COURSE ANNOUNCEMENT

HIGHLIGHTS of Lambda Calculus and Term Rewriting Systems

A 5-day minicourse by Henk Barendregt and Jan Willem Klop

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Lambda Calculus and Combinatory Logic were instrumental in codifying the fundamental notion of computability, in the days of Gödel, Church, Kleene and Turing. Later on, these formal systems became the heart of functional programming. Typed lambda calculus, with the famous Curry-Howard-de Bruijn isomorphism, became the source of applications in the realm of correctness of formal proofs in mathematics and software, with the aid of proof assistants and theorem provers. At a parallel track, term rewriting systems emerged, of which Lambda Calculus and Combinatory Logic are prominent examples. The development along this line was intertwined with the emergence of the theory of abstract data types. Recently, infinitary versions of both lambda calculus and term rewriting are studied.

ABSTRACT

This five day master class in lambda calculus and term rewriting is centered around some twenty of the main theorems, both classical and recent. Each theorem is treated in a syllabus chapter of 10 pages, concluded with a section of exercises and notes for follow-up subjects and further reading.

1. Abstract rewriting and term rewriting
   (a) Newman's Lemma and Decreasing Diagrams
   (b) Critical Pair Completion
   (c) Toyama's Theorem; modularity
   (d) Termination via Iterative Path Orders
2. Lambda Calculus and Combinatory Logic
   (a) Computable functions on numbers and data types
   (b) The fundamental theorems on reduction
   (c) Combinators and lambda terms
   (d) Reduction Strategies
3. Orthogonal term rewriting
   (a) The Erasure Lemma
   (b) Root normal forms
   (c) Reduction cycles
   (d) Combinatory Reduction Systems

4. Typed lambda calculi
   (a) Strong normalization of simply typed lambda calculus
   (b) Type algebras and intersection type structures
   (c) The Curry-Howard-de Bruijn isomorphism
   (d) Pure Type Systems
5. Infinitary rewriting
   (a) iTRSs and infinitary lambda calculus
   (b) The infinitary unique normal form property; Böhm Trees
   (c) Productivity of stream definitions
   (d) Sequentiality and definability

To register as applicant, goto `<www.win.tue.nl/math/eidma>`.
Costs for (PhD) students: 300 Euro; participants of Dutch graduate schools are entitled to 100 Euro reduction.
Further course information can be obtained from the lecturers:
`jwk@cs.vu.nl`, `henk@cs.ru.nl`.