Taiki Aiba

taiba3@gatech.edu — 978-201-4007 — linkedin.com/in/taiba3 — detoasty3.github.io

EDUCATION

Georgia Institute of Technology, Atlanta, GA 2025 - 2027
M.S. in Mathematics, M.S. in Computer Science

Georgia Institute of Technology, Atlanta, GA 2022 - 2025
B.S. in Mathematics, B.S. in Computer Science, B.S. in Applied Languages and Intercultural Studies, Minor in Economics
Studied abroad at **Ritsumeikan Asia Pacific University**, Beppu, Oita, Japan in Summer 2025

University of Illinois Urbana-Champaign, Urbana, IL 2021 - 2022
B.S. candidate in Mathematics, Minor candidate in Electrical and Computer Engineering; transferred

RESEARCH EXPERIENCE

Quad Packing Research Group, Remote Spring 2025 - Present
Advisors: Timothy Goldberg (Lenoir-Rhyne University) and Lauren Rose (Bard College)

- Select participants from the 2024 Polymath Jr REU plus other researchers met at JMM 2025.
- Proved an exact expression for the flat (r-dimensional affine subspaces of a vector space V) number, showing that each term $M(n)$ can be written as the sums and products of certain combinations of powers of 2 in the binary representation of n.
- Proved quad packing is equivalent to flat packing via an injective mapping, resolving a conjecture in a 2023 MIT Primes paper.
- Resulted in the paper *Quad-packing in the game EvenQuads* (WIP); presented at MAA-SE 2026, contributed to JMM 2026.

Georgia Tech School of Mathematics, Atlanta, GA Summer 2025 - Spring 2026
Advisor: Ernie Croot

- Found an upper bound of $3n^2/4$ for the size of largest induced 4-cycle-free subgraphs in two-dimensional grid graphs by taking 2×2 subgrids and orienting them the same way.
- Found an upper bound of $(n/2)^n$ for the number of largest induced 4-cycle-free subgraphs in two-dimensional grid graphs by considering local 2×2 subgrids and identifying a necessary constructive condition.
- Proved upper and lower bounds on the number of such subsets with $(3/4 - \varepsilon)n^2$ vertices with respect to ε by counting based on local $2k \times 2k$ subgrids and upper bounding binomial coefficients with Stirling bounds.
- Resulted in the paper *4-cycle-free induced subgraphs of grid graphs* (arXiv); presented at MAA-SE 2026.

Polymath Jr REU, **Williams College**, Remote Summer 2024, 2025, 2026
Advisors: Timothy Goldberg (Lenoir-Rhyne University) and Lauren Rose (Bard College)

- Participant in Summer 2024 and Graduate Research Mentor in Summer 2025 and Summer 2026.
- Mentored 20 undergraduates, introducing them to the research problem and the game itself through resources and weekly meetings.
- Researched the quad number $q(n)$ in the card game *Quads*; studied affine geometry and *Quads* cards as bit vectors in $\mathbb{Z}_2^6$.
- Wrote C++ code to brute-force results for $n \in [4, 16]$ and $d = \lceil \log_2 n \rceil$; used these results to conjecture that d does not matter and $q(2^n + 1) = q(2^n)$ for all n and to prove an upper bound expression for $q(n)$ and attainability for n a power of two.
- Resulted in the unpublished paper *Quad Packing* (paper); presented at JMM 2025 and MAA-SE 2025.

Georgia Tech School of Mathematics, Atlanta, GA Fall 2024 - Spring 2025
Advisor: Ernie Croot

- Researched maximal induced forests in multi-dimensional grid graphs and found and proved upper and lower bounds on d dimensions with the hand-shaking lemma and considering sums of coordinates mod $2d + 1$.
- Found a zig-zag construction giving a tight upper bound of $(2n^2 + O(n))/3$ for two-dimensional graphs.
- Worked on the paper *Maximal induced forests in grid graphs*, but scrapped it after discovering our results were already found in the paper *New bounds on the size of the minimum feedback vertex set in meshes and butterflies* by Caragiannis *et al.* (2002).

