Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

Proposal for Thesis Research in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

TITLE: Performance Engineering of Proof-Based Software Systems at Scale

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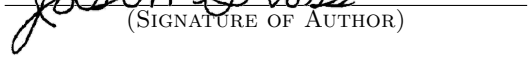
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DATE OF SUBMISSION: October 30, 2020

EXPECTED DATE OF COMPLETION: December 2020 — January 2021

LABORATORY: Computer Science and Artificial Intelligence Laboratory

BRIEF STATEMENT OF THE PROBLEM:

The proposed research is a study of performance issues that come up in engineering large-scale proof-based systems in Coq. The thesis presents lessons learned about achieving acceptable performance in Coq in the course of case-studies on formalizing category theory, developing a parser synthesizer, and constructing a verified compiler for synthesizing efficient low-level cryptographic primitives. We also present a novel method of simple and fast reification, and a prototype tool for faster rewriting and customizable reduction which does not require extending Coq's trusted code base.