

## 2007 Paper 4 Question 4

### Compiler Construction

- (a) Lexical analysis is an important first step in compilation.
- (i) Define in detail the abstract “lexing problem” that is solved by a lexical analyser. [4 marks]
  - (ii) Describe in detail how a lexical analyser can be automatically constructed from a list of regular expressions. [2 marks]
- (b) Explain why LL(1) parsing is associated with left-most derivations of parse trees. [6 marks]
- (c) Context-free grammars and ambiguity.
- (i) Define when a context-free grammar is *ambiguous*. [2 marks]
  - (ii) A *left-recursive* context-free grammar production has the form  $A \rightarrow A\alpha$ . In the same way, a *right-recursive* production has the form  $B \rightarrow \beta B$ . (Both  $\alpha$  and  $\beta$  are assumed to be non-empty sequences.) Suppose we have a grammar that contains both a left- and a right-recursive production for the same non-terminal, such as  $A \rightarrow A\alpha$  and  $A \rightarrow \beta A$ . Is such a grammar always ambiguous? [6 marks]