

A SEMIRING-SEMIMODULE GENERALIZATION OF ω -REGULAR LANGUAGES I¹

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ABSTRACT

We develop an algebraic theory on semiring-semimodule pairs and quemirings that is applicable to languages that contain finite and infinite words. We define finite automata over quemirings and prove two Kleene Theorems. As an application we obtain a Kleene Theorem for clock languages which are used to specify and verify real-time systems and one for languages accepted by weighted Büchi-automata.

1. Introduction

Automata that accept finite and infinite words (Büchi [5]) have gained new interest with the introduction of automata that provide suitable models for real-time systems, e.g., the timed automata of Alur, Dill [1, 2]. The languages accepted by these automata can be used to specify and verify real-time systems. One of these approaches are the clock languages by Bouyer, Petit [4], a generalization of the timed languages. Bouyer, Petit [4] prove a Kleene Theorem for clock languages and, for this purpose, embed these clock languages in an algebraic framework.

The purpose of our paper is to give an algebraic approach independent of any alphabets and languages, and to apply our theory to languages that contain finite and ω -words, especially to clock languages and to languages accepted by weighted Büchi-automata in the sense of Droste, Kuske [7, 8]. We introduce pairs consisting of a semiring and a (semi)module. The semiring models a language with finite words,

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