

Exercise 1.

- Consider the following context-free grammar:

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

- Give a leftmost derivation of the string $aa+a^*$
- Give a rightmost derivation of the chain $aa+a^*$
- Give a parse tree (derivation tree) of the chain $aa+a^*$
- Describe the language generated by this grammar.

Exercise 2.

- Describe the language generated by the following grammars:

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

b) $S \rightarrow S(S)S \mid \varepsilon$

c) $S \rightarrow x \mid y \mid z \mid S+S \mid S-S \mid S*S \mid S/S \mid (S)$

Exercise 3.

- Consider the grammar $G = \langle N, T, P, S \rangle$ with productions::

P:

<Instruction> \rightarrow if <Condition> then <Instruction> else <Instruction>

| if <Condition> then <Instruction>

| begin end

| i

<Condition> \rightarrow c

** \rightarrow ; i | i**

- Show that the grammar G is ambiguous by giving two different parse trees for the program fragment:

if c then if c then i else i

- How can we perform a *deterministic* syntactic analysis (parsing) for this kind of conditional instruction (the if statements)?

Exercise 4.

- Let the grammar $G = \langle \{ A, B, C \}, \{ a, b \}, P, A \rangle$ be defined as follows:

$$A \rightarrow aB$$

$$B \rightarrow bC$$

$$C \rightarrow aC \mid bC \mid \varepsilon$$

- Give the leftmost derivation of the string: **abbbaab**
- Give the rightmost derivation of the string: **abbbaab**
- Describe the **language generated** by the grammar.