G52MAL
Machines and Their Languages
Lecture 10
The Language of a CFG

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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**
Simple Arithmetic Expressions

\[ SAE = (N = \{ E, I, D \}, T = \{ +, \ast, (,), 0, 1 \}, P, E) \]

where \( P \) is given by:

\[
\begin{align*}
E & \rightarrow E + E \\
& \quad | \quad E \ast E \\
& \quad | \quad (E) \\
& \quad | \quad I \\
I & \rightarrow DI \mid D \\
D & \rightarrow 0 \mid 1
\end{align*}
\]

Note: \( A \rightarrow \alpha | \beta \) shorthand for \( A \rightarrow \alpha, A \rightarrow \beta \).
Another Example: Java

The syntax of programming languages is invariably specified by CFGs.