

H W 6

产生式	语义规则
$P \rightarrow S$	$S.next = newlabel()$ $P.code = S.code \parallel label(S.next)$
$S \rightarrow assign$	$S.code = assign.code$
$S \rightarrow if (B) S_1$	$B.true = newlabel()$ $B.false = S_1.next = S.next$ $S.code = B.code \parallel label(B.true) \parallel S_1.code$
$S \rightarrow if (B) S_1 else S_2$	$B.true = newlabel()$ $B.false = newlabel()$ $S_1.next = S_2.next = S.next$ $S.code = B.code \parallel label(B.true) \parallel S_1.code \parallel label(B.false) \parallel S_2.code$
$S \rightarrow while (B) S_1$	$begin = newlabel()$ $B.true = newlabel()$ $B.false = S.next$ $S_1.next = begin$ $S.code = label(begin) \parallel B.code \parallel label(B.true) \parallel S_1.code \parallel gen('goto' begin)$
$S \rightarrow S_1 S_2$	$S_1.next = newlabel()$ $S_2.next = S.next$ $S.code = S_1.code \parallel label(S_1.next) \parallel S_2.code$

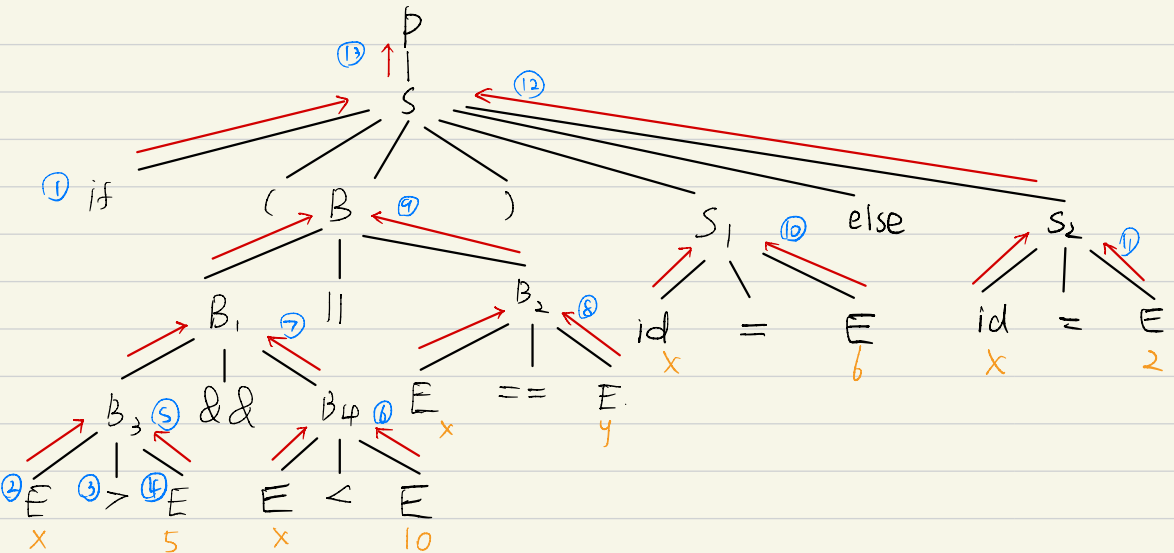
图 6-36 控制流语句的语法制导定义

产生式	语义规则
$B \rightarrow B_1 \parallel B_2$	$B_1.true = B.true$ $B_1.false = newlabel()$ $B_2.true = B.true$ $B_2.false = B.false$ $B.code = B_1.code \parallel label(B_1.false) \parallel B_2.code$
$B \rightarrow B_1 \&\& B_2$	$B_1.true = newlabel()$ $B_1.false = B.false$ $B_2.true = B.true$ $B_2.false = B.false$ $B.code = B_1.code \parallel label(B_1.true) \parallel B_2.code$
$B \rightarrow ! B_1$	$B_1.true = B.false$ $B_1.false = B.true$ $B.code = B_1.code$
$B \rightarrow E_1 \text{ rel } E_2$	$B.code = E_1.code \parallel E_2.code$ $\parallel gen('if' E_1.addr \text{ rel } op E_2.addr 'goto' B.true)$ $\parallel gen('goto' B.false)$
$B \rightarrow true$	$B.code = gen('goto' B.true)$
$B \rightarrow false$	$B.code = gen('goto' B.false)$

图 6-37 为布尔表达式生成三地址代码

1. 根据课本图6-36和图6-37给出的SDD，将控制流语句if($x > 5 \&\& x < 10 \parallel x = y$) $x = 6$ else $x = 2$ 翻译成三地址代码序列，要求：

- 画出语法分析树，标出依赖图的箭头
- 简要描述如何翻译成三地址代码的，并写出你得到的三地址代码
- 注：这里我们采用S属性的SDD，所以基于自底向上的语法分析来翻译即可。



