1. For each of the following languages, first give an NFA, and then find an equivalent 
regular expression using the method discussed in class. Show the resulting machine 
after each state has been removed. Finally, simplify the resulting regular expression as 
much as possible.

(a) (8 points) $L = \{a, b\}$ that contain the substring bb or end in aa.
(b) (8 points) $L = \{0,1\}$ that do not contain the substring 011

2. For each of the following languages, give a DFA.

(a) (6 points) $L = \{a, b\}$ contain at most one occurrence of the 
substring aa and at most one occurrence of the substring bb. So, bababb, aabb, 
abba, babababaabb $\in L$, while aaa, bbaabb, aabaa $\not\in L$
(b) (6 points) $L = \{0, 1\}$ that represent binary numbers without 
leading zeroes that are evenly divisible by 3. So: 11, 110, 1001, 1100, 1111, 10010 
$\in L$, while 1, 10, 011, 111, 1011 $\not\in L$

3. For each of the following languages, prove that the language is regular, or prove that 
the language is not regular. Recall that you prove a language is regular by creating 
either a DFA, NFA, or regular expression for that language. Careful, some of these are 
tricky ...

(a) (4 points) $L = \{a^n(b + a)^nb^n, n \geq 2\}$
(b) (4 points) $L = \{ww^R : w \in \{a, b\}^*\}$
(c) (4 points) $L = \{wxw^R : w \in \{a, b\}^*, x \in \{a, b\}^*\}$
(d) (4 points) $L = \{a^nbl : n/l is an integer\}$
(e) (4 points) $L = \{a^nbl : n \geq 10, l \leq 10\}$