INDIVIDUAL HOMEWORK 4, CPSC 421/501, FALL 2020

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Please note:
(1) You must justify all answers; no credit is given for a correct answer without justification.
(2) Proofs should be written out formally.
(3) Homework that is difficult to read may not be graded.
(4) You may work together on homework in groups of up to four, **but you must write up your own solutions individually and must acknowledge with whom you worked.** You must also acknowledge any sources you have used beyond the textbook and two articles on the class website.

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(1) Using the algorithm to convert a regular expression to an NFA, build an NFA the recognizes $L \subset \{a, b\}^*$ described by the expression $(aa \cup abaa \cup aaba)^*$. Briefly explain how you obtained your NFA.

(2) Let L_1, L_2, respectively, be languages that are recognized by DFA's M_1, M_2 respectively. Assume that M_1 has 20 states and M_2 has 30 states.
   (a) Describe an NFA for $L_1 \cup L_2$ that has 51 states. How many states could the corresponding DFA have (at most) (based on this NFA)?
   (b) Describe a DFA for $L_1 \cup L_2$ that has 600 states.
   (c) Describe as fast an algorithm as you can to test if a string lies in $L_1 \cup L_2$ (without knowing anything about M_1, M_2 except that they have, respectively, 20 and 30 states).

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