

Regular Expressions, Grammars, Top-down Parsing Homework

September 19, 2013
Due October 1, 2013

1. Which of the following grammars are LL(1)? Explain why.

(a) $S \rightarrow A B c$
 $A \rightarrow a \mid \varepsilon$
 $B \rightarrow b \mid \varepsilon$

(b) $S \rightarrow A b$
 $A \rightarrow a \mid B \mid \varepsilon$
 $B \rightarrow b \mid \varepsilon$

(c) $S \rightarrow A B B A$
 $A \rightarrow a \mid \varepsilon$
 $B \rightarrow b \mid \varepsilon$

(d) $S \rightarrow a S e \mid B$
 $B \rightarrow b B e \mid C$
 $C \rightarrow c C e \mid d$

2. Show the first and follow sets and the LL(1) table for the following grammar.

$$\begin{aligned} \langle \text{expr} \rangle &\rightarrow - \langle \text{expr} \rangle \mid (\langle \text{expr} \rangle) \mid \langle \text{var} \rangle \langle \text{exprtail} \rangle \\ \langle \text{exprtail} \rangle &\rightarrow - \langle \text{expr} \rangle \mid \varepsilon \\ \langle \text{var} \rangle &\rightarrow \text{id} \langle \text{vartail} \rangle \\ \langle \text{vartail} \rangle &\rightarrow (\langle \text{expr} \rangle) \mid \varepsilon \end{aligned}$$

3. Translate the following regular expression into a context-free grammar:

$$(a^*b|a^*)(ab|b)^*$$

4. Construct a DFA that can detect strings generated by the following regular expressions (and no other strings):

- $(a \mid (b c)^* d)^+$
- $(a a \mid b)^* (a \mid b b)^*$
- $((\varepsilon \mid a) b^*)^*$