2007 Paper 11 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 α and β 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]