

Joshua Clune

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Education

Carnegie Mellon University, Pursuing PhD in Computer Science Sept 2021 – Present

Advisor: Jeremy Avigad

Carnegie Mellon University, B.S. in Computer Science Sept 2017 – May 2021

Additional major in Philosophy, GPA: 3.86/4

Research Projects

Lean Hammer Jan 2024 - Present

- Developing a tactic to translate Lean goals to TPTP and SMT-LIB formats and subsequently reconstruct proofs found by external automatic theorem provers

Duper: An Automatic Theorem Prover for Dependent Type Theory June 2022 - Sept 2024

- Developed an automatic proof-producing superposition theorem prover in Lean 4
- Extended the prover to perform higher-order reasoning and handle problems which include dependent types
- Published in ITP 2024. <https://doi.org/10.4230/LIPIcs.ITP.2024.10>

A Formalized Reduction of Keller's Conjecture Sept 2021 - Sept 2022

- Formalized the connection between Keller graphs and Keller's original conjecture on cube tilings in Lean 3
- Produced the first verified proof that Keller's conjecture is false in eight dimensions
- Published in CPP 2023. <https://doi.org/10.1145/3573105.3575669>

A Polymorphic Logical Framework Sept 2020 - July 2021

- Developed an extension to the LF logical framework that includes polymorphic types

Program Equivalence for Assisted Grading of Functional Programs May 2019 - Nov 2020

- Developed a provably sound technique for expressing the equivalence of functional programs with SMT formulas
- Implemented the technique to cluster thousands of Standard ML homework submissions from an introductory functional programming course
- Published in OOPSLA 2020. <https://doi.org/10.1145/3428239>

Professional Experience

Applied Scientist Intern - Amazon June 2023 - Sept 2023

- Created a package for creating and reasoning about CNF formulas in Lean 4
- Implemented a fully verified LRAT checker to support verified reasoning about the unsatisfiability of CNF formulas directly in Lean

Software Engineering Intern - Bloomberg L.P. Sept 2016 - Aug 2017, June - Aug 2018

- Created a Bloomberg Terminal function to help sales representatives monitor how effectively their customers engaged in various workflows, both at the aggregate level to discover widespread trends and the individual level for closer monitoring
- Created a Bloomberg Terminal function to display specific Terminal user information while simultaneously running internal checks to ascertain the consistency of the displayed data

General Coding Intern - Readorium June 2016 - Aug 2016

- Migrated Readorium's main product from Flash to HTML5
- Developed a system of recording user transactions used to identify bugs and validate security features

Skills

Experience with: Interactive Theorem Proving, Automatic Theorem Proving, Formal Methods, Program Analysis

Languages: Lean, Standard ML, OCaml, C, Python, JavaScript, C++, SQL, Bash