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MEMBERSHIP FOR k-LIMITED ET0L LANGUAGES IS NOT DECIDABLE

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ABSTRACT

By the techniques developped in [1], we show how so-called klET0L machines can simulate register machines, hence proving that there are nonrecursive languages generable by klET0L systems (for each fixed $k \in \mathbb{N}$).

Keywords: formal languages, parallel and regulated rewriting

1. Definition and Results

We proved [1] that there are nonrecursive languages generable by 1lEDT0L systems. In this note, we show that this result is also true in the more general case of klEDT0L systems (as introduced by WÄTJEN [3]). In order to keep this note short, we refer the reader to our paper [1] as regards notations and definitions.

First, we generalize the notion of 1lET0L machine introduced in [1].

Definition 1 *Let* $k \geq 1$*. A* klET0L machine *is given by* $M = (V, V', \{P_1, \ldots, P_t\}, \{\sigma, x, y, R\})$*, where* V*,* $V' = \{\sigma, y\}$*,* $\{P_1, \ldots, P_t\}$ *are the total alphabet, the terminal alphabet and the set of tables, respectively.* σ, x, y, R *are special symbols in* V*. We say that* M *computes the function* $f : \mathbb{N}_0 \multimap\!\!\rightarrow \mathbb{N}_0$ *iff the corresponding klET0L system* $G_{M,n} = (V, V', \{P_1, \ldots, P_t\}, x^{kn}R\sigma, k)$ *with axiom* $x^{kn}R\sigma$ *generates a word of the form* $y^{km}\sigma$ *if and only if* $m = f(n)$*. Especially, there is at most one word in* $\{y\}^*\{\sigma\} \cap L(G_{M,n})$*.*

Theorem 2 *For any computable function* $f : \mathbb{N}_0 \multimap\!\!\rightarrow \mathbb{N}_0$ *and any* $k \geq 1$*, there exists a klET0L machine computing* f*.*

Proof. $f : \mathbb{N}_0 \multimap\!\!\rightarrow \mathbb{N}_0$ can be described by an r-RMP (register machine program using r registers) P. We describe a simulating klET0L machine $M = (V, V', H, \{\sigma, x, y, R\})$ with

$$V = \{\sigma, F, R, S, A_1, \ldots, A_r, y, C_1, \ldots, C_r\} \cup L \cup L',$$

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