computing (STOC) 2023. arXiv:2206.05256
Invited to SICOMP Special Issue.

SDPs AND ROBUST SATISFIABILITY OF PROMISE CSP
Brakensiek, J., Guruswami V., and Sandeep, S.
Symposium on Theory of Computing (STOC) 2023. arXiv:2211.08373

CONDITIONAL DICHOTOMY OF BOOLEAN ORDERED PROMISE CSPS
Brakensiek, J., Guruswami V., and Sandeep, S.
TheoretiCS 2023. arXiv:2102.11854
Lower Bounds for Maximally Recoverable Tensor Codes and Higher Order MDS Codes

**Brakensiek, J., Gopi, S., and Makam V.**
IEEE Transactions on Information Theory 2022. [arXiv:2107.10822](https://arxiv.org/abs/2107.10822)

The Resolution of Keller’s Conjecture

**Brakensiek, J., Heule, M., Mackey, J., and Narváez, D.**
Journal of Automated Reasoning (JAR) 2022. [arXiv:1910.03740](https://arxiv.org/abs/1910.03740)

Constraint Satisfaction Problems with Global Modular Constraints: Algorithms and Hardness via Polynomial Representations

**Brakensiek, J., Gopi, S., and Guruswami, V.**
SIAM Journal on Computing (SICOMP) 2022. [arXiv:1902.04740](https://arxiv.org/abs/1902.04740)

The Quest for Strong Inapproximability Results with Perfect Completeness

**Brakensiek, J. and Guruswami, V.**
ACM Transactions on Algorithms (TALG) 2021. [ECCC TR17-80](https://eccc.weizmann.ac.il/report/2017/080/)

Promise Constraint Satisfaction:
Algebraic Structure and a Symmetric Boolean Dichotomy

**Brakensiek, J. and Guruswami, V.**
SIAM Journal on Computing (SICOMP) 2021. [arXiv:1704.01937](https://arxiv.org/abs/1704.01937)

On the Mysteries of MAX NAE-SAT

**Brakensiek, J., Huang, N., Potechin, A., and Zwick, U.**
Symposium on Discrete Algorithms (SODA) 2021. [arXiv:2009.10677](https://arxiv.org/abs/2009.10677)

The Power of the Combined Basic LP and Affine Relaxation for Promise CSPs.

**Brakensiek, J., Guruswami, V., Wrochna, M., and Živný S.**
SIAM Journal on Computing (SICOMP) 2020. [arXiv:1907.04383](https://arxiv.org/abs/1907.04383)
Conference version:

**Symmetric Polymorphisms and Efficient Decidability of Promise CSPs.**

**Brakensiek, J.** and Guruswami, V.  
Symposium on Discrete Algorithms (SODA) 2020.

**Smoothed Complexity of 2-player Nash Equilibria**  
Boodaghians, S., **Brakensiek, J.**, Hopkins, S., and Rubinstein, A.  
Symposium on Foundations of Computer Science (FOCS) 2020. [arXiv:2007.10857](https://arxiv.org/abs/2007.10857)

**Coded Trace Reconstruction in a Constant Number of Traces.**  
**Brakensiek, J.**, Li, R., and Spang, B.  
Symposium on Foundations of Computer Science (FOCS) 2020. [arXiv:1908.03996](https://arxiv.org/abs/1908.03996)

**Constant-factor Approximation of Near-linear Edit Distance in Near-linear Time.**  
**Brakensiek, J.** and Rubinstein, A.  
Symposium on Theory of Computing (STOC) 2020. [arXiv:1904.05390](https://arxiv.org/abs/1904.05390)

**Bridging between 0/1 and Linear Programming via Random Walks**  
**Brakensiek, J.** and Guruswami, V.  
Symposium on Theory of Computing (STOC) 2019. [arXiv:1904.04860](https://arxiv.org/abs/1904.04860)

**An Algorithmic Blend of LPs and Ring Equations for Promise CSPs**  
**Brakensiek, J.** and Guruswami, V.  
Symposium on Discrete Algorithms (SODA) 2019. [ECCC TR18-059](https://eccc.weizmann.ac.il/report/2018/059)

**Efficient Low-Redundancy Codes for Correcting Multiple Deletions**  
**Brakensiek, J.**, Guruswami, V., and Zbarsky, S.  
IEEE Transactions on Information Theory 2017. [arXiv:1507.06175](https://arxiv.org/abs/1507.06175)

  Conference version:  
  Symposium on Discrete Algorithms (SODA) 2016.

