# 7 Context Free Grammars

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Why? Because RegEx cannot specify a whole programming language.

([]<{¿?}>) BEGIN ... END)

We need another solution to the specification problem.

- GRAMMARS:

$G = \langle N, T, S, P \rangle$

N set of non-terminal symbols
T set of terminal symbols $\Sigma$

$N \cap T = \emptyset$ : N and T are disjoint

$S \in N$ the "start" non-terminal

P a set of "production rules"
rules of the form

$A \to \alpha$ where $A \in N$

$\alpha \in (N \cup T)^*$

i.e. $\alpha$ is a string of terminals and non-terminals

Note $\alpha$ could be the empty string

- In a production rule $A \to \alpha$, A is the head, $\alpha$ is the body
- Shorthand:

$A \to \alpha_1$
$A \to \alpha_2$
$A \to \alpha_3$

$A \to \alpha_1 \mid \alpha_2 \mid \alpha_3$

E.G. A "synthetic" example.

$N: \{A, B, D\}$
$T: \{n, s, d, k, a\}$
$S: B$

$P: \begin{cases} A \to Asd \\ A \to DadB \\ B \to nABkD \\ D \to kn \\ D \to d \end{cases}$

- Intuition:
  Production rules are rules to rewrite strings.

e.g. $nAsBdD \xrightarrow{A \to DadB} nDadBsBdD \xrightarrow{D \to d} nDadBsBdd$

DEFINITIONS:
sentence .- a string of terminals & non terminals