Lexical and Syntax Analysis

(of Programming Languages)

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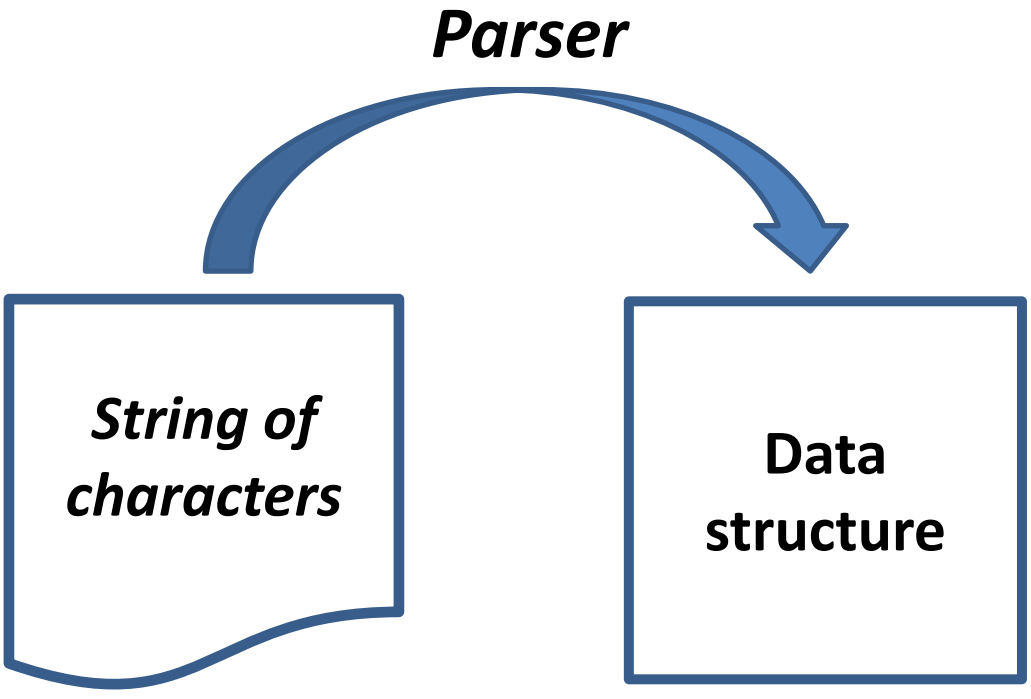
What is Parsing?



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*Easy for **programs** to **process***

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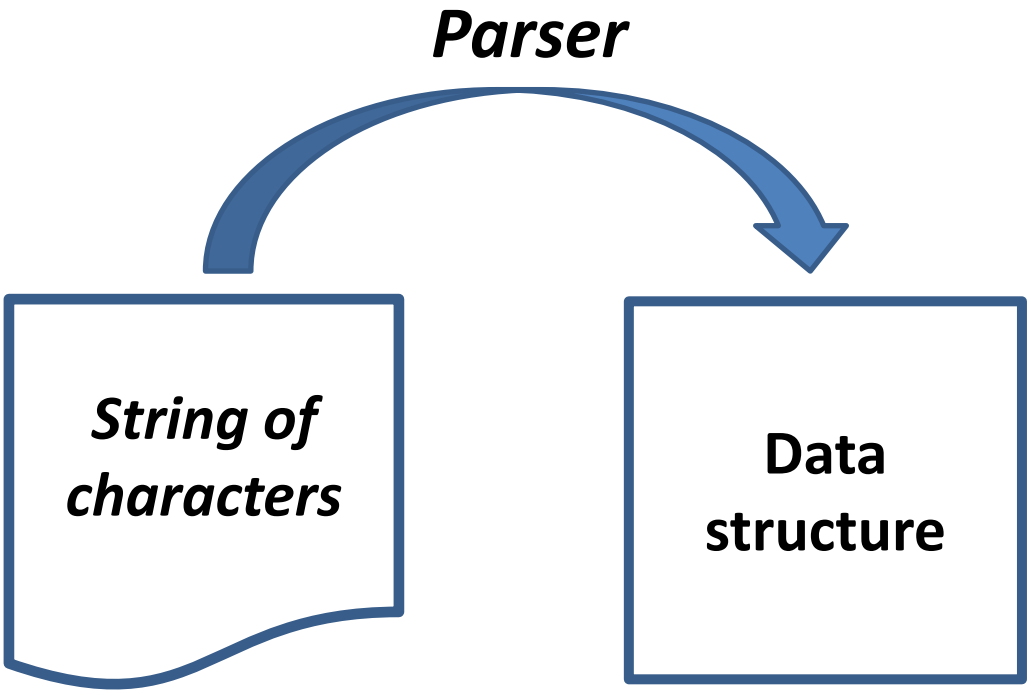

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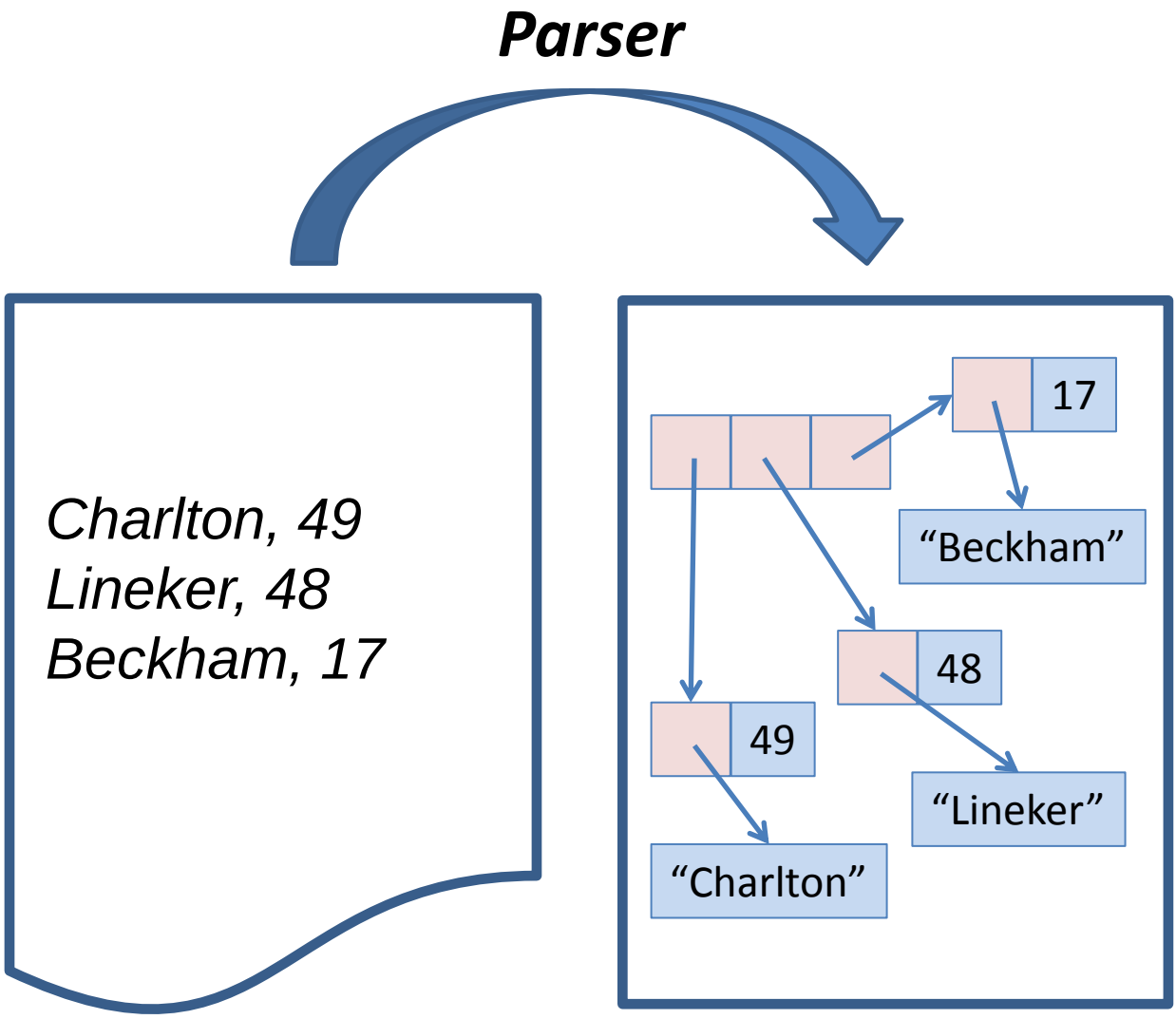

CSV *(Comma Separated Value)*

Array of pairs

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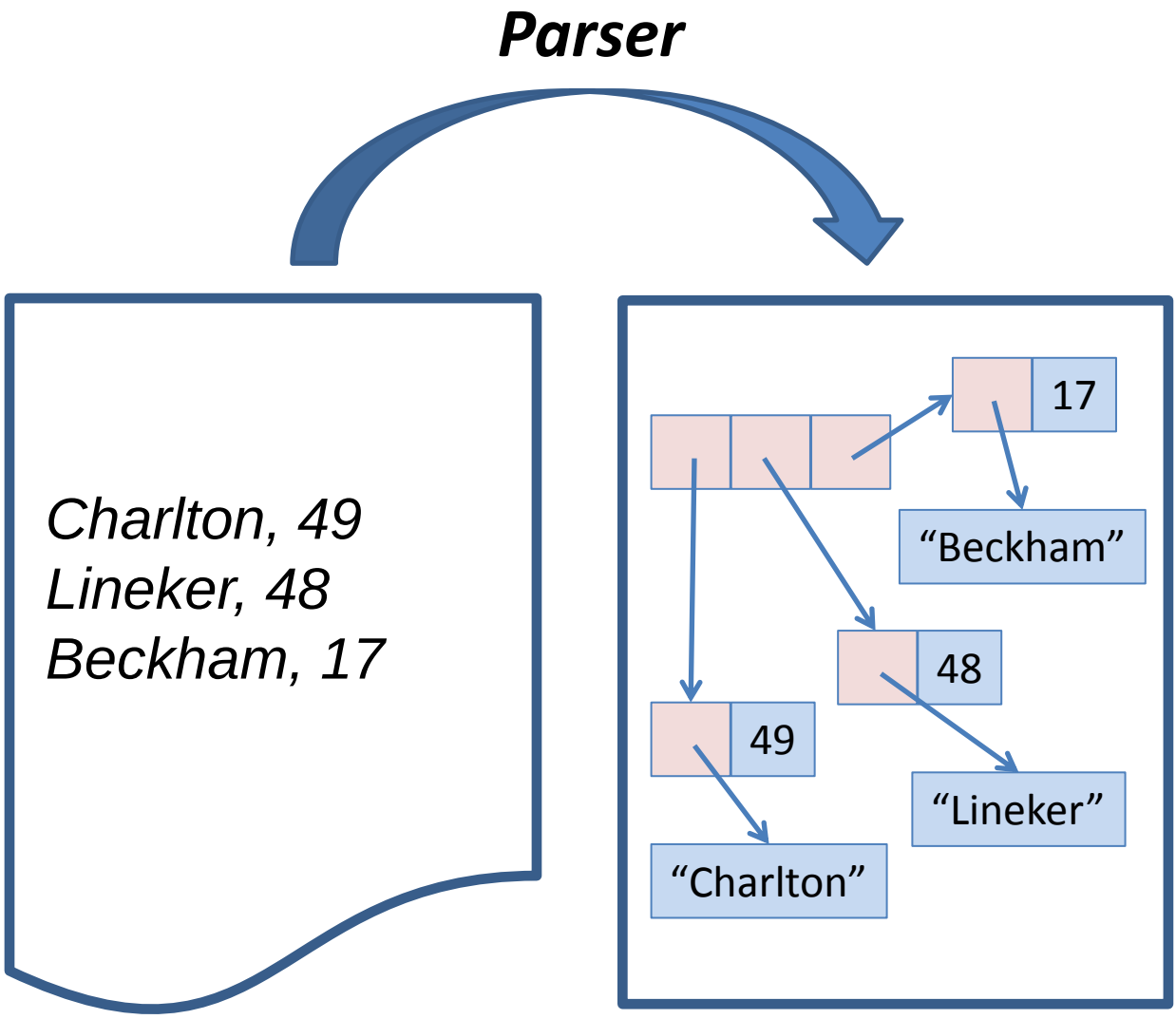

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Data structure?

A **data structure** is typically a value of a **data type** in some programming language, e.g. C.

The type of a player:

```
typedef struct {
   char* name;
   int goals;
} Player;
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The type of a squad of players:

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typedef struct {
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Data structures are **convenient to process** by a computer program.

The total goals scored by all players in a squad:

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int total(Squad s)
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LSA will teach you how to fill in the dots. (This is a rather easy example, though!)

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Everyday parsing

- Our **email clients** parse email headers, allowing search by *to & from* address etc.
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LSA of **PL**s

- In LSA, we are interested in parsing **in general**.
- But we have a special interest in parsing **programming languages** (PLs). Why?
