Theorem Proving in Isabelle

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Literature
Logic in Computer Science

- J. Barwise and J. Etchemendy: Language, Proof and Logic; CSLI, 1999
Isabelle documentation

Get it from

http://www.cl.cam.ac.uk/Research/HVG/Isabelle/

In particular:

• T. Nipkow, L. C. Paulson, M. Wenzel: Isabelle/HOL: A Proof Assistant For Higher Order Logic
• T. Nipkow: Structured proofs in Isar/HOL
• L. C. Paulson: Introduction to Isabelle
Introduction
What the . . . is Isabelle?

Isabelle is a generic theorem prover

• Provides (higher-order) meta-logic
• Built-in basic proof tactics
• Object logics are coded as theories
• Tactics/meta-tactics (‘tacticals’) can be programmed (in ML)
Object logics??

Yes. E.g.:

- Equational Logic / Conditional Equational Logic
- Which connectives are allowed? (E.g. only $\land$, $\implies$)
- Which quantifiers? (E.g. only $\forall$)
- Quantification over individuals (FOL)/ functions (HOL)?
- Excluded middle (Classical Logic vs. Intuitionistic Logic)?
- Exotic things: Modal Logic, Linear Logic, . . .
Meta-Logic...?

‘The word ”meta-logic” should not be used in front of small children’
(J.-Y. Girard)
Meta-Logic...?

- The meta-logic is just a logic (IHOL + Type classes)
- Object logics are defined in this logic
- Proofs in the object logic become proofs about the object logic: FOL says: $A$ holds; Isabelle says: $A$ can be proved in FOL

Look at the definition of FOL