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THE HADAMARD PRODUCT OF SEQUENTIAL-PARALLEL SERIES [1]

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ABSTRACT

We consider weighted branching automata over sp-posets with weights from a bisemiring. Our main result states that the behaviours of these automata are closed under Hadamard product if the underlying bisemiring is actually an idempotent commutative semiring. To build an appropriate product automaton we introduce a new running mode of branching automata. As a negative result we give an example showing that behaviours of weighted branching automata are not closed under Hadamard product in general, even if the sequential multiplication distributes over the parallel one.

Keywords: sp-posets, bisemiring, weighted branching automata, Hadamard product

1. Introduction

In this paper we continue the study of weighted automata over structures incorporating concurrency as started in [9]. Grabowski [7], Pratt [16], and Gischer [6] proposed an additional parallel composition to model concurrency and, for this, considered sequential-parallel posets[3] or sp-posets for short. Later on, Lodaya and Weil [13] introduced branching automata capable of accepting languages of sp-posets which was extended by Kuske [12] to infinite sp-posets.

In [9] a weighted version of branching automata was presented. Originally, the extension of finite automata accepting words to those with weights was initiated by Schützenberger [17] and Eilenberg [5]. For an overview on weighted automata see [18, 1, 10, 11]. A first step into "weighted concurrency" was done by Droste and Gastin [2, 3] who investigated formal power series over Mazurkiewicz traces with weights from a semiring. Unlike trace series, in weighted branching automata the

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[3] Originally, Gischer called them "series-parallel pomsets". Lodaya and Weil [13] used the term "series-parallel posets", and we speak of "sequential-parallel posets" to avoid any confusion with the concept "series" which is here used for "formal power series".