Arham Lodha

Citizenship: United States **Date of Birth:** March 17, 2004

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github.com/arham-lodha

Education

University of Texas at Austin, BS in Mathematics Expected May 2026

- GPA: 3.9565/4.0000
- **Relevant Coursework:** Differential Equations, Multivariable Calculus, Advanced Calculus, Discrete Mathematics, Probability, Numerical Analysis, Algebraic Structures, Real Analysis, Complex Analysis, Computer Graphics, Algebraic Topology, Harmonic Analysis and Representation Theory, Representation Theory, Riemann Surfaces, Honors Thesis Course
- **Exchange Program:** ETH Zurich (Spring 2025): Introduction to Modular Forms, Algebraic Topology II, and Stochastic Processes

Research Experience

DIMACS REU Participant, Rutgers University May 2025 – July 2025

Mentor: Professor Feng Luo

- Extended the Discrete Schwarz-Pick Lemma to a broader class of intersecting circle packings, a previously unproven domain in discrete conformal geometry.
- Proved the lemma's validity for packings with obtuse intersection angles, advancing prior results limited to tangent and non-obtuse cases.
- Disproved the lemma's applicability to disjoint circle packings by constructing a novel counterexample on a triangulated disk.
- Validated the counterexample's robustness against computational floating-point errors through rigorous numerical analysis.
- Co-authoring a manuscript detailing the findings for submission to a peer-reviewed journal.

Research Fellow, University of Texas at Austin May 2023 – January 2025

Mentor: Dr. Wenrui Chai

- Identified global minimum potential energy configurations of complex chemical systems by evaluating and comparing the performance of Basin Hopping and Minimum Hopping optimization algorithms.
- Applied advanced algorithmic optimization techniques to troubleshoot and resolve long-running computational research challenges.
- Independently adapted and implemented research methodologies for the analysis of novel chemical systems.
- Co-authoring a manuscript detailing algorithm performance and key scientific findings for submission to a peer-reviewed journal.

Independent Study

UT Directed Reading Program - Fourier Analysis June 2024 - July 2024

- Completed intensive study of Fourier Analysis through text "Fourier Series and Integrals" by H. Dym and H.P. McKean
- Mentored by Ph.D. candidate William Winston, focusing on advanced harmonic analysis techniques
- Presented original talk connecting Fourier Analysis to the Heisenberg-Weyl Uncertainty Principle

UT Directed Reading Program - Matroid Theory Sept 2023 - Nov 2023

- Studied "Matroid Theory: A Geometric Perspective" under guidance of Ph.D. candidate Jayden Wang
- Applied matroid theory to solve combinatorial problem: determined minimum verification checks for Sudoku puzzles

- Presented findings at UT Directed Reading Program Symposium, demonstrating matroid applications in sudoku verification

Teaching Experience

Undergraduate Course Assistant for Business Calculus, UT Austin Aug 2025 – Present

- Instructed biweekly discussion sections, delivering supplemental lectures and guiding collaborative problem-solving sessions.
- Hosted office hours and provided one-on-one tutoring in the UT CalcLab to clarify core concepts and exam strategies.
- Developed supplemental worksheets and practice problems to reinforce students' analytical and problem-solving skills.

Undergraduate Course Assistant, Probability I, UT Austin Aug 2024 – Dec 2024

- Conducted weekly office hours to provide targeted support, helping students master challenging problem sets and prepare for exams.
- Clarified complex probability concepts and reinforced effective problem-solving techniques to improve student comprehension.
- Authored supplementary review materials to distill key topics and aid in student learning.

Tutor, Tutor for AP Calculus AB/BC and AP Physics I/II/C Nov 2022 – Jun 2023

- Personally tutored 10 high school students in AP Calculus AB/BC and AP Physics I/II/C.
- Drove exceptional student outcomes, achieving a 95% average final grade and perfect 5/5 AP exam scores across all clients.

Leadership Experience

Founder & CEO, Hit Fantasy Aug 2024 – Present

- Led a cross-functional team of 5 developers and designers to build and launch a bootstrapped fantasy cricket application from concept to deployment.
- Architected and oversaw the implementation of a full-stack solution, leveraging Figma for UI/UX design and a modern tech stack (Firebase, Next.js, TypeScript).
- Acquired and retained over 550 active users during the Indian Premier League season, demonstrating strong product-market fit.

Projects

Black Hole Raytracer github.com/arham-lodha/Black-Hole-Renderer

- Inspired by Interstellar, developed a high-fidelity Black Hole Renderer in Unity using Compute Shaders and advanced ray marching techniques
- Simulated relativistic effects with precision by integrating the Schwarzschild metric and dynamically adjusting ray trajectories through a modified 4th order Runge Kutta integrator
- Designed and rendered artistic visualization of black hole's accretion disk, capturing phenomena like Black Body Radiation and astrophysical properties

GPU Accelerated Mandelbrot Renderer github.com/arham-lodha/Mandelbrot-Generator

- Programmed accelerated Mandelbrot Set Renderer in Python with user-defined complex plane domains and color schemes
- Implemented mathematical and GPU optimizations achieving 100x speedup compared to traditional implementations
- Developed dynamic precision scaling system for detailed fractal exploration

Graph Analysis Tool github.com/arham-lodha/GraphTool

- Engineered graph theory application for analyzing arbitrary graphs and reporting mathematical properties
- Implemented algorithms for pathfinding, spanning tree counting, and stochastic graph stability analysis
- Developed interactive visualization interface with graph editing capabilities
- Created modular architecture supporting future algorithm additions

Honors

University Honors, University of Texas at Austin (Fall 2022 - Spring 2024)

Technical Skills

Programming Languages:

- **Proficient:** Python, Julia, C++, Java, GLSL, HLSL, C#, JavaScript, Typescript, Dart
- **Basic:** MATLAB