

第 8 次作业

Log Creative

2021 年 6 月 28 日

8.4.1 简单的矩阵乘法程序。

```

1      for (i=0; i<n; i++)
2          for (j=0; j<n; j++)
3              c[i][j] = 0.0;
4      for (i=0; i<n; i++)
5          for (j=0; j<n; j++)
6              for(k=0; k<n; k++)
7                  c[i][j] = c[i][j] + a[i][k]*b[k][j];

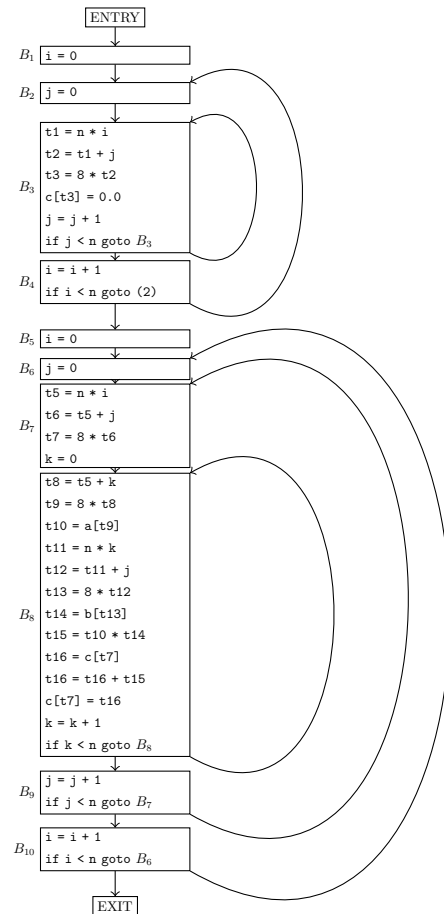
```

- 1) 假设矩阵的元素是需要 8 个字节的数值，而且矩阵按行存放。把程序翻译为三地址语句。
解.

```

1  i = 0
2  j = 0
3  t1 = n * i
4  t2 = t1 + j
5  t3 = 8 * t2
6  c[t3] = 0.0
7  j = j + 1
8  if j < n goto (3)
9  i = i + 1
10 if i < n goto (2)
11 i = 0
12 j = 0
13 t5 = n * i
14 t6 = t5 + j
15 t7 = 8 * t6
16 k = 0
17 t8 = t5 + k
18 t9 = 8 * t8
19 t10 = a[t9]
20 t11 = n * k
21 t12 = t11 + j
22 t13 = 8 * t12
23 t14 = b[t13]
24 t15 = t10 * t14
25 t16 = c[t7]
26 t16 = t16 + t15
27 c[t7] = t16
28 k = k + 1
29 if k < n goto (17)
30 j = j + 1
31 if j < n goto (13)
32 i = i + 1
33 if i < n goto (12)

```



2) 为 (1) 中得到的代码构造流图。解. 如上图所示。

3) 找出在 (2) 中得到的流图的循环。解.

1. B_3 自身
2. $\{B_2, B_3, B_4\}$
3. B_8 自身
4. $\{B_7, B_8, B_9\}$
5. $\{B_6, B_7, B_8, B_9, B_{10}\}$

8.6.1 生成三地址代码

$x = a/(b+c) - d*(e+f);$

```

1  t = b + c
2  u = a / t
3  v = e + f
4  w = d * v
5  x = u - w

```

8.6.3 把三地址代码转换为本节给出的机器模型的机器代码。假设你有任意多个寄存器可用。

```

1  LD R1, b
2  LD R2, c
3  ADD R3, b, c
4  LD R4, a
5  DIV R5, R4, R3
6  LD R6, e
7  LD R7, f
8  ADD R8, R6, R7
9  LD R9, d
10 MUL R10, R9, R8
11 SUB R11, R5, R10
12 ST x, R11

```

8.6.4 假设有三个可用的寄存器，使用本节中的简单代码生成算法，转换为机器代码。请给出每一个步骤之后的寄存器和地址描述符。解.

R1	R2	R3	a	b	c	d	e	f	t	u	v	w	x
			a	b	c	d	e	f					

$t = b + c$

LD R1, b

LD R2, c

ADD R1, R1, R2

R1	R2	R3	a	b	c	d	e	f	t	u	v	w	x
t	c		a	b	c,R2	d	e	f	R1				

$u = a / t$

LD R2, a

DIV R1, R2, R1

R1	R2	R3	a	b	c	d	e	f	t	u	v	w	x
u	a		a,R2	b	c	d	e	f		R1			

```

v = e + f
LD R2, e
LD R3, f
ADD R2, R2, R3

```

R1	R2	R3	a	b	c	d	e	f	t	u	v	w	x
u	v	f	a	b	c	d	e	f,R3		R1	R2		

```

w = d * v
LD R3, d
MUL R2, R2, R3

```

R1	R2	R3	a	b	c	d	e	f	t	u	v	w	x
u	w	d	a	b	c	d,R3	e	f		R1		R2	

```

x = u - w
SUB R1, R1, R2

```

R1	R2	R3	a	b	c	d	e	f	t	u	v	w	x
x	w	d	a	b	c	d,R3	e	f				R2	R1

```

ST x, R1

```

R1	R2	R3	a	b	c	d	e	f	t	u	v	w	x
x	w	d	a	b	c	d,R3	e	f				R2	x,R1

8.6.5 重复练习 8.6.4, 但是假设只有两个可用的寄存器。解.

R1	R2	a	b	c	d	e	f	t	u	v	w	x
		a	b	c	d	e	f					

```

t = b + c
LD R1, b
LD R2, c
ADD R1, R1, R2

```

R1	R2	a	b	c	d	e	f	t	u	v	w	x
t	c	a	b	c,R2	d	e	f	R1				

```

u = a / t
LD R2, a
DIV R1, R2, R1

```

R1	R2	a	b	c	d	e	f	t	u	v	w	x
u	a	a,R2	b	c	d	e	f		R1			

ST u, R1

R1	R2	a	b	c	d	e	f	t	u	v	w	x
u	a	a,R2	b	c	d	e	f		u			

v = e + f

LD R1, e

LD R2, f

ADD R1, R1, R2

R1	R2	a	b	c	d	e	f	t	u	v	w	x
v	f	a	b	c	d	e	f,R2		u	R1		

w = d * v

LD R2, d

MUL R1, R1, R2

R1	R2	a	b	c	d	e	f	t	u	v	w	x
w	d	a	b	c	d,R2	e	f		u		R1	

x = u - w

LD R2, u

SUB R1, R2, R1

R1	R2	a	b	c	d	e	f	t	u	v	w	x
x	u	a	b	c	d	e	f		u,R2			R1

ST x, R1

R1	R2	a	b	c	d	e	f	t	u	v	w	x
x	u	a	b	c	d,R3	e	f		u,R2			x,R1