

COMPUTER SCIENCE TRIPOS Part IB – 2024 – Paper 4

1 Compiler Construction (jdy22)

Here are two grammars for languages built from terminals **a** and **b**:

Grammar A:

$$\begin{aligned} S &\rightarrow C \ a \ C \ b \ A \\ A &\rightarrow B \\ A &\rightarrow S \\ B &\rightarrow \epsilon \\ B &\rightarrow b \\ C &\rightarrow \epsilon \end{aligned}$$

Grammar B:

$$\begin{aligned} S &\rightarrow A \ b \\ A &\rightarrow \epsilon \\ A &\rightarrow A \ a \ b \end{aligned}$$

In both grammars **S** is the start symbol.

(a) The languages $L(A)$ and $L(B)$ for grammars A and B are not equal.

(i) Give an example of a string that is in $L(A)$ but not in $L(B)$.

(ii) Give an example of a string that is in $L(B)$ but not in $L(A)$.

[2 marks]

(b) Give regular expressions describing each of $L(A)$ and $L(B)$.

[4 marks]

(c) Compute NULLABLE, FIRST sets and FOLLOW sets for each grammar.

[6 marks]

(d) State with justification whether each grammar is LL(1) and whether it is SLR(1).

[8 marks]