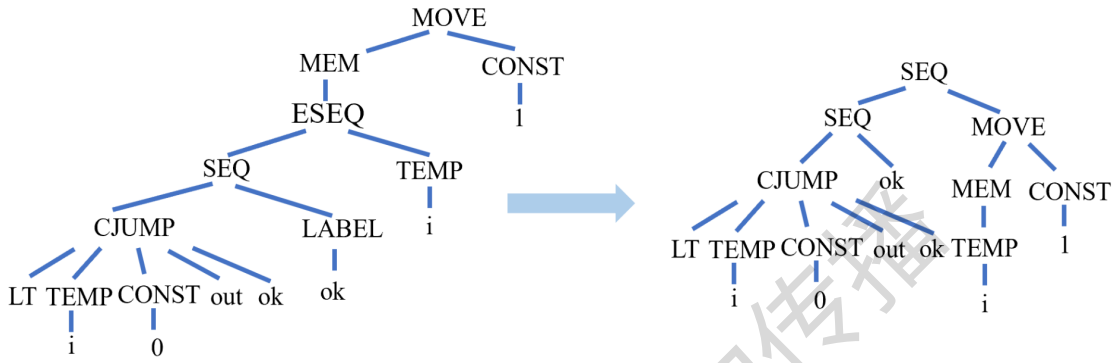
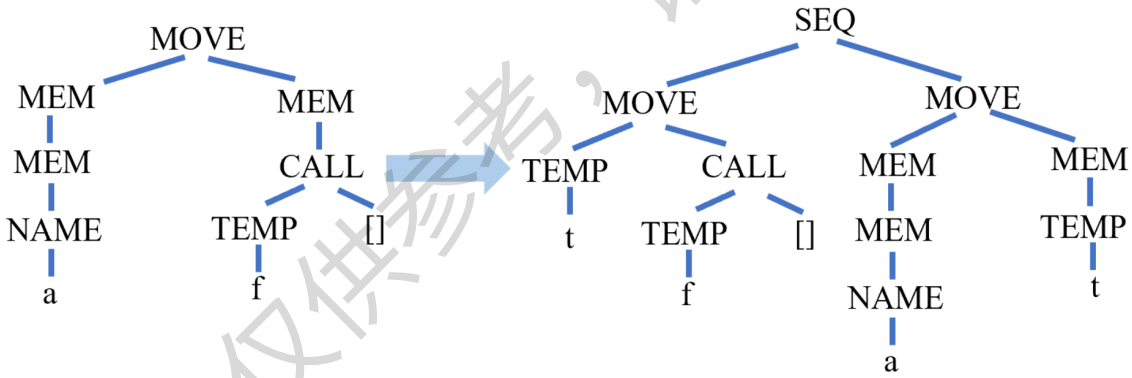
Chapter 8

8.2

a MOVE(MEM(ESEQ(SEQ(CJUMP(LT, TEMP*i*, CONST0, *Lout*, *Lok*), LABEL*ok*), TEMP*i*)), CONST1)



b MOVE(MEM(MEM(NAME*a*)), MEM(CALL(TEMP *f* , [])))

