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A COMPARISON OF THE DESCRIPTIONAL COMPLEXITY OF CLASSES OF LIMITED LINDENMAYER SYSTEMS – PART II

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ABSTRACT

We study the descriptional complexity of various limited Lindenmayer systems. We show differences in the descriptional complexity between variants, where one variant generates more languages than another one. The used measures of descriptional complexity are the number of rules and the number of symbols. The results are summarized graphically at the end of this article. The present paper is a sequel to the paper *A Comparison of the Descriptional Complexity of Classes of Limited Lindenmayer Systems – Part I* which is published in the International Journal of Foundations of Computer Science (volume 23). In that paper, we confined ourselves to propagating limited Lindenmayer systems whereas we now study arbitrary limited Lindenmayer systems.

Keywords: Lindenmayer systems, limited rewriting, minimality of descriptions, complexity hierarchies

1. Introduction

Several generating devices for formal languages have been studied in the literature with respect to the size of their descriptions (e. g., [6]). For sequentially deriving grammars, the measures number of productions, number of nonterminal symbols, and number of all symbols have been investigated.

In 1968, Lindenmayer systems (L-systems) have been introduced ([10]). In order to model the development of organisms, these devices work in parallel (in one derivation step, not only one symbol is rewritten as in a sequential grammar but all symbols are rewritten). For Lindenmayer systems, the number of tables, the number of active symbols, and the degree of nondeterminism have been studied as measures of complexity ([8, 9, 14, 1]). In [3], the measures number of rules and number of symbols were introduced for L-systems. Classes of L-systems have been compared with respect to those measures in [2].

Twenty years after the introduction of L-systems, a restricted variant of L-systems with a partially parallel derivation process has been proposed in [13]. In these so-called k-limited L-systems, only k occurrences of each symbol are replaced according