# Preface

The seven papers contained in this Special Issue of *Fundamenta Informaticae* constitute contributions in the area of Lambda Calculus and Type Theory – a domain of a very intensive research for the past decade or so. The papers selected for this issue represent a typical, but certainly not complete enough, snapshot of the wealth of problems studied currently in this field. The problems mentioned in this issue range from the proof-theoretical considerations concerning combining data types with polymorphism, through various type recostruction problems, representation of arithmetical functions, semantical foundations of the notion of substitution, and finally studies of the computational power of new programming constructs which can be naturally expressed in this framework. The papers were submitted by invitation and refereed in the usual way.

The paper by Val Breazu-Tannen and Albert Meyer "Conservativity of equational theories in typed lambda calculi" studies extensions of equational theories (such theories correspond to the evaluation of data type expressions) by the reasoning of the Girard-Reynolds polymorphic lambda calculus. The authors prove that such extensions are always conservative even when the equational theory is expressed as equating higher-order terms.

The paper by Pierre-Louis Curien "Substitution up to isomorphism" deals with a system of first-order dependent types with an explicit syntactic construct of substitution which acts on types and terms. The system is suitably modified to accomodate substitutions as a new syntactic feature. The author provides semantics in locally cartesian closed categories and proves a kind of a coherence property.

The paper by Paola Giannini, Simona Ronchi Della Rocca and Furio Honsell "Type inference. Some results, some problems" investigates the problem of type reconstruction for the type systems organized in the "cube" of H. Barendregt. They show that adding dependent types does not increase the power of typability. They also develop a machinery to express type schemes in the higher-order polymorphic calculus of Girard, $F_\omega$.[1]

The paper by Lalita Jategaonkar and John Mitchell "Type inference with extended pattern matching and subtypes" presents a type inference algorithm for a language with records and subtyping. The language is in the style of ML. It supports a restricted object-oriented programming style. The authors prove soundness of their algorithm and its completeness – it infers a most general typing for every typable expression.

The paper by Daniel Leivant and Jean-Yves Marion "Lambda calculus characterizations of poly-time" shows a number of ways in which functions computable in polynomial time can be represented in various type systems connected with simple types or restricted forms of polymorphism.

The paper by Frank Pfenning "On the undecidability of partial type reconstruction" proves that the problem of type reconstruction for the Girard-Reynolds polymorphic lambda-calculus is undecidable if the terms are partially typed, i.e. if they contain some information about typing. Decidability of the type reconstruction problem for pure untyped terms remains open.

[1] This system was recently proved by P. Urzyczyn as having undecidable type reconstruction problem.

The paper by Pawel Urzyczyn "Primitive recursion with existential types" investigates the computational power of primitive recursion for existential polymorphic types (which can be viewed as abstract data types). The author gives a complete characterization of the computational power of this construct. He shows, using this characterization and some known results, that it is strictly more powerful than the ordinary recursion in simple types and strictly less powerful than ordinary universally polymorphic recursion.

I would like to thank all the authors of this issue for their cooperation and patience and also all the referees of the papers included in this issue for their reasonably prompt response which crucially contributed to a relatively short time of publication of this issue.

Jerzy Tiuryn,
Editor of Special Issue

Warsaw, December 31, 1992