**Vertex Isoperimetry and Independent Set Stability for Tensor Powers of Cliques**  
**Brakensiek, J.**  
Intl. Workshop on Randomization and Computation (RANDOM) 2017. [arXiv:1702.04432](https://arxiv.org/abs/1702.04432)

**New Hardness Results for Graph and Hypergraph Colorings**  
**Brakensiek, J.** and Guruswami, V.  
Computational Complexity Conference (CCC) 2016. [ECCC TR16-029](https://eccc.weizmann.ac.il/report/2016/029)

**Efficient Geometric Probabilities of Multi-Transiting Exoplanetary Systems from CORBITS**  
**Brakensiek, J.**, and Ragozzine, D.  
The Astrophysical Journal, 821, 47. [arXiv:1602.07014](https://arxiv.org/abs/1602.07014)  
[Open source CORBITS code](https://github.com/jbrakensiek/corbits).

**Manuscripts**  
**Robust Factorizations and Colorings of Tensor Graphs**  
**Brakensiek, J.** and Davies, S. [arXiv:2207.08913](https://arxiv.org/abs/2207.08913)
A SIMPLE SUBLINEAR ALGORITHM FOR GAP EDIT DISTANCE
Brakensiek, J., Charikar, M., and Rubinstein, A. arXiv:2007.14368

BOUNDS ON THE SIZE OF SOUND MONOTONE SWITCHING NETWORKS ACCEPTING PERMUTATION SETS OF DIRECTED TREES
Brakensiek, J., and Potechin, A. arXiv:1301.3780

Other Writings
Automated Design of Error-Correcting Codes Part 2
Theory Dish (Stanford’s CS Theory Research Blog). Wordpress.

Automated Design of Error-Correcting Codes Part 1
Theory Dish (Stanford’s CS Theory Research Blog). Wordpress.

Research Talks and Posters
INTERNATIONAL SYMPOSIUM ON INFORMATION THEORY
Hybrid. June 2023.

DAGSTUHL SEMINAR 22201
Hybrid. May 2022. (two talks)

STANFORD TCS QUALIFICATION EXAM
Virtual. March 2021.

STANFORD THEORY LUNCH
Virtual. December 2020.

FOUNDATIONS OF COMPUTER SCIENCE
Virtual. October 2020.

MICROSOFT RESEARCH MLO SEMINAR (INVITED)
Virtual. September 2020.

CSP SEMINAR (INVITED)
Virtual. August 2020.

SYMPOSIUM ON THEORY OF COMPUTING
Virtual. June 2020.

SYMPOSIUM ON DISCRETE ALGORITHMS
Salt Lake City, Utah, January 2020.

ACO SEMINAR
Carnegie Mellon University, Pittsburgh, Pennsylvania, September 2019.

MICROSOFT RESEARCH
Redmond, Washington, July 2019.

SYMPOSIUM ON THEORY OF COMPUTING
Phoenix, Arizona, June 2019. (talk and poster)
STANFORD THEORY LUNCH
Stanford, California, January 2019.

SYMPOSIUM ON DISCRETE ALGORITHMS
San Diego, California, January 2019.

DAGSTUHL SEMINAR 18231
Schloss Dagstuhl, Wadern, Germany, June 2018
Recipient of NSF Support Grant

CMU THEORY LUNCH (invited talk)
Carnegie Mellon University, Pittsburgh, Pennsylvania, January 2018.

AMS CONTRIBUTED PAPERS IN COMBINATORICS
Joint Mathematics Meetings, San Diego, California, January 2018

SYMPOSIUM ON DISCRETE ALGORITHMS
New Orleans, Louisiana, January 2018

APPROX/RANDOM CONFERENCE
Berkeley, California, August 2017 (two talks)

CONFERENCE ON COMPUTATIONAL COMPLEXITY
Tokyo, Japan, May/June 2016

MEETING OF THE MINDS UNDERGRADUATE POSTER SESSION
Carnegie Mellon University, Pittsburgh, Pennsylvania, May 2016
Recipient of Early Research Award

CMU THEORY LUNCH (invited talk)
Carnegie Mellon University, Pittsburgh, Pennsylvania, January 2016.