- *"If we can parse a PL, we can parse **anything**."* ☺
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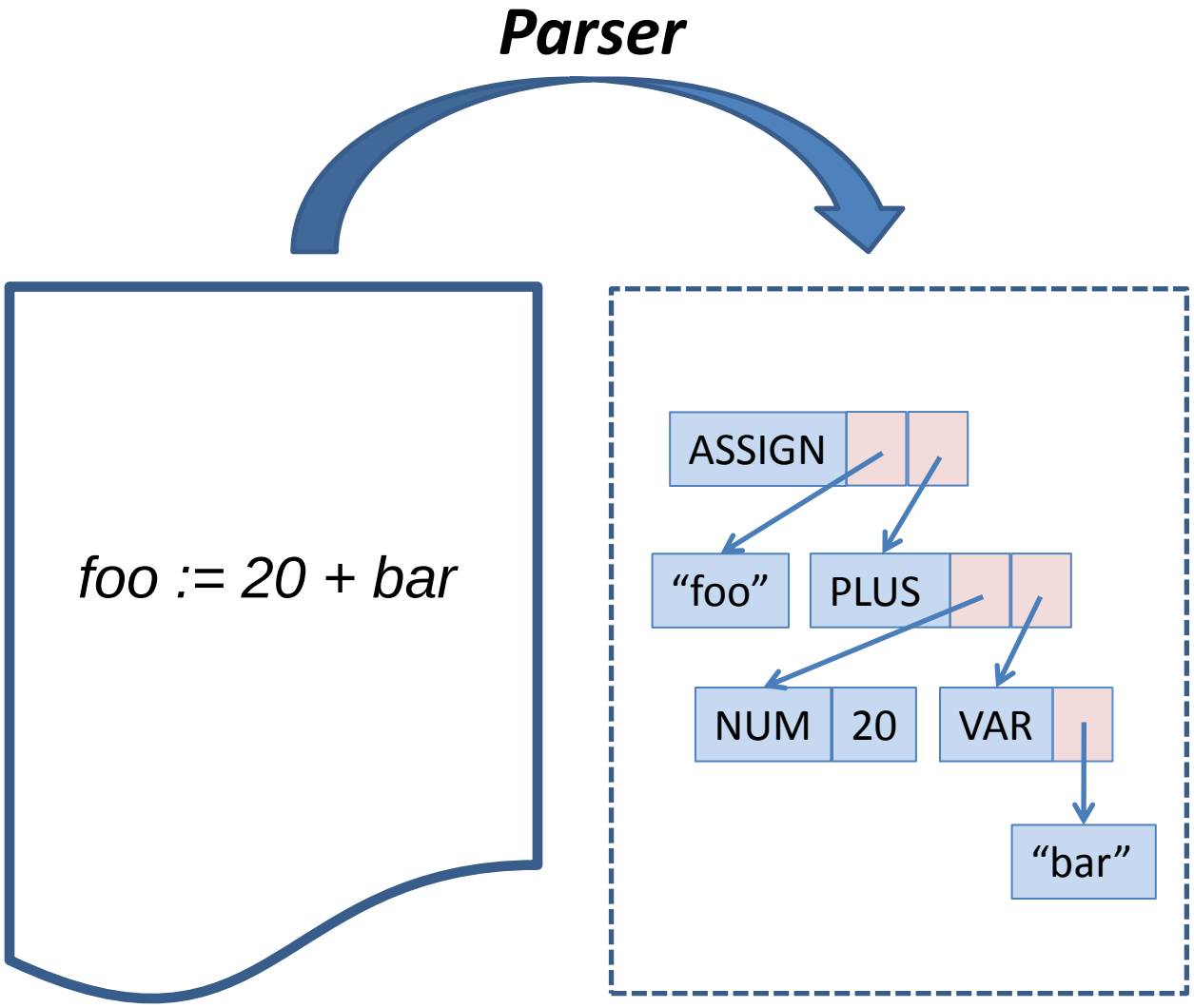

A pascal statement

An abstract syntax tree

We will return to this example later!

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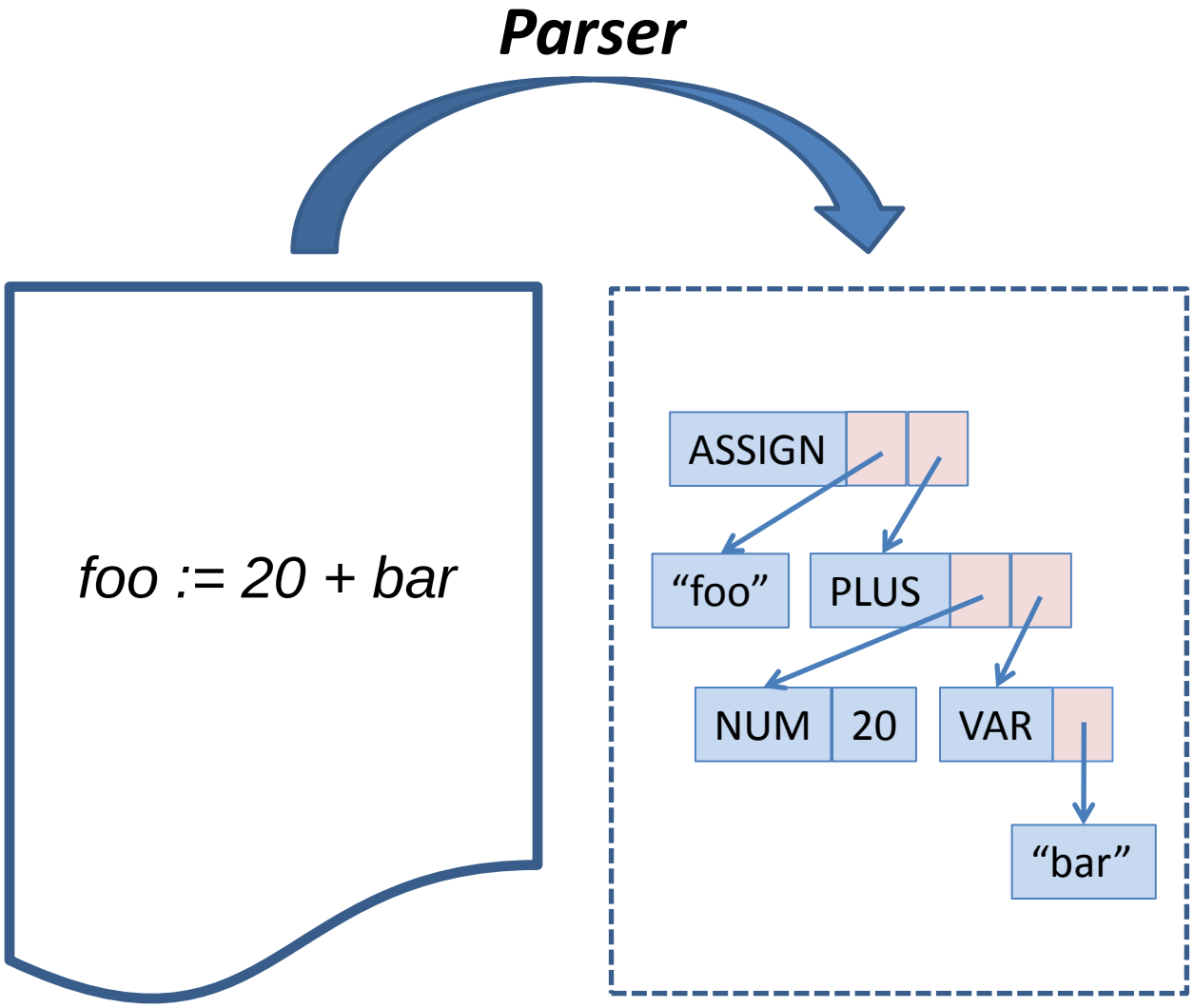

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LSA & CGO

