2015 KAML SPRING SEMINAR

math

June 05 (FRI, 5pm-6pm), 2015
Science Building #225

Speaker
Prof. Chung-Kil Huh
(Seoul National. Univ.)

Title

Mechanization of Proof: From 4-Color Theorem to Compiler Verification

I will give a broad introduction to how to mechanize mathematics (or proof), which will be mainly about the proof assistant Coq. Mechanizing mathematics consists of
(1) defining a set theory,
(2) developing a tool that allows writing definitions and proofs in the set theory, and
(3) developing an independent proof checker that checks whether a given proof is correct (i.e., whether it is a valid combination of axioms and inference rules of the set theory).
Such a system is called proof assistant and Coq is one of the most popular ones.

In the first half of the talk, I will introduce applications of proof assistant, ranging from mechanized proof of 4-color theorem to verification of an operating system. Also, I will talk about a project that I lead, which is to provide, using Coq, a formally guaranteed way to completely detect all bugs from compilation results of the mainstream C compiler LLVM.

In the second half, I will discuss the set theory used in Coq, called Calculus of (Inductive and Coinductive) Construction. It will give a very interesting view on set theory. For instance, in calculus of construction, the three apparently different notions coincide:
(1) sets and elements,
(2) propositions and proofs, and
(3) types and programs.

If time permits, I will also briefly discuss how Von Neumann Universes are handled in Coq and how Coq is used in homotopy type theory, led by Fields medalist Vladimir Voevodsky.

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