

Pushdown automata and context free languages

1. Construct pushdown automaton from the context free grammar

$$S \rightarrow XY, \quad X \rightarrow XV \mid \mathbf{b}, \quad Y \rightarrow UY \mid \mathbf{a}, \quad U \rightarrow \mathbf{aa}, \quad V \rightarrow \mathbf{bb}$$

2. Consider the grammar $S \rightarrow A \mid \varepsilon$, $A \rightarrow \mathbf{aAbA} \mid \mathbf{abA} \mid \mathbf{aAb} \mid \mathbf{ab}$. Construct pushdown automaton from this grammar.

For the following strings check the computation paths of your PDA. When the path is an accepting one, describe also the corresponding derivation from the grammar and draw the derivation tree.

a) **abbaab**

b) **aabbab**

What is the language generated by the grammar?

3. Construct pushdown automaton from the grammar $S \rightarrow \mathbf{aSa} \mid \mathbf{bSb} \mid \mathbf{aa} \mid \mathbf{bb} \mid \mathbf{a} \mid \mathbf{b}$

Give an accepting computation of your PDA for the string **ababa** (if it exists).

4. The language L consists of the non empty strings $s \in \{0,1\}^*$ where the middle character of s is 0. (Ex. $1, 011, 10110 \in L$ and $11, 101 \notin L$.) Show that this L is context free.