Andrew Tockman

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https://github.com/tckmn https://tck.mn/portfolio

Education

Massachusetts Institute of Technology (Cambridge, MA) **2023 – present**

- Candidate for Master of Engineering in Electrical Engineering and Computer Science

Massachusetts Institute of Technology (Cambridge, MA) **2019 – 2023**

- Bachelor of Science in Mathematics
- Bachelor of Science in Computer Science and Engineering
- Minor in Linguistics
- GPA: 5.0/5.0

Work Experience

Lunarch Studios **Feburary 2021 – June 2022**
Developer (Full-Time summer 2021, Part-Time otherwise) remote

- Worked on Islands of Insight, massively multiplayer online puzzle video game
- Created puzzle-authoring interface used for writing thousands of handmade logic puzzles
- Designed internal puzzle database, interfacing with publisher's database for game content
- Implemented spectral-graph-theory-based approach for puzzle generation

TomoCredit **summer 2020**
Software Engineering Intern remote

- Redesigned and implemented new version of landing page (HTML/CSS/JS)
- Fixed bugs and added features in onboarding flow and customer dashboard (JavaScript/React)

Infuse Energy **summer 2017 – 2018**
Programming Intern Houston, TX

- Created web portal with pricing calculator, customer data queries, etc., consolidating and vastly improving speed of existing tools (Python, SQL, HTML/CSS/JS)
- Built mathematical model to predict future energy usage (Python)
- Improved visual appearance of customer email reports (HTML/CSS) including graphs (Python)
- Wrote detailed documentation of all of the above

Teaching Experience

MIT 6.5210 Advanced Algorithms **fall 2024**
Teaching Assistant Cambridge, MA

- Held office hours to help students with algorithms and abstract problem solving
- Organized peer grading logistics

MIT 6.512 Formal Reasoning About Programs **spring 2023**
Undergraduate Teaching Assistant Cambridge, MA

- Held office hours to help students with formal verification and computer-assisted proofs
- Graded most submissions and gave personalized feedback on proof scripts for each problem set
- Tested newly written problem sets for the course

MIT 18.701 Algebra I **fall 2022**
Undergraduate Mentor Cambridge, MA

- Met with mentees once a week to help with problem sets, proof writing skills, and conceptual understanding

MIT Educational Studies Program **periodically since 2019**
Teacher Cambridge, MA

- Planned and taught mini-classes such as Complex Analysis, Weird Programming Languages, Code Golf, Cryptic Crosswords, Atomic Chess, Toki Pona, Math in Logic Puzzles, and Surreal Numbers and Games

Research

Bedrock2: metrics verification **Feburary – May 2021, September 2023 – present**

- Worked on the Bedrock2 programming language, a language embedded in Coq designed for formal verification
- Added timing information to program executions, allowing proofs about program runtimes
- Threaded timing proofs through entire verified compiler pipeline, yielding end-to-end timing proofs on source programs
- Wrote source examples of programs with time bound proofs, designed tactic code to streamline proofs
- Produced first verification stack capable of fully general time specifications including I/O, with IoT lightbulb as example

Theoretical computer science (various areas) **August 2020 – present**

- Worked with Erik Demaine's research group on various theory problems, including but not limited to:
  - dynamic optimality of binary search tree algorithms
  - several questions in computational origami, e.g. fold and cut algorithms and complexity of folding problems
  - computational complexity of many problems, games, and puzzles; and theoretical frameworks for analyses
  - formal verification of reductions and hardness results

Linguistic prosodic labelling **fall 2021**

- Analyzed example speech clips using the ToBI labelling system for use as example data
- Investigated linguistic phenomena that ToBI fails to account for, comparing it to the PoLaR system

Publications / Presentations

Thomas Carotti, Andy Tockman, Pratap Singh, Andres Erbsen, Samuel Gruetter, Adam Chlipala. "Foundational Verification of Running-Time Bounds for Interactive Programs."

- Submitted to PLDI 2025
- Copy of submission available at `https://tck.mn/bedrock-metrics.pdf`

MIT Hardness Group, Josh Brunner, Lily Chung, Erik D. Demaine, Della Hendrickson and Andy Tockman. "*ASP-Completeness of Hamiltonicity in Grid Graphs, with Applications to Loop Puzzles*."

MIT Hardness Group, Della Hendrickson and Andy Tockman. "*Complexity of Planar Graph Orientation Consistency, Promise-Inference, and Uniqueness, with Applications to Minesweeper Variants*."

- Both presented at FUN 2024
- Both published in proceedings of 12th International Conference on Fun with Algorithms (2024)

Hugo Akitaya, Josh Brunner, Erik D. Demaine, Della Hendrickson, Victor Luo, and Andy Tockman. "*Complexity of Simple Folding Orthogonal Crease Patterns*."

- Presented at TJCDCGGG 2020+1
- Published in Thai Journal of Mathematics special issue: Discrete and Computational Geometry, Graphs, and Games (2023)

Leadership / Service

Tech Squares (MIT square dancing club) **September 2023 – present**
Class Coordinator, Rooming Coordinator Cambridge, MA

- Organized semester-long square dancing classes of ∼25 people, responsible for all class-related decisions
- Handled logistics of space reservations
- Planned and taught smaller advanced/challenge level classes

ET **2019 – present**
Lieutenant Commander, etc. Cambridge, MA

- Held various house positions at MIT independent living group ET
- Organized mealplan, oriented new members, planned events, managed chore distribution system, etc.

MIT Asymptones (a cappella group) **June 2021 – December 2022**
Musical Director Cambridge, MA

- Ran auditions and rehearsals, led the group and its musical decisions

MathROOTS (virtual) **June 2021**
Residential Counselor Cambridge, MA

- Assisted with MathROOTS summer program run by MIT PRIMES, for gifted high school students from underrepresented backgrounds (run virtually due to the pandemic)
- Designed and ran daily social events for students for the duration of the program
- Supported students individually with personal/academic counseling

Awards

International Linguistics Olympiad **2017 – 2019**
Contestant Dublin, Prague, Yongin

- 2017: silver medalist
- 2018: gold medalist, 2nd place in team contest, best solution for problem #1
- 2019: gold medalist

Skills

Languages: English (native), Spanish (intermediate)
Programming languages:

proficient	C, Ruby, Python, Mathematica, HTML/CSS/JavaScript, Haskell, Coq
some experience	Rust, Java, C++, SQL
minimal experience	x86 assembly, Perl, Julia, R, OCaml

Tools: LaTeX, git, vim, bash/zsh, nix, basic GIMP/Inkscape (raster/vector graphics)