

## Homework 3

**posted Feb. 4, due Feb. 15 at the beginning of the class (no late turn-ins will be accepted).**

**Please put a cover page over the homework. The grade will be written on the second page.**

1 (50 pts) Examine the revised MiniJava grammar posted for Project 2. Find out the nonterminals which have production rules that will make it impossible to generate an LL(k) parser. You can try to feed the grammar to JavaCC to get some initial ideas. However, to clearly understand why some production rules are rejected, you need to approach this problem by taking the following steps.

- 1.1 If a nonterminal has two or more production rules, decide whether there exist a  $k$ , such that their FIRST( $k$ ) sets do not overlap.
- 1.2 If a nonterminal has one or more nullable production rule(s), find out whether there exist a  $k$ , such that their FOLLOW( $k$ ) sets do not overlap each other and also do not overlap with any FIRST( $k$ ) sets for the nonterminal.
- 1.3 If a production rule has Kleene closures or optional phrases, check to see there exist a  $k$ , such that the FIRST( $k$ ) sets of such Kleene closures or optional phrases will be sufficient to determine whether to skip them in the production rule.

If a nonterminal passes all tests from 1.1 to 1.3, then we know that nonterminal do not have offending production rules that need to be modified.

**For this homework, please list only those nonterminals which do not pass the tests and explain why they do not.**

For project two, you will need to modify the offending production rules found above, but you do not need to present the corrected production rules for this homework.

2 (20 pts). Exercise 3.6 in the textbook.

3 (10 pts). Exercise 3.7 (a) and (b) in the textbook. [Question 3.7(b) checks to see if you can extend the techniques discussed in the class to compute FIRST set to look at two tokens instead of one.

4 (20) Give bottom-up parses for the following input strings and grammars:

- a) The input 000111 according to the grammar of  $S \rightarrow 0 S 1 \mid 0 1$ .
- b) The input  $aaa * a + +$  according to the grammar of  $S \rightarrow S S + \mid S S * \mid a$ .

5 (10) Exercise 3.5 in textbook.