SYMPOSIUM ON DISCRETE ALGORITHMS
Arlington, Virginia, January 2016.

CMU THEORY LUNCH
Carnegie Mellon University, Pittsburgh, Pennsylvania, November 2015

PI MU EPSILON UNDERGRADUATE STUDENT PRESENTATIONS
MAA MathFest, Hartford, Connecticut, August 2013
Recipient of Pi Mu Epsilon Student Presentation Award

MAA UNDERGRADUATE POSTER SESSION
Joint Mathematics Meetings, San Diego, California, January 2013
Recipient of Outstanding Presentation Award

DIVISION OF PLANETARY SCIENCE POSTER SESSION
Reno, Nevada, October 2012
Recipient of Hartmann Student Travel Grant

RESEARCH SCIENCE INSTITUTE SYMPOSIUM
MIT, Cambridge, Massachusetts, August 2012
Research
Microsoft Research PhD Fellowship, 2021

Awards
IJCAR Best Paper Award co-winner, 2020
NSF Graduate Research Fellowship, 2018
CRA Outstanding Undergraduate Researcher Award, 2018
Goldwater Scholarship, 2016
Davidson Fellow, 2013
Top Five Awardee: Written Research, Research Science Institute, 2012

Competition
Putnam Fellow (top 5 individual) and 1st place team, 2016
8th place individual and 2nd place team, Putnam Competition, 2015
10.5th place individual, Putnam Competition, 2014
Two-time Gold Medalist: International Olympiad in Informatics, 2013-14
Silver Medalist: International Mathematical Olympiad, 2014
Samuel L. Greitzer/Murray S. Klamkin Award for Mathematical Excellence, 2014
USA Mathematical Olympiad sole perfect scorer, 2014
Akamai Foundation Scholarship, 2014
USA Mathematical Olympiad Winner, 2012, 2014
International Mathematical Olympiad invitee (declined), 2012
Bronze Medalist: Romanian Masters of Mathematics, 2012

Other
CMU Senior Leadership Recognition, 2018

Awards
Phi Kappa Phi, 2018
Phi Beta Kappa early inductee, 2017
Knaster-McWilliams Scholar, 2014-18
Pi Mu Epsilon, 2012

Work Experience
Course Assistant
Course assistant for Stanford course CS 269I (Incentives in Computer Science) taught by Aviad Rubinstein. Recognized to be in top 5% of CAs.

Research Intern for Microsoft
Research in the algorithms group at Microsoft Research under the supervision of Sivakanth Gopi.

Course Assistant
Course assistant for Stanford course CS 354 (Unfullfilled Algorithmic Fantasies) taught by Aviad Rubinstein. Recognized to be in top 5% of CAs.

Teaching Assistant
Teaching assistant for CMU course 15-458/15-858 (Discrete Differential Geometry) taught by Keenan Crane.

Research Assistant
Theoretical computer science research under Venkatesan Guruswami at CMU

Mathematics Olympiad Grader
Graded exams which helped to decide the USA International Math Olympiad team
Research Assistant
Astrostatistics research under Chad Schafer and Peter Freeman at CMU

Technical Consultant for Expii, Inc.
Web design

Other
MCS College Council
Undergraduate representative for 2017-18 academic year.

(Sub)reviewer/referee
Conferences: ISIT 2019; ICALP 2019; FOCS 2019; ESA 2019; FSTTCS 2019; SODA 2020; ISIT 2020; ICALP 2020; CCC 2020; MFCS 2020; SODA 2021; APPROX 2021; ICALP 2021; ISIT 2021; MFCS 2021; STOC 2021; FOCS 2021; SODA 2022; CCC 2022; STOC 2022; ICALP 2022; FOCS 2023; ESA 2023
Journals: Journal of the ACM; IEEE Transactions on Information Theory; ACM Transactions on Algorithms; SIAM Journal on Computing; Theory of Computing; ACM Transactions on Computation Theory; Electronic Journal of Combinatorics; Theory of Computing Systems; Information and Computation; Mathematical Reviews/MathSciNet

Photography
Photograph “Symphony of Architectural Geometry” selected as the 2013, Week 52 photo in the MAA Found Math column of the Mathematical Association of America. Also featured in the MAA’s 100th anniversary calendar.

Computer Languages
Recently used: C/C++, Python, Sagemath, Julia, $\LaTeX$, MATLAB, and Haskell