⑥ 语句 $E > E$ 归结为 B_3 : $\left. \begin{array}{l} \text{if } x > 5 \text{ goto } B_3.\text{true} \\ \text{goto } B_3.\text{false} \end{array} \right\} B_3.\text{code}$

⑦ 语句 $E < E$ 归结为 B_4 : $\left. \begin{array}{l} \text{if } x < 10 \text{ goto } B_4.\text{true} \\ \text{goto } B_4.\text{false} \end{array} \right\} B_4.\text{code}$

⑧ 语句 B_3 及 B_4 归结为 B_1 : $\left. \begin{array}{l} \text{if } x > 5 \text{ goto } L_4 \\ \text{goto } B_1.\text{false} \\ L_4: \text{if } x < 10 \text{ goto } B_1.\text{true} \\ \text{goto } B_1.\text{false} \end{array} \right\} B_1.\text{code}$
 $B_1.\text{true} = L_4$

⑨ 语句 $E == E$ 归结为 B_2 : $\left. \begin{array}{l} \text{if } x == y \text{ goto } B_2.\text{true} \\ \text{goto } B_2.\text{false} \end{array} \right\} B_2.\text{code}$

⑩ 语句 B_1 及 B_2 归结为 B : $\left. \begin{array}{l} \text{if } x > 5 \text{ goto } L_4 \\ \text{goto } L_3 \\ L_4: \text{if } x < 10 \text{ goto } B.\text{true} \\ \text{goto } L_3 \\ L_3: \text{if } x == y \text{ goto } B.\text{true} \\ \text{goto } B.\text{false} \end{array} \right\} \begin{array}{l} B_1.\text{code} \\ B_2.\text{code} \end{array}$
 $B_1.\text{false} = L_3$

⑪ 语句 $id = E$ 归结为 S_1 : $\left. \begin{array}{l} x = 6 \end{array} \right\} S_1.\text{code}$

⑫ 语句 $id = E$ 归结为 S_2 : $\left. \begin{array}{l} x = 2 \end{array} \right\} S_2.\text{code}$

⑬ 语句 $\text{if } (B) S_1 \text{ else } S_2$ 归结为 S : $\left. \begin{array}{l} \text{if } x > 5 \text{ goto } L_4 \\ \text{goto } L_3 \\ L_4: \text{if } x < 10 \text{ goto } L_2 \\ \text{goto } L_3 \\ L_3: \text{if } x == y \text{ goto } L_2 \\ \text{goto } L_1 \\ L_2: x = 6 \\ \text{goto } S.\text{next} \\ L_1: x = 2 \end{array} \right\} \begin{array}{l} B.\text{code} \\ S_1.\text{code} \\ S_2.\text{code} \end{array}$

⑭ 语句 S 归结为 P : $\left. \begin{array}{l} \text{if } x > 5 \text{ goto } L_4 \\ \text{goto } L_3 \\ L_4: \text{if } x < 10 \text{ goto } L_2 \\ \text{goto } L_3 \end{array} \right\} \begin{array}{l} B.\text{true} = L_2 \\ B.\text{false} = L_1 \\ S.\text{code} \end{array}$

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L3: if x==y goto L2
      goto L1
L2: x = 6
      goto L0
L1: x = 2
L0: 后续代码

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$S_{next} = L_0$

练习 6.4.8: 一个按行存放的实数型数组 $A[i, j, k]$ 的下标 i 的范围为 $1 \sim 4$, 下标 j 的范围为 $0 \sim 4$, 且下标 k 的范围为 $5 \sim 10$ 。每个实数占 8 个字节。假设数组 A 从 0 字节开始存放。计算下列元素的位置。

1) $A[3, 4, 5]$ 2) $A[1, 2, 7]$ 3) $A[4, 3, 9]$

练习 6.4.9: 假定 A 是按列存放的, 重复练习 6.4.8。

$$addr = ((i-1) + (j-0) \times 4 + (k-5) \times 4 \times 5) \times 8$$

$$1) addr = ((3-1) + 4 \times 4 + (5-5) \times 4 \times 5) \times 8 = 144$$

$$2) addr = ((1-1) + 2 \times 4 + (7-5) \times 4 \times 5) \times 8 = 384$$

$$3) addr = ((4-1) + 3 \times 4 + (9-5) \times 4 \times 5) \times 8 = 760$$

练习 8.2.2: 假设 a 和 b 是元素为 4 字节值的数组, 为下面的三地址语句序列生成代码。

2) 三个语句的序列

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x = a[i]
y = b[i]
z = x * y

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2) LD R_1, i

MUL $R_1, R_1, 4$

LD $R_2, a(R_1)$

LD $R_1, b(R_1)$

MUL R_1, R_2, R_1

ST z, R_1