XIII Simposio Latinoamericano de Lógica Matemática

Kurt Gödel 1906-2006

Oaxaca, México; August 2006

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10:15 - 11:45		Olmedo/Estrada Freund	Pazos Celani/Cabrer	Chávez/Oziewicz Chávez/Oziewicz	Cárdenas Schwarze/Marshall
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Time	Monday LCSAI	Tuesday LCSAI	Wednesday AL	Thursday AL	Friday AL
10:15 - 11:45		Diaz/Uzcategui Pino	Ziliani Oliva	Figallo/Ramón/Saad Caicedo	Figallo Cimadamore
16:00 - 17:30	Dionisio/Gouveia/Marcos Pimentel/Miller	Arrazola/Osorio Paiva/dal Pian		Gomes/Sarmiento/Videla Pascual	Lewin/Pigozzi Figallo/Sanza

Teaching and experimenting with deductive systems using a generic proof assistant

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There is nowadays a sizable number of systems that implement 'mathematics in the computer'. Among such systems, tactic provers are those tools that allow users both to write interactive or semi-automated computer-assisted proofs and to heuristically explore theorem-proving tactics with a very high level of confidence. Some generic proof assistants provide in fact an environment that is flexible enough so as to allow many different logics to be implemented as theories. Such is the case of ***Isabelle***, a software that allows for the definition and use of deductive systems for many logics, presentable in many different formats: natural deduction rules, Hilbert-style axioms and rules, sequent-style rules, tableau rules, and so on. ***Isabelle*** brings a good amount of built-in logic machinery. The logical framework it provides is based on a constructive higherorder logic with three main components: (i) a meta-implication that may be used in implementing the rules of the specific object-logic being thereby represented and that takes care of the discharge of assumptions; (ii) a meta-universal quantification that may be used in implementing a number of object-logic quantifiers; (iii) a meta-equality that may be used in implementing abbreviations as rewrite rules. In more detail, we are talking about a mechanizable theorem-prover in which: (i) object-logic formulas are precise simply-typed λ-terms disambiguated by way of a priority grammar; (ii) rules of the object-logic are represented not as functions but as formulas of the underlying higher-order logic; (iii) the combination and application of those rules is performed by way of a uniform method of inference, namely higher-order resolution used in syntactic equation solving; (iv) tactics are implemented independently of the object-logic being represented. The flexibility of ***Isabelle*** is augmented by the possibility of defining new tacticals as combinations of tactics that allow for the implementation of automated deduction. For such, the general purpose functional programming language ***ML***, used in the proof assistant's implementation, comes to help.

Such highly flexible models of logic software have a strong potentiality still largely to be unleashed in their use in computer-based learning and their integration to the standard set of teaching strategies and resources. Used as laboratories for experimentation with abstract entities, the right software can turn a computer into a sort of 'bubble chamber' where ideas can be tested and improved —or rejected. In addition, computers can also help one in 'creating intuition' about certain subjects. This outlook converts the computer into a genuine tool for doing philosophical and mathematical research.

This presentation reports on the authors' experiences in teaching Computational Logic using the Isabelle proof assistant with the main purpose of encouraging experimentation with classical and non-classical logics.