

Lecture 25:

- Code Generation

Announcements:

- HW-5 due Friday
- Proj Part 2 due Mon (examples, test cases, initial design/plan)

IR Code Generation

(3) Generating Functions: FunDef nodes

- Create a new frame template (as currTemplate)
- Push a new variable environment (via varTable)
- Store each argument provided on operand stack (from the CALL)
- Visit each statement node (to generate its code)
- Add a return (PUSH, RET) if last statement isn't a return
- Pop the variable environment
- Add the frame template to the VM

IR Code Generation

(4) Basic function code-generation examples:

(a) Empty function

... just adds a return

```
void f() {  
}
```

Frame Template 'f'
0: PUSH(null)
1: RET()

(b) One-parameter function

... store arg into local memory

... assumes parameter value is on operand stack

```
void f(x: int) {  
}
```

Frame Template 'f'
0: STORE(0) // parameter x
1: PUSH(null)
2: RET()

IR Code Generation

(c) Two-parameter function ... note: args on operand stack in reverse order!

```
void f(x: int, y: bool) {  
}
```

Frame Template 'f'
0: STORE(0) // parameter x
1: STORE(1) // parameter y
2: PUSH(null)
3: RET()

(d) Simple return

... note: no optimization!

```
int f(x: int) {  
    return x + 1  
}
```

Frame Template 'f'
0: STORE(0) // parameter x
1: LOAD(0) // load var x
2: PUSH(1)
3: ADD()
4: RET()

IR Code Generation

(5) Simple rvalues (i.e., literals)

... convert lexeme to associated Java value, and push as literal

```
public void visit(SimpleRValue node) {  
    String val = node.literal.lexeme;  
    if (node.literal.tokenType == TokenType.INT_VAL)  
        add(VMInstr.PUSH(Integer.parseInt(val)));  
    else if (node.literal.tokenType == TokenType.DOUBLE_VAL)  
        add(VMInstr.PUSH(Double.parseDouble(val)));  
    else if (node.literal.tokenType == TokenType.STRING_VAL) {  
        val = val.replace("\\n", "\n");  
        val = val.replace("\\t", "\t");  
        val = val.replace("\\r", "\r");  
        add(VMInstr.PUSH(val));  
    }  
    else if (val.equals("true"))  
        add(VMInstr.PUSH(true));  
    else if (val.equals("false"))  
        add(VMInstr.PUSH(false));  
    else if (val.equals("null"))  
        add(VMInstr.PUSH(VM.NULL));  
}
```

Note: add(instr) and add(instr, comment) are helpers in CodeGenerator