Assignment 2 Due: 5/3

Problem 1:

a) Find all strings in \( L((a + b)^*b(a + ab)^*) \) of length less than four.

b) Find a regular expression for the language \( \{ab^n w : n \geq 3, w \in \{a, b\}^+\} \)

Problem 2:

a) Construct an NFA which accepts this language: \( L(aa^*(a + b)) \)

b) Construct an NFA which accepts this language: \( L((a + b)a^*) \cap L(baa^*) \)

c) For the following automaton, find its corresponding regular expression:

![Automaton Diagram]

Problem 3:

a) Construct a DFA for the this grammar: \( S \rightarrow abA, \ A \rightarrow baB, \ B \rightarrow aA | bb \)

b) Define a right linear grammar for \( L((aab^*ab)^*) \)

c) Find a right linear grammar for the following automaton:

![Automaton Diagram]

Problem 4: (express the language in terms of basic set operations)

a) Prove that if \( L_1 \) and \( L_2 \) are regular then \( L_1 \setminus L_2 \) (set difference) is also regular.

b) The symmetric difference of two sets \( S_1 \) and \( S_2 \) is defined as:

\[ S_1 \Delta S_2 = \{ x : x \in S_1 \text{ or } x \in S_2 \text{ but not in both } S_1 \text{ and } S_2 \} \]

Show that the family of regular languages is closed under symmetric difference.

Problem 5: Prove that the following languages are not regular:

a) \( L = \{a^n b^l a^k : k \neq n + l\} \)

b) \( L = \{a^n b^l a^k : n = l \text{ or } l \neq k\} \)

c) \( L = \{a^n b^l : n \leq l\} \)

d) \( L = \{ww : w \in \{a, b\}^*\} \)