Proof Assistants

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Part III CST – 2024-2025

Who are you?

Proof Assistants

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- precise formal notion
- machine-checked

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- develop
- maintain & evolve
- *partly* automated

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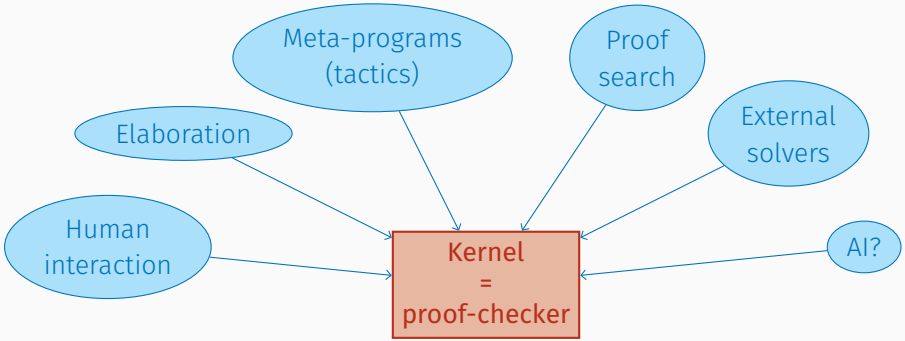
... and programmers too!

The kernel and the rest



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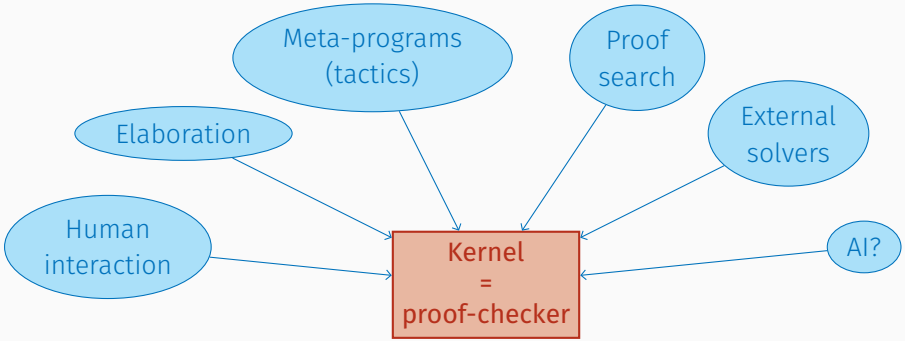

Demo in a minute

Prehistory ('70s) Automath, Mizar, LCF

A short history

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Four colour theorem (2005) first "important" certified proof

CompCert (2005), seL4 (2009) "real-life" certified programs

Odd order theorem (2012), Flyspeck (2014) first big mathematical theorems

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BoringSSL (2017-...), Everest (2016-...) integration in mainstream applications
HoTT, Liquid Tensor Experiment (2021) proof assistants for cutting-edge maths

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... and more papers/projects than I can name!

Higher-order logic

HOL Light

PVS

A family picture

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Dependent type theory

Coq → Rocq

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Idris

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And many many more

...

This course

+

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+

goals basic autonomy & familiarity, transferable knowledge

subject basic PL theory *à la* Part IB – Semantics

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+

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Resources on the course webpage!

Structure

- ~6 Isabelle/HOL lectures (Bauereiss)
- ~5 Coq lectures (Lennon-Bertrand)
- 4 practical sessions (bring your computer)

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Assignements: two small projects, one in Isabelle/HOL, one in Coq.

Install the proof assistants

NOW !

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Instructions on the course webpage.