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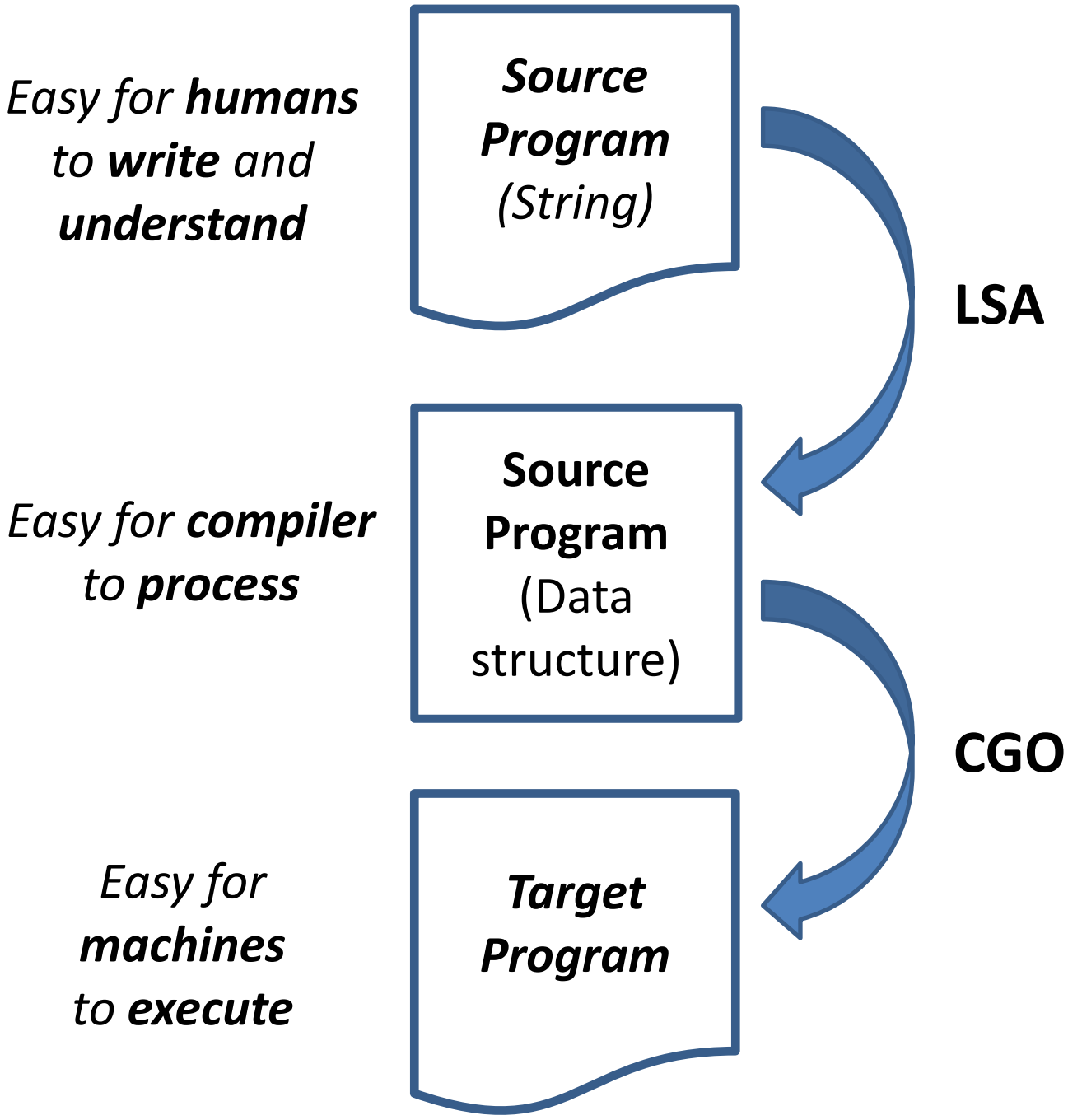
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Easy for **compiler** to **process**
Source Program (Data structure)
CGO
Easy for **machines** to **execute**
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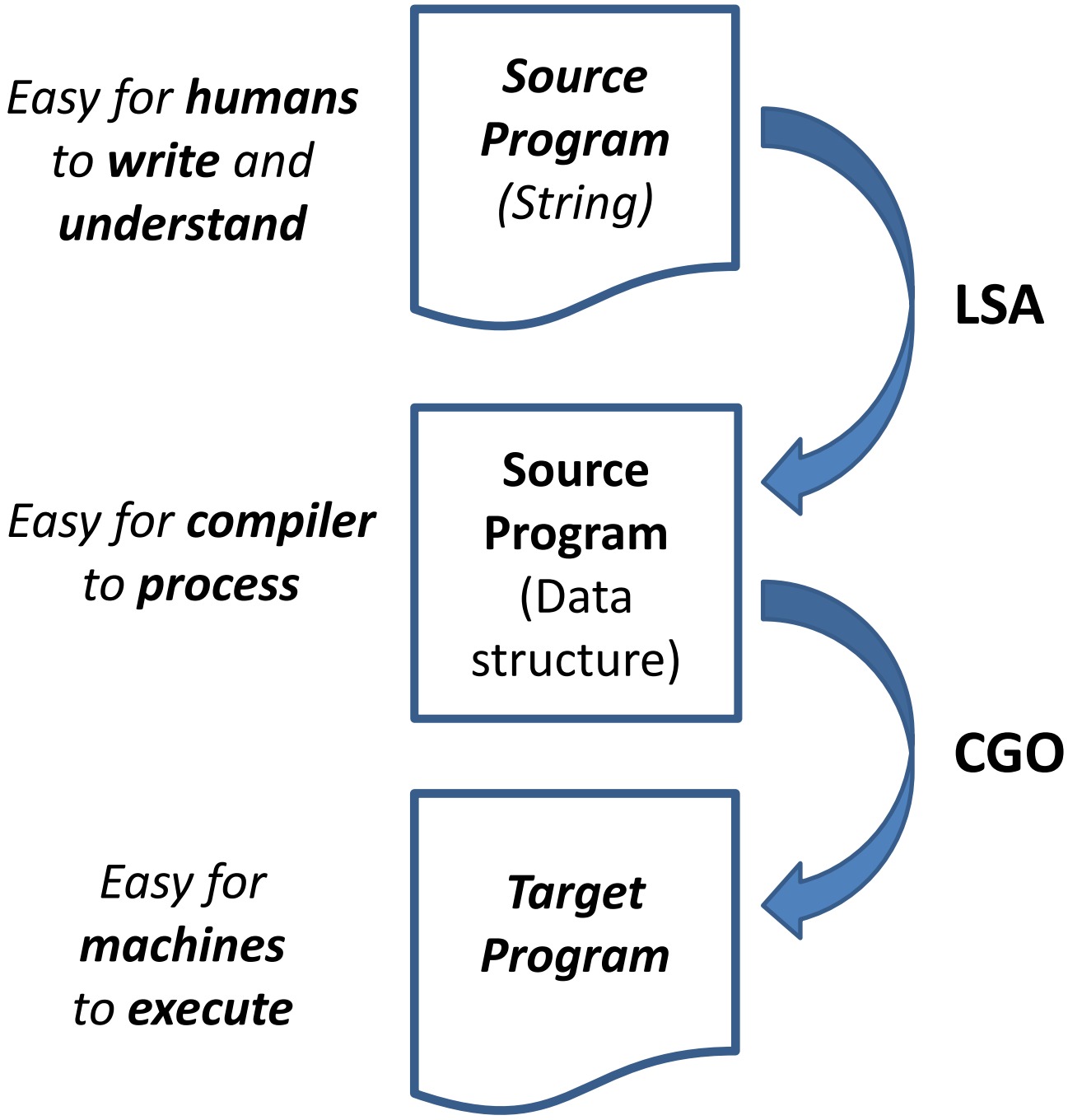
