Teaching Automated Theorem Proving for Propositional Classical Logic with DERIVE

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Abstract

Automated Theorem Proving (ATP) is one of the most important concepts when teaching Propositional Classical Logic in Computer Sciences degrees. An ATP is an algorithm that checks the validity of a formula.

The kind of exercises that can be solved using an ATP can be grouped in the following three Logic problems:

1. Checking the satisfiability of a formula (SAT). Satisfiability is the problem of determining if there exists an interpretation that assigns TRUE to the given formula.
2. Checking the validity of a formula (TAUT). A formula of propositional logic is a tautology (or it is valid) if all possible interpretations assign TRUE to the formula.
3. Checking the correctness of an inference, that is, determining if a formula (conclusion) can be logically deducted from a set of formulae (hypothesis).

In this talk the file ATPCL.mth is introduced. This utility file allows us to use DERIVE as an ATP for Propositional Classical Logic since different algorithms such as Quine, Semantic Tableaux and Short Normal Form + Resolution have been implemented. This file is an extension with more algorithms and more didactically oriented of the previous file presented in ACA 2008 (in "*Nonstandard Applications of Computer Algebra*" session) where an implementation of the Semantic Tableaux was presented.

We will describe how to use this utility file as a didactical tool supporting the process of teaching and learning of automated logic deduction by solving problems related to validity, satisfiability and deduction.

On the other hand, in order to use DERIVE as a PeCAS (Pedagogical CAS), a graphical approach of the execution of Semantic Tableaux main algorithm can be optionally shown. This visual approach has been proclaimed by our students to be a very important tool for easier understanding the concepts involved.