COMPUTER SCIENCE TRIPOS Part IB – 2022 – Paper 4

1   Compiler Construction (tgg22)

This question concerns constructing $LL(1)$ parsers from context-free grammars.

(a) Suppose we have a grammar that contains these productions.

$$
\begin{aligned}
S &\rightarrow \text{if } E \text{ then } S \text{ else } S \text{ end} \\
S &\rightarrow \text{if } E \text{ then } S \text{ end}
\end{aligned}
$$

Note that these productions have a shared initial segment. Explain how this prevents us from automatically generating an $LL(1)$ parser directly from this grammar.   [2 marks]

(b) Rewrite the productions from Part (a) so that they could be suitable as input to an $LL(1)$ parser generator.   [4 marks]

(c) Eliminate the shared initial segments from these grammar productions.

$$
\begin{aligned}
A &\rightarrow aAbCeDg \\
A &\rightarrow aAbCd \\
B &\rightarrow eDgEf
\end{aligned}
$$

[5 marks]

(d) Give a general method for eliminating shared initial segments from a grammar.   [5 marks]

(e) Argue carefully that the grammar produced by your method generates the same language as the original grammar.   [4 marks]