

# Contextual Analysis

AST, Interpretation, CFG

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Lecture #3 out of 10

90 minutes

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Concrete vs. Abstract

Identification

Static Type Checking

AST Visitor

Decorated AST

Control Flow Graph

## Code Understanding Pipeline



Chapter #1:

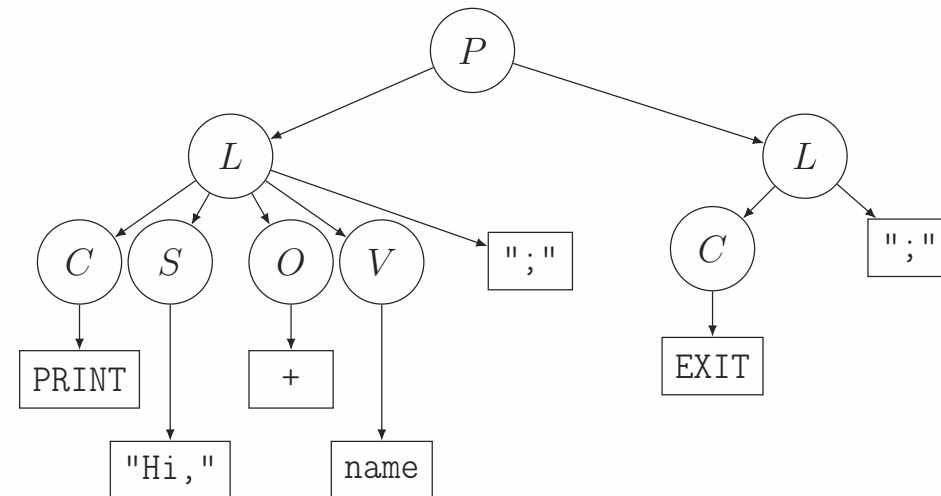
## Concrete vs. Abstract

The concrete syntax of a programming language is defined by a context free grammar (CFG). The abstract syntax of an implementation is the set of trees used to represent programs in the implementation.

Simple program:

```
1 | PRINT "Hi," + name;  
2 | EXIT;
```

Concrete Syntax Tree:



Abstract Syntax Tree:



Chapter #2:

# Identification

```
int x;  
loop { int x; x++; };  
print x;
```



Somehow we must link different  $x$  to different places, where they are declared, maybe with the help of "Identification Table," or by attaching attributes to AST nodes, or both. We may want to track their indentation levels.



Chapter #3:

# Static Type Checking

Dynamically-typed languages perform type checking at runtime, while statically typed languages perform type checking at compile time.

```
var x = "Sofi";  
loop { var x; x++; };  
print "Hello," + x;
```



Chapter #4:

## AST Visitor

ANTLR4 lets us implement the following interface:

```
1 public interface ParseTreeListener {  
2     void visitTerminal(TerminalNode var1);  
3     void visitErrorNode(ErrorNode var1);  
4     void enterEveryRule(ParserRuleContext var1);  
5     void exitEveryRule(ParserRuleContext var1);  
6 }
```

Then:

```
1 MyLexer lexer = new MyLexer(text); // Lexer
2 MyParser parser = new MyParser(
3     new CommonTokenStream(lexer) // Parser
4 );
5 MyListener lsr = new MyListener(); // ParseTreeListener
6 new ParseTreeWalker().walk(lsr, parser.program());
```

Chapter #5:

## Decorated AST

```
int x;  
loop { int x; x++; };  
print x;
```



Chapter #6:

## Control Flow Graph



```
int x = 42;  
loop { int x = 0; x++; };  
print x;
```

