

2. CFG, SSA

1. 划分基本块

B1:

$$i = 1$$

$$\text{sum} = 0$$

$$x = 10$$

$$y = 5$$

B2 =

L1: if $i > 100$ goto L2

B3:

$$t1 = x * y$$

$$t2 = i * 4$$

$$t3 = t2 + a$$

$$M[t3] = t1$$

$$t4 = x * y$$

$$\text{sum} = \text{sum} + t4$$

$$t5 = i + 1$$

$$i = -15$$

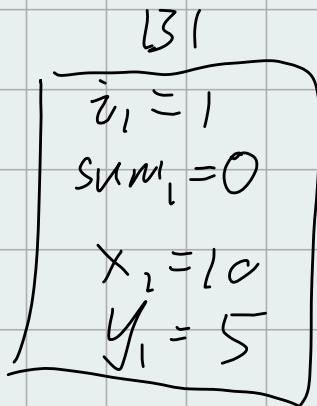
goto L1

B4:

L2:

$$\text{result} = \text{sum}$$

print(result)



↓

B2

$$L_1: i_2 = \phi(i_1, i_3)$$

$$\text{sum}_2 = \phi(\text{sum}_1, \text{sum}_3)$$

if $\bar{i}_2 > 100$ goto L2.

B3

↙ False

↙ True

B4

L2:

$$\text{result}_1 = \text{sum}_2$$

print(result1)

$$t1_1 = x_1 * y_1$$

$$t2_1 = i_2 * 4$$

$$t3_1 = t2_1 + a$$

$$M[t3_1] = t1_1$$

$$t4_1 = x_1 * y_1$$

$$\text{sum}_3 = \text{sum}_2 + t4_1$$

$$t5_1 = i_2 + 1$$

$$\bar{i}_3 = t5_1$$

goto L1

3. 代码优化

E. 伪语句量删除.

A. 常量传播、算术简并

$$x_1 = 10, y_1 = 5$$

$$\rightarrow t1 = x_1 * y_1 = 50$$

$$t4 = x_1 * y_1 = 50$$

$$\text{if } i > 100 \rightarrow \text{if } T > 400 + a$$

变量已被相关计算或
为死代码，可删除

B. 公共子表达式删除

$t1, t4$ 计算逻辑一样。

只保留 $t1$ ，代码变为 $sum = sum + t1$

C. 循环不变量外提

$t1 = 50$ 的计算不依赖循环不变量 T

D. 避免前溢

基础伪语句量之

发生伪语句量 $t2 = i * 4$

$$t3 = t2 + a$$

将循环里的 $i * 4$ 替换为加法

引入临时变量 T .

初始化 $T = 4 + a$; 循环内 $T = T + 4$

$$M[t3] \rightarrow M[T]$$

最終結果：

B1

$$sum = 0$$

$$val = 50$$

$$T = a + 4$$

$$limit = a + 4 * 0$$

B2

L1:

if $T > limit$ goto L2

True

B4

L2:

result = sum

print(result)

B3

$M[T] = val$

$sum = sum + val$

$$T = T + 4$$

goto L1