Complexity of Array Languages*

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We consider the complexity of (d-dimensional) array Chomsky-type grammars, see [1, 2]. Briefly stated, we observe that there is a huge complexity gap between one-dimensional array languages (whose complexity results can be mostly inferred by the well-known string case) and the case of two and more dimensions.

There, as main results, we obtain that both fixed and general membership for regular and context-free array languages, even in the unary case, is NP-complete, while the nonemptiness problem is undecidable for regular array languages. This result nicely fits into the picture observed in other picture describing formalisms [3, 4].

Moreover, every recursively enumerable string language can be obtained via an at least two-dimensional #-context-free array grammar, so that the membership problem for this grammar and language type is undecidable, while it is PSPACE-complete for monotonic array grammars and languages.

References

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