# Nathaniel Yazdani

researcher in **programming languages** & **formal methods** (**PL**/**FM**)

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## RELEVANT EXPERIENCE

### BedRock Systems | Formal Methods Intern
2021 – 2022                                     **boston**, massachusetts
- Supervised by Dr. Gregory Malecha and Dr. Gordon Stewart
- Collaborated with many engineers/researchers daily as a close team
- Contributed to formal verification of console multiplexer and virtual ethernet switch for a microkernel-based hypervisor operating system
- Solved contingent reasoning gaps by delving deep into automation infrastructure and language semantics (for variadic functions in C++)
- Specified and verified real C++ sources denoted into Iris concurrent separation logic via BedRock C++ semantics (*i.e.*, BRiCk w/ `cpp2v` tool)

### Northeastern University | Research+Teaching Assistant
2019 – 2021                                     **boston**, massachusetts
- Doctoral research advised by Prof. Amal Ahmed
- Collaborated with 2 other PhD researchers in joint project
- Formalized source-level static+dynamic semantics of Rust as Coq library independent of separation logic (*i.e.*, no Iris logical framework)
- Supervised grading (*e.g.*, rubrics) for introductory programming course

### IMDEA Software Institute | Research Intern
2017 (summer)                                     **madrid**, spain
- Internship research advised by Prof. Aleks Nanevski
- Prototyped compositional verification of intrusive concurrent protocol (an elimination layer, *cf.*, "helping" in concurrency literature)
- Learned SSReflect tactic language and FCSL logical framework

### University of Washington | Research+Teaching Assistant
2015 – 2019                                     **seattle**, washington
- Undergraduate research advised by Prof. Ras Bodik (for honors thesis)
- Graduate research advised by Prof. Dan Grossman
- Collaborated with 3 PhD researchers and 2 engineers from industry
- Invented program synthesizer for tree traversals via symbolic tracing of definitional interpreter to derive DSL's encoding into SMT
- Developed groundbreaking tools for automated proof repair via deductive metaprogramming implemented as OCaml plugin for Coq
- Led course staff and built autograder for compilers class (3 times)

## HIGHER EDUCATION

### Northeastern University | Ph.D., *Computer Science*
2019 – **today** (on leave)                                     **boston**, massachusetts

### University of Washington | M.Sc., *Computer Science*
2017 – 2019                                     **seattle**, washington

### University of Washington | B.Sc., *Computer Science*
2015 – 2017 (with honors, *magna cum laude*)                                     **seattle**, washington

## TECHNICAL SKILLS

Functional programming..............Haskell, OCaml

Systems programming.......................C, C++, Rust

Theorem proving......................................Coq, Lean

Logic programming...........................λProlog, ELPI

Constraint solving................................SMT-LIB, Z3

Program analysis........................symbolic methods

Proof automation.........tactics, metaprogramming

Compiler engineering....................DSLs, IRs, LLVM

## RESEARCH PAPERS

### Proof repair across type equivalences
*PLDI 2021* | doi: `10.1145/3453483.3454033`
with Talia **Ringer**, John **Leo**, Dan **Grossman**, ... (+1)

### Ornaments for proof reuse in Coq
*ITP 2019* | doi: `10.4230/LIPIcs.ITP.2019.26`
with Talia **Ringer**, John **Leo**, Dan **Grossman**

### Adapting proof automation to adapt proofs
*CPP 2018* | doi: `10.1145/3167094`
with Talia **Ringer**, John **Leo**, Dan **Grossman**

### Domain-specific symbolic compilation
*SNAPL 2017* | doi: `10.4230/LIPIcs.SNAPL.2017.2`
with Rastislav **Bodik**, Mangpo **Phothilimthana**, ... (+1)

## RESEARCH AWARDS+HONORS

### Undergraduate Research Fellowship
*Washington Research Foundation*
2016 – 2017

### Undergraduate Research Leader
*University of Washington*
2017

### Outstanding Undergraduate Researcher
*Computing Research Association*
2017 (as honorable mention)

### Graduate Research Fellowship
*National Science Foundation*
2018 (as honorable mention)