Erik Sundblad

Introduction to Computation Theory
Quiz 4 – In-class (20 pts)

Answer all questions

⊔ → accept

1. Examine the formal definition of a Turing machine to answer the following questions and explain your reasoning.
   a. Can a Turing machine ever write the blank symbol ⊔ on its tape?
   b. Can the tape alphabet Γ be the same as the input alphabet Σ?
   c. Can a Turing machine's head ever be in the same location in two successive steps?
   d. Can a Turing machine contain just a single state?

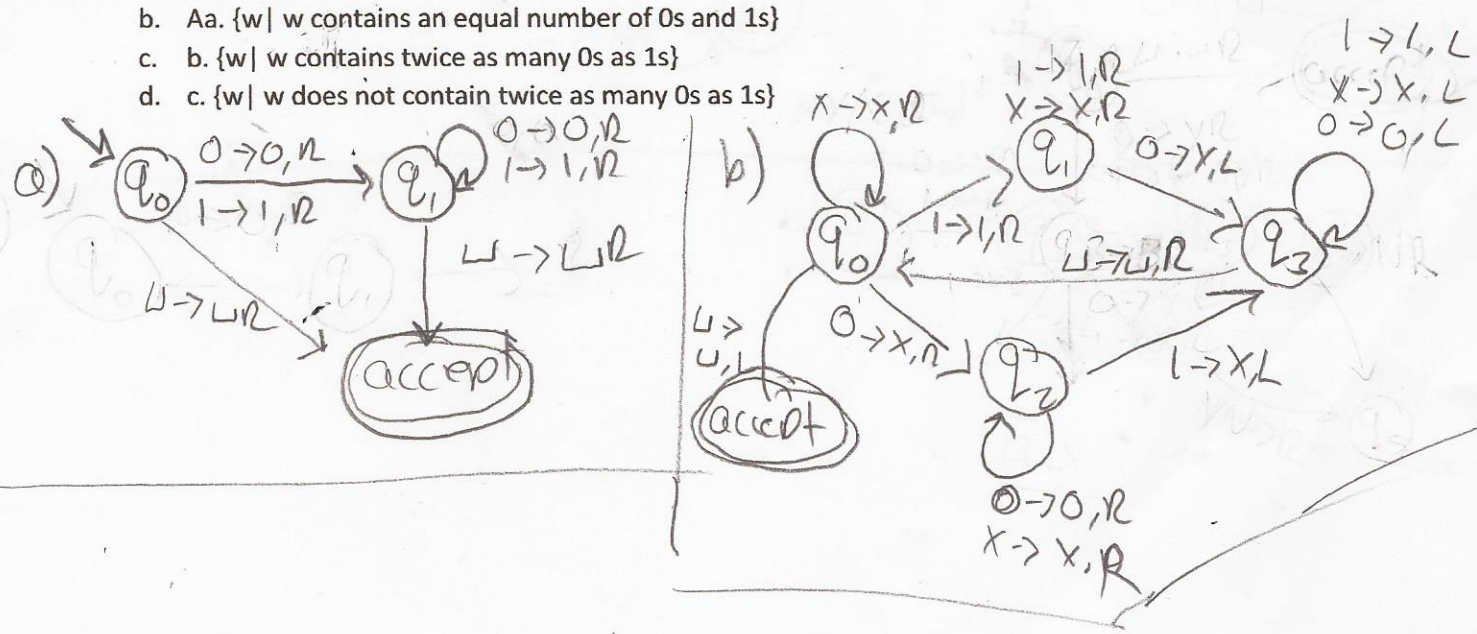
a) Yes! a turing machine can write any letters in its Alphabet

b) No! the '⊔' is in Γ but never in Σ

c) yes! At the left end of the tape a move to the left stays in place

d) No! at a minimum a turing machine has an accept and reject state.

2. Give implementation-level descriptions of Turing machines that decide the following
   a. languages over the alphabet {0,1}.
   b. Aa. {w| w contains an equal number of 0s and 1s}
   c. b. {w| w contains twice as many 0s as 1s}
   d. c. {w| w does not contain twice as many 0s as 1s}



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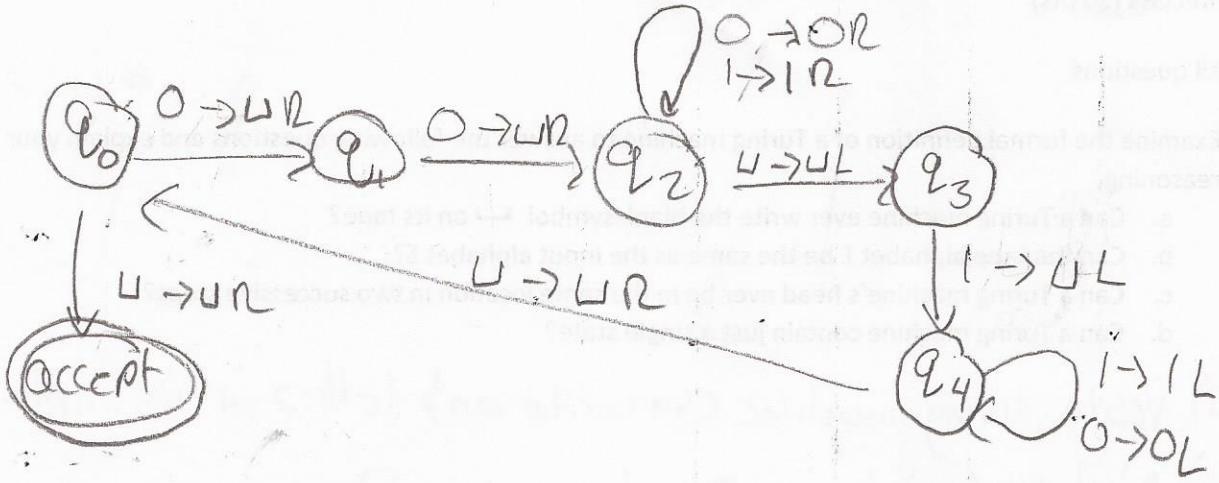
c) TM where $\{w : w \text{ contains } 2\times \text{ as many } 0\text{'s as } 1\text{'s}\}$



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