SOPA LANGUAGE

SER 502 : LANGUAGES AND PROGRAMMING PARADIGMS

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WHY SOPA?

“WHY DOES PROGRAMMING HAVE TO BE SO COMPLEX ?”

SOPA was designed with simplicity and ease of use in mind. It is specifically tailored for non-programmers while retaining essential programming constructs.

- **Simple Syntax**: Easy to read and write.
- **Intuitive Structure**: Programs flow naturally.
- **Accessible**: Ideal for beginners and professionals alike.

HIGHLIGHTS OF SOPA

- Readability: Human-friendly syntax with minimal boilerplate.
- Core Constructs: Includes essential programming structures:
  - Variable declarations and assignments.
  - Conditional blocks (if-else, ternary operators).
  - Loops (for, while).
  - Basic mathematical and logical operations.
- Ease of Learning: Designed for rapid understanding and use.

GRAMMAR

```
program ::= block
block ::= start decl; command stop
decl ::= decl ; decl | const identifier = assignments_allowed | var identifier
command ::= command ; command | identifier := expression | if statement_list then command else command endif | repeat
repeat_statement command endrepeat | unless statement_list command until | print_statement | condition ? command : command | block
assignments_allowed ::= number | '"' (.)*? '"'
statement_list ::= '(' condition ')'
repeat_statement ::= '(' identifier ',' number ',' number ')'
print_statement ::= show expression | show '"' (.)*? '"'
condition ::= expression operators expression | boolen
expression ::= expression + expression | expression - expression | expression * expression | expression / expression | expression %
expression | expression ^ number | sqrt expression | (expression) | identifier := expression | identifier | number
boolen ::= true | false | expression = expression | not boolean
operators ::= '==' | '<' | '>' | '<=' | '>=' | '!=' | '&&' | '||' | '!'
identifier ::= lowerCase (letters | _ | digit)*
letters ::= (lowerCase | upperCase)+
lowerCase ::= 'a' | 'b' | 'c' | 'd' | 'e' | 'f' | 'g' | 'h' | 'i' | 'j' | 'k' | 'l' | 'm' | 'n' | 'o' | 'p' | 'q' | 'r' | 's' | 't' | 'u' | 'v' | 'w' | 'x' | 'y' | 'z'
upperCase ::= 'A' | 'B' | 'C' | 'D' | 'E' | 'F' | 'G' | 'H' | 'I' | 'J' | 'K' | 'L' | 'M' | 'N' | 'O' | 'P' | 'Q' | 'R' | 'S' | 'T' | 'U' | 'V' | 'W' | 'X' | 'Y' | 'Z'
digit ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
number ::= '-' (digit)+ | (digit)+
```

KEY FEATURES

01

BASIC DATA TYPES

- Integer, Boolean, and String.
- Declaration and assignment.

02

OPERATIONS

- Arithmetic: Addition, Subtraction, Multiplication, Division, Modulus.
- Relational: >, <, >=, <=, ==, !=.
- Logical: and, or, not.

03

CONTROL STRUCTURES

- Conditional Blocks: If-else and ternary.
- Loops: repeat (for loop) and unless (while loop).

ADDITIONAL FUNCTIONALITIES

- MODULUS -

```
start
var a;
var b;
a := 8;
b := 2;
show a%b;
stop
```

- SQRT -

```
start
var b;
b := 4;
show sqrt(b);
stop
```

SYNTAX OVERVIEW

Program Structure

- All programs must start with start and end with stop.

Variable names:

- Must start with an alphabet.
- Can include underscores and digits.

