Cpt S 317 Homework #3

Please print your name!

1. Let L_1 and L_2 be two regular languages. They are specified by the following regular expressions: $L_1 = 0(0 + 11)^*$ and $L_2 = 0^*11^*$.

(1). Draw a DFA accepting L_1.
(2). Draw a DFA accepting L_2.
(3). Draw a DFA accepting $L_1 \cap L_2$.
(4). What is the regular expression for $L_1 \cap L_2$?

2. A natural number can be encoded as a unary string. For instance, 5= the string of *aaaaa*. Therefore, we may treat a set of numbers as a language over a unary alphabet (that contains only one symbol, e.g., a). Write down the regular expression for the following sets of numbers: (1). all the n such that $n \bmod 3 = 1$. (2). all the n such that $n \bmod 3 = 0$ or $n \bmod 4 = 2$.

3. Show that deterministic FAs are closed under complement. That is, for any deterministic FA M, there is a deterministic FA M' such that $L(M') = \Sigma^* - L(M)$, assuming that both M and M' have the same alphabet.

4. According to your proof of Problem 3, draw a deterministic finite automaton that accepts the complement of $(00 + 1)^*$. And also find a regular expression for the language accepted by M'.

5. Let L be a regular language on Σ and $\Sigma' \subset \Sigma$. The result of dropping symbols in Σ' from a word w is denoted by $w^{-\Sigma'}$. For instance, $aaabacba^{-\{b\}}$ is *aaaaca*. Define $L^{-\Sigma'} = \{w^{-\Sigma'} : w \in L\}$. That is, $L^{-\Sigma'}$ is the result of dropping symbols in Σ' from each word in L. Show that if L is a regular language, then $L^{-\Sigma'}$ is also a regular language. (Hint: use structural induction)