

## Homework Assignment #2

### Note

This assignment is due 2:10PM Wednesday, October 3, 2012. Please write or type your answers on A4 (or similar size) paper. Drop your homework by the due time in Yih-Kuen Tsay's mail box on the first floor of Management College Building 2. Late submission will be penalized by 20% for each working day overdue. You may discuss the problems with others, but copying answers is strictly forbidden.

### Problems

There are five problems in this assignment, each accounting for 20 points.

1. The following grammar in EBNF is motivated by declarations in C:

$$\begin{aligned}
 \langle \text{declaration} \rangle &::= \langle \text{type} \rangle \langle \text{declarator} \rangle ';' \\
 \langle \text{type} \rangle &::= \mathbf{int} \mid \mathbf{char} \\
 \langle \text{declarator} \rangle &::= '*' \langle \text{declarator} \rangle \\
 &\mid \langle \text{declarator} \rangle '[' \mathbf{number} ']' \\
 &\mid \langle \text{declarator} \rangle '(' \langle \text{type} \rangle ')' \\
 &\mid '(' \langle \text{declarator} \rangle ')' \\
 &\mid \mathbf{name}
 \end{aligned}$$

Show that the grammar is ambiguous.

2. Rewrite the grammar in Problem 1 so that the new grammar is unambiguous and still generates the same declarations.
3. The dangling-else ambiguity arises if a grammar has the following two productions:

$$\begin{aligned}
 S &::= \mathbf{if} E \mathbf{then} S \\
 S &::= \mathbf{if} E \mathbf{then} S \mathbf{else} S
 \end{aligned}$$

Write an unambiguous grammar that generates the same conditionals and matches an **else** with the nearest unmatched **if**.

4. The grammar below generates numbers in the binary notation.

$$\begin{aligned}
 C &::= C 0 \mid A 1 \mid 0 \\
 A &::= B 0 \mid C 1 \mid 1 \\
 B &::= A 0 \mid B 1
 \end{aligned}$$

Show that the generated numbers are all multiples of 3 (i.e., divisible by 3).

5. Show that all multiples of 3 are generated by the grammar in Problem 4.