

2001 Paper 4 Question 4

Compiler Construction

Consider the following grammar giving the concrete syntax of a language:

$$\begin{aligned} E &\rightarrow id \\ C &\rightarrow E = E; \\ C &\rightarrow \{B\} \\ C &\rightarrow C \text{ repeatwhile } E \\ C &\rightarrow \text{if } E \text{ then } C \\ C &\rightarrow \text{if } E \text{ then } C \text{ else } C \\ B &\rightarrow B C \\ B &\rightarrow C \\ S &\rightarrow C \text{ eof} \end{aligned}$$

where C **repeatwhile** E has the same meaning as **do** C **while** E in C or Java.

- (a) List the terminals and non-terminals of this grammar and explain the significance of S . [3 marks]
- (b) Identify any ambiguities in the above grammar and rewrite it to remove them, ensuring that your new grammar generates exactly the same set of strings. [4 marks]
- (c) Specify a suitable abstract syntax, for example by giving a type declaration in a programming language of your choice, which might be used to hold parse trees for this language. [3 marks]
- (d) Give *either* a recursive descent parser *or* a characteristic finite state machine (e.g. for SLR(1)) with associated parser for your grammar. Your parser need not return a parse tree—it suffices for your parser either to accept or to reject the input string. [10 marks]