

Mukul Agarwal

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Education

Purdue University (West Lafayette, IN)

Aug 2023 - May 2027

B.S., Computer Science (Honors) | B.S., Mathematics

- **Awards:** Dean's List and Sem. Honors (6/6 semesters); Summer Undergraduate Research Fellowship (2025)
- **Relevant Coursework:** Graduate-level Randomized Algorithms, Complexity Theory, Algorithmic Game Theory, Numerical Optimization, Algebra, Analysis

Experience

Undergraduate Researcher – Prof. Kent Quanrud

May 2026 - Present

Purdue University

West Lafayette, IN

- Developed randomized polynomial-time algorithms for matroid intersection coloring problem, improving approximation guarantees while weakening assumptions required by prior results. Designed a deterministic scheme for fractional instances of the problem and extended algorithms to list-coloring. (*Manuscript in preparation*).

Teaching Assistant / Course Development Assistant

Jan - Apr 2025; Jan 2026 - Present

Purdue University

West Lafayette, IN

- Led CS 381 (Analysis of Algorithms) weekly recitations and a 150+ student final review of reductions in NP; developed original homework, recitation, and exam problems on dynamic programming, string matching and network flow.
- Developed CS 250 (Computer Architecture) assignments, project handouts, and automated testing software in Spring 2025 to streamline an existing project and reduce burden on students and course staff.

Projects

Algorithm Visualizations (Astro.js, Rust/WASM)

Jul 2026 - Present

- Built implementations/visualizations of randomized algorithms including Multiplicative Weights Update, Karger-Stein random contraction (Min-Cut), and HyperLogLog. Used Rust (compiled to WebAssembly) to improve performance over plain JS.

Nix-based System Configuration

2023 - Present

- Packaged software for NixOS and contributed 10+ upstream package updates and bug fixes to Nixpkgs.
- Maintained a declarative NixOS and Nix-Darwin configuration spanning multiple hosts, reproducible development environments, and system profiles.

Tree Lookup Profiling & Benchmarks (C/C++, x86-64 Assembly)

Jan - May 2025

- Implemented fuzzing system to generate synthetic data for tree based lookup structures similar to realistic workloads; implemented optimization guided by profiling and performance on these workloads to improve performance of naïve AVL Tree 'search' implementation by over 20%.

Technical Skills

- **Languages:** C, C++, Rust, Python, Haskell, OCaml, Scala.
- **Technologies:** Nix/NixOS, Git, Docker, WebAssembly, GitHub Actions, Perf, Valgrind

Academic Activities & Seminars

- **CS Theory Reading Group (Summer 2025):** Organized an undergraduate and graduate theory reading group at Purdue; presented on shortest path algorithms that use matrix multiplication/min-sum product.
- **Mathematics Directed Reading Program (2025):** Studied Montgomery & Vaughan's *Multiplicative Number Theory* (Jan - Apr 2025) and Silverman's *Rational Points on Elliptic Curves* (Sep - Dec 2025); presented proofs/sketches of Dirichlet's and Mordell's Theorems.