

Homework 4

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Problems

0.1 Given implementation-level description of a Turing machine M that decides the language $A = \{w_1 \sim w_2 \mid w_1, w_2 \in \{0, 1\}^*, w_2 \text{ is bitwise complement of } w_1\}$. For example, M should accept “101 ~ 010” and reject “101 ~ 101”. Hint: see the Turing machine M_1 in the book

Scan the across the tape to corresponding positions on either side of the \sim symbol to check whether these positions contain opposite symbols. If they do not, or if no \sim is found, *reject*. Cross off symbols as they are checked to keep track of which symbols correspond.

When all symbols to the left of the \sim have been crossed off, check for any remaining symbols to the right of the \sim . If any symbols remain, *reject* ; otherwise, *accept*.

0.2 Give a formal description of M including a state diagram for δ .

$$Q = \{q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_A, q_R\}$$

$$\Sigma = \{0, 1, \sim\}$$

$$\Gamma = \{0, 1, \sim, x, _ \}$$

$$q_0 = q_1$$

$$q_{\text{Accept}} = q_A$$

$$q_{\text{Reject}} = q_R$$
