Title: Formalizing Mathematics using the Lean Theorem Prover

Speaker: Leonardo de Moura, Microsoft Research

Abstract:

Lean is a new open source theorem prover being developed at Microsoft Research and Carnegie Mellon University, with a small trusted kernel based on dependent type theory. It aims to bridge the gap between interactive and automated theorem proving, by situating automated tools and methods in a framework that supports user interaction and the construction of fully specified axiomatic proofs. The goal is to support both mathematical reasoning and reasoning about complex systems, and to verify claims in both domains.

In this talk, we provide a short introduction to the Lean theorem prover, describe how mathematical structures (e.g., groups, rings and fields) are encoded in the system, quotient types, the type class mechanism, and the main ideas behind the novel elaboration algorithm implemented in Lean. More information about Lean can be found at http://leanprover.github.io. The interactive book ``Theorem Proving in Lean'' (http://leanprover.github.io/tutorial) is the standard reference for Lean. The book is available in PDF and HTML formats. In the HTML version, all examples and exercises can be executed in the reader's web browser.

Bio:

Leonardo de Moura is a Principal Researcher in the RiSE group at Microsoft Research. He joined Microsoft in 2006, before that he was a Computer Scientist at SRI International. His research areas are automated reasoning, theorem proving, decision procedures, SAT and SMT. He is the main architect of Lean, Z3, Yices 1.0 and SAL. Lean is a new open source theorem prover. Z3 and Yices are SMT solvers, and SAL (the Symbolic Analysis Laboratory) is an open source tool suite that includes symbolic and bounded model checkers, and automatic test generators. Z3 has been open sourced (under the MIT license) in the beginning of 2015. Leonardo received the Haifa Verification Conference Award in 2010. In 2014, the TACAS conference (Tools and Algorithms for the Construction and Analysis of Systems) has given an award for "The most influential tool paper in the first 20 years of TACAS" to his paper "Z3: An Efficient SMT Solver". In 2015, Z3 received the Programming Languages Software Award from ACM SIGPLAN.