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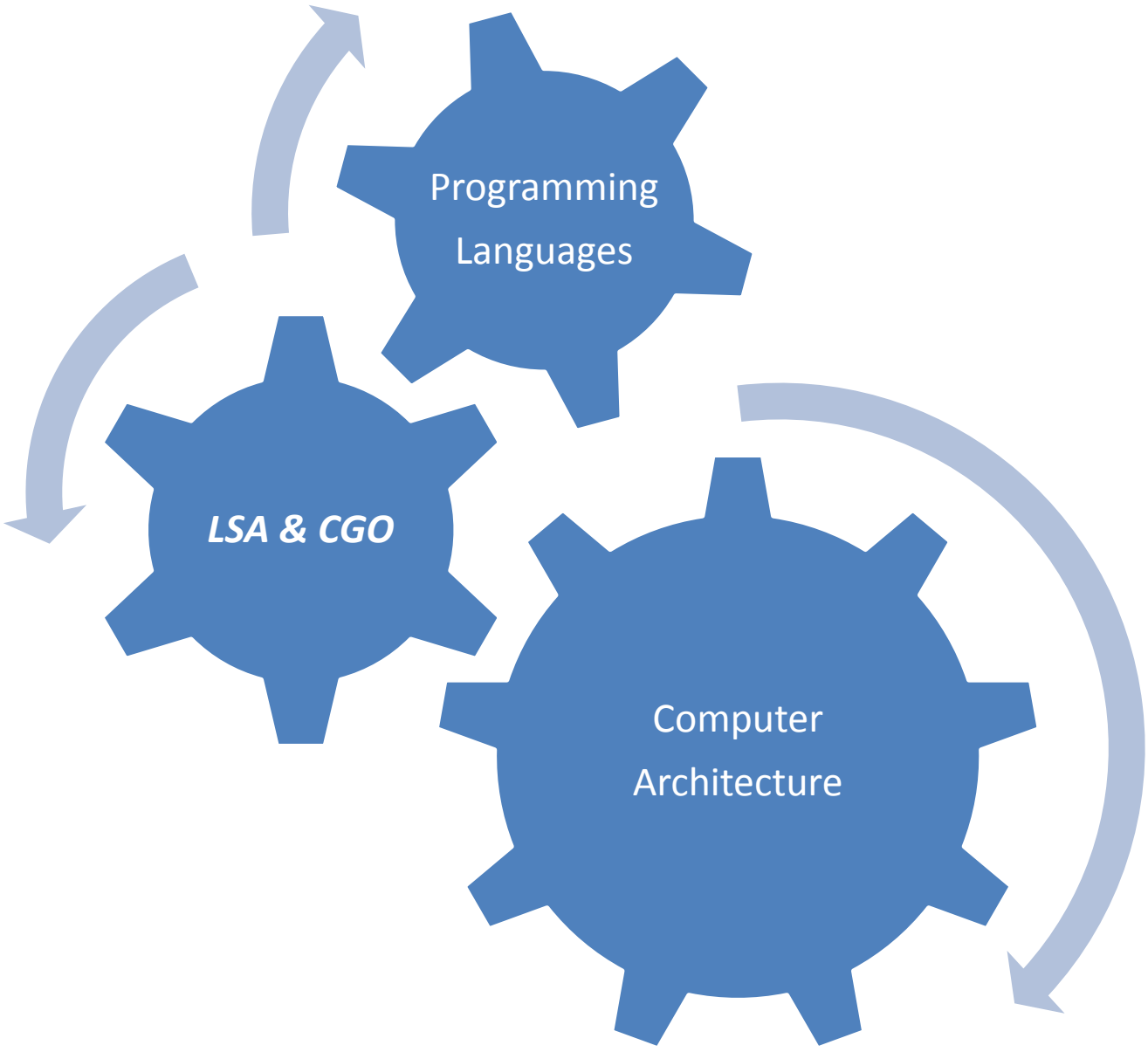

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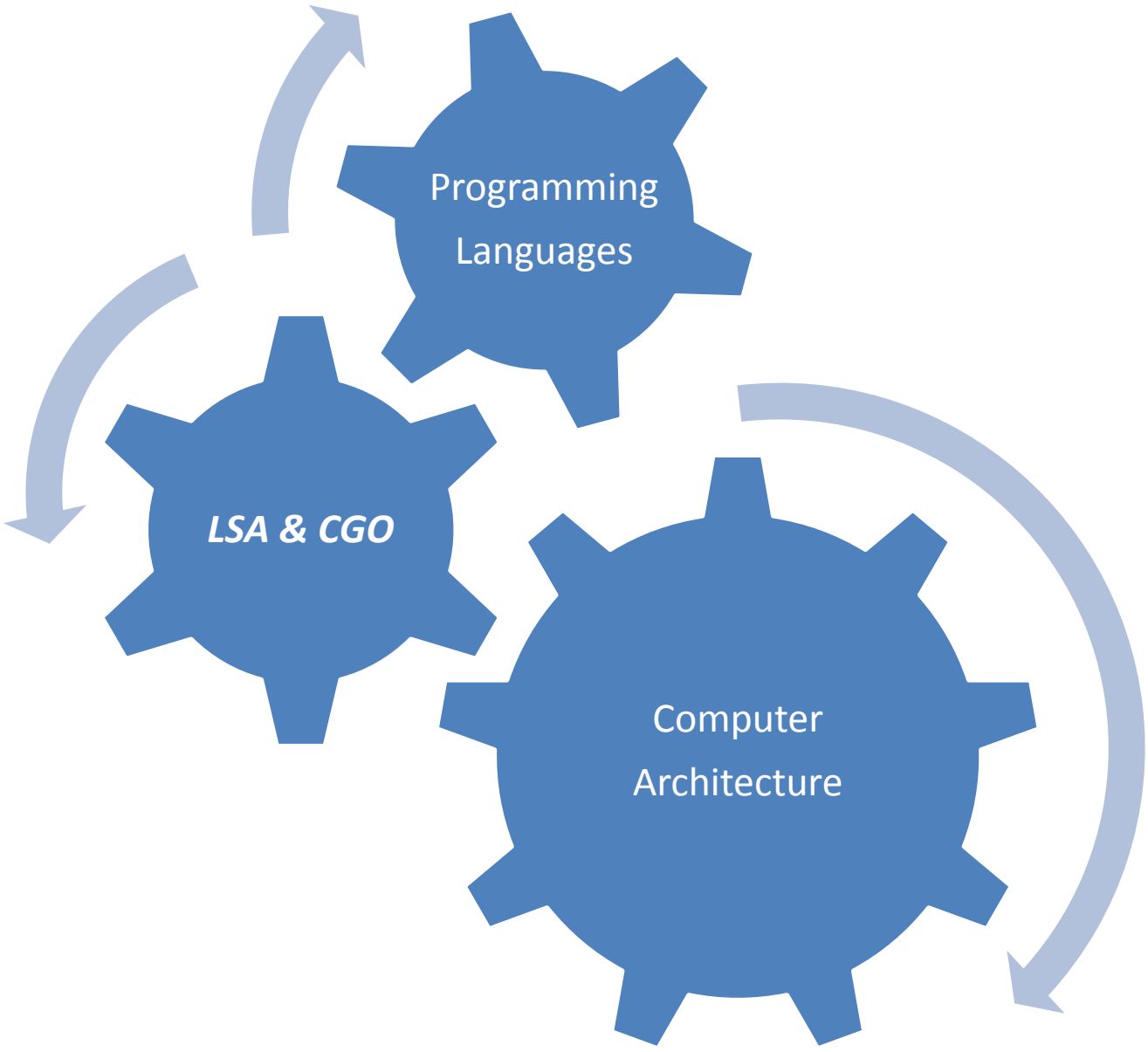

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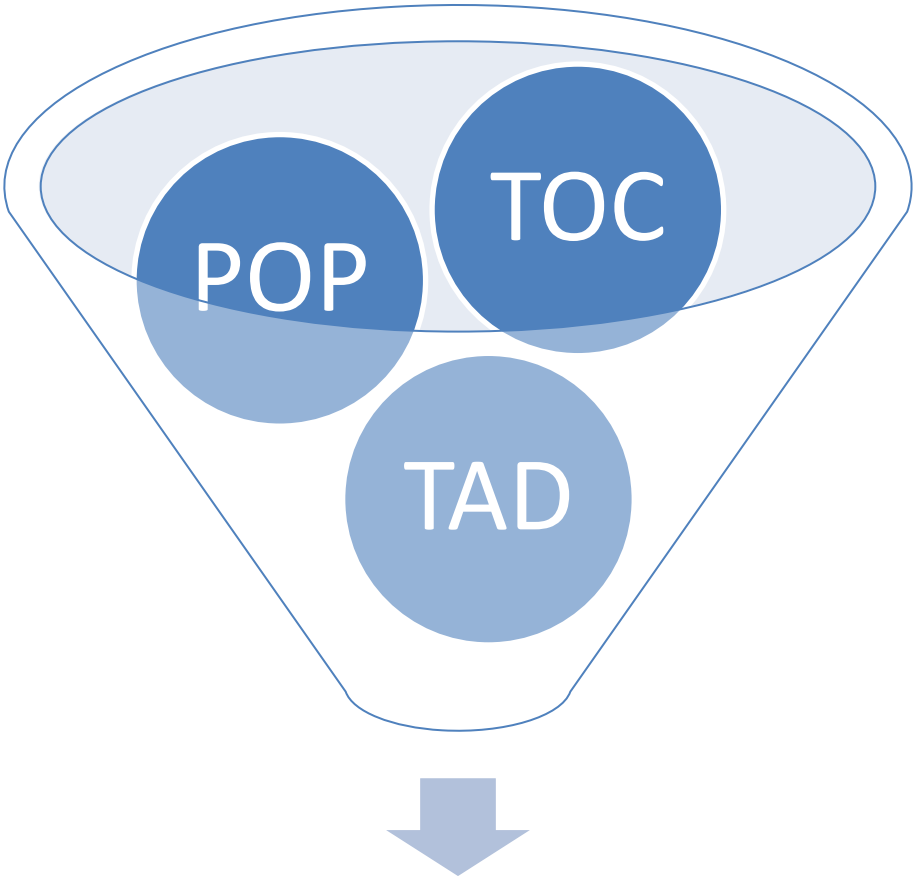

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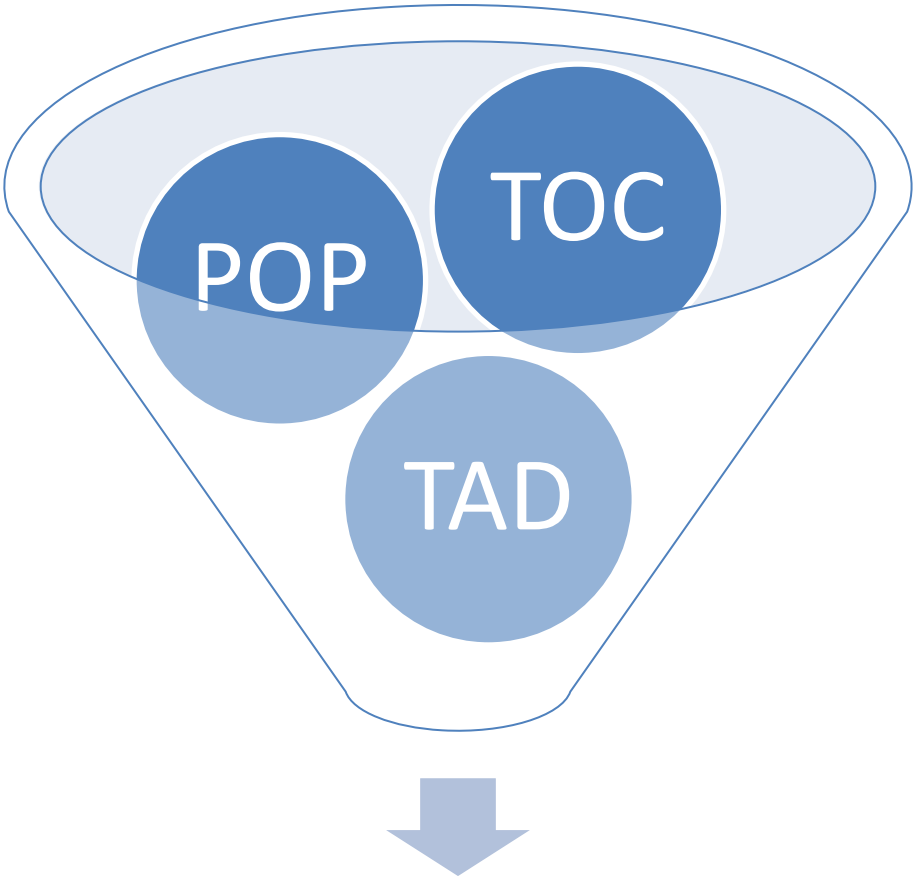

LSA

PARSING

=

LEXICAL ANALYSIS
+
SYNTAX ANALYSIS

PARSING

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LEXICAL ANALYSIS
+
SYNTAX ANALYSIS

Lexical Analysis

(Also known as "**scanning**")

- Identifies the **lexemes** in a sentence.
- **Lexeme:** a minimal meaningful unit of a language.
- Converts each lexeme to a **token**.
