HOMEWORK #6, CPSC 421/501, FALL 2017

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Please note:

(1) Proofs should be written out formally.
(2) Homework that is difficult to read may not be graded.
(3) You may work together on homework, **you must write up your own solutions individually.** You must acknowledge with whom you worked (specify their `ugrad.cs.ubc.ca` email addresses). You must also acknowledge any sources you have used beyond the textbook and two articles on the class website.
(4) When you submit your homework to `gradescope.com`, you need to put the solutions to different problems on different pages; `gradescope.com` will ask you to identify which pages correspond to which problems. Please use the problem numbers below.
(5) Bonus questions count for marks above the 10% homework grade.

Homework Problems

(1) Problem 1.42 of [Sip]. [This is also Problem 1.42 in the 2nd Edition of [Sip].]

(2) Consider the language F of Problem 1.54 of [Sip]. [This is also Problem 1.54 in the 2nd Edition of [Sip].] Use the Myhill-Nerode theorem (see class notes) to show that F is not regular. In other words, show that

$$\mathrm{AcceptingFuture}(F, s) \stackrel{\mathrm{def}}{=} \{t \mid st \in F\}$$

has infinitely many possible values as s varies over all strings in $\{a, b, c\}^*$.

(3) Consider the language F of Problem 1.54 of [Sip]. Setting L to be the language described by the regular expression ab^*c^*, show that $F \cap L$ is not a regular language, using the pumping lemma. Explain why this implies that F is not regular.

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(4) Parts (b,c) of Problem 1.54 of [Sip].

(5) Let L be given by the regular expression $(1, 10, 1001)^*$.
   (a) Recall that for any language L and string s, AcceptingFuture(L, s) is defined to be
$$\{t \mid st \in L\}.$$
   Determine the values of AcceptingFuture(L, s) for the values $s = \epsilon$, $s = 0$, $s = 1$.
   (b) Based on part (a), build the part of a DFA for L that gives the initial state, q_0, of the DFA, the transitions out of q_0 upon reading either a 0 or a 1. Explicitly describe which state(s) are associated to which values of AcceptingFuture(L, s) for the values of s in part (a).
   (c) Complete part (b) to the complete description of a DFA for L by computing other values of AcceptingFuture(L, s) and associating to each distinct value a distinct state of the DFA.

Bonus question: 1.45 [same in 2nd edition].

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