

G52MAL

Machines and Their Languages

Lecture 10

The Language of a CFG

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Simple Arithmetic Expressions

$SAE = (N = \{E, I, D\}, T = \{+, *, (,), 0, 1, \dots, 9\}, P, E)$
where P is given by:

$$\begin{array}{l} E \rightarrow E + E \\ \quad | \quad E * E \\ \quad | \quad (E) \\ \quad | \quad I \end{array}$$

$$I \rightarrow DI \mid D$$

$$D \rightarrow 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9$$

Note: $A \rightarrow \alpha \mid \beta$ shorthand for $A \rightarrow \alpha, A \rightarrow \beta$.

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Recap: Definition of CFG

A CFG $G = (N, T, P, S)$ where

- N is a finite set of **nonterminals** (or **variables** or **syntactic categories**)
- T is a finite set of **terminals**
- $N \cap T = \emptyset$ (disjoint)
- P is a finite set of **productions** of the form $A \rightarrow \alpha$ where $A \in N$ and $\alpha \in (N \cup T)^*$
- $S \in N$ is the **start symbol**

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Another Example: Java

The syntax of programming languages is invariably specified by CFGs.

Example: The Java Language Specification, Third Edition. Section 14.5, page 368 gives a CFG for Java statements.

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