

Homework 2

Sep 17, 2025

1 (30') Design a finite automaton that accepts the following language

$$L = \left\{ w \in \{0,1\}^* \mid w = w_1 w_2 \cdots w_n \text{ such that } \sum_{i=1}^n w_i 2^{n-i} \equiv 0 \pmod{5} \right\}.$$

In other words, the language L is the set of all binary strings that represent multiples of 5, written with the most significant bit first (MSB). Draw the state diagram of the finite automaton.

2 (40'). Design a finite automaton that recognizes the following language

$$L = \{w \in \{0,1\}^* : w \text{ does not contain substring } 10\}.$$

Draw its state diagram.

3 (30'). Use the definition of big-O notation to prove the following:

- 1) If $f_1 = O(g_1)$ and $f_2 = O(g_2)$, then $f_1 f_2 = O(g_1 g_2)$.
- 2) If $f_1 = O(g)$ and $f_2 = O(g)$, then $f_1 + f_2 = O(g)$.