

## INDIVIDUAL HOMEWORK 5, CPSC 421/501, FALL 2021

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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) To be handed in on Individual Homework 6, NOT ON HOMEWORK 5:
    - (a) **Describe in 15–35 English words** an algorithm, suitable for implementation on a DFA, that recognizes the language

$$L_1 = \{w \in \{a, b\}^* \mid w \neq \epsilon \text{ and } w \text{ begins and ends with the same symbol}\}.$$

This description should be “high level,” e.g., with no technical details about the specific states of the DFA you intend to implement.

- (b) Describe a DFA that recognizes  $L_1$  above, based on your answer to part (a).
- (c) **Briefly describe** how your DFA works.
- (d) Based on the above, describe a DFA that recognizes

$$L_2 = \{w \in \{a, b\}^* \mid w = \epsilon \text{ or } w \text{ begins and ends with the same symbol}\},$$

and **describe in 12 English words or fewer** how you built this DFA from the DFA in part (b).

- (2) Build an NFA with three states that recognizes the language  $L = \{aa, aaa, ab\}^*$  and explain how your NFA works.

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Research supported in part by an NSERC grant.

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