2006-03-23

APPLIED LOGIC DV1 (4p) – Tillämpad logik

The course presents fundamental algorithmic and proof-theoretic methods of logic and show how they are applied in contemporary computer science.

Contents

Constructive logic and type theory: Lambda calculus and functional programming. Algorithmic interpretation of logical connectives. Intuitionistic logic. Martin-Löf type theory. Logical frameworks. Program extraction from proofs. Integrated program logics. Other methods of program verification.

Proof theory and automatic theorem proving: Proof search in the tableaux calculus. The completeness theorem and termination of proof search. Systems for automated theorem proving. The resolution method.

Decidable and undecidable axiom systems. Complete theories. Quantifier elimination. Algorithms for propositional logic. Binary decision diagrams. Modal logics. Possible worlds semantics. Computational Tree Logic. Model checking. Reasoning about knowledge in multiagent systems.

Literature

M R A Huth and M F Ryan. *Logic in Computer Science: Modelling and reasoning about systems.* Second edition. Cambridge University Press 2004.

R M Smullyan. *First-Order Logic.* Dover Publishing 1995.

T Coquand, P Dybjer, E Palmgren and A Setzer. *Constructive Logic and Type Theory* — a chapter of the book manuscript *Type-theoretic foundations of constructive mathematics,* Uppsala 2005.

Level and prerequisites. The course is at C-level in mathematics. Prerequisites are 40 course points in mathematics and/or theoretical computer science, including a basic logic course such as Logik och bevisteknik DV1, or Logik MN1, and a basic course in discrete mathematics. Knowledge of a functional programming language (ML, Haskell or LISP) and automata theory is helpful. The course may be studied as a complement to Logik MN2.

Course start and examination. March 23, 15.15 – 17.00, in room 1145 MIC, Polacksbacken, Uppsala. Written exam on June 1.

Instructors.

Professor Erik Palmgren, tel. 018-471 32 85, Email: palmgren@math.uu.se.
Teaching assistant: Johan Granström, georg@math.uu.se.
Webpage of the course: www.math.uu.se/~palmgren/tillog .

Kursansvarig institution: Matematiska institutionen.