

Max Fan
Curriculum Vitae

University of Illinois Urbana-Champaign **B.S. in CS & Philosophy, 8/2021 - 5/2024 (expected)**
3.96/4 GPA, in the James Scholar Honors Program.

- Courses include: Proof Automation (**graduate** class), Formal Methods Seminar (**graduate** class), Formal Software Development Methods (**graduate** section), ML for Compilers and Architecture (**graduate** class), Topics in Automated Deduction (**graduate** class), Programming Language Semantics (**graduate** class), Programming Languages and Compilers, Formal Models of Computation, Programming Language Design, 2 × Philosophy of Logic (**graduate** Philosophy class), Conceptual Engineering Seminar (**graduate** Philosophy class), Theory of Knowledge (Philosophy class).

Note: Philosophy of Logic is an advanced graduate logic course with rotating topics.

- Course Assistant (undergrad **TA**) for Data Structures. Sped up build tools and compiler infrastructure by over **50×**, saving three person-work-years of cumulative student time per semester waiting for code to compile. Held office hours.
- Responsibly reported cybersecurity bugs in school infrastructure ([publicly thanked](#) by the university cybersecurity vulnerability disclosure program).

Relevant Work Experience

Illinois Theorem Provers Lab, University of Illinois **Research Assistant, 8/2022 - present**
Conducted type theory and programming languages research at the Illinois Theorem Provers lab, under Professor Talia Ringer.

- Worked on generalizing proof repair to make verification via interactive theorem proving more practical using setoids and quotient types ([paper draft](#), in progress).
- Formally verified programs in Coq and Cubical Agda.

Robust Software Engineering, NASA Ames **Research Intern, 6/2023 - 8/2023**
Conducted research to make safety-critical systems more robust and reliable using runtime verification.

- Extended the Copilot compiler for formally specifying and monitoring runtime properties for hard real-time systems, with C and FPGA backends.
- Discovered and patched soundness and performance bugs in the Copilot compiler.
- Developed a future-time temporal logic semantics that appears asymptotically more efficient to monitor at run time (paper in progress).

Fidelity Investments **Software Engineering Intern, 6/2022 - 8/2022**
Worked in the Fidelity research and development group.

- Proposed and built a high-performance analytics engine in Rust to deliver more comprehensive insight into market activity (over **100×** performance speedup over previous analysis infrastructure).
- Researched formal methods for smart contract safety, culminating in a presentation and report with firm-wide recommendations to decision-makers.

Paper and Presentations

- Cosmo Viola, **Max Fan**, and Talia Ringer. 2023. Towards Proof Repair in Cubical Agda. <https://arxiv.org/pdf/2310.06959.pdf>
- **Max Fan**. 2023. Reasoning about Distributed Programs in Hanabi with Modal Logic. Presented at the University of Illinois Graduate Formal Methods Seminar.
- **Max Fan**. 2023. Seeing is Believing: Efficient Monitoring of Future-Time Temporal Logic. Presented to the NASA Ames Robust Software Engineering Group and NASA Langley Formal Methods Research Group.
- Cosmo Viola and **Max Fan**. 2022. Going Beyond Type Equivalences: Towards More General Proof Repair. Presented at the University of Washington-Seattle Programming Languages and Software Engineering Lab.

Academic Awards, Grants, and Scholarships

- Awarded the **National Science Foundation Graduate Research Fellowship (NSF GRFP)**, 2024.
- Awarded the **Goldwater scholarship**, a merit-based national scholarship established by Congress for undergraduate research in STEM, 2023-present.
- Invited to the **Hausdorff Research Institute for Mathematics “Prospects of formal mathematics”**. Funded by the German government and only given to roughly thirty researchers at a time (usually an equal mix of professors, postdocs, and PhD students), 2023.
- Awarded the **James Scholar Preble Research Award**, given by the University of Illinois to outstanding undergraduates in research, 2023.
- Received a **conference grant** to attend ACM International Conference on Functional Programming (ICFP) through the Programming Languages Mentoring Workshop, 2023 and 2024.
- Won the **HackIllinois “top contributor” award** for contributions to open source projects over a short timeframe, 2021.
- Founded a cybersecurity capture-the-flag team that **won 8th and 14th place nationally at picoCTF**, a competition by CMU, 2018-2021.

Leadership

- Co-chairing **ACM@UIUC SIGPLAN**, a student group at the University of Illinois on the design, implementation, and theory of programming languages, 2022-present.
- Organizing the weekly Programming Languages/Formal Methods/Software Engineering research lunch, 2022-present.
- Led **Open Source @ Illinois**, the premiere open-source software club at the University of Illinois, as **Vice-President**, 2021-2023.