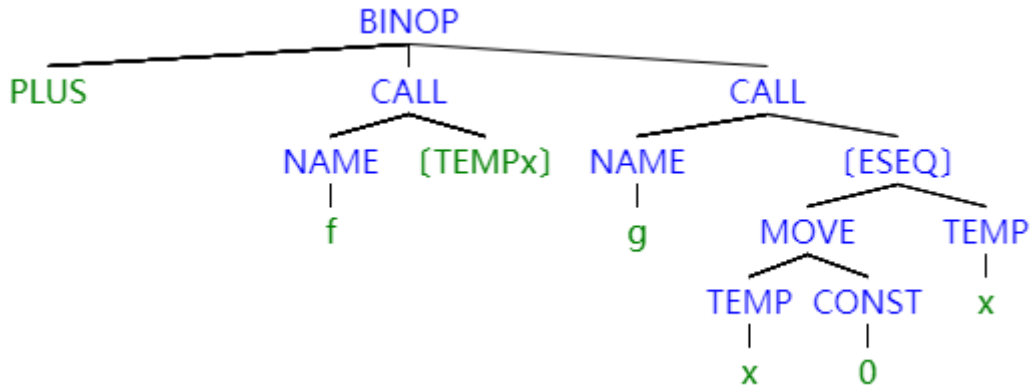


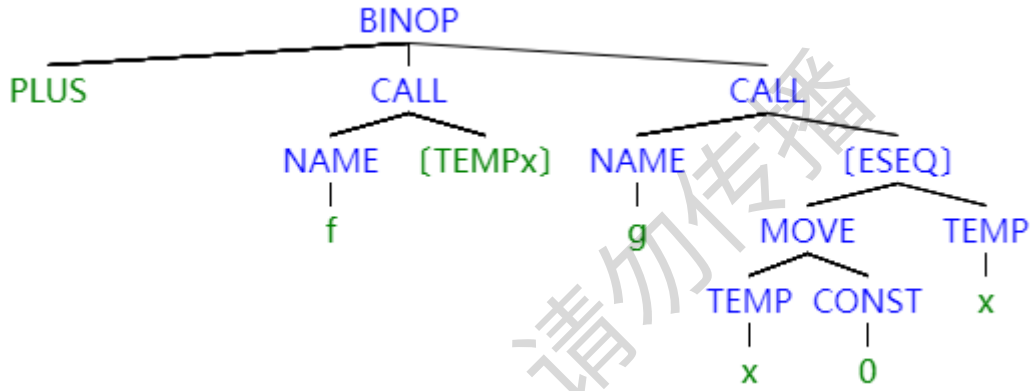
c BINOP(PLUS,CALL(NAME*f*,[TEMP*x*]),

CALL(NAME*g*, [ESEQ(MOVE(TEMP*x* , CONST0), TEMP*x*)]))

BINOP(PLUS, CALL(NAME f, [TEMP x]), CALL(NAME g, [ESEQ(MOVE(TEMP x, CONST 0), TEMP x)]))

the tree diagram:





after applying the rewriting rules (first time):

BINOP(PLUS, CALL(NAME f, [TEMP x]), ESEQ(MOVE(TEMP x, CONST 0), CALL(NAME g, [TEMP x])))

after applying the rewriting rules (second time):

ESEQ(SEQ(MOVE(TEMP t, TEMP x), MOVE(TEMP x, CONST 0)), BINOP(PLUS, CALL(NAME f, [TEMP t]), CALL(NAME g, [TEMP x]))

after applying the *CALL* rule:

ESEQ(SEQ(MOVE(TEMP t, TEMP x), MOVE(TEMP x, CONST 0)), BINOP(PLUS, ESEQ(MOVE(TEMP t1, CALL(NAME f, [TEMP t])), TEMP t1), ESEQ(MOVE(TEMP t2, CALL(NAME g, [TEMP x])), TEMP t2))

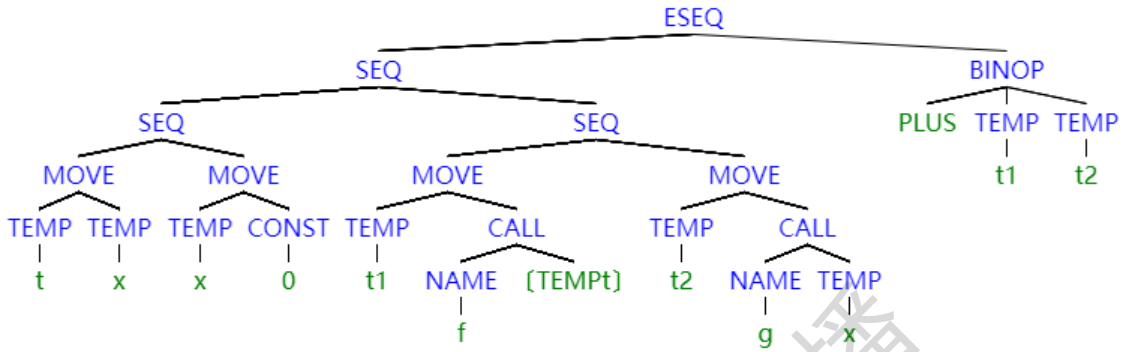
after applying the rewriting rules (third time):

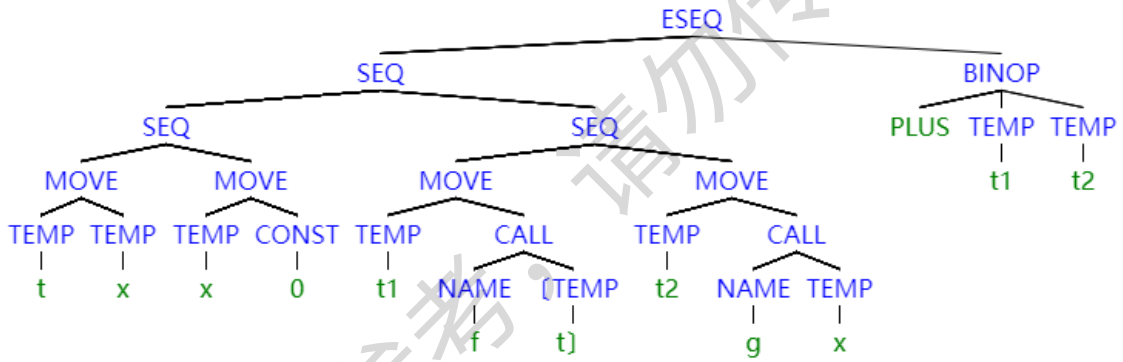
ESEQ(SEQ(MOVE(TEMP t, TEMP x), MOVE(TEMP x, CONST 0)), ESEQ(SEQ(MOVE(TEMP t1, CALL(NAME f, [TEMP t])), MOVE(TEMP t2, CALL(NAME g, [TEMP x]))), BINOP(PLUS, TEMP t1, TEMP t2)))

after applying the rewriting rules (fourth time):

