

Handout 2: Problem Set 2

*Instructor: John Hopcroft**Teaching Assistant: Zhengyang Liu, Tao Xiao***Due by Monday, Dec 16th, 4pm.**

Problem 1 Given a fa automation $M = (Q, \Sigma, \delta, q_0, F)$ and homomorphism h specify Q_h, δ_h, q_{0h} and F_h for a fa automation $M_h = (Q_h, \Sigma, \delta_h, q_{0h}, F_h)$ where $L(M_h) = h(L(M))$.

Problem 2 Given $L = (00+1)^*$, $h(a) = 01$, and $h(b) = 10$ what is $h^{-1}(L)$? Prove that your answer is correct.

Problem 3 Let $M = (\{A, B, C, D\}, \{0, 1\}, \delta, A, \{D\})$ where

$$\delta = \begin{array}{c|cc} & 0 & 1 \\ \hline A & C & B \\ B & D & A \\ C & A & D \\ D & B & C \end{array}$$

$L(M)$ is the set of all strings of 0's and 1's with an odd number of 0's and an odd number of 1's. Write an induction hypothesis that you would use to prove this statement.

Problem 4 Use the pumping lemma to prove that the following set are not regular.

1. $\{w \subset w^R \mid w \in (a+b)^*\}$
2. $\{a^i b^j c^k \mid i \geq j \geq k\}$
3. $\{0^i \mid i \text{ is a prime}\}$