An encoding of the λ-calculus into the calculus of String MultiSet Rewriting*

Attila Bagossy and Péter Battyányi

Department of Computer Science, Faculty of Informatics, University of Debrecen, Kassai út 26., 4028 Debrecen, Hungary
bagossyattila@mailbox.unideb.hu, battyanyi.peter@inf.unideb.hu

Abstract. We propose a version of String MultiSet Rewriting (SMSR), based on the paper of Barbuti et al [1]. We define an encoding of the λ-calculus into SMSR, and then present an alternative proof of the finiteness of developments theorem on the basis of this encoding.

Keywords: String MultiSet Rewriting · λ-calculus · finiteness of developments.

Extended abstract

In the past few years many formalisms have been designed by computer scientists in order to model biological systems consisting of interacting components. Most of these systems are high level abstractions of biological phenomena aiming to describe the organization of the components and their possible interactions ([3], [4], [2]). However, the implementation of efficient simulators for high level languages did not prove to be an easy task. The calculus of String MultiSet Rewriting (SMSR) [1] seemed to offer an a solution acceptable from both approaches: by its maximal matching operator it is able to represent higher level languages and the SMSR system is simple enough to enable the development of efficient simulators (see www.di.unipi.it/msvbio/). A term in SMSR consists of a multiset of strings formed by elements of a certain alphabet. By the maximal matching operator we are capable of manipulating tree-like structures, a multiset of strings can be replaced by another multiset at the same time. This is the very characteristic that we make extensive use of in present work.

In our presentation we introduce a slightly modified version of SMSR [1], called SMSR*, and we define reduction rules in this structure so that we can embed the λ-calculus in the calculus obtained. The interesting thing is that SMSR* is a commutative structure with respect to the order of strings forming the multisets. Hence, we have obtained a representation of the non-commutative λ-calculus in a commutative structures which is not very difficult to implement. As an application, we present a proof of the finiteness of developments theorem by translating a simplified version of the λ-calculus into SMSR*.

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References