ESEQ(SEQ(SEQ(MOVE(TEMP t, TEMP x), MOVE(TEMP x, CONST 0)), SEQ(MOVE(TEMP t1, CALL(NAME f, [TEMP t])), MOVE(TEMP t2, CALL(NAME g, [TEMP x])))), BINOP(PLUS, TEMP t1, TEMP t2))

the corresponding tree diagram:





Another solution:

First apply the *CALL* rule, then apply the rewrite rule

BINOP(PLUS, CALL(NAME f, [TEMP x]), CALL(NAME g, [ESEQ(MOVE(TEMP x, CONST 0), TEMP x)]))

apply the *CALL* rule

BINOP(

PLUS,

ESEQ(

MOVE(TEMP t1, CALL(NAME f, [TEMP x])),

TMEP t1),

ESEQ(

MOVE(TEMP t2, CALL(NAME g, [ESEQ(MOVE(TEMP x, CONST 0), TEMP x)])),

TEMP t2)

)

apply the rewriting rule

ESEQ(

MOVE(TEMP t1, CALL(NAME f, [TEMP x])),

BINOP(PLUS, TEMP t1,

ESEQ(

MOVE(TEMP t2, CALL(NAME g, [ESEQ(MOVE(TEMP x, CONST 0), TEMP x)])),

TEMP t2)

)

apply the rewriting rule

ESEQ(

MOVE(TEMP t1, CALL(NAME f, [TEMP x])),

BINOP(PLUS, TEMP t1,

ESEQ(

MOVE(TEMP t2, ESEQ(MOVE(TEMP x, CONST 0), CALL(NAME g, [TEMP x])),

TEMP t2)

)

apply the rewriting rule

ESEQ(

MOVE(TEMP t1, CALL(NAME f, [TEMP x])),

BINOP(PLUS, TEMP t1,

ESEQ(

```
            SEQ(
                MOVE(TEMP x, CONST 0),
                MOVE(TEMP t2, CALL(NAME g, [TEMP x))
            )
            TEMP t2)
)
```

apply the rewriting rule

```
ESEQ(
    SEQ(MOVE(TEMP t1, CALL(NAME f, [TEMP x])),
        SEQ(MOVE(TEMP x, CONST 0),
            MOVE(TEMP t2, CALL(NAME g, [TEMP x))
        )
    )
    BINOP(PLUS, TEMP t1, TEMP t2)
)
```

8.6

1 $m \leftarrow 0$
2 $v \leftarrow 0$
3 if $v \geq n$ goto 15
4 $r \leftarrow v$
5 $s \leftarrow 0$
6 if $r < n$ goto 9
7 $v \leftarrow v + 1$
8 goto 3
9 $x \leftarrow M[r]$
10 $s \leftarrow s + x$
11 if $s \leq m$ goto 13
12 $m \leftarrow s$
13 $r \leftarrow r + 1$
14 goto 6
15 return m

```
graph TD
  1[B1 m <- 0 v<-0]
  2[B2 if v >= n goto 15]
  3[B3 r <- v s <- 0]
  4[B4 if r < n goto 9]
  5[B5 v <- v+1 goto 3]
```

```
  6[B6 x <- Mr s<-s+x if s<=m goto 13]
  7[B7 m<-s]
  8[B8 r <- r+1 got0 6]
  9[B9 return m]
1 --> 2
2 --> 3
2 --> 9
3 --> 4
4 --> 5
4 --> 6
5 --> 2
6 --> 8
6 --> 7
7 --> 8
8 --> 4
```

8.7

the tree intermediate form:

```
LABEL(one)
MOVE(TEMP m, CONST 0)
MOVE(TEMP v, CONST 0)
JUMP(NAME three)
-----------------------------------------
LABEL(three)
CJUMP(GE, TEMP v, TEMP n, fifteen, four)
-----------------------------------------
LABEL(four)
MOVE(TEMP r, TEMP v)
MOVE(TEMP s, CONST 0)
JUMP(NAME six)
-----------------------------------------
LABEL(six)
CJUMP(LT, TEMP r, TEMP n, nine, seven)
-----------------------------------------
LABEL(seven)
MOVE(TEMP v, BINOP(PLUS, TEMP v, CONST 1))
JUMP(NAME three)
-----------------------------------------
LABEL(nine)
MOVE(TEMP x, MEM(TEMP r))
MOVE(TEMP s, BINOP(PLUS, TEMP s, TEMP x))
CJUMP(LE, TEMP s, TEMP m, thirteen, twelve)
-----------------------------------------
LABEL(twelve)
MOVE(TEMP m, TEMP s)
JUMP(NAME thirteen)
-----------------------------------------
LABEL(thirteen)
MOVE(TEMP r, BINOP(PLUS, TEMP r, CONST 1))
JUMP(NAME six)
-----------------------------------------
LABEL(fifteen)
```

```
MOVE(TEMP a1, TEMP m)
JUMP(return address)
```

traces答案不唯一: B1 B2 B3 B4 B5 | B6 B7 B8 | B9