HW 1 - Computational Models - Fall 2013

Notation: We denote by $\#_\sigma(w)$ the number of times the word $\sigma \in \Sigma^*$ is a substring in the word $w \in \Sigma^*$.

1. For each of the following languages over $\Sigma = \{0, 1\}$, present a drawing representing a DFA that accepts it:

   (a) Σ^*

   (b) $\{0\}||\{1\}^*$

   (c) $\{\epsilon, 100\}$

   (d) $\{w|\ w \text{ does not contain } '0101'\}$

   (e) $\{w|\ w \text{ contains } '00' \text{ or doesn't contain } '101'\}$

   (f) $\{xy|\ \#_0(x) \bmod 2 = 0 \text{ and } \#_1(y) \bmod 2 = 1\}$

   (g) $\{w|\ |w| \bmod 4 = 0\}$

   (h) $\{w|\ w$ contains exactly three '1's$\}$

   (i) The complement of $((\{1\} \cup \{01\} \cup \{001\})^*||(\epsilon \cup \{0\} \cup \{00\}))$

2. Fix n. Let L_n be the language of words over $\Sigma = \{0, 1\}$ such that the nth character from the end is 0. Present a DFA that accepts L_n. Give a formal description and not a drawing.

3. Given that L is a regular language over some alphabet Σ, prove that $\{xy|\ (x \in L)\ XOR\ (y \in L)\}$ is regular.

4. Is $\{w|\ \#_{01}(w) = \#_{10}(w)\}$ regular? Justify.