

# Acceptance Power of Unlimitedly Deep Pushdown Automata

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October 8, 2017

**Abstract.** This paper discusses an acceptance strength of an altered version of pushdown automata referred to as unlimitedly deep pushdown automata.

Consider the classic construction of the general pushdown automaton for context-free grammar. During every move, the automaton either pops or extends its pushdown depending on the symbol occurring on the pushdown top. If an input symbol occurs on the pushdown top, the automaton compares the pushdown top symbol with current input symbol, and if they coincide, the automaton pops the topmost symbol from pushdown and proceeds to the next input symbol on the input tape. If a nonterminal occurs on the pushdown top, the automaton expands its pushdown so it replaces the top nonterminal according to an expansion rule with a string.

In this paper, we discuss a slight generalization of this automaton. The generalized version works exactly as above automaton except that it can make expansions deeper in the pushdown. Whenever automaton is unable to find an expansion rule applicable to the topmost nonterminal, automaton proceeds to search deeper in the pushdown to the second topmost nonterminal. If still, no expansion rule is applicable, the automaton continues going deeper into the pushdown until it either finds nonterminal to be expanded or reaches the pushdown bottom.

Using induction hypothesis, we will prove that the language accepted by the unlimitedly deep pushdown automaton is equal to the language generated by a state grammar that is modified to include erasing productions. Such a grammar has the generative power that coincides with the recursively enumerable languages [1]. Therefore, the acceptance power of the unlimitedly deep pushdown automaton matches the one of the Turing machines.

## References

- [1] G. Horvat, A. Meduna, On state grammars, Acta Cybernetica 1988 (8) (1988)237245