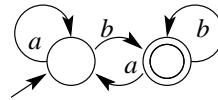


Question 9.1-1: (Solution, p 3) Consider the following finite automaton.



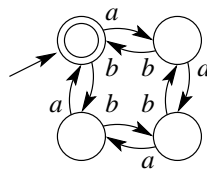
a. Check the strings that the automaton will accept.

- | | |
|----------------|-----------------|
| ___ <i>b</i> | ___ <i>bab</i> |
| ___ <i>a</i> | ___ <i>bbbb</i> |
| ___ <i>aba</i> | ___ <i>baba</i> |

b. Give an English description of the set of strings accepted by this automaton.

Question 9.1-2: (Solution, p 3) Draw a finite automaton that accepts all strings containing only *a*'s and *b*'s that begin in *a*.

Question 9.1-3: (Solution, p 3) Consider the following finite automaton.



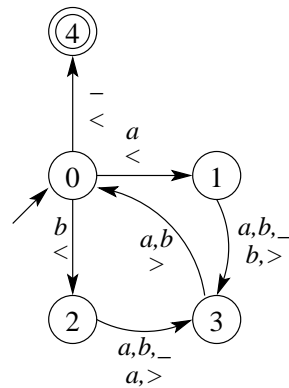
Check the strings that are within the language accepted by this finite automaton.

- | | |
|-----------------|---------------------|
| ___ <i>ab</i> | ___ <i>aabbb</i> |
| ___ <i>bbb</i> | ___ <i>bbbabb</i> |
| ___ <i>baaa</i> | ___ <i>aabaabaa</i> |
| ___ <i>abba</i> | |

Question 9.1-4: (Solution, p 3) Design a finite state automaton that will recognize the language of all strings containing only *a*'s and *b*'s where there are at least 3 *b*'s.

Question 9.2–1: (Solution, p 3)

Consider the following Turing machine. (Note that the underscore represents a blank on the tape.)



$\frac{0}{ab}$

At right, diagram this Turing machine’s computation as it goes through the string *ab*. If you run out of blanks in the table, stop.

To represent the machine’s initial position in the table at right, we write “ $\frac{0}{ab}$ ”. This represents a tape containing “*ab*” (with blanks extending infinitely both ways), where the Turing machine is currently in state 0 of its finite automaton, and its head is pointing to the initial *a*.

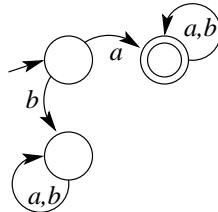
Question 9.2–2: (Solution, p 3) Design a Turing machine that transforms a string containing only *a*’s, *b*’s, and *c*’s by replacing each letter preceding an *a* to a *b*. (Do not worry about the case when the string begins with an *a*.) Thus, *bccb* would remain unchanged while *caccaa* would change to *bacbba*. The Turing machine should always eventually enter an accepting state to terminate.

Solution 9.1–1: (Question, p 1)

- a. \checkmark b \checkmark bab
 $_$ a \checkmark $bbbb$
 $_$ aba $_$ $baba$

b. It accepts exactly those strings containing only a 's and b 's that end in a b .

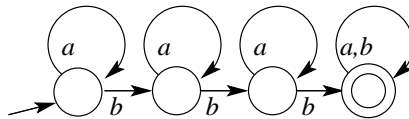
Solution 9.1–2: (Question, p 1)



Solution 9.1–3: (Question, p 1)

- \checkmark ab $_$ $aabbb$
 $_$ bbb \checkmark $bbbabb$
 $_$ $baaa$ \checkmark $aabaabaa$
 \checkmark $abba$

Solution 9.1–4: (Question, p 1)



Solution 9.2–1: (Question, p 2)

$\frac{0}{ab}$
$\frac{1}{ab}$
$\frac{3}{bab}$
$\frac{0}{bab}$
$\frac{2}{bab}$
$\frac{3}{bab}$
$\frac{0}{bab}$
$\frac{4}{bab}$

(At this point, the machine has nowhere to go, and so it stops.)

Solution 9.2–2: (Question, p 2)