- Throws away ignorable text such as spaces, new-lines, and comments.

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- Every token has an **identifier**, used to denote the **kind** of lexeme that it represents, e.g.

Token identifier	denotes a
PLUS	+ operator
ASSIGN	:= operator
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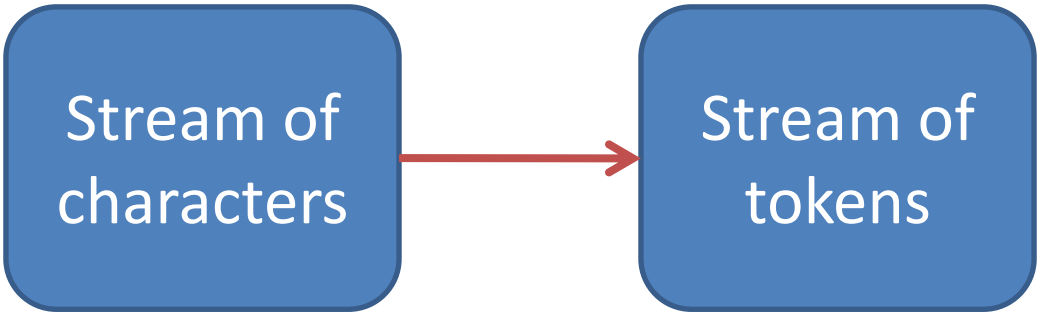

Example input:

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Example output:

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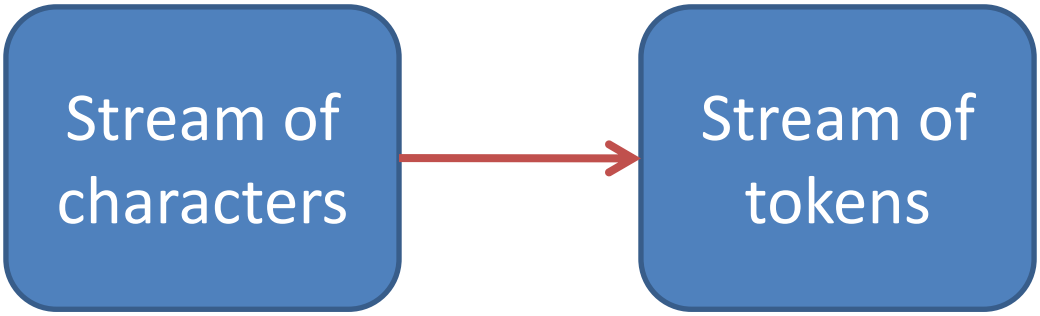

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letter	=	*a	...	z*
number	=	*digit* · *digit**
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Example numbers:

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Example variables:

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- **Syntax**: the set of rules defining valid strings of a language.
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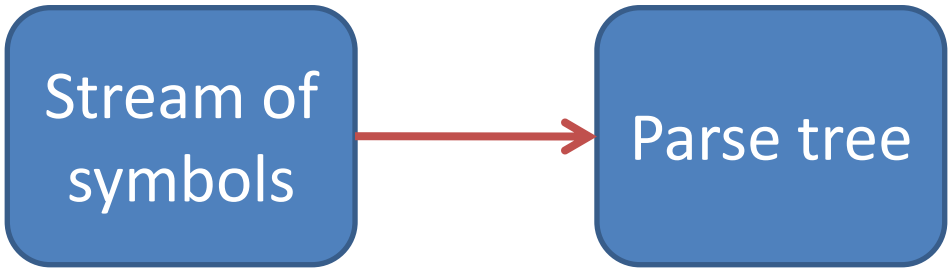

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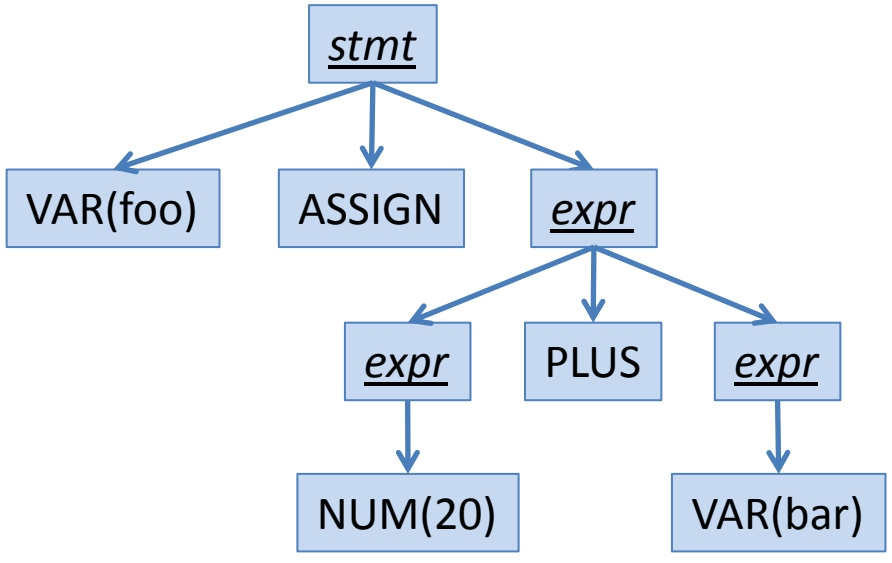

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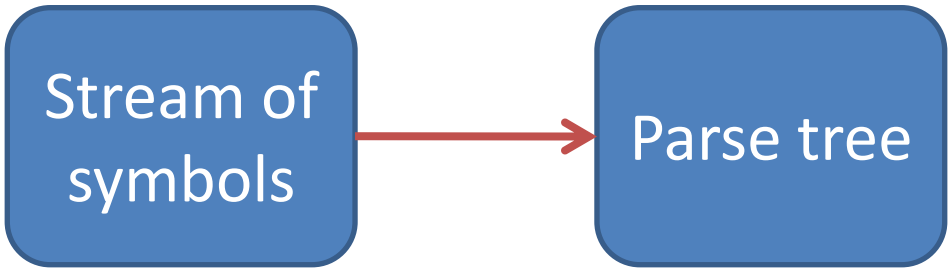

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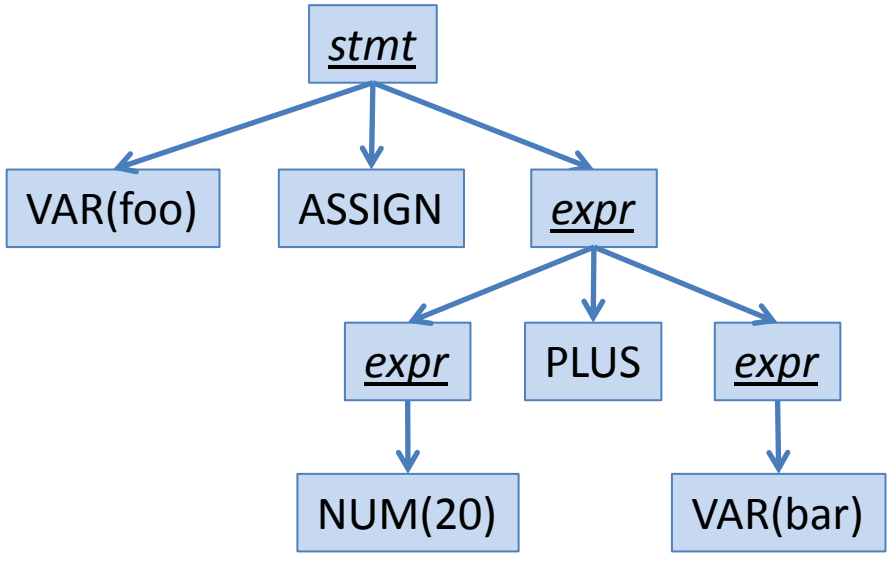

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Why bother with Lexical Analysis?

