Lean and Education

by Johan Commelin
Three talks

- Lean and Education I
  - Medley of projects and tools
- Liquid Tensor Experiment
  - Intermezzo on epistemology of proof
- Lean and Education II
  - Finale
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  Finale …
This talk

- Demo
- Community website + chat
- Online options
- Natural Number Game + Game server
- Widgets
- Tutorials
- Velleman’s “How to prove it with Lean”
- List of Lean courses around the world
- Macbeth’s course
- Massot’s lean-verbose and informalization
https://lean.math.hhu.de
Community website + chat

- https://leanprover-community.github.io
- https://leanprover.zulipchat.com
Online options

- Web editor: https://lean.math.hhu.de
- Gitpod
- Codespaces
Natural Number Game

- https://www.ma.imperial.ac.uk/~buzzard/xena/natural_number_game/
- In Lean 3 by Kevin Buzzard and Mohammad Pedramfar
- Revamped into a generic game server in Lean 4 by Patrick Massot and later Jon Eugster and Alexander Bentkamp (see next slide)
Game server

- [ ] https://adam.math.hhu.de
  Live demo server

- [ ] https://github.com/leanprover-community/lean4game
  Game server

- [ ] https://github.com/hhu-adam/NNG4
  Game data for the Natural Number Game
Widgets

- The “goal view” window is a website
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- Widgets: use javascript for extra interaction!
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- Widgets: use javascript for extra interaction!
- Basics: type info + goal diffs
Widgets demos
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- Commutative diagrams
  Mathlib4/test/CommDiag.lean
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- SciLean by Tomas Skrivan
  https://github.com/lecopivo/SciLean
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☐ Rubik’s cube
   https://github.com/kendfrey/rubiks-cube-group
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☐ Sudoku
  https://github.com/TwoFX/sudoku
Tutorials

- See “Learning resources” on community website

- “Mathematics in Lean”
  https://leanprover-community.github.io/mathematics_in_lean
  WIP book by several authors
  already usable as solid intro
  targets mathematicians (no focus on types or logic)
Velleman’s “How to prove it with Lean”

- [ ] https://djvelleman.github.io/HTPIwL/

- [ ] Companion to the book “How to prove it”
Lean courses around the world

- [x] https://math.commelin.net/files/lean_teaching.html

- [x] Soon integrated in community website
Macbeth’s course: Mechanics of proofs

- [ ] https://github.com/hrmacbeth/math2001

- [ ] Online lecture notes

- [ ] Fully parallel: English and Lean

- "custom tactics which perform exactly one step of reasoning"
  
  "It lets you off the hook in grading – you can just say ‘that’s not enough detail – Lean wouldn’t accept it!’ "

lean-verbose and informalization

https://github.com/PatrickMassot/lean-verbose

Controlled natural language Lean tactics
by Patrick Massot
lean-verbose and informalization

□ https://github.com/PatrickMassot/lean-verbose
   Controlled natural language Lean tactics
   by Patrick Massot

□ tinyurl.com/LeanIpam
   Mechanic informalization of Lean to English
   by Patrick Massot and Kyle Miller