Georgia Tech School of Mathematics, Atlanta, GA Fall 2023 - Spring 2024
Advisor: Ernie Croot

- Studied grid-counting problems (e.g., rook problem) and searched for bijections to spanning trees (á la Temperley's bijection) in order to apply the Kirchhoff Matrix-Tree Theorem.
- Explored the Prouhet-Tarry-Escott problem and attempted to find results using contour integration and algebraic bounding.
- Explored the Kirchhoff Matrix-Tree Theorem and researched domino tiling enumerations on a grid to attempt to strengthen existing bounds (used this problem to transition to researching grid graphs).

Georgia Tech School of Modern Languages, Atlanta, GA Summer 2024
Advisor: Kyoko Masuda

- Researched frequency of female versus male pronouns in the manga *Sazae-san* and drew conclusions based on different age groups.
- Submitted collaborative research paper in Japanese to the SGSJ in 2024; presented at SGSJ 2024.

Georgia Tech School of Electrical and Computer Engineering, Atlanta, GA Fall 2023
Advisor: Aaron Lanterman

- Translated documents of the PC-FX game console from Japanese to English, compiled in a GitHub repository for general usability.
- Analyzed the C Compiler of the GMAKER Starter Kit (processing flow/registers), allowing user-made software to run.

READING EXPERIENCE

Georgia Tech School of Mathematics, Atlanta, GA — Spring 2025
Advisor: Xingxing Yu

- Wrote the unpublished paper *On the Turán Number of the Blow-Up of the Hexagon* (paper), surveying Janzer *et al.* (2022).
- Gave a one-hour whiteboard presentation to a class of ∼10 students; collaborated with a Ph.D. student and a post-doctorate.

Independent Reading, Atlanta, GA — Summer 2023

- Read about Burnside's lemma, including applications to classic problems and competition problems (AMC/AIME).
- Wrote the unpublished paper *Burnside's lemma and applications in competition problems* (paper); presented at MAA-SE 2026.

Georgia Tech Directed Reading Program, Atlanta, GA — Fall 2022 - Spring 2025

- Read and presented on generating functions in combinatorics and algebra in Fall 2022, combinatorial problem solving techniques in Spring 2023 (slides), the Union-Closed Sets Conjecture in Fall 2023 (slides), Sudoku and graph theory in Spring 2024 (slides), quantitative finance in Fall 2024, and data structures/algorithms, focusing on the Gomory-Hu Tree, in Spring 2025 (slides).

PUBLICATIONS

1. T. Aiba and E. Croot, *4-cycle-free induced subgraphs of grid graphs*, arXiv:2604.08397.

CONFERENCES

1. *Burnside's lemma and applications in competition problems*, MAA Southeastern Sectional Meeting, University of North Alabama, Florence, AL, Contributed Papers Session #6, March 2026. (slides)
2. *Quad-packing in the game EvenQuads*, MAA Southeastern Sectional Meeting, University of North Alabama, Florence, AL, Recreational Math Session #2, March 2026. (slides)
3. *4-cycle-free induced subgraphs of grid graphs*, MAA Southeastern Sectional Meeting, University of North Alabama, Florence, AL, Contributed Papers Session #1, March 2026. (slides)
4. *Quad Packing*, MAA Southeastern Sectional Meeting, High Point University, High Point, NC, Undergraduate Paper Session II-4, March 2025. (slides)
5. *Quad Packing*, Joint Mathematics Meetings, Seattle Convention Center, Seattle, WA, AMS Special Session on Polymath Jr REU Student Research Session, I, January 2025. (slides)
6. 「サザエさん」の女性登場人物が用いるジェンダー表現の考察, The Society for Gender Studies in Japanese Conference, Tokyo International University, Toshima, Tokyo, Japan, July 2024.

AWARDS

Outstanding Graduating Mathematics Major — April 2025
Awarded to select outstanding undergraduate senior mathematics majors annually. In 2025, I was one of five award recipients.

Outstanding Senior in Japanese — April 2025
Awarded to one outstanding undergraduate senior annually in the Japanese department.

University of Illinois Freshman Math Contest Third Place — October 2021
Ranked third out of 22 first-years in a five-question proof-based math contest across the three University of Illinois campuses.

