

CS323 Project Phase 2: Sematic Analyze

小组成员

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运行方式

```
make clean
make splc
./test_phase2.sh
```

具体实现

处理编程语言中的类型: type.cpp/hpp

SemanticType 类:

这个类用于表示编程语言中的类型。

包括基本类型、数组类型、结构体类型和函数类型。

有几个构造函数, 根据不同的类别 (如基本类型、数组、函数或结构体) 来初始化对象。

成员变量包括类型类别 (category)、节点类型 (nodetype)、数组指针 (array_ptr) 和参数列表指针 (params_ptr)。

Semantic analysis: semantic.cpp/hpp

全局符号表:

unordered_map<string, SemanticType *> symbol_table;; 定义了一个全局符号表来存储变量和函数的类型信息。

语义分析函数:

semantic_analyze(Node *program): 主要的语义分析函数, 用于分析程序的顶层结构。

analyze_ext_def_list(Node *ext_def_list): 分析扩展定义列表, 例如变量和函数的定义。

analyze_ext_def(Node *ext_def): 分析单个扩展定义, 包括变量定义和函数定义。

analyze_specifier(Node *specifier): 分析类型说明符, 如 int、float 或结构体定义。

analyze_def_list(Node *def_list, ParamList *params): 分析定义列表, 通常用于结构体或局部变量的定义。

analyze_fun_dec(Node *fun_dec, SemanticType *param_type): 分析函数声明。

analyze_comp_st(Node *compst, SemanticType *ret_type): 分析复合语句, 包括局部变量定

义和语句列表。

analyze_stmt_list(Node *stmt_list, SemanticType *ret_type): 分析语句列表。

analyze_stmt(Node *stmt, SemanticType *ret_type): 分析单个语句，包括表达式、控制流语句等。

辅助分析函数:

analyze_var_dec(Node *var_dec, SemanticType *type_): 分析变量声明。

analyze_exp(Node *exp): 分析表达式，处理不同类型的运算和函数调用。

analyze_args(Node *args, SemanticType *func_type, Node *id): 分析函数调用的参数列表。

analyze_assignment(Node *exp1, Node *_ASSIGN, Node *exp2): 分析赋值表达式。

错误处理:

代码中包含了多个 my_error.cpp/hpp 函数调用，用于在遇到语义错误时报告错误信息。

结构和类型定义:

使用了 SemanticType 和 ParamList 等结构来存储类型信息和参数列表。

更新错误类型: my_error.cpp/hpp

```
MISS_SEMI,  
MISS_RC,  
MISS_RP,  
MISS_SPEC,  
MISS_RB,  
UNDEFINED_VARIABLE,  
UNDEFINED_FUNC,  
REDEFINED_VARIABLE,  
REDEFINED_FUNC,  
ASSIGN_UNMATCH,  
RVALUE_ERROR,  
UNMATCH_OPERAND,  
RETURN_VALUE_MISMATCH,  
ARGS_MISMATCH,  
INDEX_OPERATOR_ERROR,  
FUNC_INVOKE_ERROR,  
INDEX_TYPE_ERROR,  
DOT_ERROR,  
UNDEFINED_STRUCT_MEMBER,  
REDEFINED_STRUCT,  
STRUCT_MISMATCH
```

