

# CSCI 341 Workshop 5

Stack Automata

December 11, 2025

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

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

**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.

$$L_3 = \{w \mid w \text{ has the same \# of } a\text{s and } b\text{s} \}$$

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

$$P \rightarrow N \mid \text{ADD } P P \mid \text{SUB } P P \mid \text{DIV } P P \mid \text{MUL } P P$$

$$N \rightarrow 0 \mid 1 \mid 2 \mid 3 \mid \dots$$

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.