TEACHING

Georgia Institute of Technology, Atlanta, GA — Spring 2023 - Spring 2026

- CS 3510: Design and Analysis of Algorithms (Teaching Assistant: Fall 2024, Spring 2025, Fall 2025, Spring 2026)
- CS 2050: Introduction to Discrete Mathematics for Computer Science (Teaching Assistant: Summer 2023, Fall 2023, Spring 2024)
- MATH 2551: Multivariable Calculus (Lecture Assistant: Spring 2023)

University of Illinois Urbana-Champaign, Urbana, IL — Spring 2022

- CS 124: Introduction to Computer Science I (Course Assistant: Spring 2022)

WORK EXPERIENCE

Math League, LLC, Curriculum Specialist, Remote — July 2021 - Present
IBM, Software Developer Intern, San Jose, CA — August 2026 - December 2026
Capital One, Software Engineer Intern, McLean, VA — June 2026 - August 2026
Amazon, Software Development Engineer Intern, Boston, MA — June 2024 - August 2024
Art of Problem Solving, Math Teaching Assistant, Waltham, MA — July 2022 - June 2026

CERTIFICATIONS

Akuna Capital, Options 201 — September 2024
MIT Professional Learning, No Code AI and Machine Learning — August 2023 - December 2023

SERVICE

MATHCOUNTS Foundation, Question Writing Committee Member, Remote February 2025 - Present
Propose problems for the MATHCOUNTS Competition Series. Attend in-person meetings to review and edit the problems. Volunteer at the annual MATHCOUNTS National competition held in-person.

Mathematical Association of America, AMC 10/12 Editorial Board Member, Remote September 2024 - Present
Propose problems for the AMC 10/12. Attend meetings to discuss proposals and determine which problems are suitable.

Mustang Math, Problem Writing Team Member, Remote July 2024 - Present
Assist with hosting math contests primarily aimed at middle school students. Propose, edit, and review problems for the contests.

Schoolhouse.world, Volunteer Tutor, Remote June 2022 - Present
Host tutoring sessions for middle and high school students, most notably a series on how to write mock AMC problems.

De Mathematics Competitions, Founder, Director, and Tutor, Remote September 2020 - Present
Write and direct mock American Mathematics Competitions contests on the website Art of Problem Solving. Tutor a third-grade student for the AMC 8, a contest primarily aimed at middle school students.

Georgia Tech Undergraduate Mathematics Advisory Committee, President, Atlanta, GA Fall 2023 - Spring 2025
Hosted 2-4 social events (e.g., puzzle tournaments, graduate student dinners, parties) for math majors every semester. Led and handled the logistics of all events, redesigned and edited the UMAC website with photos, and co-designed flyers for every event.

GT Competitive Math, Founder and President, Remote Summer 2023 - Spring 2026
Founded and led a Discord server of 60 Georgia Tech students and alumni to discuss math competitions such as the Putnam.

Georgia Tech High School Math Day, Student Volunteer, Atlanta, GA Spring 2023, 2024, 2025, 2026, 2027
Served as a problem writer and a volunteer on the day of for a math contest taken by 300+ high school students annually. Wrote problems for the contest, proctored, collected papers, and graded submissions.

Georgia Tech Japan Student Association, Executive Board Officer, Atlanta, GA Fall 2023 - Spring 2026
Led weekly conversation practices to enrich Japanese learners' conversation skills. Assisted in hosting occasional special events related to the Japanese language and culture.

SKILLS

Programming: C/C++, Python 3, Java, Go, Rust, JavaScript/TypeScript, SQL, R, Verilog/SystemVerilog
Libraries: NumPy, pandas, PyTorch, TensorFlow, scikit-learn, SimPy, Matplotlib
Technologies: React, Node.js, Spring Boot, Firebase, Docker, GCP, MongoDB, Git, Bash, Linux, Jira
Languages: English (native), Japanese (advanced), Spanish (beginner)
Interests: Set (winner of JMM 2025 Set Championships), running, drawing, blogging, electric guitar (9 years), piano (9 years), writing math problems, competitive programming