Context Free Grammars

A context free grammar (CFG) is a finite set of production rules over:

An alphabet Σ of "terminal symbols"

A finite set V of "nonterminal symbols"

A start symbol (one of the elements of V) usually denoted S.

A production rule for a nonterminal $A \in V$ takes the form

$A \to w_1 | w_2 | \cdots | w_k$

Where each $w_i \in (V \cup \Sigma)^*$ is a string of nonterminals and terminals.

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Examples

$S \to 0S0|1S1|0|1|\varepsilon$

$S \to 0S|S1|\varepsilon$

$S \to (S)|SS|\varepsilon$

The alphabet here is {(,)} i.e. parentheses are the characters.

$S \to AB$

$A \to 0A1|\varepsilon$

$B \to 1B0|\varepsilon$

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Arithmetic

$E \rightarrow E + E|E * E|(E)|x|y|z|0|1|2|3|4|5|6|7|8|9$

Generate $(2 * x) + y$

Generate $2 + 3 * 4$ in two different ways

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Parse Trees—remember where parentheses go

Suppose a context free grammar G generates a string x

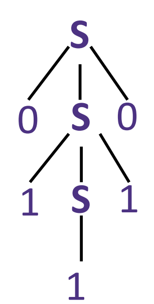
A parse tree of x for G has

Rooted at S (start symbol)

Children of every A node are labeled with the characters of w for some $A \rightarrow w$

Reading the leaves from left to right gives x.

$S \rightarrow 0S0|1S1|0|1|\varepsilon$



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