Questions

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

![Finite Automaton Diagram](image)

a. Check the strings that the automaton will accept.

- b
- a
- aba

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.

![Finite Automaton Diagram](image)

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

- ab
- bbb
- baaa
- abba
- abbbb
- bbbabb
- aabaabaa

**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.)

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 “\(\text{ab}\)”. This represents a tape containing “\(\text{ab}\)” (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, \(bc\) would remain unchanged while \(ac\) would change to \(bac\). The Turing machine should always eventually enter an accepting state to terminate.
**Solution 9.1–1:** (Question, p 1)

a. 

\[
\begin{array}{c|c|c}
 & b & bab \\
- & a & bbbb \\
- & aba & baba \\
\end{array}
\]

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)

![Diagram of a DFA for accepting strings that end in a \(b\)]

**Solution 9.1–3:** (Question, p 1)

\[
\begin{array}{c|c|c}
 & ab & aabbb \\
- & bbb & bbabb \\
- & baaa & aabaabaa \\
- & abba & \\
\end{array}
\]

**Solution 9.1–4:** (Question, p 1)

![Diagram of a DFA accepting strings that can be decomposed into \(a\), \(b\), and \(ab\)]

**Solution 9.2–1:** (Question, p 2)

![Transition table for a DFA accepting \(a\), \(b\), and \(ab\)]

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

**Solution 9.2–2:** (Question, p 2)

![Diagram of a DFA with transitions for \(a\), \(b\), and \(c\)]