Complier Homework 5

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exercise 4.2.1

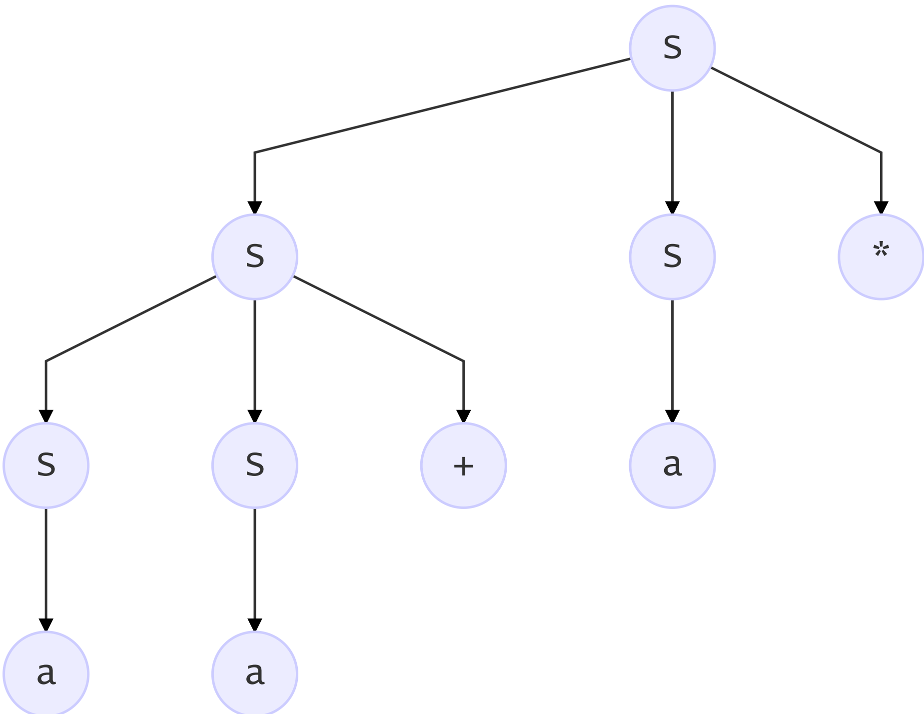
Problem

Consider th context-free grammar: $S \rightarrow SS + |SS * |a$ and the string $aa + a*$

- b) Give a right most derivation for the string.
- c) Give a parse tree for the string.
- d) Is the grammar ambiguous or unambiguous? Justify your answer.

Answer

- **b) most derivation**
  $S \Rightarrow SS* \Rightarrow Sa* \Rightarrow SS + a* \Rightarrow Sa + a* \Rightarrow aa + a*$
- **c) parse tree**



- **d)** This grammar is unambiguous. Because excapt $S \rightarrow a$, only two grammar shoule be use on the sparse tree, $S \rightarrow SS+$ once, and $S \rightarrow SS*$ once. Since * is the right most character, $S \rightarrow SS*$ should be use first, it should be on higher layer of the tree. So we can only construct one kind of sparse tree, and this grammar is unambiguous.

exercise 4.4.1

Problem

For the following grammars, devise predictive parsers and show the parsing tables. (You may use left-factor and/or eliminate left-recursion from your grammars first).

- b) grammars : $S \rightarrow +SS | * SS | a$
- c) grammars : $S \rightarrow S(S)S | \varepsilon$
- d) grammars : $S \rightarrow S + S | SS | (S) | S * | a$

Answer

- **b)**

no left-factor
no left-recursion.
parsing tables

non-terminal	+	*	a	$
S	$S \rightarrow +SS$	$S \rightarrow +SS$	$S \rightarrow +SS$	

- **c)**

no left-factor
eliminate left-recursion

> $S \rightarrow A | \varepsilon$
> $A \rightarrow (S)SA$
> **parsing tables**
>
> | non-terminal | (|) | $ |
> |---|---|---|---|
> | S | $S \rightarrow A$ | | $S \rightarrow A$ |
> | A | $A \rightarrow (S)SA$ | | $A \rightarrow \varepsilon$ |

- **d)**
  eliminate left-factor

> $S \rightarrow SA | (S) | a$
> $A \rightarrow +S | S | *$

eliminate left-recursion

> $S \rightarrow (S)S' | aS'$
> $A \rightarrow +S | S | *$
> $S' \rightarrow AS | \varepsilon$

parsing tables

non-terminal	(	)	a	*	+	$
S	$S \rightarrow (S)S'$		$S \rightarrow aS'$			
A	$A \rightarrow S$		$A \rightarrow S$	$A \rightarrow *$	$A \rightarrow +S$	
S'	$S' \rightarrow AS$		$S' \rightarrow AS$	$S' \rightarrow AS$	$S' \rightarrow AS$	$S' \rightarrow \varepsilon$