

CSCI 341 Workshop 5

Stack Automata

December 11, 2025

Problem 1. Design a stack automaton that recognizes the following language.

$$L_1 = \{a^n b^m a^n \mid n, m \in \mathbb{L}\}$$

Problem 2. Design a stack automaton that recognizes the following language.

$$L_2 = \{a^{2n-1} b^{3n+1} \mid n \in \mathbb{N}\}$$

Problem 3. Design a stack automaton with 2 stack symbols that recognizes the following language.

$$L_3 = \{w \mid w \text{ has the same } \# \text{ of } as \text{ and } bs\}$$

How is this different than a counter-automaton?

Problem 4. Design a stack automaton that recognizes the following language.

$$L_4 = \{w \mid ww^{\text{op}}\}$$

These are the *even-length palindromes*.

Problem 5. Design a stack automaton that recognizes the language of *pre-fix arithmetic expressions* for the alphabet $A = \{\text{ADD}, \text{SUB}, \text{DIV}, \text{MUL}\} \cup \mathbb{N}$. These are derived from the variable P in the grammar

$$\begin{aligned} P &\rightarrow N \mid \text{ADD } P \ P \mid \text{SUB } P \ P \mid \text{DIV } P \ P \mid \text{MUL } P \ P \\ N &\rightarrow 0 \mid 1 \mid 2 \mid 3 \mid \dots \end{aligned}$$

Note the spaces (these are not letters, they're just there for clarity). Now draw a parse tree that yields the following word:

ADD DIV 9 31 MUL 2 5

Use the parse tree to find its value.