## **Conjecture Synthesis for Inductive Theories**

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**Abstract** We have developed a program for inductive theory formation, called *IsaCoSy*, which synthesises conjectures 'bottom-up' from the available constants and free variables. The synthesis process is made tractable by only generating irreducible terms, which are then filtered through counter-example checking and passed to the automatic inductive prover IsaPlanner. The main technical contribution is the presentation of a constraint mechanism for synthesis process. We evaluate IsaCoSy as a tool for automatically generating the background theories one would expect in a mature proof assistant, such as the Isabelle system. The results show that IsaCoSy produces most, and sometimes all, of the theorems in the Isabelle libraries. The number of additional un-interesting theorems are small enough to be easily pruned by hand.

**Keywords** Theory formation • Induction • Synthesis • Theorem proving • Lemma discovery

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