Noah Singer

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Education

2022– **Ph.D. in Computer Science**, *Carnegie Mellon University*, Computer Science Department, School of Computer Science, Pittsburgh, PA
Coadvised by Pravesh Kothari and Aayush Jain. Supported by an NSF GRFP fellowship.

2018–2022 **A.B. in Computer Science and Mathematics**, *Harvard University*, Harvard College, Cambridge, MA
Magna cum laude with highest honors in field, GPA 3.97.

Research Interests

I am broadly interested in complexity and algorithms; the use of mathematical techniques towards answering questions in these areas; and applications to areas like cryptography, coding theory, and combinatorics. My recent research mostly focuses on combinatorial optimization and average-case problems. I also have an ongoing project on understanding the approximability of constraint satisfaction problems in streaming models, resulting in several publications [6, 3, 2] and my undergraduate thesis [4].

Papers

Manuscripts

[1] Raghuvansh R. Saxena, Noah Singer, Madhu Sudan, and Santhoshini Velusamy. *Streaming beyond Sketching for Maximum Directed Cut*. In submission. arXiv: 2211.03916 [cs.DS].

Publications

[2] Raghuvansh R. Saxena, Noah Singer, Madhu Sudan, and Santhoshini Velusamy. "Streaming Complexity of CSPs with Randomly Ordered Constraints". In: *Proceedings of the 2023 Annual ACM-SIAM Symposium on Discrete Algorithms*. SODA 2023 (Florence, Italy, Jan. 22–25, 2023). To appear. Jan. 2023.

[3] Joanna Boyland, Michael Hwang, Tarun Prasad, Noah Singer, and Santhoshini Velusamy. "On Sketching Approximations for Symmetric Boolean CSPs". In: *Approximation, Randomization, and Combinatorial Optimization. Algorithms and Techniques*. APPROX 2022 (virtual, Sept. 19–21, 2022). Ed. by Amit Chakrabarti and Chaitanya Swamy. Vol. 245. LIPIcs. Schloss Dagstuhl — Leibniz-Zentrum für Informatik, July 2022, 38:1–38:23. DOI: 10.4230/LIPIcs.APPROX/RANDOM.2022.38.

[5] Noah Singer and Madhu Sudan. "Point-Hyperplane Incidence Geometry and the Log-Rank Conjecture". In: *ACM Transactions on Computation Theory* 14.2 (June 2022). DOI: 10.1145/3543684.

[6] Noah Singer, Madhu Sudan, and Santhoshini Velusamy. "Streaming Approximation Resistance of Every Ordering CSP". In: *Approximation, Randomization, and Combinatorial Optimization. Algorithms and Techniques*. APPROX 2021 (Aug. 16–18, 2021). Ed. by Mary Wootters and Laura Sanità. Vol. 207. LIPIcs. Schloss Dagstuhl — Leibniz-Zentrum für Informatik, July 2021, 17:1–17:19. DOI: 10.4230/LIPIcs.APPROX/RANDOM.2021.17.

Thesis

[4] Noah Singer. "On Streaming Approximation Algorithms for Constraint Satisfaction Problems". BA thesis. Cambridge, MA: Harvard University, Mar. 2022. 140 pp. URL: https://nrs.harvard.edu/URN-3:HUL.INSTREPOS:37371750.

Awards

Spring 2022 **NSF GRFP Fellowship**

Spring 2022 **Hoopes Prize**
$5k award from Harvard College for undergraduate thesis [4].

Spring 2022 **CRA Outstanding Undergraduate Researcher Award**, Honorable Mention

Fall 2021 **Harvard College Research Program Grant**
$800 grant supporting work on sketching complexity of constraint satisfaction, and eventual publication in APPROX [3] and undergraduate thesis [4].

Spring 2021 **Phi Beta Kappa, Alpha Iota of Massachusetts**
Elected in group of 24 juniors from the Harvard College Class of 2022.

2019–2021 **Certificate of Distinction in Teaching**
Awarded by Harvard Office of Undergraduate Education on basis of instructor ratings in student evaluations. Overall scores were (/5): CS 121 Fall 2019, 4.83; CS 121 Fall 2020, 4.88; CS 124 Spring 2021, 4.82; CS 121 Fall 2021, 4.79.

Summer 2020 **Herchel Smith-Harvard Undergraduate Research Fellow**
$5K grant supporting research on log-rank conjecture and incidence geometry, leading to work published in *ACM Transactions on Computation Theory* [5].

Teaching

Graded and hosted office hours and recitation sections for the following courses in the Harvard CS department:

- *CS 121: Introduction to Theoretical Computer Science* (Fall 2021, Fall 2020, Fall 2019)
- *CS 124: Data Structures and Algorithms* (Spring 2021)
- *CS 161: Operating Systems* (Spring 2020)

In CS 121 and 124, organized advanced sections with weekly guest lectures.

Served as a teaching assistant for the *New Horizons in TCS* program at TTIC over Summer 2022. Edited scribe notes for *CS 229r: Information Theory for Computer Science* at Harvard (Fall 2022).

Internships

Summer 2021 **Research Intern**, *DIMACS REU @ Rutgers University*, remote
Worked with Prof. Eric Allender on complexity of circuit minimization and related problems. Supported by NSF grant CCF-1852215.

Summer 2020–Spring 2022 **Research Intern**, *Harvard University*, Cambridge, MA
Worked with Prof. Madhu Sudan on communication and streaming complexity, supported by Herchel-Smith Fellowship and Harvard College Research Program.

Summer 2019 **Software Engineering Intern**, *Airbnb*, San Francisco, CA
Built a production data pipeline to discover and manage large quantities of search advertising keywords targeting Airbnb hosts, efficiently scaling up listing creation due to search ads by over 20% and generating tens of thousands of dollars in weekly revenue.

Service

2020–2022 **Peer Concentration Adviser**, *Harvard University*, Department of Computer Science

2020–2022 **WiCS Mentor**, *Harvard Women in Computer Science*

Spring 2019 **Volunteer**, *Digital Literacy Project*
Taught basic programming in Scratch and Processing.js to middle school students in Allston.

Updated November 9, 2022.