Compiler Lab Report:
HW1

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Overview

1. constantPropagation要求两个常数在BinaryOp时，被直接计算并化简为IntExp。 此处只需在visit BinaryOp时，判断参数、计算结果并覆写newnode即可。
2. executor要求预执行代码，合并所有计算节点，最后打印返回值。需要覆写以下visit函数：
    1. Assign：使用unordered_map<string, int>存储变量，并处理右侧的exp为IntExp。
    2. Return：打印结果即可。
    3. BinaryOp：从unordered_map<string, int>调用Assign处的值，将变量IdExp转换为int并计算，最后将整个节点转换成IntExp。
    4. UnaryOp：由于在minusIntConverter中处理过了，此处直接clone即可。
    5. Esc：使用visitList遍历所有Stm，然后处理exp，并调用evaluateExpression计算其值即可。整个节点的值等同于exp的计算结果。其中

此处为了统一处理，将所有数值计算导入evaluateExpression函数进行计算。

3. 这里实现了FDMJ的所有运算。

Code Implementation

1. **constantPropagation.cc** ： visit(BinaryOp *node)

对于所有BinaryOp，如果左右均为常量，直接根据op运算得到结果即可。

```
  if (l->getASTKind() == ASTKind::IntExp && r->getASTKind() ==
ASTKind::IntExp) {
    int val1 = static_cast<IntExp *>(l)->val;
    int val2 = static_cast<IntExp *>(r)->val;
    int val = 0;
    if      (node->op->op == "+")  val = val1 +  val2;
    else if (node->op->op == "-")  val = val1 -  val2;
    else if (node->op->op == "*")  val = val1 *  val2;
    else if (node->op->op == "/")  val = val1 /  val2;
    else if (node->op->op == "||") val = val1 || val2;
    else if (node->op->op == "&&") val = val1 && val2;
    else if (node->op->op == "<")  val = val1 <  val2;
    else if (node->op->op == "<=") val = val1 <= val2;
    else if (node->op->op == ">")  val = val1 >  val2;
    else if (node->op->op == ">=") val = val1 >= val2;
    else if (node->op->op == "==") val = val1 == val2;
    else if (node->op->op == "!=") val = val1 != val2;
    else {
      cerr << "Error: Unknown operator in the BinaryOp statement" << endl;
      newNode = nullptr;
      return;
    }
    // switch (node->op->op) // TODO: 需要把op变成enum
    // {
    // case "+":  val = val1 +  val2; break;
    // case "-":  val = val1 -  val2; break;
    // case "*":  val = val1 *  val2; break;
    // case "/":  val = val1 /  val2; break;
    // case "||": val = val1 || val2; break;
    // case "&&": val = val1 && val2; break;
    // case "<":  val = val1 <  val2; break;
    // case "<=": val = val1 <= val2; break;
    // case ">":  val = val1 >  val2; break;
    // case ">=": val = val1 >= val2; break;
    // case "==": val = val1 == val2; break;
```

```
    // case "!=": val = val1 != val2; break;
    // default: cerr << "Error: Unknown operator in the BinaryOp statement"
<< endl; return;
    // }
    newNode = new IntExp(node->getPos()->clone(), val);
    return;
```

2. **executor.cc**： evaluateExpression(Exp *exp)

对于所有情况处理exp/op并返回int结果。

```
int Executor::evaluateExpression(Exp *exp) {
  if (!exp) {
      std::cerr << "Error: Null expression encountered!" << std::endl;
      return 0;
  }

  switch (exp->getASTKind()) {
      case ASTKind::IntExp: {
        return static_cast<IntExp*>(exp)->val;
      }
      case ASTKind::IdExp: {
        IdExp *idExp = static_cast<IdExp*>(exp);
        if (symbolTable.find(idExp->id) != symbolTable.end()) {
          return symbolTable[idExp->id];
        } else {
          std::cerr << "Error: Undefined variable " << idExp->id <<
std::endl;
          return 0;
        }
      }
      case ASTKind::BinaryOp: {
        BinaryOp *binOp = static_cast<BinaryOp*>(exp);
        int val1 = evaluateExpression(binOp->left);
        int val2 = evaluateExpression(binOp->right);
        string op = static_cast<string>(binOp->op->op);
        if (op == "+")       return val1 + val2;
        else if (op == "-")  return val1 - val2;
        else if (op == "*")  return val1 * val2;
        else if (op == "/") {
          if (!val2) {
            std::cerr << "Error: Division by zero!" << std::endl;
            return 0;
          }
```

```
          return val1 / val2;
        }
        else if (op == "||") return val1 || val2;
        else if (op == "&&") return val1 && val2;
        else if (op == "<")  return val1 <  val2;
        else if (op == "<=") return val1 <= val2;
        else if (op == ">")  return val1 >  val2;
        else if (op == ">=") return val1 >= val2;
        else if (op == "==") return val1 == val2;
        else if (op == "!=") return val1 != val2;
        else {
          cerr << "Error: Unknown operator in the BinaryOp statement" <<
endl;
          newNode = nullptr;
          return 0;
        }
      }
      case ASTKind::Esc: {
        Esc *esc = static_cast<Esc*>(exp);
        visit(esc);
        return static_cast<IntExp*>(esc->exp)->val;
      }
      default:
        cerr << "Type: " << stringASTKind(exp->getASTKind()) << endl;
        cerr << "Error: Unsupported expression type!" << endl;
        return 0;
  }
}
```

