Contextual Analysis

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Lecture #3 out of 10 80 minutes

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Concrete vs. Abstract

Identification

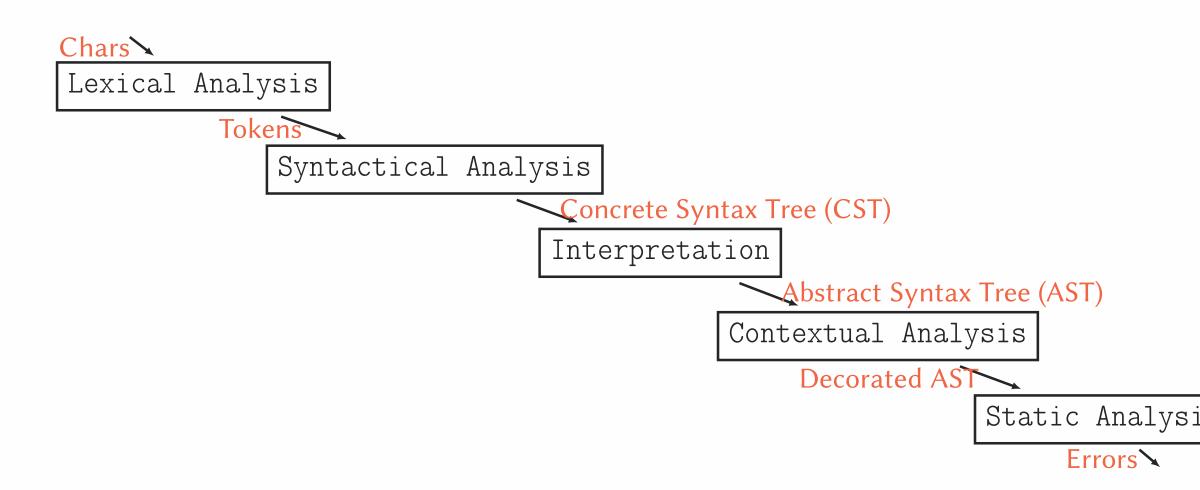
Static Type Checking

AST Visitor

Decorated AST

Control Flow Graph

Code Understanding Pipeline



Chapter #1:

Concrete vs. Abstract

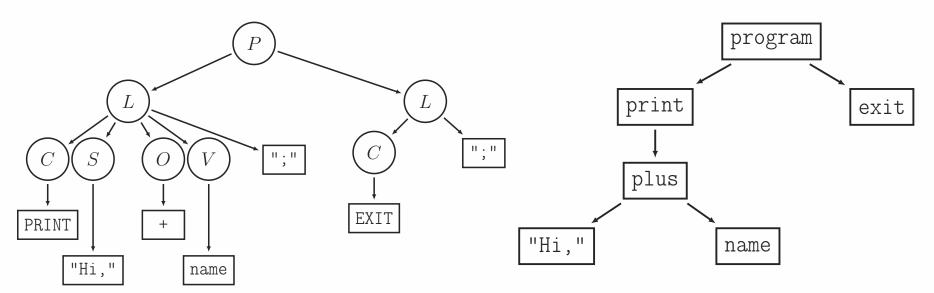
The *concrete syntax* of a programming language is defined by a context free grammar (CFG). The *abstract syntax* of an implementation is the set of trees used to represent programs in the implementation.

Simple program:

```
PRINT "Hi," + name;
EXIT;
```

Concrete Syntax Tree:

Abstract Syntax Tree:

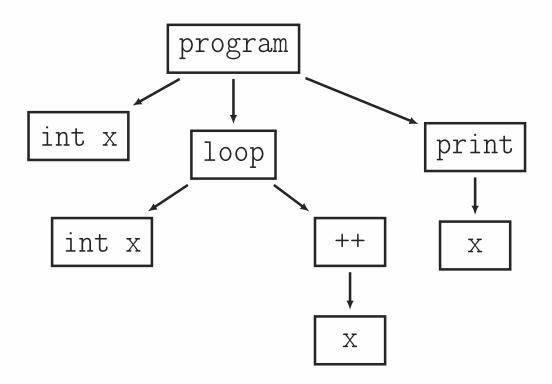


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Chapter #2:

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.

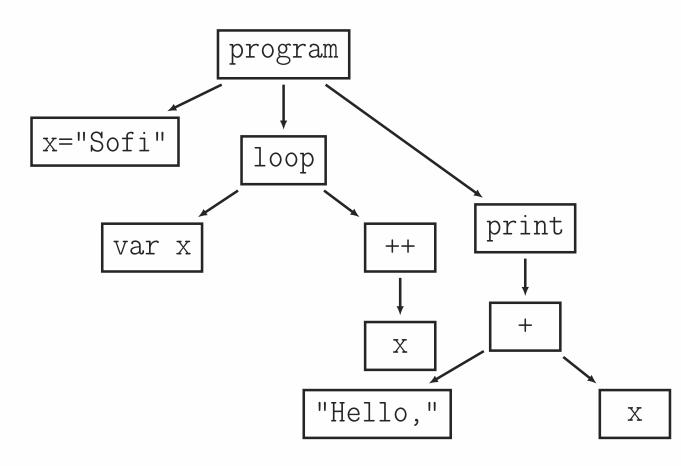
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Chapter #3:

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;
```



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Chapter #4:

AST Visitor

ANTLR4 lets us implement the following interface:

```
public interface ParseTreeListener {
  void visitTerminal(TerminalNode var1);
  void visitErrorNode(ErrorNode var1);
  void enterEveryRule(ParserRuleContext var1);
  void exitEveryRule(ParserRuleContext var1);
}
```

Then:

```
MyLexer lexer = new MyLexer(text); // Lexer
MyParser parser = new MyParser(
    new CommonTokenStream(lexer) // Parser

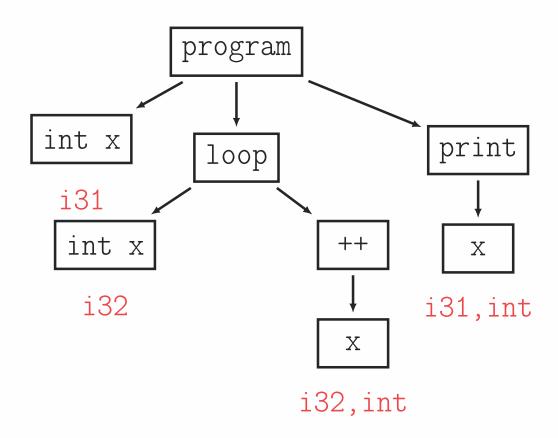
MyListener lsr = new MyListener(); // ParseTreeListener
new ParseTreeWalker().walk(lsr, parser.program());
```

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Chapter #5:

Decorated AST

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

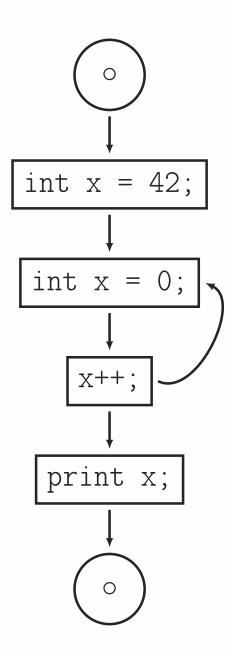


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Chapter #6:

Control Flow Graph

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



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References