Introduction to Formal Language

(交大資工系 2014 Spring)

Midterm (A 卷)

(請按順序作答，並列出演算過程)

Time: 13:20 -15:10 4/21/2014

Place: EC122

(11 problems and 110 points in total)

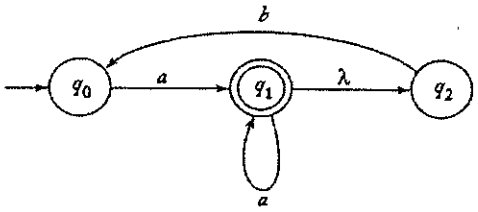
[1] Find dfa's for the following languages on Σ = {a, b}.

(a) L_1 = { abaa, abb, bab, bbab },

(b) L_2 = { w: |w| mod 3=1},

(c) all strings with no more than two a's. (9 points)

[2] Convert the nfa below to an equivalent dfa. (8 points)



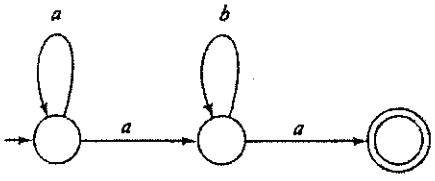
[3] Give regular expressions for the following languages over Σ = {a, b}.

(a) L_3 = { $a^n b^m$, $n \leq 2$, $m \geq 2$ },

(b) L_4 = { $a^n b^m$, (n+m) is odd },

(c) all strings containing an odd number of a's. (9 points)

[4] Find the regular expression for the language accepted by



(8 points)

[5](a) Find a dfa for the language

$$L = \{w \in \{a,b\}^* : n_a(w) \text{ is even and } n_b(w) \text{ is odd}\}.$$

(b) Find a regular grammar for L in (a). (10 points)

[6] Construct right-linear and left-linear grammars for $L_3 = \{ a^n b^m, n \leq 2, m \geq 2 \}$. (8 points)

[7] Given two dfa's M_1 and M_2,

(a) construct an nfa accepting $L(M_1) \cup L(M_2)$; (3 points)

(b) construct an nfa accepting $\overline{L(M_1)}$; (3 points)

(c) construct an nfa accepting $L(M_1) \cap L(M_2)$; and (4 points)

(d) design an algorithm to determine if $L(M_1) = L(M_2)$. (4 points)

(14 points)

[8](a) Show that $L = \{ ww^R : w \in \{a,b\}^* \}$ is not regular. (6 points)

(b) Show that $L = \{a^{n!} : n \geq 1\}$ is not regular. (6 points)

[9]Find context-free grammars for

(a) $L = \{ ww^R : w \in \{a,b\}^* \}$,

(b) $L = \{ a^n b^n : n \geq 1 \}$,

(c) $L = \{ a^n b^m : n \leq m \leq 2n \}$. (12 points)

[10] Convert the grammar

$$S \rightarrow AB|aB,$$
$$A \rightarrow aab|\lambda,$$
$$B \rightarrow bbA$$

into Chomsky normal form. (8 points)

[11]Describe the CKY parsing algorithm for context-free grammars in less than1.5 pages and briefly explain how the complexity $O(|w|^3)$ can be reached in this algorithm. (12 points)