CSCI 341 Workshop 5

Stack Automata

November 5, 2025

Problem 1. Show that the language $L_{AB} = \{a^n b^n \mid n \in \mathbb{N}\}$ is decidable.

Problem 2. We are going to show that the language

$$L_{11?} = \{\lfloor \mathcal{T} \rfloor * x \mid x \text{ halts on input } 11 \text{ in the Turing machine } \mathcal{T}\}$$

is undecidable as follows:

(1)

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

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

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 $A = \{\texttt{ADD}, \texttt{SUB}, \texttt{DIV}, \texttt{MUL}\} \cup \mathbb{N}$. These are derived from the variable P in the grammar

$$P \to N \mid \texttt{ADD}\ P\ P \mid \texttt{SUB}\ P\ P \mid \texttt{DIV}\ P\ P \mid \texttt{MUL}\ P\ P$$
$$N \to \texttt{0} \mid \texttt{1} \mid \texttt{2} \mid \texttt{3} \mid \ldots$$

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

$$\texttt{ADD DIV}\ 9\ 31\ \texttt{MUL}\ 2\ 5$$

Use the parse tree to find its value.