

Introduction to Lean 4

MATH230

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① Lean

Lean is a functional programming language and an interactive theorem prover. It can be used to write general purpose computer programs and as an assistant in the process of authoring and verifying proofs about mathematics and software. This open source project was launched by Leonardo de Moura at Microsoft Research in 2013. Lean 4 is the latest version and is maintained by de Moura and others at the Lean Focussed Research Institute.

Lean is not the only language to implement the theoretical ideas that we have discussed throughout this course. Other languages include Agda, Idris, and Rocq. For the purposes of this course we will only be using Lean.

Getting Started

It is simplest to run Lean through the editor VS Code. Following the instructions at [this link](#) shows you how to do this. There are plugins for other editors, if you're that way inclined. However, if you're very new to programming, then it is recommended you stick to VSCode. This is the setup available in the computer labs of Jack Erskine.

These lectures were prepared with reference to the free textbook *Theorem Proving in Lean 4*. This can be referred to for more details.

Recall: Curry-Howard

Example

Lean, indeed all programming languages, have a number of keywords used to structure programs. For our purposes of theorem proving, we will not need to know all of the keywords of Lean. For now, it suffices to consider only the following two keywords:

de Moura's Stone

Lean's infoview is one of its key features. Along with the editor one writes the proof in, Lean provides another infoview to display a lot of information regarding the current proof. This is indispensable when proofs start to get even moderately long.

Example

Further Reading

This lecture was prepared with the aid of the following references.
These should be consulted for further detail on the topics.