Amar Shah

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Research Interests

I am interested in building safe and reliable software. Specifically, I aim to develop better tools for compilers, formal verification, and program synthesis.

Education

University of California, Berkeley   January 2020 - December 2023
BA Computer Science and Math; Minor in Logic   *GPA: 3.90*; *CS GPA: 4.00 / 4.00*

1. <u>Undergrad Coursework</u>: Linear Algebra, Discrete Math, Probability Theory, Abstract Algebra, Real Anlaysis, Complex Analysis, Algebraic Geometry, Set Theory, Number Theory, Computability, Complexity Theory, Data Structures, Algorithms, Computer Architecture, Quantum Computing, Social Choice Theory, Mechanics, Electricity & Magnetism, Quantum Mechanics, Multivariable Caculus, Prog. Languages & Compilers

2. <u>Graduate Coursework:</u> Topology & Measure Theory, Functional Analysis, Model Theory, Metamathematics, Quantum Complexity, Algorithms, Formal Methods, Analysis of Boolean Functions

Research Experience

Professor Zhendong Su's Group   February 2024 - August 2024
- Fuzzing for SMT solvers and other verification tools

Professor Sanjit Seshia's Group (UC Berkeley)   August 2022 - Present
- Worked on SMT solvers and program synthesis tools
- *Algaroba:* A tool that eagerly reduces SMT queries over Algebraic Datatypes to Uninterpreted Function queries. Github: https://github.com/amarshah1/algarobatool
- *Bootstrapping for Distributed Systems:* A tool that leverages genetic algorithms and program synthesis to learn properties of distributed systems from only positive examples. Github: https://github.com/zwang271/eecs219c-project

University of Maryland Math REU   June 2022 - August 2022
- Worked with Professor Maria Cameron on optimal control in stochastic systems

UC Berkeley Logic Group   January 2022 - May 2022
- Worked with Dr. Dino Rossegger on the MLR $\neq$ KLR hypothesis in Algebraic Randomness

UC Berkeley CS Theory Group   January 2021 - August 2021
- Worked with Sam Gunn on a strengthening of the Solovay-Kitaev Theorem about quantum gates

Refereed Conference & Journal Publications

[1] **Amar Shah**, Federico Mora, and Sanjit Seshia. "An Eager Satisfiability Modulo Theories Solver for Algebraic Datatypes". In: *To Appear at Proceedings of the AAAI Conference on Artificial Intelligence*. 2024. URL: https://arxiv.org/abs/2310.12234.

[2] Jiaxin Yuan, **Amar Shah**, Channing Bentz, and Maria Cameron. "Optimal control for sampling the transition path process and estimating rates". In: *Communications in Nonlinear Science and Numerical Simulation (CNSNS)* 129 (2024), p. 107701. ISSN: 1007-5704. DOI: https://doi.org/10.1016/j.cnsns.2023.107701.

Refereed Short Papers

[1] "An Eager SMT Solver for Algebraic Data Type Queries". Programming Languages Design & Implementation (PLDI). July 2023. **Undergraduate Student Research Competition Winner**.

Conference Posters and Presentations

[1] "Results for Optimal Controllers in Transition Path Theory". Joint Mathematical Meetings. Jan. 2023.

[2] "Optimal Control in Transition Path Theory". Gulf Coast Undergrad Research Symposium. Oct. 2022.

Other Talks

[1] "Model Theory & o-minimality". Berkeley Math Directed Reading Program. Dec. 2021.

[2] "Quantum Logic Gates". MathIly-Er High School Camp. July 2021.

[3] "Solovay-Kitaev Theorem & Representation Theory". Berkeley Directed Reading Program. May 2021.

Teaching Experience

Undergraduate Student Instructor

Math 1A: Calculus	Fall 2022
CS 70: Discrete Mathematics & Probability Theory	Summer 2021

Teaching Assistant

Berkeley Math Circle Elementary	Fall 2021, Spring 2022

Course Reader

C 191: Quantum Information Science & Technology	Spring 2023
CS 170: Efficient Algorithms & Intractable Problems	Spring 2023
CS 70: Discrete Mathematics & Probability Theory	Fall 2021, Spring 2022

Awards

PLDI Undergraduate Student Research Competition Winner	2023
EECS Evergreen Research Award (UC Berkeley)	2023
Summer Undergraduate Research Fellow (UC Berkeley)	2023
Math Outstanding Graduate Student Instructor (UC Berkeley)	2023
Gulf Coast Undergraduate Research Symposium Outstanding Presentation	2022
Dean's List (UC Berkeley): Fall 2021, Spring 2022, Fall 2023, Spring 2023	2021-2023
EECS Honors Program: Focus in Mathematical Logic (UC Berkeley)	2020-2023
Math Honors Program (UC Berkeley)	2020-2023
Honors to Date (UC Berkeley)	2020-2023
Eagle Scout	2019

Academic Service

BUMP Mentor	Fall 2021, Fall 2023
Berkeley Math Tournament Problem Writer	2020
Berkeley Science Journal reviewer	Jan. - Dec. 2020

Miscellaneous

Activities:	IEEE Upsilon Pi Epsilon (**CS Honors Society**); Math Directed Reading Program; Student Association of Applied Statistics; Quantum Computing @ Berkeley; Undergrad Theoretical Computer Science; Math Undergrad Student Association
Programming Languages:	Python; C; OCaml; Java; Javascript; MATLAB; LaTeX; Assembly (RISC-V)
Tools:	SAGEMath; PyTorch; TensorFlow; NumPy; HTML; CSS; GCP; UNIX; Git
Languages:	English (native), Hindi (fluent), Spanish (basic)

Non Academic

Berkeley Student Cooperative (Kitchen, Garden, Social and Waste Reduction Manager)	2020-2023
Community Homestead (Farm and Social Work)	2019