

# Context Free Grammar Exercises

**Exercise 4.2.1:** Consider the context-free grammar:

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

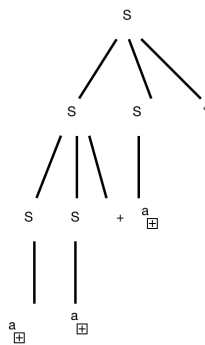
and the string  $aa+a*$ .

- Give a leftmost derivation for the string.
- Give a rightmost derivation for the string.
- Give a parse tree for the string.

1.-  $S(\text{leftmost})=SS^* \rightarrow SS+S^* \rightarrow aS+S^* \rightarrow aa+S^* \rightarrow aa+a^*$

2.-  $S(\text{rightmost})=SS^* \rightarrow Sa^* \rightarrow SS+a^* \rightarrow Sa+a^* \rightarrow aa+a^*$

3.-



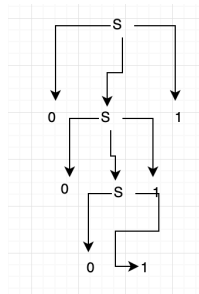
## 4.2.2

a)  $S \rightarrow 0S1 \mid 01$  with string 000111.

b)  $S \rightarrow +SS \mid *SS \mid a$  with string  $+*aaa$ .

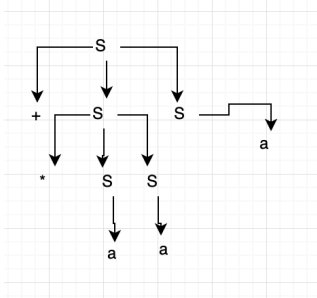
a)

- $S(\text{leftmost}) \rightarrow 0S1 \rightarrow 00S11 \rightarrow 000111$
- $S(\text{rightmost}) \rightarrow 0S1 \rightarrow 00S11 \rightarrow 000111$



b)

- 1.-S(leftmost)  $\rightarrow$  +SS $\rightarrow$ +\*SSS $\rightarrow$ +\*aSS $\rightarrow$ +\*aaS $\rightarrow$ +\*aaa
- 2.- S(rightmost) $\rightarrow$ +SS $\rightarrow$ +Sa $\rightarrow$ +\*SSa $\rightarrow$ +\*Saa $\rightarrow$ +\*aaa



#### 4.2.3

a)S  $\rightarrow$  (01+)\*