3. **executor.cc** : visit(Esc *node)

```
  if (node->sl != nullptr)
    sl = visitList<Stm>(*this, node->sl);
  if (node->exp != nullptr) {
    node->exp->accept(*this);
    e = static_cast<Exp *>(newNode);
  }
  int result = evaluateExpression(e);
  node->exp = new IntExp(node->getPos(), result);
```

4. **executor.cc** : visit(BinaryOp *node)

直接调用evaluateExpression。

```
int val1 = evaluateExpression(node->left);
int val2 = evaluateExpression(node->right);
int val = evaluateExpression(node);
newNode = new IntExp(node->getPos()->clone(), val);
```

5. **executor.cc** : visit(Assign *node)

此处针对右侧值做了AST简化。

```
int value = evaluateExpression(node->exp);
IntExp* intExp = new IntExp(node->getPos()->clone(), value);

if (l->getASTKind() == ASTKind::IdExp)
  symbolTable[static_cast<IdExp *>(l)->id] = value;

newNode = new Assign(node->getPos()->clone(), l, intExp);
```

Graphs and Figures

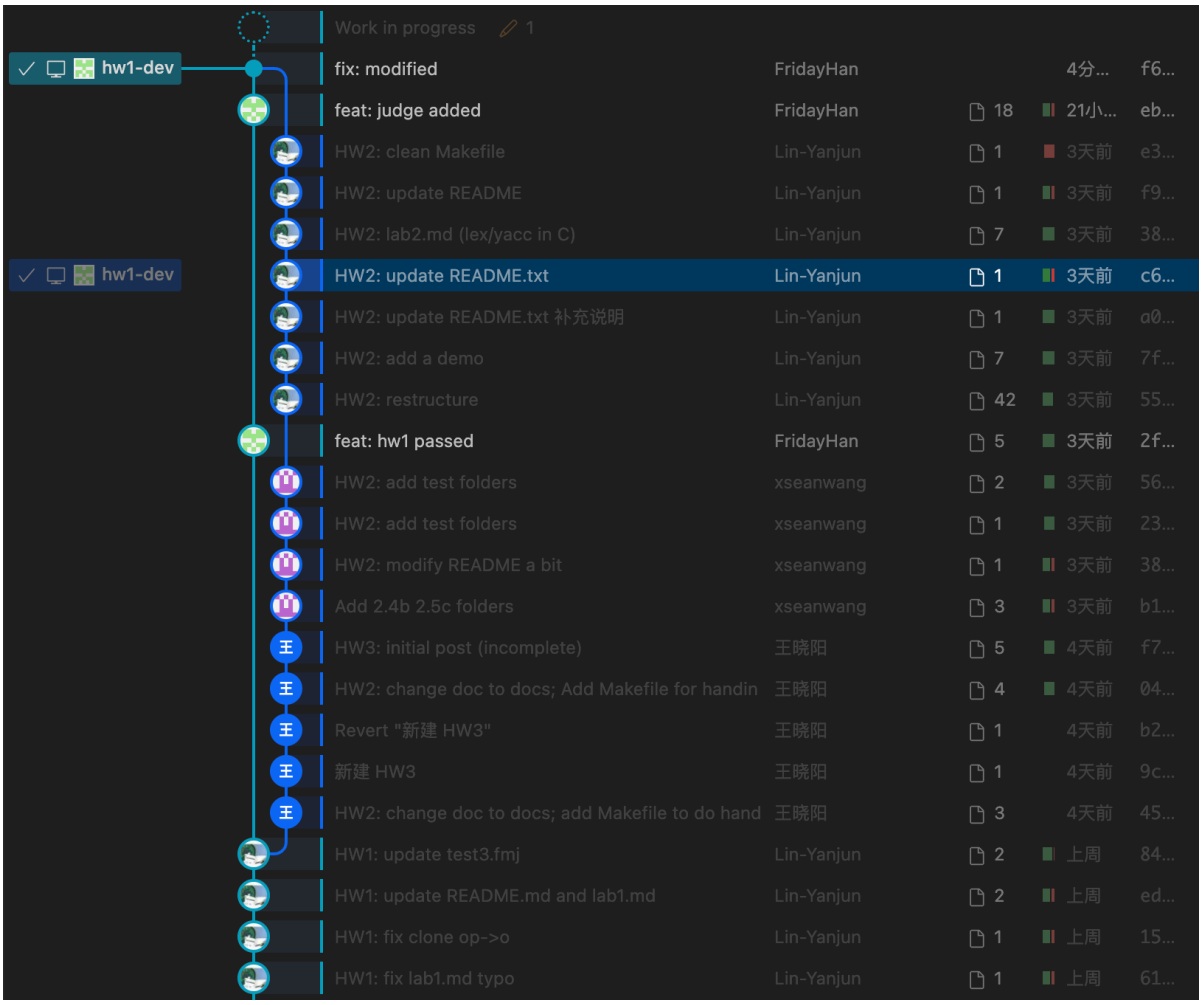
```
➜  HW1 git:(hw1-dev) ✗ make rebuild && make run
-- The C compiler identification is GNU 10.5.0
-- The CXX compiler identification is GNU 11.4.0
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Check for working C compiler: /usr/bin/cc - skipped
-- Detecting C compile features
-- Detecting C compile features - done
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Check for working CXX compiler: /usr/bin/c++ - skipped
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Found FLEX: /usr/bin/flex (found suitable version "2.6.4", minimum required is "2.6")
-- Found BISON: /usr/bin/bison (found suitable version "3.8.2", minimum required is "3.8")
-- Configuring done
-- Generating done
