

Theoretical Computer Science - Bridging Course

Tutorial 05

Albert-Ludwigs-Universität Freiburg

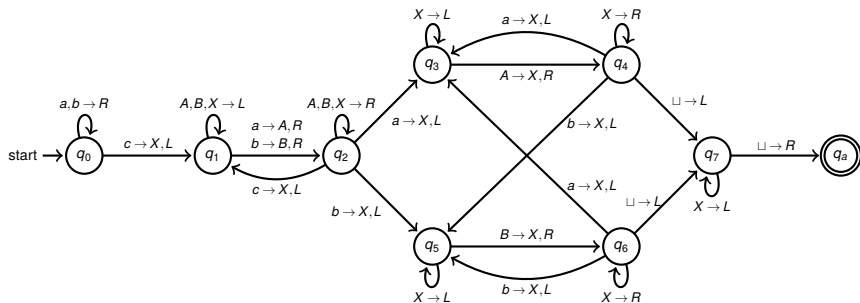


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Exercise 1: Interpret a Turing Machine



- (a) Simulate M with inputs $s_1 = abccba$, $s_2 = aaccxaa$, $s_3 = abccab$ until it halts.
- (b) Give the language $L(M)$ of strings that are accepted by M .

Exercise 2: Construct a Turing Machine

- (a) Draw a state diagram of a Turing machine M recognizing the language $L := \{a^n b^n a^n \mid n \geq 0\}$.
- (b) Simulate your Turing machine with the input strings $s_1 = aabbaa$ and $s_2 = abaaa$.
- (c) Describe a 3-Tape Turing machine which requires less head movements in total to recognize L .

Exercise 3: Decidable vs Semi-Decidable Languages

- (a) What is the difference between a decider and a recognizer?
- (b) Show that the following language is semi-decidable

$\{p \in \mathbb{Z}[X] \mid p \text{ is a integer polynomial with an integer root}\}.$

- (c) Are there languages that are not even semi-decidable?