CSC 320 FALL 2019
FOUNDATIONS OF COMPUTER SCIENCE
UNIVERSITY OF VICTORIA
ASSIGNMENT 2

1. For each of the following languages give a regular expression that describes it.
   a) $\{w \in \{0,1\}^* | w$ begins and ends with a 01$\}$
   b) $\{w \in \{0,1\}^* | w$ has at most one pair of consecutive 1's$\}$
   c) $\{w \in \{0,1\}^* | w$ contains n 0's where n is divisible by 5$\}$

2. a) Consider the regular language described by the regular expression $R = (0 \cup 1)^*1(0 \cup 1)$.
   Construct an NFA that accepts the same language using the construction algorithm given in Lemma 1.55 of the textbook.
   b) Consider the DFA $M = (\{q_1, q_2, q_3\}, \{0,1\}, \delta, q_1, \{q_3\})$, where δ is defined in the table below. Construct a regular expression that describes the same language as M using the algorithm described in Lemma 1.60 of the textbook.

	0	1
$\to q_1$	q_2	q_3
q_2	q_1	q_3
* q_3	q_2	q_1

3. Consider the language $L = \{w\bar{w} \mid w \in \{0,1\}^*$ and $\bar{w}$ is w with all the bits toggled$\}$. So, for example, $101010 \in L$ where $w = 101$ and $\bar{w} = 010$. Use the pumping lemma to prove that L is not regular.

4. Consider the language $L = \{1^p \mid p$ is a prime number$\}$. Use the pumping lemma to prove that L is not regular.

5. Use the pumping lemma and one of the closure properties listed below to show that the language $L = \{w \mid w \in \{0,1\}^*$ is not a palindrome$\}$ is not regular.

   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.