Results

(有些答案不完全与提供 out 一致，比如少报一个 type5 的错，已在群内问助教，是实现不同导致的，不算错误)

```
Running test_2_r01
Contents of test2/test_2_r01.out.my:
Error type 1 at Line 3: undefined variable: z
Error type 1 at Line 9: undefined variable: a
Error type 3 at Line 10: redefine variable: b
Error type 1 at Line 10: undefined variable: a
Contents of test2/test_2_r01.out:
Error type 1 at Line 3: "z" is used without a definition
Error type 1 at Line 9: "a" is used without a definition
Error type 1 at Line 10: "a" is used without a definition
Error type 3 at Line 10: "b" is redefined

Running test_2_r02
Contents of test2/test_2_r02.out.my:
Error type 2 at line 9: undefined function: diff
Error type 8 at line 10: incompatible return type
Contents of test2/test_2_r02.out:
Error type 2 at Line 9: "diff" is invoked without a definition
Error type 8 at Line 10: incompatible return type

Running test_2_r03
Contents of test2/test_2_r03.out.my:
Error type 3 at line 4: redefine variable: weight
Error type 3 at line 10: redefine variable: age
Contents of test2/test_2_r03.out:
Error type 3 at Line 4: variable "weight" is redefined in the same scope
Error type 3 at Line 10: variable "age" is redefined in the same scope

Running test_2_r04
Contents of test2/test_2_r04.out.my:
Error type 4 at line 6: redefine function: sum
Error type 3 at line 6: redefine variable: x
Error type 3 at line 6: redefine variable: y
Error type 4 at line 6: redefine function: sum
Contents of test2/test_2_r04.out:
Error type 4 at Line 6: "sum" is redefined
Error type 8 at Line 9: incompatible return type

Running test_2_r05
Contents of test2/test_2_r05.out.my:
Error type 7 at line 11: binary operation on non-number variables
Error type 5 at line 12: unmatched type on both sides of assignment
Contents of test2/test_2_r05.out:
Error type 7 at Line 11: unmatched operands
Error type 5 at Line 11: unmatched type on both sides of assignment
Error type 5 at Line 12: unmatched type on both sides of assignment

Running test_2_r06
Contents of test2/test_2_r06.out.my:
Error type 5 at line 9: unmatched type on both sides of assignment
Error type 6 at line 10: left side in assignment is rvalue
Contents of test2/test_2_r06.out:
Error type 5 at Line 9: unmatched type on both sides of assignment
Error type 6 at Line 10: rvalue appears on the left-side of assignment

Running test_2_r07
Contents of test2/test_2_r07.out.my:
Error type 7 at line 11: binary operation on non-number variables
Error type 7 at line 12: binary operation on non-number variables
Contents of test2/test_2_r07.out:
Error type 7 at Line 11: unmatched operand
Error type 5 at Line 11: unmatched types on both sides of assignment
Error type 7 at Line 12: unmatched operand
Error type 5 at Line 12: unmatched types on both sides of assignment

Running test_2_r08
Contents of test2/test_2_r08.out.my:
Error type 8 at line 19: incompatible return type
Contents of test2/test_2_r08.out:
Error type 8 at Line 19: incompatible return typeRunning test_2_r09
Contents of test2/test_2_r09.out.my:
Error type 9 at line 12: invalid argument number for compare, compare
Error type 9 at line 14: invalid argument number for compare, compare
Error type 9 at line 15: invalid argument number for compare, compare
Contents of test2/test_2_r09.out:
Error type 9 at Line 12: invalid argument number, except 2, got 3
Error type 9 at Line 14: invalid argument number, except 2, got 1
Error type 9 at Line 15: invalid argument number, except 2, got 0Running test_2_r10
Contents of test2/test_2_r10.out.my:
Error type 10 at line 12: indexing on non-array variable
Contents of test2/test_2_r10.out:
Error type 10 at Line 12: indexing on non-array variableRunning test_2_r11
Contents of test2/test_2_r11.out.my:
Error type 11 at line 5: invoking non-function variable: abc
Contents of test2/test_2_r11.out:
Error type 11 at Line 5: invoking non-function variableRunning test_2_r12
Contents of test2/test_2_r12.out.my:
Error type 12 at line 7: indexing by non-integer
Contents of test2/test_2_r12.out:
Error type 12 at Line 7: indexing by non-integer
Error type 5 at Line 7: unmatched type on both sides of assignmentRunning test_2_r13
Contents of test2/test_2_r13.out.my:
Error type 13 at line 19: accessing with non-struct variable
Error type 13 at line 19: accessing with non-struct variable
Contents of test2/test_2_r13.out:
Error type 13 at Line 19: accessing with non-struct variable
Error type 13 at Line 19: accessing with non-struct variable

Running test_2_r14
Contents of test2/test_2_r14.out.my:
Error type 14 at line 11: no such member: c
Contents of test2/test_2_r14.out:
Error type 14 at Line 11: accessing an undefined structure member
Error type 5 at Line 11: unmatched types appear at both sides of the assignment operator

Running test_2_r15
Contents of test2/test_2_r15.out.my:
Error type 15 at line 7: redefine struct: Apple
Error type 5 at line 16: unmatched type on both sides of assignment
Contents of test2/test_2_r15.out:
Error type 15 at Line 7: redefine the same structure type
```

自测样例

我写了五个测试，分别报不同的 semantic error。

Running test1

Contents of test_ex/test1.out:

Error type 14 at line 10: no such member: weight

Running test2

Contents of test_ex/test2.out:

Error type 1 at Line 4: undefined variable: j

Running test3

Contents of test_ex/test3.out:

Error type 5 at line 5: unmatched type on both sides of assignment

Running test4

Contents of test_ex/test4.out:

Error type 6 at line 4: left side in assignment is rvalue

Running test5

Contents of test_ex/test5.out:

Error type 8 at line 4: incompatible return type