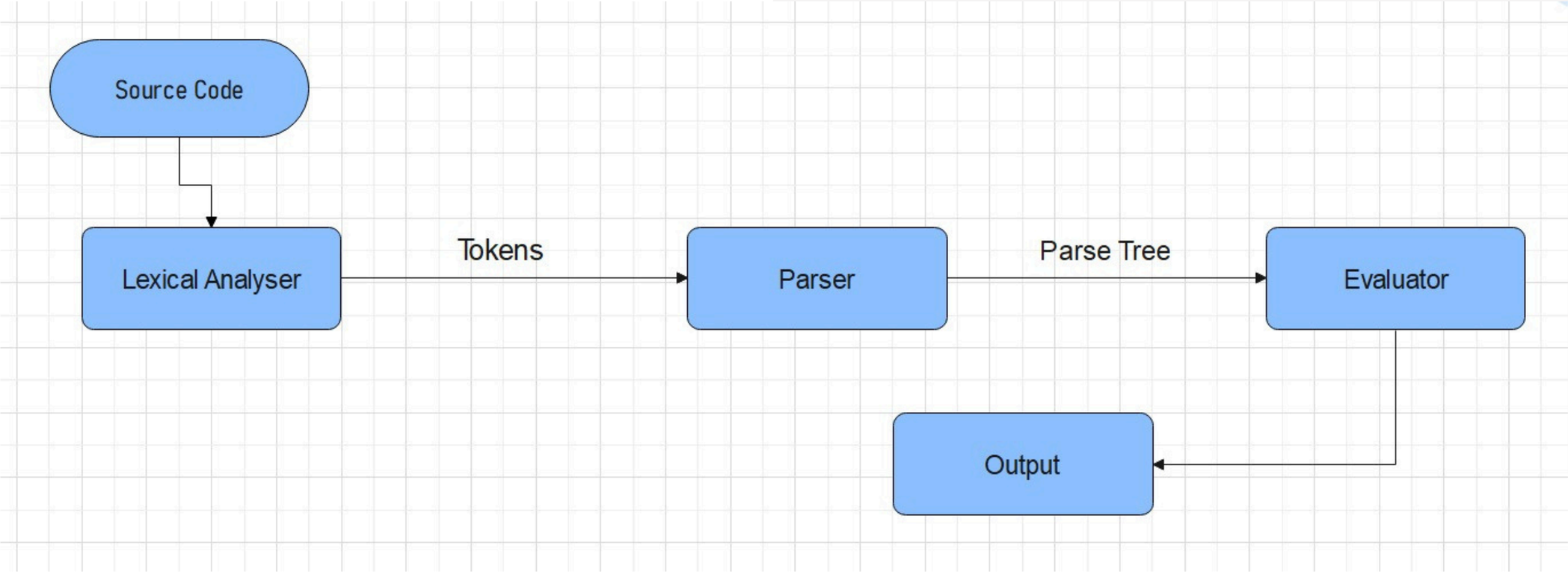
```
x := condition ? true_value : false_value;
```

```
var x;
const y = 10;
const z = "hello";
```

```
x := 5;
y := "world";
z := true;
```

```
repeat (i, 1, 10)
  show i;
endrepeat;
```

Compilation flow



COMPILATION FLOW

1. Lexical Analyzer

Purpose: Scans the SOPA source code and breaks it into tokens.

Output: A series of tokens representing keywords, identifiers, operators, etc.

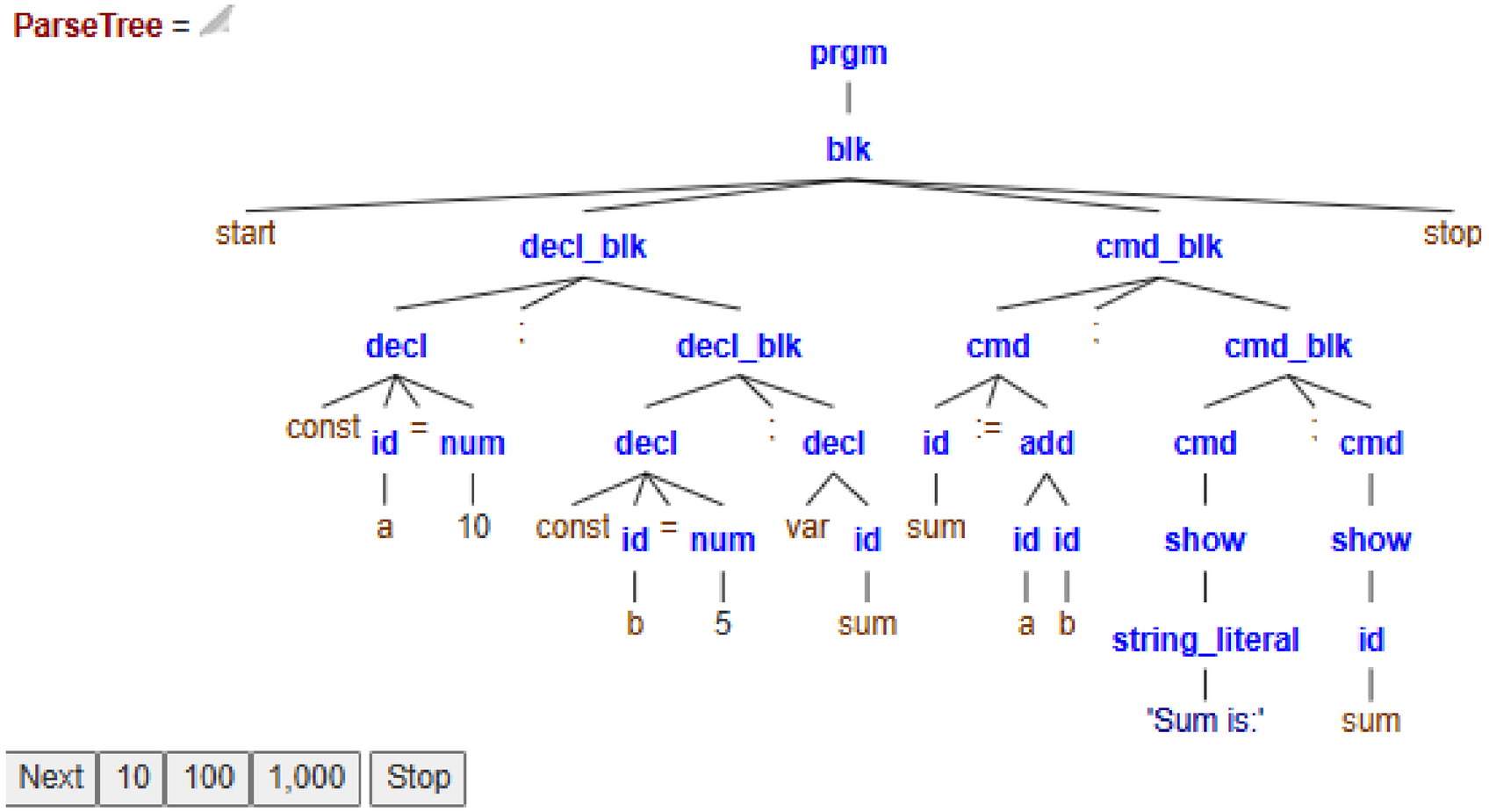
```
?- InputString = 'start
     const a = 10;
     const b = 5;
     var sum;
     sum := a + b;
     show "Sum is:";
     show sum;
   stop',
   tokenize(InputString, Tokens).
```

