Parsing Expression Grammars

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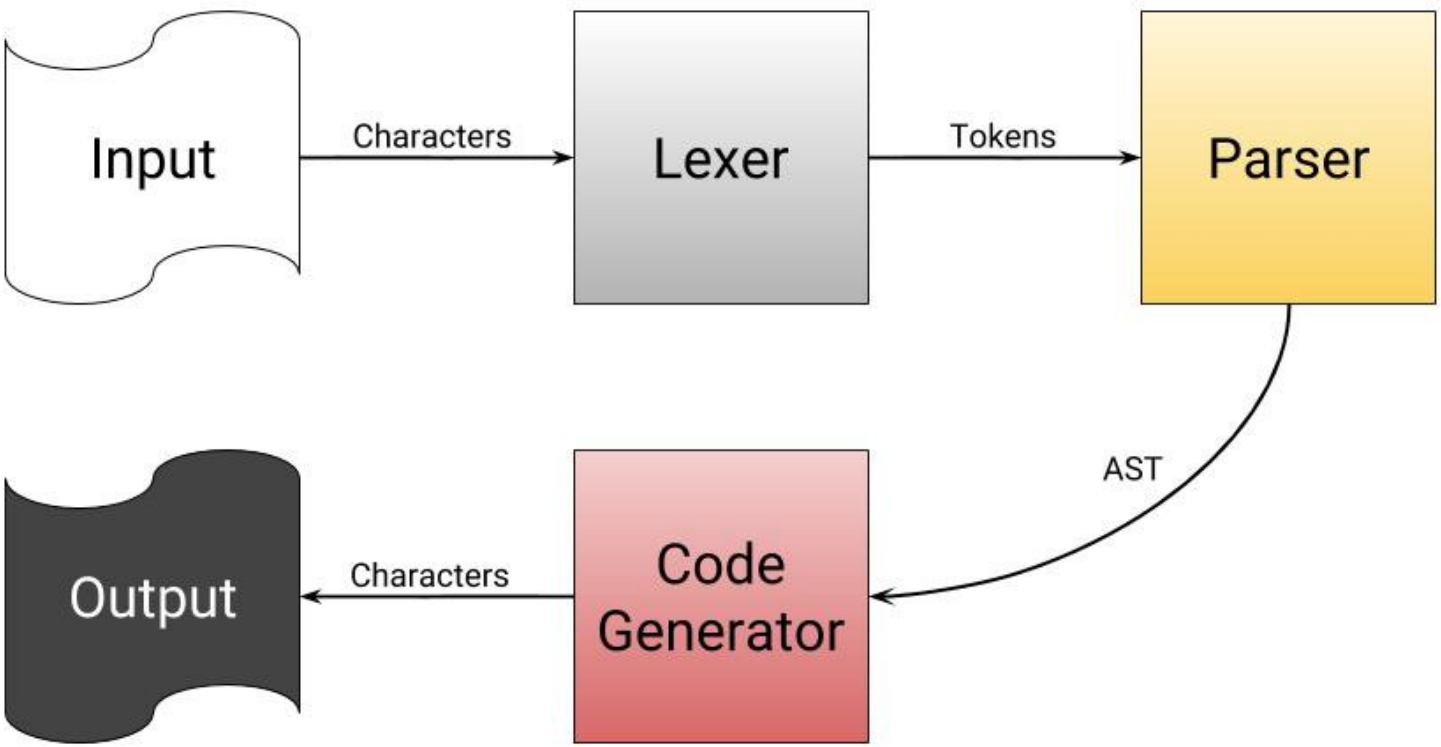
Anno Accademico 2020-21

January 9, 2021

Parsing

What's a parser?

Part of the compiler. Checks the stream of tokens produced by the *lexer* for syntactical errors and produces an IR representation (usually an abstract syntax tree) of the source that is used in later steps to generate machine code.



Context free grammars

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Syntax described by a **Context Free Grammar**.

CFG: definition

Context free grammar defined as:

$$\mathbf{G = (V, \Sigma, P, S)}$$

- V = variables
- Σ = terminals
- P = productions (or rules)
- S = start variables

Productions are in the form A $\rightarrow \alpha$, where A$\in$ V, $\alpha \in (V \cup \Sigma)$

S $\Rightarrow$ A | bb

A $\Rightarrow$ B | b

B $\Rightarrow$ S | a

Given the rules of grammar G, we want to find a sequence of productions that generates a target expression (**derivation**).

Parsing is the process of discovering such sequence.

$S \rightarrow \gamma_1 \rightarrow \gamma_2 \rightarrow \cdots \rightarrow \gamma_n \rightarrow \textit{expression}$

Leftmost derivation: at each step expand the leftmost non-terminal symbol

Rightmost derivation: at each step expand the rightmost non-terminal symbol

1	*Expr*	→	*Expr* + *Term*
2		|	*Expr* - *Term*
3		|	*Term*
4	*Term*	→	*Term* × *Factor*
5		|	*Term* ÷ *Factor*
6		|	*Factor*
7	*Factor*	→	(*Expr*)
8		|	num
9		|	ident

Figure: classic grammar for arithmetic expressions

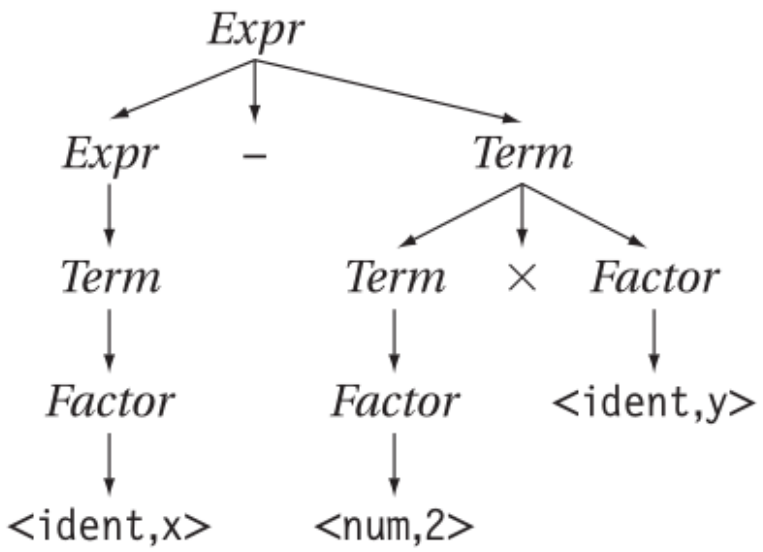

Figure: parse tree for the expression x-2*y

Formal definiton of PEG

A concrete example: *pgen*