

Discussion 6

Note about TMs

1. There are three ways of describing TMs: (i) formal, (ii) implementation-level and (iii) high-level.
2. A TM, on input string w may either *halt* (enter q_{accept} or q_{reject}) or never halt (*loop*).
3. A TM is a decider if it halts on every input.

Problems

1. (a) Explain why the following is not a description of a legitimate Turing machine.
“On input $\langle p \rangle$, a polynomial over variables x_1, \dots, x_k :
 1. Try all possible settings of x_1, \dots, x_k to integer values.
 2. Evaluate p on all of these settings.
 3. If any of these settings evaluate to 0, *accept*; otherwise, *reject*.”
- (b) Formulate the language that the TM was intended to recognize, and describe a correct TM that recognizes this language.

2. Give implementation level description for Turing machines recognizing the following languages.

(a) $L_1 = \{w\#z \mid w \in \{0, 1\}^* \text{ and } z = 1^n \text{ and } |w| = n\}$.

(b) $L_2 = \{w\#z \mid w, z \in \{0, 1\}^* \text{ and the binary number represented by } z \text{ is equal to } |w|\}$.