

COMP4403 Crib Sheet

Parsing Theory

Context Free Grammars

Basic Example of Context Free Grammar

$E \rightarrow E Op E$

$E \rightarrow "(E)"$

$E \rightarrow number$

$Op \rightarrow "+"$

$Op \rightarrow "-"$

$Op \rightarrow "*"$

Has start symbol E , nonterminals $\{E, Op\}$, and terminals

$\{ \text{"(", ")", "number", "+", "-", "*"} \}$

A context-free grammar consists of:

- A finite set, Σ , of terminal symbols.

- A finite nonempty set of nonterminal symbols (disjoint from the terminal symbols).

- A finite nonempty set of productions of the form of $A \rightarrow \alpha$, where A is a nonterminal symbol, and α is a possibly empty sequence of symbols, each of which is either a terminal or nonterminal symbol.

- A start symbol that must be a nonterminal symbol

Directly Derives

If there is a production in the form of $N \rightarrow \gamma$ then we can directly derive $\alpha N \beta \rightarrow \alpha \gamma \beta$, where α and β are

possibly empty sequences of terminal and nonterminal symbols.

Derives

Given a sequence of terminal and nonterminal symbols, α , derives a sequence β , written $\alpha \Rightarrow^* \beta$ if there is a finite sequence of zero or more direct derivation steps that start from α and finishing with β , there must be one or more sequence $\gamma_1, \gamma_2, \dots, \gamma_n$ such that $\alpha = \gamma_0 \Rightarrow \gamma_1 \Rightarrow \dots \Rightarrow \gamma_n = \beta$. Note that zero steps are allowed.

Nullable

A possibly empty sequence of symbols, α , is nullable if $\alpha \Rightarrow^* \epsilon$ or $\alpha \Rightarrow^*$ Nullable rules

- *is nullable*

- any terminal symbol is not nullable

- a sequence of symbols is nullable if all of its constructs are nullable

- a set of alternatives is nullable if any of its constructs are nullable

- EBNF constructs for optionals and repetitions are nullable

- a nonterminal is nullable if there is a production with a nullable right-hand side