

Question 1 (40%)

Given the language $L = \{w \in \{a,b\}^* \mid w = w^R\}$, namely the set of palindromes over the alphabet $\{a,b\}$, is it possible to show that L is *not* a regular language by using the Pumping Theorem for FALs? Explain.

Question 2 (30%)

Given the context-free grammar

$$G = \langle \{S, A\}, \{a, b\}, S, \\ \{S \rightarrow aAa, \\ S \rightarrow bAb, \\ S \rightarrow \varepsilon, \\ A \rightarrow SS\} \rangle$$

- (a) give a derivation of the string *abbbaaba*;
- (b) draw the parse tree for the same string.

Question 3 (30%)

Given $\Sigma = \{a, b, (,), \cup, *, \varepsilon\}$, construct a context-free grammar for the language

$L = \{w \in \Sigma^* \mid w \text{ is a regular expression}\}.$