INDIVIDUAL HOMEWORK 8, CPSC 421/501, FALL 2023

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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) Let

$$L = \left\{ s \in \{a,b\}^* \;\middle|\; s \neq \epsilon \text{ and } s \text{ begins and ends with the same symbol} \right\}$$

which begins

$$= \{a, b, aa, bb, aaa, aba, \ldots\}.$$

(a) Describe an algorithm for recognizing L that can be implemented on a Turing machine.
(b) Describe a Turing machine $M = (Q, \Sigma, \Gamma, \delta, q_0, q_{\text{accept}}, q_{\text{reject}})$ that implements this algorithm. Make sure you explicitly state the values of $Q, \Sigma, \Gamma, \delta, q_0, q_{\text{accept}}, q_{\text{reject}}$.
(c) Given the input $s = aab$, describe all configurations of your algorithm, using the notation on pages 169 and 172 of [Sip]; e.g., the initial configuration is q_0aab.
(d) Given an input of length n, how much time does your Turning machine take, i.e., how many steps?

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