

**A computer only
understands its own
machine language.**



WHEN I STARTED
PROGRAMMING, WE DIDN'T
HAVE ANY OF THESE
SISSY "ICONS" AND
"WINDOWS."



ALL WE HAD WERE ZEROS
AND ONES -- AND
SOMETIMES WE DIDN'T
EVEN HAVE ONES.



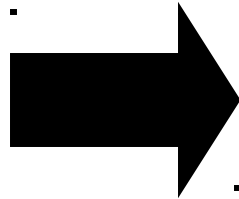
I WROTE AN
ENTIRE
DATABASE
PROGRAM
USING ONLY
ZEROS.

YOU HAD
ZEROS? WE
HAD TO USE
THE LETTER
"O."

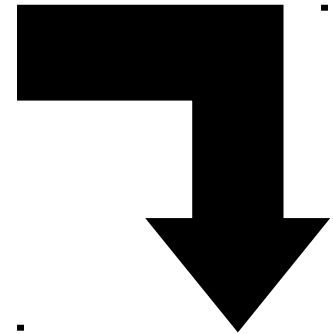




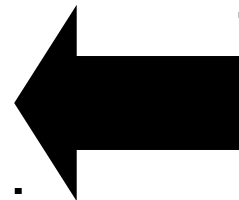
Program that a
human being
understands



Program
written in
Language X



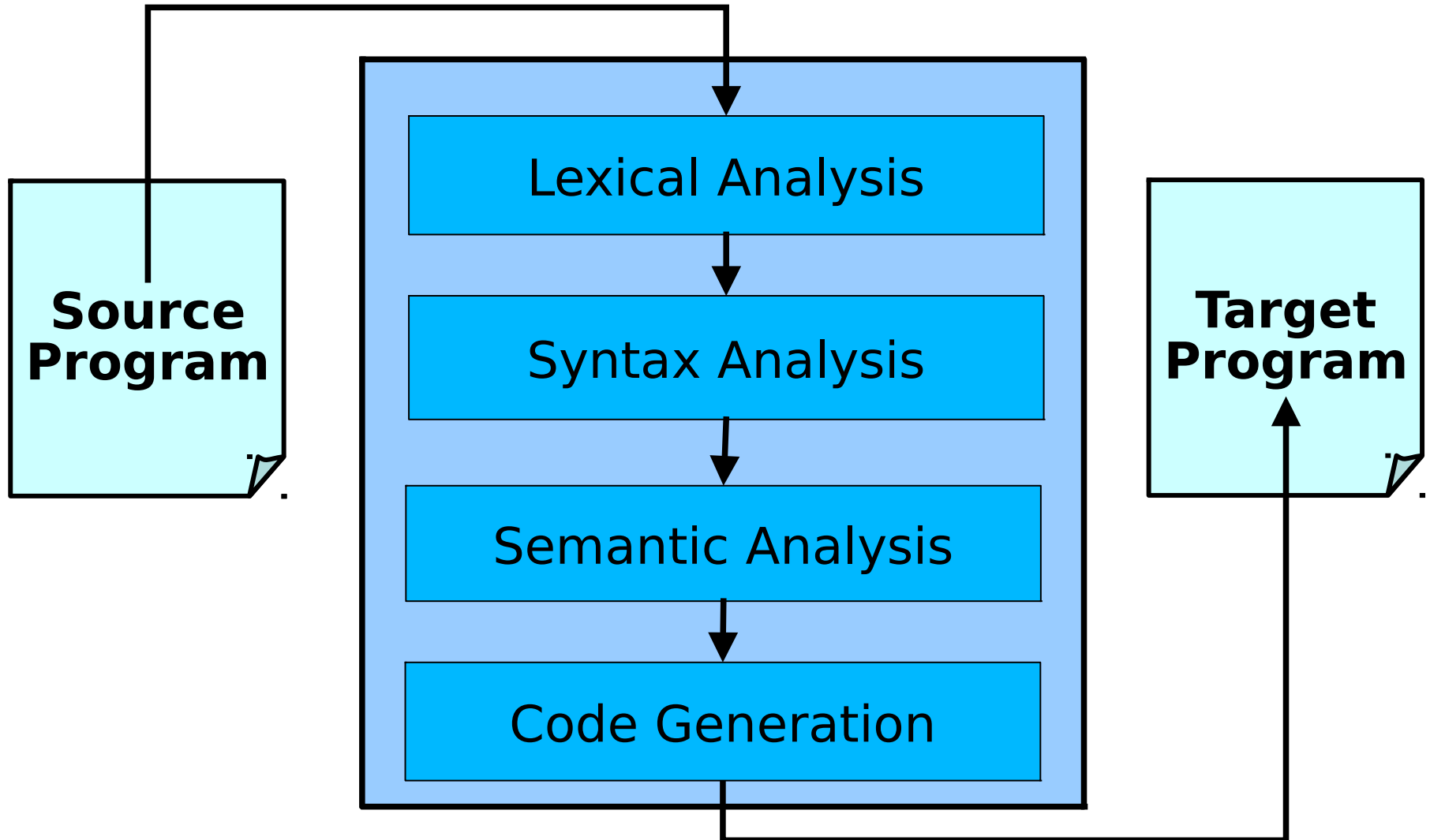
Translator for
Language X



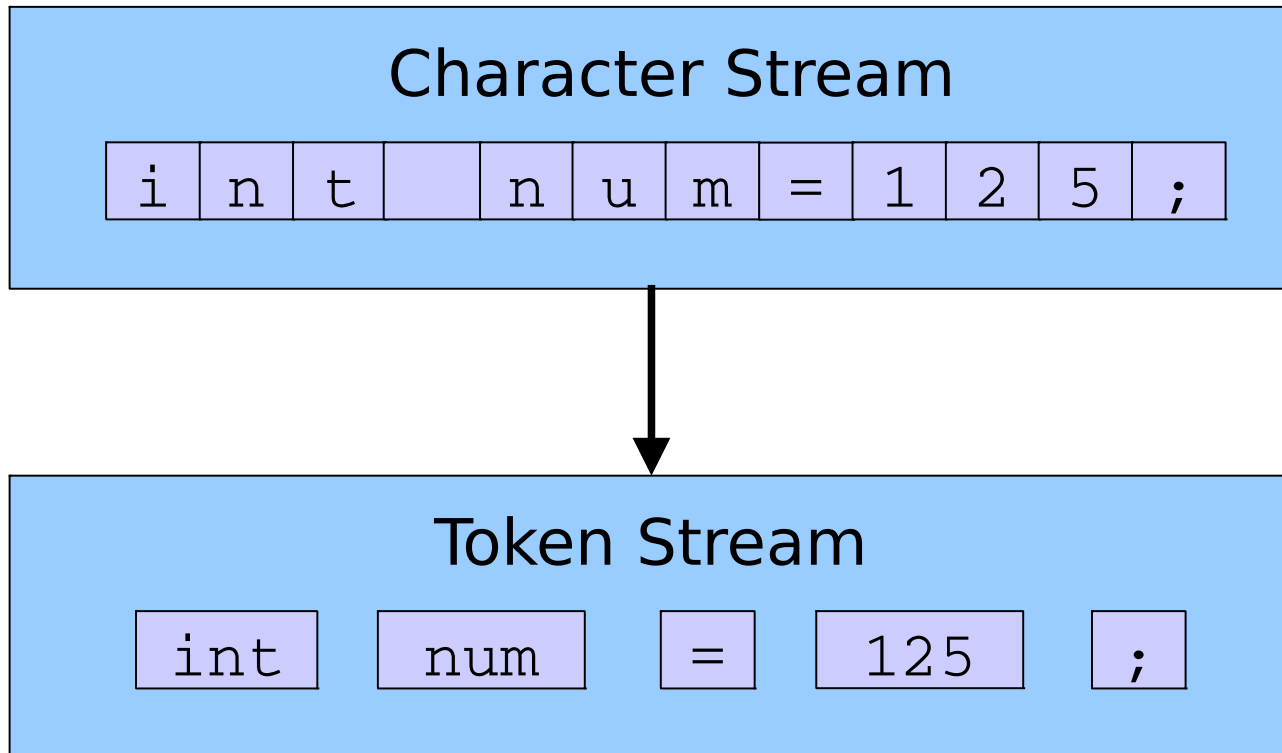
Program that
a computer
understands



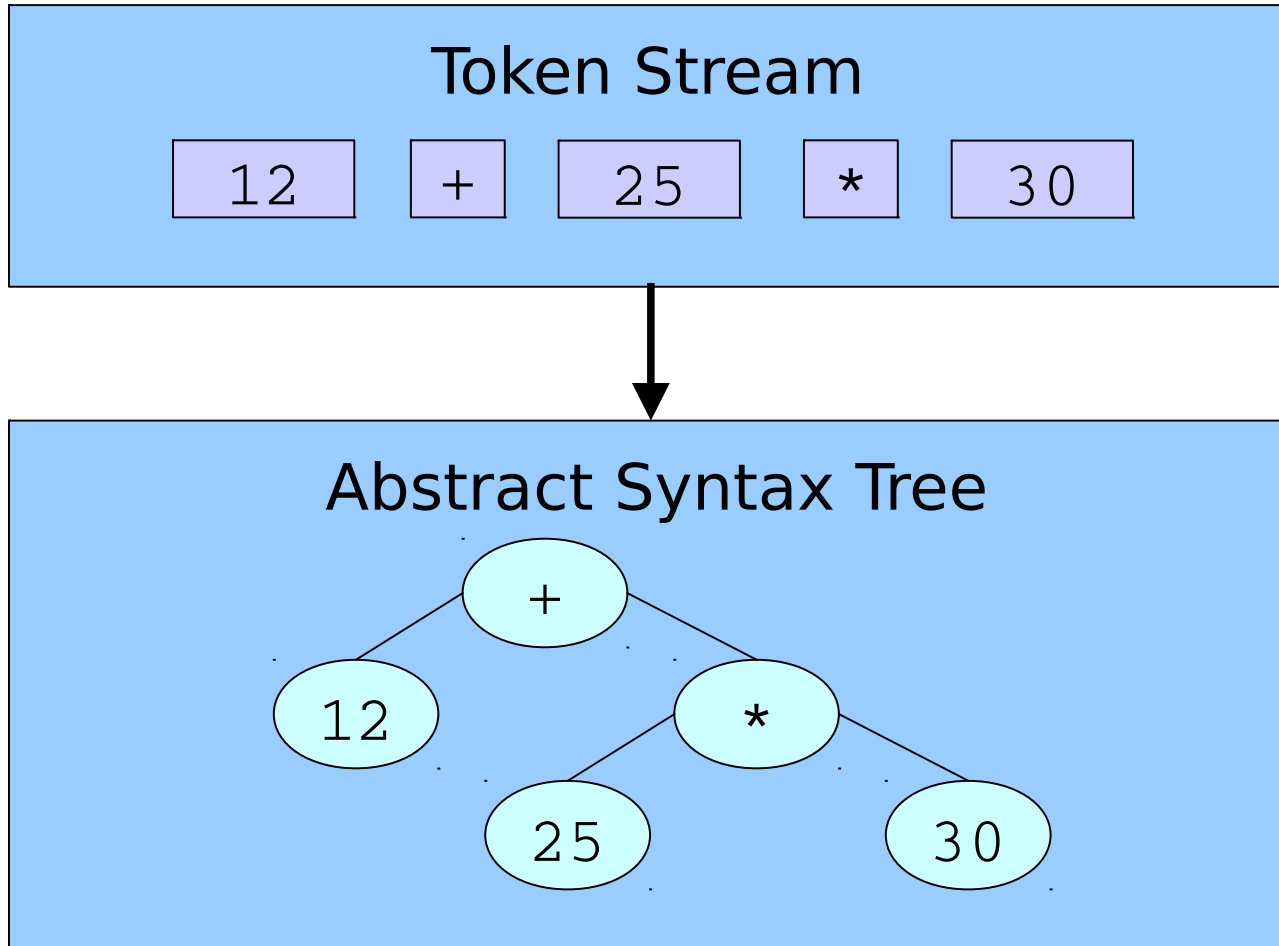
Translation Phases



Lexical Analysis

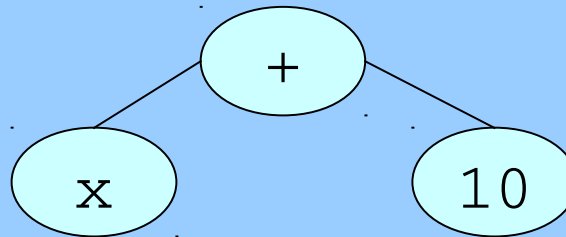


Syntax Analysis



Semantic Analysis

Abstract Syntax Tree

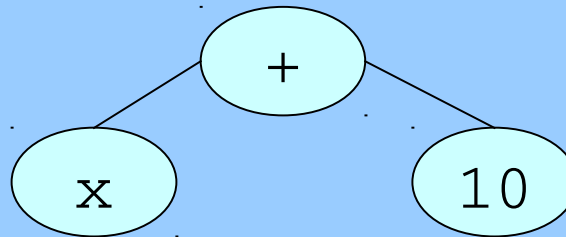


Check that:

- *Variable "x" has been declared.*
- *The type of the operands and the + operator should be numeric.*

Code Generation

Abstract Syntax Tree



Target Code

```
mov eax, [x]
add eax, 10
```