

1. Consider the context-free grammar

$$S \rightarrow SS + \mid SS * \mid a$$

- (a) Show that the string $aa + a*$ can be generated by this grammar.
- (b) Construct a parse tree for this string.
- (c) What language does this grammar generate? Justify your answer.

2. Which of the following grammars are ambiguous?

- (a) $S \rightarrow 0S1 \mid 01$
- (b) $S \rightarrow +SS \mid -SS \mid a$
- (c) $S \rightarrow S(S)S \mid \epsilon$
- (d) $S \rightarrow aSbS \mid bSaS \mid \epsilon$
- (e) $S \rightarrow a \mid S + S \mid SS \mid S^* \mid (S)$

3. Check whether the following grammars are perfect for LL(1), LR(0), SLR(1) parsers or not:

- (a) $S \rightarrow dA \mid aB$
 $A \rightarrow bA \mid c$
 $B \rightarrow bB \mid c$
- (b) $S \rightarrow A \mid a$
 $A \rightarrow a$
- (c) $S \rightarrow (L) \mid a$
 $L \rightarrow L, S \mid S$
- (d) $S \rightarrow AaAb \mid BbBa$
 $A \rightarrow \epsilon$
 $B \rightarrow \epsilon$
- (e) $S \rightarrow Aa \mid bAc \mid dc \mid bda$
 $A \rightarrow d$
- (f) $S \rightarrow L = R \mid R$
 $R \rightarrow L$
 $L \rightarrow *R \mid a$
- (g) $S \rightarrow Aa \mid bAc \mid Bc \mid bBa$
 $A \rightarrow d$
 $B \rightarrow d$