

HW1 - Formal languages

February 24, 2025

1. Propose a complete deterministic finite state automaton that recognises the set of words over the alphabet $\{a, b\}$ containing the factors aab or $aaab$.
2. Let $\Sigma = \{a, b\}$. Let $L_1 = \{\varepsilon, aa, bb\}$ and $L_2 = \{a\}$ be two languages. Compute the following operations:

$$L_1^2 \quad L_2^* \quad L_1^2 \cap L_2^* \quad L_2^* \setminus L_1$$

3. Let $\Sigma = \{a, b\}$. Propose finite state automata that recognise the underlying languages:
 - (a) $(a|b)^*b(a|b)^*$
 - (b) $ba^* + ab + (a + bb)ab^*$
4. Let $\Sigma = \{a, b, c\}$. Give regular expressions that accept the following languages:
 - (a) The set of words with even length ending with ab .
 - (b) The set of words containing at least three letters and whose third-to-last letter is an a or a c .
5. Let $L = \{w \in \{a, b, c\}^* \mid (|w|_a = 0) \Rightarrow (|w|_b = 0)\}$. Is L rational? Justify.