

CSE 355: Intro to Theoretical Computer Science

Recitation #11 Solution

1. [4 pts] Exam the formal definition of the Turing-Machine to answer the following question:

1.1) Can a TM ever write a blank symbol \sqcup on its type?

Yes, blank symbol \sqcup is in Γ . Turing machine can write any symbols on type.

1.2) Can the type alphabet Γ be the same as input alphabet Σ ?

No. Alphabet Σ does not include the blank symbol \sqcup , but \sqcup is in Γ , so the two will always be different.

1.3) Can the Turing machine's head ever be in the same location in two successive steps?

Yes. When the reading/writing head is at the left-most position and try to move left, it will stay at the same location.

1.4) Can a Turing machine just contain a single state?

No. A Turing machine need at least two states, one is the accepting state q_{accept} , one is the rejecting state q_{reject} .

2. [6 pts] Give the informal description of the TM that decides the following language, assume $\Sigma = \{0, 1\}$.
(Note: check textbook pp. 160, TM M₁ for an example of such description)

$$L = \{\omega \mid \omega \text{ contains equal number of } 0\text{s and } 1\text{s}\}$$

TM M on input string ω :

1. Scan the tape and mark the first 0 that has not been marked. If no unmarked 0 is found, go to step #4; otherwise move the head back to the front of the tape.
2. Scan the tape and mark the first 1 that has not been marked. If no unmarked 1 is found, *reject*.
3. Move the head back to the front of the tape and go to step #1.
4. Move the head back to the front of the tape. Scan the tape to see if any unmarked 1s remain, if none are found, *accept*; otherwise, *reject*.