# 1996 Paper 3 Question 4

## Compiler Construction

Describe what is meant by a *phrase structured grammar* and a *context free grammar*. [3 marks]

Describe an algorithm to calculate the set $L_T(P)$ of all terminal symbols that can start a string derived from the non-terminal $P$ using one or more productions of a given context free grammar. Illustrate your answer by calculating $L_T$ sets for the following grammar:

`S -> U V`

`V -> + U V |` $\epsilon$

`U -> X W`

`W -> * X W |` $\epsilon$

`X -> ( S ) | n` [6 marks]

Describe an algorithm to calculate the set `FOLLOW(P)` of terminal and non-terminal symbols for a given context free grammar, where

`FOLLOW(P) = { X | S` $\stackrel{*}{\Rightarrow}$ `... P X ... }`

i.e. all symbols that can follow `P` in a sentential form derived from the sentence symbol `S`. Illustrate your answer by calculating the `FOLLOW` sets for the grammar given above. [6 marks]

Outline possible ways in which the space used by the Action and Goto matrices of an SLR(1) parser can be reduced. [5 marks]