HW Solution

CS/ECE 374: Algorithms & Models of Computation, Spring 2019 Version: **1.0**

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(100 PTS.) Regularize this.

For each of the following languages over the alphabet $\{0, 1\}$, give a regular expression that describes that language, and briefly argue why your expression is correct.

A (20 PTS.) All strings that contain the subsequence 101.

B (20 PTS.) All strings that do not contain the subsequence 111.

C (20 PTS.) All strings that start in 11 and contain 110 as a substring.

D (20 PTS.) All strings that do not contain the substring 100.

E (20 PTS.) All strings in which every nonempty maximal substring of consecutive 0s is of length 1. For instance 1001 is not in the language while 10111 is.

4 Solution:

A $(1+0)^*1(1+0)^*0(1+0)^*1(1+0)^*$

This regular expression requires that at some point in the string a 1 must appear, later followed by a 0, and later followed by a 1, thereby requiring a subsequence of 101 but also allowing anything in between, before, or after these digits.

B $(0)^*(1+\epsilon)(0)^*(1+\epsilon)(0)^*$

Any string with subsequence 111 is a string that contains 3 or more 1's. This regex allows at most two 1's, and any number of zeros in between or on either end.

C $111^*0(0+1)^*$

After the initial 11, as soon as there is a 0, the string contains the subtring 110. This substring allows any number of 1's at the beginning, a 0, and then anything afterwards.

D $0^*(1+10)^*$

The above regular expression must cover all cases that do not contain 100. therefore we must cover all cases where 001, 010, 011, 101, 110, 111 are all covered but not 100. We also must insure that the prefix of these statements do not result in a length four sub-string that contains 100. This expression covers all above states.

E $(0+\epsilon)(1+10)^*$

This regular expression requires all strings that do not contain any consecutive sequences of 0's of length greater than one. The expression above covers all cases that can be build while still satifying the above conditions.