UNIVERSITY OF WESTERN ONTARIO

Computer Science 331a, Fall 2006

Foundations of Computer Science

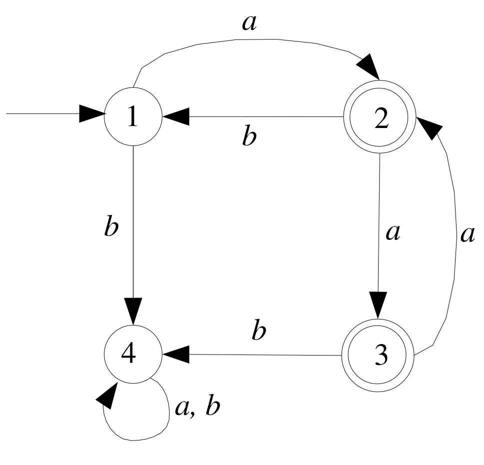
ASSIGNMENT 3

Due date: Tuesday, November 14, 2006

1. Find a context-free grammar that generates the language L where:
a) $L = (10 + 01)^*$
b) $L = \{a^i b^j : i \geq j \geq 0\}$

2. Given the regular grammar $G = (N, \Sigma, P, S)$, where
$N = \{A, B, S\}$
$\Sigma = \{a, b\}$
and the set P contains the productions
$S \longrightarrow abA \mid B \mid baB \mid \epsilon$
$A \longrightarrow bS \mid b$
$B \longrightarrow aS$,
construct an equivalent NFA M such that $L(G) = L(M)$. Trace the transitions of M that lead to the acceptance of the string $abba$ and compare with the derivation of the same string in G.

3. Given the DFA defined by



construct an equivalent regular grammar.

4. Let $L = \{a^{2i+1}b^{3i} \; : \; i \geq 0\}$. Give a context-free grammar G such that $L(G) = L$ and justify (i.e. prove) your answer.

5. Given the context-free grammar G

$$\begin{array}{lcl} S & \longrightarrow & aAa \mid bBb \mid \epsilon \\ A & \longrightarrow & C \mid a \\ B & \longrightarrow & C \mid b \\ C & \longrightarrow & CDE \mid \epsilon \\ D & \longrightarrow & A \mid B \mid ab \end{array}$$

construct a reduced context-free grammar (without non-terminating symbols and without unreachable symbols) equivalent to G.

6. Given the context-free grammar G

$$\begin{array}{lcl} S & \longrightarrow & aSASb \mid Saa \mid AA \\ A & \longrightarrow & caA \mid Ac \mid bca \mid \lambda \end{array}$$

construct a λ-free context-free grammar G' that is λ-equivalent to G.