CSC 320 FALL 2019
FOUNDATIONS OF COMPUTER SCIENCE
UNIVERSITY OF VICTORIA
ASSIGNMENT 1

1. For each of the following languages give the formal specification of the corresponding finite automaton (DFA). Include both a transition table and transition diagram.
   a) $\{w \in \{0,1\}^* | w \text{ ends with a } 00\}$
   b) $\{w \in \{0,1\}^* | w \text{ contains } 011 \text{ as a substring}\}$
   c) $\{w \in \{0,1\}^* | w \text{ begins and ends with a } 01\}$

2. a) Construct the finite automaton that accepts the union of the languages in 1 a) and b) using the construction given in Theorem 1.25 of the textbook.
   b) Build a new finite automaton that accepts the same language as the one in 2 a) with less states.

3. a) Give the formal specification of the nondeterministic finite automaton (NFA) that accepts the language $\{w \in \{0,1\}^* | w \text{ contains } 000 \text{ or } 010 \text{ as a substring}\}$ using exactly four states. Include both a transition table and transition diagram.
   b) Convert the NFA in part a) to an equivalent DFA. Give only the portion of the DFA that is reachable from the start state.

4. Consider the language $L/a = \{w | wa \in L\}$ where L is a language over Σ and $a \in \Sigma$. Using a construction proof, show that if L is a regular language, then L/a is also a regular language.

5. Give an algorithm that decides, for two regular languages L_1 and L_2, over Σ, whether there is a string $w \in \Sigma^*$ such that w is in neither L_1 nor L_2. You may assume that all of the following are true:

   The class of regular languages is closed under union.
   The class of regular languages is closed under intersection.
   The class of regular languages is closed under complement.
   The class of regular languages is closed under string reverse.
   The class of regular languages is closed under concatenation.