Theory of Computation

Fall 2013, Homework # 2

Due: November 11, 2013

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1. (25 pts) Instead of using the pumping lemma, use Myhill-Nerode theorem to show $\{ww \mid w \in \Sigma^*\}$ to be non-regular.

2. (25 pts) Consider the following two languages. Are they regular? Justify your answer.

   - $L_1 = \{\beta\beta^R\gamma \mid \beta \in \{0,1\}^+, \gamma \in \{0,1\}^*\}$
   - $L_2 = \{\beta\gamma\beta^R \mid \beta \in \{0,1\}^+, \gamma \in \{0,1\}^*\}$

   (Here β^R denotes the reversal of β.)

3. (25 pts)

   (a) Let A=$\{1^k y \mid y \in \{0,1\}^*,\ y$ contains *at least* k 1's, for $k \geq 1\}$. Show that A is regular.

   (b) Let B=$\{1^k y \mid y \in \{0,1\}^*,\ y$ contains *at most* k 1's, for $k \geq 1\}$. Show that B is not regular.

4. (25 pts) Given a DFA $M = (Q, \Sigma, \delta, q_0, F)$, define the relation R_M over the set Σ^* to be xR_My iff $\delta(q_0, x) = \delta(q_0, y)$, $x, y, \in \Sigma^*$. Suppose R_M has the following 6 equivalence classes

   (a) $C_1 = (00)^*$,

   (b) $C_2 = (00)^*01$,

   (c) $C_3 = (00)^*0$,

   (d) $C_4 = 0^*100^*$,

   (e) $C_5 = (00)^*1$,

   (f) $C_6 = 0^*10^*1(0+1)^*$.

   And $L(M)$ is the union of C_1, C_2, and C_4. Draw the state transition diagram of M. Explain how the automaton is constructed.