

List of open problems

Separability Problems, 14.07.2017

1. Delivered by Michaël Cadilhac.
Consider a variety $V = \{\text{regular } L \mid \forall_{s,x,t \in \Sigma^*} sx^3t \in L \Rightarrow sx^2t \in L\}$.
and a following problem. Given: functional transducer τ . Question:
does it hold that for all languages $K, L \subseteq \Sigma^*$ we have (K, L) as well
not V -separable implies $(\tau(K), \tau(L))$ not V -separable. Is this problem
decidable?
2. Delivered by Wojciech Czerwiński.
Given two one counter automata with zero tests A and B over Σ such
that $L(A) = \Sigma^* \setminus L(B)$. Determine whether $L(A)$ is regular. Is this
problem decidable? Conjecture: yes.
3. Delivered by Charles Paperman.
Let us consider an XML-style encoding of a tree, but enhanced by writ-
ing depth of every opening tag. For example encoding of path of length
3 is a word $b\#1\#c\#2\#d\#3\#\bar{d}\bar{c}\bar{b}$. Let $\text{flat}(L)$ is set of all encodings of
trees from the tree language L . Consider a following problem. Given
a regular tree language K . Determine whether languages $\text{flat}(K)$ and
 $\text{flat}(\bar{K})$ are regular separable or not. Is this problem decidable?
4. Delivered by Georg Zetsche.
Consider deterministic branching \mathbb{Z} -VASSes, which define languages
of trees. Is regular separability decidable for such languages?
5. Delivered by Georg Zetsche.
Is there a Nerode style characterization of regular separability?
6. Delivered by Thomas Colcombet.
Let A and B be NFAs such that $L(A)$ and $L(B)$ are disjoint. Is there
always a UFA C of polynomial size such that $L(C)$ separates $L(A)$
and $L(B)$? Conjecture: yes.
7. Delivered by Thomas Colcombet.
Let A be UFA. Is always $L(\bar{A})$ recognizable by polynomial size UFA?
Conjecture: yes.
8. Delivered by Thomas Colcombet.
Are always two disjoint languages of register automata separable by
language of unambiguous register automaton? Conjecture: yes.
9. Delivered by Georg Zetsche.
We say that $L \subseteq \Sigma^*$ is bounded if there are words $w_1, \dots, w_k \in \Sigma^*$

such that $L \subseteq w_1^* \cdot \dots \cdot w_k^*$. Is the following problem decidable: given a VASS, is its language bounded?

10. Delivered by Wojciech Czerwiński.

A VAS is *communication-free* if every its transition decreases at most one counter by at most one. Is regular separability for languages of communication-free VASes decidable?