

CSE625: Introduction to Formal Languages – Homework 4

Due: May 4th, 2009 (Mon) in class. No late homework is accepted.

Problem 1: [18 pts] Construct an NFA- Λ to recognize each of the following regular expressions. (You don't have to go through the Kleen Theorem construction if you can draw such an NFA- Λ directly.)

(1.1) $(0 + 1)^*(011 + 01010)(0 + 1)^*$

(1.2) $(0 + 1)(01)^*(011)^*$

(1.3) $010^* + 0(01 + 10)^*11$

(1.4) $((ab)^*b + ab^*)^*$

(1.5) $aa(ba)^* + b^*aba^*$

(1.6) $(ab + (aab)^*)(aa + a)$

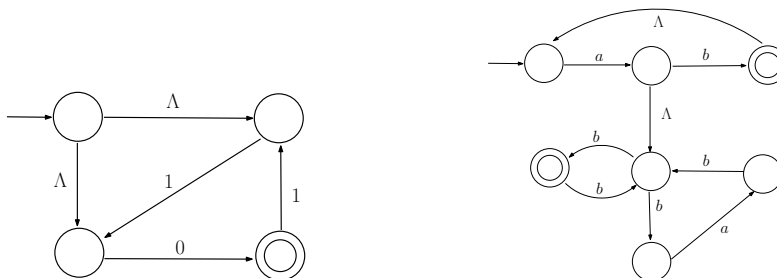


Figure 1: Two NFA- Λ for Problem 2.

Problem 2: [14 pts] Give the regular expression corresponding to the languages accepted by each of the NFA- Λ in Figure 1 (a) and (b).

Problem 3: [40 pts] Prove using the Pumping Lemma that the following languages are not regular.

(2.1) $\{x \in \{0, 1\}^* \mid \text{the middle symbol of } x \text{ is } 0\}$.

(2.2) $\{a^i b^j \mid (i + j) \text{ is a prime}\}$.

(2.3) $\{\omega \in \{a, b, c\}^* \mid \text{the number of } a\text{'s in } \omega \text{ times the number of } b\text{'s in } \omega \text{ equals the number of } c\text{'s in } \omega\}$.

(2.4) $\{\omega \neq \omega^{Rev} \mid \omega \in \{a, b\}^*\}$ (where ω^{Rev} is the reverse of string ω).

(2.5) $\{a^{n^3} \mid \text{integer } n \geq 0\}$.