University of Central Florida
School of Computer Science
COT 4210 Spring 2004

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Homework 5

Due date: March 31

1. Construct an extended PDA for the language given by the following grammar

$$\begin{aligned} S &\rightarrow aBB + bAA \\ A &\rightarrow bAB + a \\ B &\rightarrow aBA + b \end{aligned}$$

2. Consider the language L generated by the following grammar.

$$\begin{aligned} S &\rightarrow AT + BR + \lambda \\ W &\rightarrow AT + BR + a + b \\ T &\rightarrow WA + a \\ R &\rightarrow WB + b \\ A &\rightarrow a \\ B &\rightarrow b \end{aligned}$$

   (a) Find a minimum-length string in L which satisfies the pumping lemma for CFLs.

   (b) Find a non-empty string $u \in L$ such that $u^i \in L$ for all $i \geq 0$.

   (c) Find strings u, v such that $|u| \geq 6$, $v \neq \lambda$, and such that $u^i v \in L$ for all $i \geq 0$.

3. (a) Find L_1, L_2 such that the symmetric difference $L_1 \oplus L_2$ is infinite and $\overline{L_1} \cap \overline{L_2}$ is not context-free.

   (b) Find non-regular CFLs L_1, L_2 such that the symmetric difference $L_1 \oplus L_2$ is infinite and $\overline{L_1} \cap \overline{L_2}$ is context-free.

4. Consider the type of automaton that you obtain by replacing the stack in a PDA by a queue. Let us call this type of machine a FIFO-automaton. For simplicity, assume FIFO-automata accept by accepting state only.

   - Briefly explain how a FIFO automaton can implement "PUSH(X,Q)" (add X to the front of Q), "TAIL(Q)" (read the tail element in Q), and "REMOVE-TAIL(Q)" (remove the tail element in Q).
   - Does there exist a non-context free language L that is accepted by a FIFO-automaton? Justify your answer.