

## A nondeterministic parser for $Perm_2$ grammars

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Permutation grammars are context-free grammars extended with permutation rules of type  $A_1A_2\dots A_n \rightarrow A_{\sigma(1)}A_{\sigma(2)}\dots A_{\sigma(n)}$ , where  $A_1, A_2, \dots, A_n$  are nonterminal symbols of the grammar,  $\sigma$  is a permutation and  $n \geq 2$ . If the non context-free rules in a specific grammar have at most  $n$  symbols on either side, than it is called a permutation grammar of order  $n$  and it generates a language among the  $Perm_n$  language family. In [3] was shown that these language families strictly contain the context-free class and they are strictly contained in the context-sensitive class. In [2] an infinite and strict hierarchy was proved between  $Perm_{4n-2}$  and  $Perm_{4n-1}$  for all  $n \geq 1$ .

A nondeterministic polynomial time CYK-based parser is proposed to deal with the parsing problem of permutation grammars of order 2, namely to parse a context-free grammar extended by interchange rules of type  $AB \rightarrow BA$ . Firstly, the known CYK parser [1] is modified to parse context-free grammars which contain chain productions, those of the form  $A \rightarrow B$ , then the algorithm is further modified to apply the available interchange rules randomly. The first modification is necessary because it is not known whether unit productions could be eliminated from a permutation grammar or not.

## References

- [1] Hopcroft, John E., Rajeev Motwani, and Jeffrey D. Ullman. *Introduction To Automata Theory, Languages, And Computation 2<sup>nd</sup> Edition*. Addison-Wesley (2001): 298-302.
- [2] Madejski, Grzegorz. "Infinite Hierarchy of Permutation Languages." *Fundamenta Informaticae* 130.3 (2014): 263-274.
- [3] Nagy, Benedek. "Languages generated by context-free grammars extended by type  $AB \rightarrow BA$  rules." *Journal of Automata, Languages and Combinatorics* 14.2 (2009): 175-186.