Foundations and Applications of
Type-and Example-directed Program Synthesis

SHF : MEDIUM : Collaborative Research

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Collaboration Plan

The two PIs are uniquely qualified to carry out the proposed research. Both PIs are experts in type systems and logic. PI Zdancewic has been developing a pure type-and-example-based system that will form the initial kernel of the proposed work. PI Walker brings experience in data-driven synthesis from his past NSF-sponsored work on the PADS project. Together PIs Walker and Zdancewic have already begun to work together and are currently making progress on the technical components of this proposal.

During the academic year of 2015-2016, PI Walker is on sabbatical at the University of Pennsylvania. There he and PI Zdancewic have already begun a collaboration on this project. They will work closely together for the remainder of the year. They expect this concentrated time together will accelerate the research productivity of the PIs and their students. When the sabbatical is over, the PIs will set up weekly Skype video conference calls together and with their students to discuss research on program synthesis. These meetings will continue throughout the duration of the grant. The PIs will also schedule periodic in-person meetings. (The University of Pennsylvania and Princeton University are only 1 hour away by car or train.) We have budgeted travel funds both for going to conferences and to facilitate commutes back and forth between institutions when necessary.

Software-development Infrastructure. We have set up a joint git repository, which holds our code. Git will store a main software development branch and will allow us to generate experimental branches, which may be later merged back in to the core. Our git repository also includes test suites, notes, technical reports, and documents relevant to the project (such as this proposal).

Research Tasks and Timeline. Table 1 (see the following page) summarizes the major pieces of the research in terms of area. The table lists the central research tasks and provides expected start and finish times.

Research Task		Start	Finish
Core Type-theoretic Synthesis Algorithms			
Negative examples		In progress	Year 1
Performance optimization		In progress	Year 4
Example minimization		In progress	Year 4
Advanced Type Systems			
Polymorphism, GADTs, refinements		In Progress	Year 1
Regular expression typing, Dependency		Year 1	Year 2
Effect Typing		Year 2	Year 4
Theory			
Meta-theoretic properties		In progress	Year 4
Applications			
Synthesizing functional program benchmarks		In progress	Year 4
Synthesizing configuration transformations		Year 2	Year 3
Synthesizing Augeas Lenses		Year 3	Year 4

Table 1: Timeline for investigation and completion of research tasks.