Tokens =
[*kw*(start), *kw*(const), *id*(a), =, *num*(10), ;, *kw*(const), *id*(b), =, *num*(5), ;, *kw*(var), *id*(sum), ;, *id*(sum), :=, *id*(a), +, *id*(b), ;, *kw*(show), *string*('Sum is:'), ;, *kw*(show), *id*(sum), ;, *kw*(stop)]

2. Parser

Purpose: Analyzes the sequence of tokens to ensure the syntax is correct.

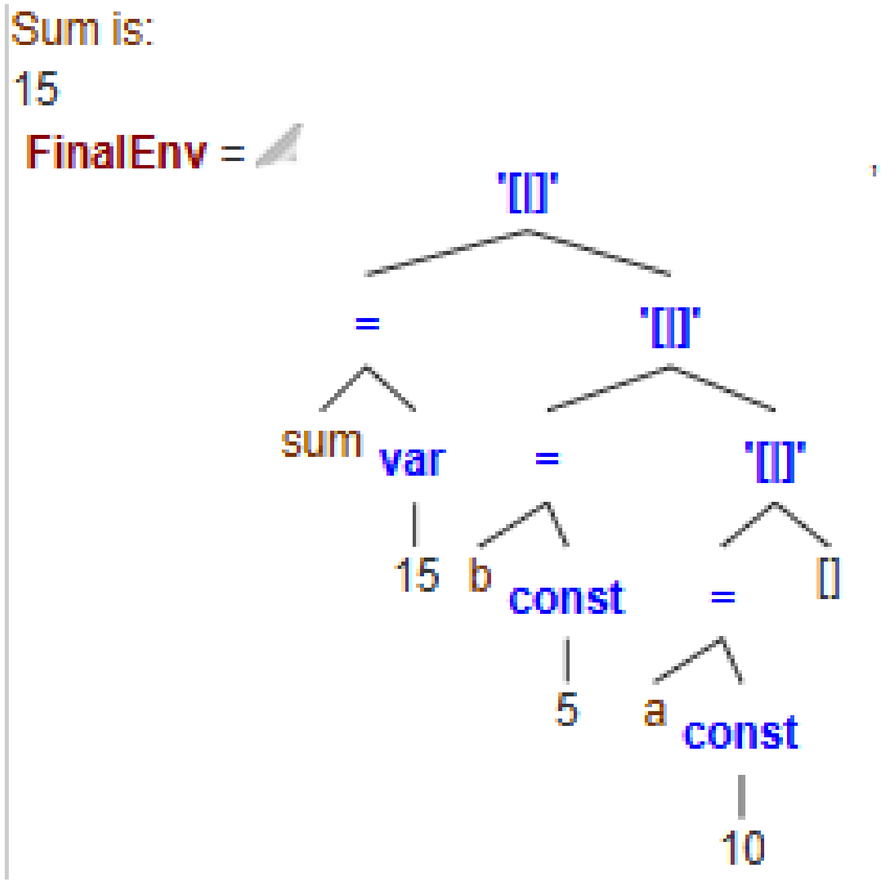
Output: A parse tree representing the program's structure.



3. Semantics

Purpose: Defines the logical meaning of each construct in the language.

Output: Ensures program behavior matches expected outcomes.



SAMPLE CODE

ADDITION

```
start
const x=8;
var y;
y:= x+2;
show y;
stop
```

NESTED FOR LOOP

```
start
repeat(i,2,10)
start
repeat(j,1,3)
show j;
endrepeat
stop
endrepeat
stop
```

SAMPLE CODE

WHILE LOOP

```
start
var a;
a := 1;
unless(a<10)
show "You can do this !!!" ;
a := a + 1;
until
stop
```

SQUARE ROOT

```
start
var b;
b := 4;
show sqrt(b);
stop
```

IF - ELSE

```
start
var a;
var b;
a := 10;
b := 20;
if(a>20)
show "a is greater";
else
show " b is greater";
endif
stop
```

FUTURE SCOPE

- Adding support for:
- Lists and Arrays: Enhance data management capabilities.
- Advanced Data Structures: Incorporate trees, queues, and stacks for more complex programs.
- String Manipulation: Extend operations to allow robust handling of textual data.

THANK YOU