

Tutorial 3

Foundations of Computing Science

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Questions

1. Give implementation-level descriptions of Turing Machines that decide the following languages:
 - a. $\{w \mid w \text{ contains an equal number of 0s and 1s}\}$
 - b. $\{w \mid w \text{ is of the form } a^n b^m c^p, \text{ where } n > m > p \}$
 - c. $\{a^n b^m c^p \mid n \times m = p, \text{ and } n, m, p \geq 1\}$

2. Which of the following problems are decidable and which are not decidable. Explain your answer.
 - a. Given a Turing machine M , a state q and a string w , whether M ever reaches state q when started with input w from its initial state.
 - b. Given a TM M , whether M ever writes a non blank symbol when started on the empty tape.
 - c. Given a TM M and a string w , whether M moves its head to the left when started with input w .
 - d. $A = \{ \langle M \rangle \mid M \text{ is a DFA that accepts some string containing an equal number of 0s and 1s} \}$.
 - e. $\text{INFINITE}_{\text{DFA}} = \{ \langle A \rangle \mid A \text{ is a DFA and } L(A) \text{ is an infinite language} \}$