

Source File: ~/4301/11/lab11.(C|CPP|cpp|c++|cc|cxx|cp)
Input: Under control of main function
Output: Under control of main function
Value: 3

For $\Sigma = \{a, b, 0, 1, =, \sqcup\}$, construct a Turing machine for the following:

$$\left\{ \begin{array}{l} (x =, x = ans) \mid x \in \{a, b\}^* \text{ and} \\ ans = \begin{cases} 1, \text{ if } x \text{ has a substring of length four that} \\ \text{begins and ends with the same symbol, and} \\ 0, \text{ otherwise} \end{cases} \end{array} \right\}$$

This assignment will use the same header file and sample main function used for Lab 09. A sample execution sequence is shown in Figure 1. To use the Makefile as distributed in class, add a target of lab11 to targets2srcfiles.

Additional notes:

- As each input line is read in, the main function creates the initial tape contents as follows: ten blanks followed by the original input line followed by more blanks.
- The halt state is 0 and the start state is 1.

```

1  newuser@csunix ~> cd 4301
2  newuser@csunix ~/4301> ./getlab.ksh 11
3  * Checking to see if a folder exists for Lab 11. . .No
4  * Creating a folder for Lab 11
5  * Checking to see if Lab 11 has sample input and output files. . .Yes
6  * Copying input and output files for Lab 11
7  from folder /usr/local/4301/data/11 to folder ./11
8  * Checking to see if /usr/local/4301/src/lab11main.C exists. . .Yes
9  * Copying file /usr/local/4301/src/lab11main.C to folder ./11
10 * Checking to see if /usr/local/4301/include/lab11.h exists. . .No
11 * Copying file /usr/local/4301/src/Makefile to folder ./11
12 * Adding a target of lab11 to targets2srcfiles
13 * Touching file ./11/lab11.cpp
14 * Edit file ./11/lab11.cpp in Notepad++
15 newuser@csunix ~/4301> cd 11
16 newuser@csunix ~/4301/11> ls
17 00.dat      00.out      Makefile    lab11.cpp   lab11main.C
18 newuser@csunix ~/4301/11> make lab11
19 g++ -g -Wall -std=c++11 -c lab11main.C -I/usr/local/4301/include -I.
20 g++ -g -Wall -std=c++11 -c lab11.cpp -I/usr/local/4301/include -I.
21 g++ -o lab11 lab11main.o lab11.o -L/usr/local/4301/lib -lm
22 newuser@csunix ~/4301/11> cat 00.dat
23 aab=
24 aba=
25 baa=
26 babab=
27 aabbb=
28 bbbaa=
29 abbba=
30 aabbbbb=
```

Figure 1. Commands to Compile, Link, & Run Lab 11 (Part 1 of 4)

```
31 bbbbbbbbaa=
32 bbbabbbabbb=
33 =
34 a=
35 b=
36 aa=
37 ab=
38 ba=
39 bb=
40 aaa=
41 baa=
42 aba=
43 bbb=
44 abba=
45 baba=
46 babba=
47 abbbba=
48 bbabababa=
49 bbaaaabaaa=
50 babaaabaaa=
51 abaaaaaaaaaaa=
52 bababaabababa=
53 newuser@csunix ~/4301/11> cat 00.dat | ./lab11
54 Your Name
55 CS 4301
56 Lab 11
57 {(x=, x=ans) | x is in {a, b}* and
58     ans = 1 if x has a substring of length four that
59     begins and ends with the same symbol
60     ans = 0 otherwise}
61
62 Input:  aab=
63 Output:          aab=0
64
65 Input:  aba=
66 Output:          aba=0
67
68 Input:  baa=
69 Output:          baa=0
70
71 Input:  babab=
72 Output:          babab=0
73
74 Input:  aabbb=
75 Output:          aabbb=0
76
77 Input:  bbbaa=
78 Output:          bbbaa=0
79
```

Figure 1. Commands to Compile, Link, & Run Lab 11 (Part 2 of 4)

```
80 Input:  abbba=  
81 Output:          abbba=0  
82  
83 Input:  aabbbbb=  
84 Output:          aabbbbb=1  
85  
86 Input:  bbbbbbbaa=  
87 Output:          bbbbbbbaa=1  
88  
89 Input:  bbbabbbabbb=  
90 Output:          bbbabbbabbb=1  
91  
92 Input:  =  
93 Output:          =0  
94  
95 Input:  a=  
96 Output:          a=0  
97  
98 Input:  b=  
99 Output:          b=0  
100  
101 Input:  aa=  
102 Output:          aa=0  
103  
104 Input:  ab=  
105 Output:          ab=0  
106  
107 Input:  ba=  
108 Output:          ba=0  
109  
110 Input:  bb=  
111 Output:          bb=0  
112  
113 Input:  aaa=  
114 Output:          aaa=0  
115  
116 Input:  baa=  
117 Output:          baa=0  
118  
119 Input:  aba=  
120 Output:          aba=0  
121  
122 Input:  bbb=  
123 Output:          bbb=0  
124  
125 Input:  abba=  
126 Output:          abba=1  
127
```

Figure 1. Commands to Compile, Link, & Run Lab 11 (Part 3 of 4)

```
128 Input: baba=
129 Output:          baba=0
130
131 Input: babba=
132 Output:          babba=1
133
134 Input: abbbba=
135 Output:          abbbba=1
136
137 Input: bbabababa=
138 Output:          bbabababa=1
139
140 Input: bbaaaabaaa=
141 Output:          bbaaaabaaa=1
142
143 Input: babaaabaaa=
144 Output:          babaaabaaa=1
145
146 Input: abaaaaaaaaa=
147 Output:          abaaaaaaaaa=1
148
149 Input: bababaabababa=
150 Output:          bababaabababa=1
151
152 newuser@csunix ~/4301/11> cat 00.dat | ./lab11 > my.out
153 newuser@csunix ~/4301/11> diff 00.out my.out
154 newuser@csunix ~/4301/11>
```

Figure 1. Commands to Compile, Link, & Run Lab 11 (Part 4 of 4)