

Leftmost derivation : always replace the leftmost variable $\Rightarrow L_1, \overset{*}{\underset{*}{\uparrow}}$
Rightmost : always replace the rightmost variable $\Rightarrow m, \overset{*}{\underset{*}{\uparrow}}$

Prop: $A \xRightarrow{*} w$ iff $A \xRightarrow{*} w$ iff $A \xRightarrow{*} w$

Parse Trees

(i) Each interior node is labelled by a variable in V
 (ii) Each leaf is labelled by a variable, a terminal
 or ϵ . If a leaf is labelled by ϵ then it must
 be the only child of its parent.

yield of a parse tree: the string obtained by concatenating the labels of the leaves from left to right

$$\text{Ex } S \rightarrow \varepsilon \mid 0 \mid 1 \mid 0S0 \mid 1S1$$

Yield: 0.11g

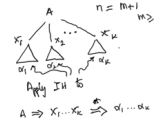


(\Rightarrow) By induction on the no. of steps of the derivation
 $A \Rightarrow d$.

$n = 1$

A

x_1, x_2, \dots, x_K



1. $A \xRightarrow{*} w$
2. $A \xRightarrow{*} w$
3. $A \xRightarrow{*} w$
4. There is a parse tree with root A and yield w .

Convention $\alpha, \beta, \gamma \in (V \cup T)^*$ $a, b, c, 0, 1, 2, \dots \in T$
 $A, B, C, S, \dots \in V$

Ambiguity

$$\begin{array}{c}
 E \\
 \swarrow \quad \searrow \\
 E \quad + \quad E \\
 | \quad \quad | \quad \swarrow \quad \searrow \\
 a \quad \quad E \quad + \quad E \\
 \quad \quad | \quad \quad | \quad \swarrow \quad \searrow \\
 \quad \quad b \quad \quad a \quad \quad E \quad + \quad E \\
 \quad \quad \quad \quad | \quad \quad | \\
 \quad \quad \quad \quad a \quad \quad b
 \end{array}$$

Alternatively: ... if there are two different leftmost derivations ...

Removing Ambiguity for arithmetic expressions CFG

Parse tree for $a + b * a$

