CS 631-02 RISC-V Code Gen & Machine Code

$$\texttt{./ntlang -e } \underbrace{\texttt{"a0 + a1 + 3"}}_{\text{expr}} \texttt{ -c foo } \underbrace{\texttt{> foo.s}}_{\text{shell}}$$

↗

complete .s
program

main + func
codegen_main.s foo
expr

compile.c

compile_expr (tree, config)

① write out codegen_main.s

② compile_expr_tree(tree)

↳ foo:
codegen_func_s:

↓

ret

codegen_main.s

↓

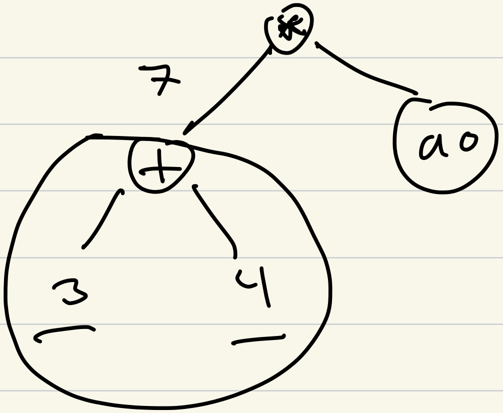
```
codegen_func_s:
        add a0,a0,a1
        ret
```

return 0

```
li a0,0
ret
```

Constant Folding

(3+4) * a0



IR

Intermediate representation

└ RTL register transfer language

Machine Code

$2^{\boxed{5}} = 32$

Binary Form of Assembly

00B50533 $\underbrace{\text{add}}\ \underbrace{\text{a0}}_{rd},\underbrace{\text{a0}}_{rs1},\underbrace{\text{a1}}_{rs2}$

$$\underbrace{0000\ 000}_{\text{funct7}}\underbrace{0\ 1011}_{\substack{rs2\\11\\a1}}\ \underbrace{0101\ 0}_{\substack{rs1\\10\\a0}}\underbrace{000}_{\text{Funct3}}\ \underbrace{0101\ 0}_{\substack{rd\\10\\a0}}\underbrace{0110011}_{\substack{\text{opcode}\\ \text{R-Type}}}$$