Introduction to the Theory of Computation
Homework 3

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Due January, 6th

1. Exercise 1.18(a),(d),(i),(l),(m),(n).
2. Let $\Sigma = \{0, 1\}$. Find a regular expression corresponding to the language L which is recursively defined as follows.
   - $\varepsilon \in L$, or
   - $001x \in L$ if $x \in L$, or
   - $x11 \in L$ if $x \in L$.
3. Give a regular expression corresponding to the language of all strings over $\{\mathtt{a}, \mathtt{b}\}$ that contain no more than one occurrence of the string aaaa. (The string aaaaa should be viewed as containing two occurrences of aaaa.) Your regular expression should not be overly complicated.
4. Exercise 1.19.
5. Prove the following using structural induction. Given an alphabet Σ, for any string $x \in \Sigma^*$, there exists a regular expression R over Σ such that $L(R) = \{x\}$.
6. Prove the following using mathematical induction. Given an alphabet Σ, for any $n \in \mathcal{N}$ and any language $L \subseteq \Sigma^*$, if $|L| = n$, then there exists a regular expression R such that $L(R) = L$. (You should also make use of the previous result.)