

WEIGHTED MULLER TREE AUTOMATA AND WEIGHTED LOGICS ¹

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ABSTRACT

We introduce weighted Muller tree automata, over totally commutative complete semirings, acting on infinite trees. We show that their behaviours coincide with the semantics of weighted restricted MSO-sentences and the semantics of weighted incomplete universal MSO-sentences, provided that the underlying semiring is idempotent.

Keywords: Weighted logics over trees, weighted Muller tree automata, infinitary formal power tree series

1. Introduction

In 1969, Rabin [45] introduced a tree automaton model working on infinite trees, the so-called Rabin tree automaton, and he proved that the class of infinitary tree languages accepted by these automata coincides with the family of tree languages definable by monadic second order logic. This important result led to the proof of Rabin's famous Tree Theorem namely that the monadic second order theory of the infinite binary tree is decidable [45]. It also led to the development of several models of automata acting on infinite trees, like Büchi, Muller, Streett, alternating, parity, etc., cf. [50, 51] for surveys. Tree automata theory contributes to other fields of Computer Science like logic and game theory as well as to practical applications like model checking (cf. [50, 51]). On the other hand, it is well-known that any program can be described by an infinite tree [13, 33, 52]. In this way, the study of infinite trees approached the solutions of two important classical problems: The program optimization [33], and the existence of a general method for proving termination of nondeterministic or concurrent programs under any reasonable notion of fairness [34].

In a different research line, weighted tree automata over finite trees have been considered by many researchers [2, 5, 7, 8, 9, 10, 19, 26, 38, 44] and have been used in several areas like code selection [6, 30] and monadic second order evaluations on

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