

Solution to Homework Problem 17

Task. Use the general algorithm to transform a finite automaton B from Homework 1.4 – as simplified in Homework 3, into a Turing machine. Show step-by-step, on an example of a word $Aa0$, how this word will be processed by your Turing machine.

Automaton B from Homework 1.4 as simplified in Homework 3: reminder. This automaton has three states: s , c , and e ; s is the starting state, c is the only final state. The transitions are as follows:

- from s , A leads to c , every other symbol leads to e ;
- from c , every other symbol leads to c ;
- from e , every symbol leads back to e .

Solution. Here are the rules for the Turing machine:

start, $- \rightarrow R, s$
 $s, A \rightarrow R, c$
 $s, 0 \rightarrow R, e$
 $s, 1 \rightarrow R, e$
 $c, A \rightarrow R, c$
 $c, a \rightarrow R, c$
 $c, 0 \rightarrow R, c$
 $c, 1 \rightarrow R, c$
 $e, A \rightarrow R, e$
 $e, a \rightarrow R, e$
 $e, 0 \rightarrow R, e$
 $e, 1 \rightarrow R, e$
 $s, - \rightarrow \text{reject}$
 $c, - \rightarrow \text{accept}$
 $e, - \rightarrow \text{reject}$

Tracing.

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|---|----------|---|---|---|-----|-------|
| - | A | a | 0 | - | ... | start |
| - | <u>A</u> | a | 0 | - | ... | s |

| | | | | | | |
|---|---|----------|----------|----------|-----|----------|
| - | A | <u>a</u> | 0 | - | ... | <i>c</i> |
| - | A | a | <u>0</u> | - | ... | <i>c</i> |
| - | A | a | 0 | <u>=</u> | ... | <i>c</i> |
| - | A | a | 0 | <u>=</u> | ... | accept |