Regular Expressions, Grammars, Parsing Homework

September 18, 2014
Due October 07, 2014 at beginning of class – no late homeworks accepted

REGULAR EXPRESSIONS

1. For each regular expression below, construct a DFA that can detect strings generated by the regular expressions (and no other strings):

    a. (a | b) * a (a | b) (a | b)
    b. ((0 | 1)* (2 | 3) +) | 0 0 1 1
    c. k (k | d)* (_ (k | d) +) *

2. For each below, write a regular expression that:
    a. Accepts strings consisting only of an even number of 0s and an even number of 1s.
    b. Accepts comments, consisting of a string surrounded by /* and */, without an intervening */, unless it is inside double-quotes (").

TOP DOWN PARSING

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

    (a)   S' → S
            S → aAa | ε
            A → abS | c
    (b)
            S → AB
            A → a | ε
            B → b | ε

    (c)   S → A
            A → Bb Cd
            B → aB | ε
            C → cC | ε

    (d)   S → A S | C D
            A → a | ε
            S → s
            C → c | ε
            D → d | s

4. Show the FIRST and FOLLOW sets and the LL(1) table for the following grammar.

$$S' \rightarrow A$$
$$A \rightarrow kB = e$$
$$B \rightarrow SB \mid \varepsilon$$
$$S \rightarrow [eC] \mid .k$$
$$C \rightarrow eC \mid \varepsilon$$

5. Show the parse using the grammar in exercise 4 for the string
$$k[e] = e$$

BOTTOM UP PARSING

6. Show that this grammar is not LALR(1).

$$S \rightarrow (X \mid E] \mid F)$$
$$X \rightarrow E) \mid F]$$
$$E \rightarrow A$$
$$F \rightarrow A$$
$$A \rightarrow c$$

7. Build the LR(0) DFA for this grammar:

$$S \rightarrow id = A ;$$
$$A \rightarrow id = A \mid E$$
$$E \rightarrow E + P \mid P$$
$$P \rightarrow id \mid (A ; A) \mid (V, V) \mid \{ A, A \} \mid \{ V ; V \}$$
$$V \rightarrow id$$

a. Is this an LR(0) grammar? Give evidence.
b. Is this an SLR(1) grammar? Give evidence.
c. Is this an LR(1) grammar? Give evidence.

8. Consider the following grammar:

$$S \rightarrow A \& B \mid B$$
$$B \rightarrow B \% d \mid C$$
$$C \rightarrow C \wedge \mid a \mid d$$

Construct the LR(1) DFA for the grammar. Is the grammar LR(1)? Justify your answer.