

**Source File:** ~/4301/05/lab05.(C|CPP|cpp|c++|cc|cxx|cp)

**Input:** Under control of `main` function

**Output:** Under control of `main` function

**Value:** 2

For  $\Sigma = \{a, b\}$ , construct a finite state automata that accepts the set consisting of

$$\{x \mid x \in \{a, b\}^* \text{ and every substring of length four has at least two } b's\}$$

Note that every substring with length less than four is in this language. Valid strings include  $\epsilon$ , a, ab, ba, aaa, bab, abba, baba, aabba, babab, aabbaa, bababa, abababb, babbabb, abbbabb, babababb, ababbaab, and bababbaa, but not aaaaa, aaaab, aaaba, aabaa, aaabaa, baaaaa, bbaaaaab, aabaaaab, or aabaaaba.

This assignment will use the same header file and sample `main` function used for Lab 04. A sample execution sequence is shown in Figure 1. To use the `Makefile` as distributed in class, add a target of `lab05` to `targets2srcfiles`.

Additional notes:

- The `main` function appends the character '%' to each line as it is read in.
- The halt state is 0 and the start state is 1.

```

1 newuser@csunix ~> cd 4301
2 newuser@csunix ~/4301> ./getlab.ksh 05
3   * Checking to see if a folder exists for Lab 05. . .No
4   * Creating a folder for Lab 05
5   * Checking to see if Lab 05 has sample input and output files. . .Yes
6   * Copying input and output files for Lab 05
7     from folder /usr/local/4301/data/05 to folder ./05
8   * Checking to see if /usr/local/4301/src/lab05main.C exists. . .Yes
9   * Copying file /usr/local/4301/src/lab05main.C to folder ./05
10  * Checking to see if /usr/local/4301/include/lab05.h exists. . .No
11  * Copying file /usr/local/4301/src/Makefile to folder ./05
12  * Adding a target of lab05 to targets2srcfiles
13  * Touching file ./05/lab05.cpp
14  * Edit file ./05/lab05.cpp in Notepad++
15 newuser@csunix ~/4301> cd 05
16 newuser@csunix ~/4301/05> ls
17 00.dat      00.out      Makefile    lab05.cpp    lab05main.C
18 newuser@csunix ~/4301/05> make lab05
19 g++ -g -Wall -std=c++11 -c lab05main.C -I/usr/local/4301/include -I.
20 g++ -g -Wall -std=c++11 -c lab05.cpp -I/usr/local/4301/include -I.
21 g++ -o lab05 lab05main.o lab05.o -L/usr/local/4301/lib -lm
22 newuser@csunix ~/4301/05> cat 00.dat
23
24 a
25 b
26 aa
27 ab
28 ba
29 bb

```

**Figure 1.** Commands to Compile, Link, & Run Lab 05 (Part 1 of 5)

```
30  aaa
31  aab
32  aba
33  abb
34  baa
35  bab
36  bba
37  bbb
38  aaaa
39  abba
40  baba
41  bbbb
42  aaaaa
43  aaaab
44  aaaba
45  aabaa
46  aabba
47  babab
48  aaabaa
49  aabaaa
50  aabbaa
51  abaaaa
52  ababab
53  ababbb
54  baaaaa
55  bababa
56  aabbaab
57  abababb
58  babbabb
59  babbbbaa
60  bbaaaab
61  bbaaaba
62  bbaabaa
63  bbbbaaaa
64  aabaaaab
65  aabaaaba
66  aabaabaa
67  aabbaaaa
68  ababbaab
69  abbbbaabb
70  babababb
71  babbbbaa
72  newuser@csunix ~/4301/05> cat 00.dat | ./lab05
73  Your Name
74  CS 4301
75  Lab 5
76  {x | x in {a, b}* and every substring of length four has at least two b's}
77
78  Input: *** valid input ***
```

**Figure 1.** Commands to Compile, Link, & Run Lab 05 (Part 2 of 5)

```
79
80 Input: a *** valid input ***
81
82 Input: b *** valid input ***
83
84 Input: aa *** valid input ***
85
86 Input: ab *** valid input ***
87
88 Input: ba *** valid input ***
89
90 Input: bb *** valid input ***
91
92 Input: aaa *** valid input ***
93
94 Input: aab *** valid input ***
95
96 Input: aba *** valid input ***
97
98 Input: abb *** valid input ***
99
100 Input: baa *** valid input ***
101
102 Input: bab *** valid input ***
103
104 Input: bba *** valid input ***
105
106 Input: bbb *** valid input ***
107
108 Input: aaaa --- invalid input ---
109
110 Input: abba *** valid input ***
111
112 Input: baba *** valid input ***
113
114 Input: bbbb *** valid input ***
115
116 Input: aaaaa --- invalid input ---
117
118 Input: aaaab --- invalid input ---
119
120 Input: aaaba --- invalid input ---
121
122 Input: aabaa --- invalid input ---
123
124 Input: aabba *** valid input ***
125
126 Input: babab *** valid input ***
127
```

**Figure 1.** Commands to Compile, Link, & Run Lab 05 (Part 3 of 5)

```
128 Input: aaabaa --- invalid input ---
129
130 Input: aabaaa --- invalid input ---
131
132 Input: aabbaa *** valid input ***
133
134 Input: abaaaa --- invalid input ---
135
136 Input: ababab *** valid input ***
137
138 Input: ababbb *** valid input ***
139
140 Input: baaaaa --- invalid input ---
141
142 Input: bababa *** valid input ***
143
144 Input: aabbaaab *** valid input ***
145
146 Input: abababb *** valid input ***
147
148 Input: babbabb *** valid input ***
149
150 Input: babbbaa *** valid input ***
151
152 Input: bbaaaab --- invalid input ---
153
154 Input: bbaaabaa --- invalid input ---
155
156 Input: bbaabaa --- invalid input ---
157
158 Input: bbbaaaaa --- invalid input ---
159
160 Input: aabaaaab --- invalid input ---
161
162 Input: aabaaaba --- invalid input ---
163
164 Input: aabaabaa --- invalid input ---
165
166 Input: aabbaaaa --- invalid input ---
167
168 Input: ababbaab *** valid input ***
169
170 Input: abbbaabb *** valid input ***
171
172 Input: babbabbb *** valid input ***
173
174 Input: babbabaa *** valid input ***
175
```

Figure 1. Commands to Compile, Link, & Run Lab 05 (Part 4 of 5)

```
176 newuser@csunix ~/4301/05> cat 00.dat | ./lab05 > my.out
177 newuser@csunix ~/4301/05> diff 00.out my.out
178 newuser@csunix ~/4301/05>
```

**Figure 1.** Commands to Compile, Link, & Run Lab 05 (Part 5 of 5)