-- Build files have been written to: /Users/han/Desktop/Compiler/FudanCompilerH2025/HW1/build
[13/13] Linking CXX executable tools/main/main
cd /Users/han/Desktop/Compiler/FudanCompilerH2025/HW1/test && \
for file in $(ls .); do \
        if [ "${file##*.}" = "fmj" ]; then \
            echo "Parsing ${file%%.*}"; \
                /Users/han/Desktop/Compiler/FudanCompilerH2025/HW1/build/tools/main/main "${file%%.*}"; \
                # echo "Comparing parsed write-out with load+then-write-out"; \
                # diff "${file%%.*}.2.ast" "${file%%.*}.2-debug.ast" ; \
                # echo "Comparing parsed write-out with load+then-clone-then-write-out"; \
                # diff "${file%%.*}.2.ast" "${file%%.*}.2-debug3.ast" ; \
                # echo "Comparing parsed write-out with load+then-clone-then-minusConst-converted-write-out"; \
                # diff "${file%%.*}.2.ast" "${file%%.*}.2-debug4.ast" ; \
        fi \
done; \
cd .. > /dev/null 2>&1
Parsing test1
-7
Parsing test2
2
Parsing test3
2
Parsing test4
-2
Parsing test5
1
```

```
➜  FudanCompilerH2025 git:(hw1-dev) ✗ ./compiler_judge/compiler_judge ./compiler_judge/HW1

Test: signed_overflow    [ AC ]
Test: sample_post_order    [ AC ]
Test: sample_4    [ AC ]
Test: sample_3    [ AC ]
Test: deepseek_test_1    [ AC ]
Test: sample_1    [ AC ]
Test: simple_test_1    [ AC ]
Test: sample_2    [ AC ]

Summary:

  Accepted (8/8):
    signed_overflow: passed
    sample_4: passed
    sample_3: passed
    sample_post_order: passed
    deepseek_test_1: passed
    sample_1: passed
    simple_test_1: passed
    sample_2: passed
```



References

- 虎书Ch1/2/3