第十四次作业参考答案

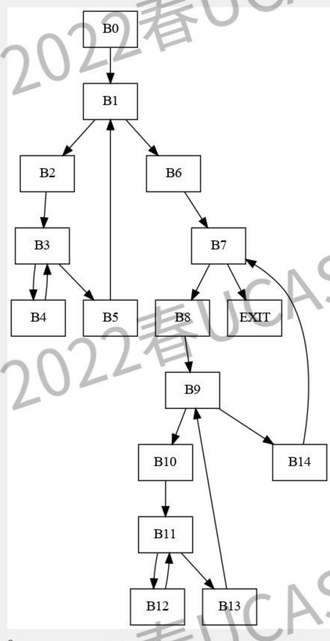
1. 考虑下面的矩阵乘法程序：
   1. 假设每个矩阵元素占4字节，且矩阵按行存放，把程序翻译成本节中的三地址语句并标出基本块
   2. 为1. 中得到的代码构造流图
   3. 找到2. 中流图中的循环

```
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];
```

1.

```
B0:
(1)  i = 0
B1:
(2)  if i >= n goto (13)
B2:
(3)  j = 0
B3:
(4)  if j >= n goto (11)
B4:
(5)  t1 = i * n
(6)  t2 = t1 + j
(7)  t3 = t2 * 4
(8)  c[t3] = 0.0
(9)  j = j + 1
(10)  goto (4)
B5:
(11)  i = i + 1
(12)  goto (2)
B6:
(13)  i = 0
B7:
(14)  if i >= n goto (40)
B8:
(15)  k = 0
B9:
(16)  if k >= n goto (38)
B10:
(17)  j = 0
B11:
(18)  if j >= n goto (36)
B12:
(19)  t4 = i * n
(20)  t5 = t4 + k
(21)  t6 = t5 * 4
(22)  t7 = a[t6]
(23)  t8 = k * n
(24)  t9 = t8 + j
(25)  t10 = t9 * 4
(26)  t11 = b[t10]
(27)  t12 = t7 * t11
(28)  t13 = i * n
(29)  t14 = t13 + j
(30)  t15 = t14 * 4
(31)  t16 = c[t15]
(32)  t17 = t16 + t12
(33)  c[t15] = t17
(34)  j = j + 1
(35)  goto (18)
B13:
(36)  k = k + 1
(37)  goto (16)
B14:
(38)  i = i + 1
(39)  goto (14)
```

2.



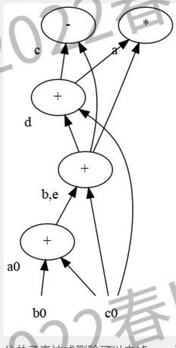
3.

{ B1, B2, B3, B4, B5 }
{ B3, B4 }
{ B7, B8, B9, B10, B11, B12, B13, B14 }
{ B9, B10, B11, B12, B13 }
{ B11, B12 }

1. 考虑下面的基本块
   1. 构造 DAG
   2. 假设只有 a 在基本块出口活跃，尝试优化下面的代码，并简述用到的技术

```
a = b + c
b = a + c
d = b + c
e = a + c
c = b - d
a = e * d
```

1. 如图



2. 公共子表达式删除可以去掉 e ，死代码删除可以去掉 c 的计算，最后得到

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