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. Undergrad Coursework: 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, Machine Learning
2. Graduate Coursework: Topology & Measure Theory, Functional Analysis, Model Theory, Metamathematics, Quantum Complexity, Algorithms, Formal Methods, Analysis of Boolean Functions

Research Experience

Professor Zhendong Su's Group (ETH Zurich, Future) January 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

Pre-Publications

[1] **Amar Shah**, Federico Mora, and Snajit Seshia. "An Eager SMT solver for Algebraic Datatypes". In: *Under Review for Association for the Advancement of Artifical Intelligence (AAAI)*. 2024.

[2] "Optimal control for sampling the transition path process and estimating rates". In: *Under Review in Communications in Nonlinear Science and Numerical Simulation (CNSNS)* (2023).

Conference Posters and Presentations

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

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

[3] "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 — Fal 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