

# 1998 Paper 10 Question 1

## Compiler Construction

Give *short* answers for each of the following.

- (a) Give a program which has a different result when interpreted using dynamic scoping from that using static scoping.
- (b) Give a program (using `let` to declare variables) which runs with no run-time type errors under dynamic typing but is invalid in a static typing regime such as that of Java or C.
- (c) Compared with `int v[8]`, why might the declaration `int v[e]` cause less efficient code to be compiled if  $e$  is not a constant expression, or even if  $e$  is a large constant?
- (d) Give two context-free grammars which accept the same strings with one being ambiguous and one non-ambiguous.
- (e) Give a data-structure type declaration in a language of your choice which might be useful to represent parse trees for the following grammar:

$$\begin{aligned} E &\rightarrow E + T \mid E - T \mid T \\ T &\rightarrow P \wedge T \mid P \\ P &\rightarrow ( E ) \mid n \end{aligned}$$

Here  $E$  is the start symbol and  $n$  is a terminal symbol representing the result of lexing an integer constant.

[4 marks each]