

This assignment is due in class Thursday 2007-09-20 at 14:30.

1. (a) Given the grammar shown in Figure 1 find two distinct derivations for

```

if 3<x then
  if 5>y
  then x := 2 ;
  else y := 4 ;

```

Show your derivation trees. (Assume that “3<x” and “5>y” match an unspecified rule for *cond*, and that similarly “x” and “y” satisfy a lexical or grammar rule for *variable* and that “2” and “4” satisfy a lexical or grammar rule for *value*.)

- (b) Show that the grammar given in Figure 2 only admits one derivation under the same kind of assumptions.
 - (c) Give a grammar that only admits the “other derivation” allowed by that shown in Figure 2.
2. A pseudo-MAPLE grammar for if-statements is sketched in Figure 3. Is there any ambiguity possible with respect to matching else’s or elif’s here?
3. Try to determine the grammar of MAPLE expressions that use only +, -, *, /, mod, ^, variables, and ()-parentheses.

Express this grammar as precisely as possible, preferably using just BNF, but possibly with additional disambiguation or precedence rules. Be sure that your grammar disallows expressions that MAPLE disallows, such as “x^{-y}”.

You can assume that someone else has defined what variables are.

Beware! `u + a*b mod c*d + v` parses as

$$((u + (a*b)) \text{ mod } (c*d)) + v$$

which may not be what you expect, but is MAPLE’s best approximation of mathematician’s habits.

Figure 1: Grammar 1

$if_stat \rightarrow if\ cond\ then\ stat\ else\ stat$
 $\quad \quad \quad | \quad if\ cond\ then\ stat$
 $stat \rightarrow assignment_stat \quad | \quad if_stat$
 $assignment_stat \rightarrow variable := value ;$

Figure 2: Grammar 2

$bal_if_stat \rightarrow if\ cond\ then\ bal_stat\ else\ bal_stat$
 $if_stat \rightarrow if\ cond\ then\ bal_stat\ else\ stat$
 $\quad \quad \quad | \quad if\ cond\ then\ stat$
 $bal_stat \rightarrow assignment_stat \quad | \quad bal_if_stat$
 $stat \rightarrow assignment_stat \quad | \quad if_stat$
 $assignment_stat \rightarrow variable := value ;$

Figure 3: MAPLE-like if-Grammar

$cond \rightarrow \dots$
 $stat \rightarrow if_stat \quad | \quad \dots$
 $else_clause_opt \rightarrow else\ stat \quad | \quad \epsilon$
 $elif_clause \rightarrow elif\ cond\ then\ stat$
 $elif_clauses \rightarrow elif_clauses\ elif_clause \quad | \quad \epsilon$
 $if_stat \rightarrow if\ cond\ then\ stat$
 $\quad \quad \quad elif_clauses$
 $\quad \quad \quad else_clause_opt$
 $\quad \quad \quad endif$
