作业 14

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练习8.2.1: 考虑下面的矩阵乘法程序:

- 1. 假设每个矩阵元素占 4 字节,且矩阵按行存放,把程序翻译成本节中的三地址语句并标出基本块
- 2. 为 1. 中得到的代码构造流图
- 3. 找到 2. 中流图中的循环

```
for (i=0; i<n; i++)
    for (j=0; j<n; j++)
        c[i][j] = 0.0;

for (i=0; i<n; i++)
    for (k=0; k<n; k++)
        for (j=0; j<n; j++)
        c[i][j] = c[i][j] + a[i][k]*b[k][j];</pre>
```

答:

```
B1:
1) i = 0
B2:
2) j = 0
B3:
3) t1 = n * i
4) t2 = t1 + j
5) t3 = 4 * t2
6) c[t3] = 0.0
7) j = j + 1
8) if j < n goto (3)
B4:
9) i = i + 1
10) if i < n goto (2)
B5:
11) i = 0
B6:
12) k = 0
B7:
13) j = 0
```

```
B8:
14) t4 = n * i
15) t5 = t4 + j
16) t6 = t5 * 4
17) t7 = c[t6]
18) t8 = t4 + k
19) t9 = t8 * 4
20) t10 = a[t9]
21) t11 = n * k
22) t12 = t11 + j
23) t13 = t12 * 4
24) t14 = b[t13]
25) t15 = t10 * t14
26) t16 = t7 + t15
27) j = j + 1
28) if j < n \text{ goto } (14)
B9:
29) k = k + 1
30) if k < n \text{ goto } (13)
B10:
31) i = i + 1
32) if i < n goto (12)
```

```
ENTRY
B1: [i = 0]
B2:
     j = 0
B3:
     t1 = n * i
     t2 = t1 + j
     t3 = 4 * t2
     c[t3] = 0.0
     j = j + 1
     if j < n goto B3
     i = i + 1
B4:
     if i < n goto B2
B5:
     i = 0
B6:
     k = 0
B7:
     j = 0
     t4 = n * i
B8:
     t5 = t4 + j
     t6 = t5 * 4
     t7 = c[t6]
     t8 = t4 + k
     t9 = t8 * 4
     t10 = a[t9]
     t11 = n * k
     t12 = t11 + j
     t13 = t12 * 4
     t14 = b[t13]
     t15 = t10 * t14
     t16 = t7 + t15
     j = j + 1
     if j < n goto B8
B9:
     k = k + 1
     if k < n goto B7
B10: i = i + 1
     if i < n goto B6
```

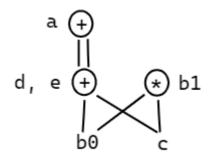
循环如下:

- 1. B3 自身
- 2. {B2, B3, B4}
- 3. B8 自身
- 4. {B7, B8, B9}
- 5. {B6, B7, B8, B9, B10}

练习 8.2.2: 考虑右面的基本块

- 1. 构造 DAG
- 2. 假设只有 a 在基本块出口活跃,尝试优化右面的代码,并简述用到的技术

答:



```
d = b + c
a = d + d
```

死代码删除 b = b * c, 公共子表达式删除 e = b + c