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Structure and content

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Objectives

To learn how to implement efficient **parsers**

- using a general purpose programming language (*C*);
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- Idea is to **practice** the techniques developed in the lectures.
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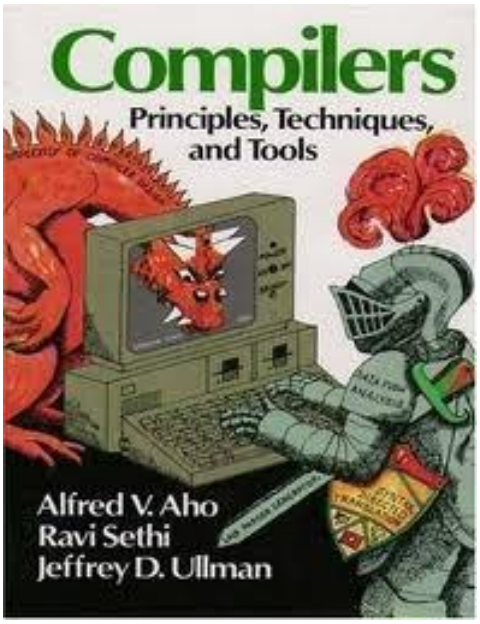

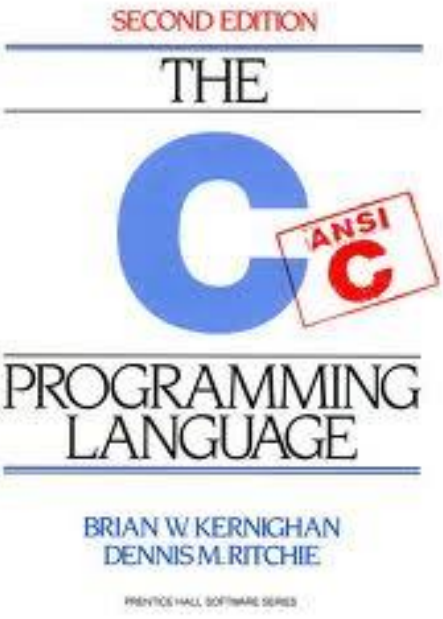

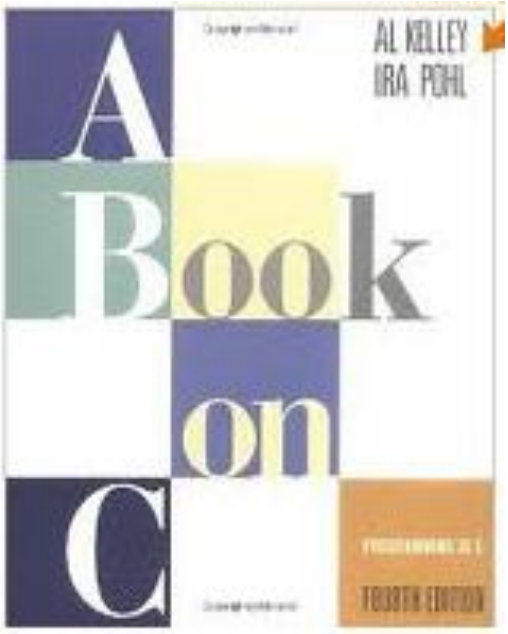

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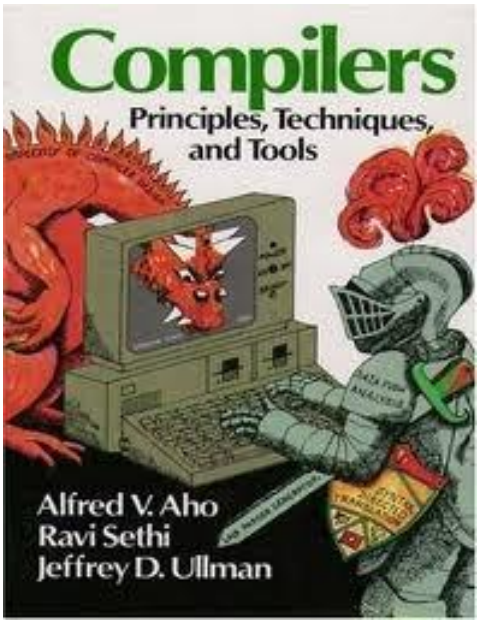

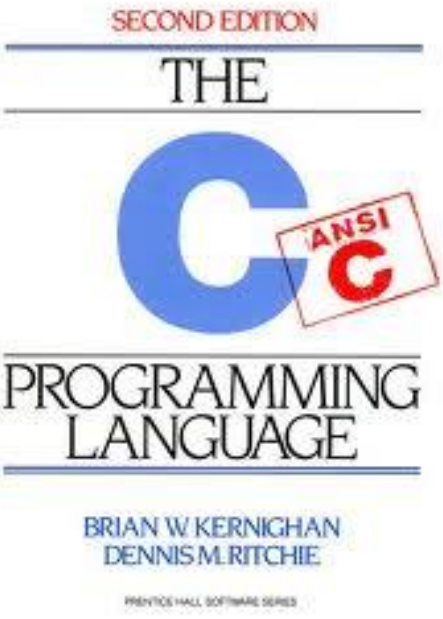

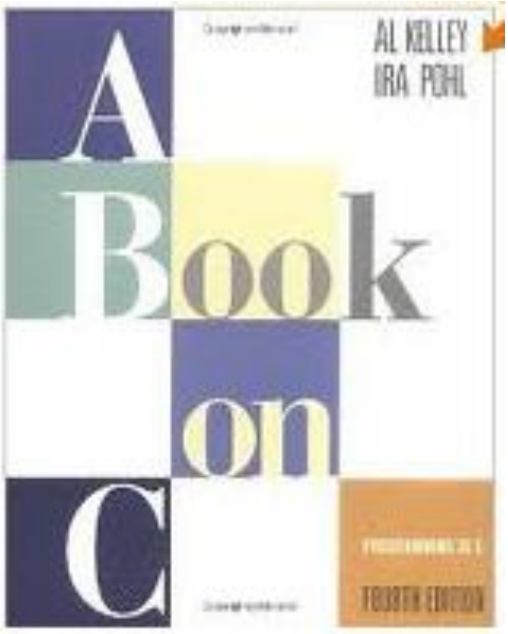

Don’t break **the flow**!