Subset Sum Problem KPS

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1 Introduction

The subset sum problem can be easily derived from the partition problem. It is formulated as follows: Let V be a finite set and *weight* be a function on V with positive integer values (this is an additive function). It is requested to find, if it exists, a subset of V, denoted W, such that *weight*(W) $= k$. A solution to this problem is provided in [1] by using a recognizer P system with membrane creation. We use the following notations introduced above: $V = \{v_1, \ldots, v_n\}$ is a finite set, with $weight(v_i) = k_i$, where k_i is a positive integer, $1 \leq i \leq n$.

We build the following skP system (for the maximally parallel mode)

$$\mathrm{sk}\Pi_S(n) = (A, L, IO, \mu, C'_1, C'_2, 0),$$

where A, L, IO and μ are as in skΠ_P built for the partition problem; $C'_i = (i, w'_i, 0, R'_i)$, $1 \leq i \leq 2$, with $w'_1, 0 = w_{1,0}$ and $w'_2, 0 = A_1\mathrm{code}'(n)$, where code'(n) $= v_1^{k_1} \ldots v_n^{k_n}$; $R'_1 = R_1$ and R'_2 consist of $r_{2,i}$, $1 \leq i \leq n+1$ from R_2, the rewriting rules replacing $r_{2,i,j}$, $1 \leq i < j \leq n$, are

$$r'_{2,n+1+i} : v_i \to v\{= B_i = X\}, \quad 1 \leq i \leq n$$

and the rules replacing $r_{2,n+2}, r_{2,n+3}$ are

$$r'_{2,2n+2} : Y \to (F, 1)\{\neq k\}, \quad r'_{2,2n+3} : Y \to (T, 1)\{= k\}.$$

For the asynchronous and sequential modes, the rule $r_{2,n+1}$ is replaced by

$$r'_{2,n+1} : X \to Y \left\{ \prod_{1 \leq i \leq n} (= B_i \neq v_i = X \mid \neq B_i = X) \right\}.$$

We make the following notations: if $V = \{a_1, \ldots, a_n\}$ and $weight(a_h) = k_h$, $1 \leq h \leq n$, is the weight function, then $W_l = \{a_{i_1}, \ldots, a_{i_{p_l}}\}$, $1 \leq l \leq 2^n$, describes a subset of V. Let us denote for each W_l, $1 \leq l \leq 2^n$

$$m'_l = \sum_{1 \leq h \leq p_l} k_{i_h} \quad \text{and} \quad M' = \max\{m'_h \mid 1 \leq h \leq 2^n\}.$$

References

1. Gutiérrez-Naranjo, M., Pérez-Jiménez, M., Romero-Campero, F.: A linear solution of subset sum problem by using membrane creation pp. 103–201 (2005). https://doi.org/10.1007/11499220˙27