Homework 3
CptS 317, Spring 2020

Due Date: February 14, 2020, In Class.

There will be six problems, each of which is equally weighted.

1. Give English descriptions of the languages represented by the following regular expres-
sions. Descriptions should be as simple as possible, but should avoid merely spelling
out the conditions of the regular expression. As an example, if the regular expression
is 0(0 + 1)*, an answer such as “The language of all binary strings starting with 0”
would be ideal, while “The language of all binary strings where the first symbol is 0
and it is followed by an arbitrary number of 0s or 1s” might receive less points. Both
are technically correct, but the former is easier to comprehend.

a) (0 ∪ 1)*1(0 ∪ 1) ∪ (0 ∪ 1)*1(0 ∪ 1)(0 ∪ 1)

b) (a ∪ b ∪ c)*b(a ∪ b ∪ c)*c(a ∪ b ∪ c)* ∪ (a ∪ b ∪ c)*c(a ∪ b ∪ c)*b(a ∪ b ∪ c)*

2. Convert the following DFA into 2-state GNFAs using the iterative process discussed in
class and in the textbook (i.e. first turn into a 5-state GNFA, then remove one state
at a time). Note: in both cases, q1 is the start state.
3. Let $R$, $S$, and $T$ be any three regular expressions. State true or false for the following. If your answer is false, give a counterexample.

   a) $(\epsilon \cup R)^* S = R^* S$
   b) $(R \cup S)^* S^* = (R^* S)^*$
   c) $S(RS \cup R)^* = (SR \cup R)^* R$

4. Convert the following NFA to a DFA
5. Give regular expressions generating the following languages:

   a) \{w | w \text{ begins with a 1 and ends with a 0}\}
   b) \{w | w \text{ doesn’t contain the substring 110}\}
   c) \{w | w \text{ contains an even number of 0s, or exactly two 1s}\}
   d) All strings except the empty string

6. Use the Pumping Lemma to prove the following languages are not regular:

   a) \{0^m1^n0^m | m, n \geq 0\}
   b) \{w | w \in \{0, 1\}^* \text{ is not a palindrome}\}