

Lecture 16

Context-Sensitive Analysis

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Troy Vasiga et al
University of Waterloo

Big Picture of WLM Compilation

From WLM to MIPS

Zooming In On Compiler

Example

Input file:

```
int wain(int a, int b) {  
    return a;  
}
```

Example

Tokens from Scanner

Example

Parse Tree

Parse Tree

You will need to construct the parse tree since it gives

- ▶ structure to deal with each language “component” (e.g., statements, loops, if statements, etc.)
- ▶ the ability to traverse and combine information about “earlier” components

In A9P1, you will have to process a `.w1mi` file and generate a parse tree. In later parts of A9 and in A10/11, you may need to “decorate” the tree. By this, we mean a node in the tree may have fields such as:

- ▶ the symbol/token at the node
- ▶ the list of subtrees (i.e., the list of children a.k.a. the righthand side of the rule)
- ▶ the “meaning” of this node (if there is a meaning)

Traversing the parse tree

By the end of the compilation process, the parse tree should be traversed twice:

- ▶ one traversal is to construct the symbol table (for variables) and detect context-sensitive errors
- ▶ one traversal will create the code

Of course, it may be possible to do this all in one traversal, but that gets much more complicated and error-prone.

Next steps

- ▶ further error checking (context-sensitive analysis)
- ▶ code generation

Context-Sensitive Analysis

- ▶ Input:

- ▶ Output:

Possible errors

If a program is syntactically valid, what else can go wrong?

- ▶ variables:

- ▶ variables:

Solving the “variable declaration” problems

We have already.

Solving the “undeclared variable” problem

Solving the “duplicate variable” problem

Testing

- ▶ Make a script!
- ▶ Store expected output in a file and automatically `diff` against it.
- ▶ Start making many, small test cases now.
- ▶ Devise a good naming system for all input/output files.
- ▶ Write a “wrapper” script to test all your tests as you progress along.

Key context-sensitive result

Key idea: generate a symbol table containing information about variables

Note that we will add information to this symbol table as we progress through A9 and A10.