Homework 10

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Exercise 1

针对以下 C 程序片段，直接在源程序上进行循环优化（循环不变计算外提，强度消弱与复写传播优化等）

```
int a[100][100], b[100][100], c[100][100];
int i, j, k; // int :  4 bytes
for(i = 0; i < 100; i++)
    for(j = 0; j < 100; j++)
          for(k = 0; k < 100;k ++)
             c[i][j] = c[i][j] + a[i][k] * b[k][j];
```

解 循环不变计算外提后的代码如下

```
int a[100][100], b[100][100], c[100][100];
int i, j, k; // int :  4 bytes
for(i = 0; i < 100; i++)
{
    t3 = c + i * 400;
    t2 = a + i * 400;
    for(j = 0; j < 100; j++)
    {
        t1 = t3 + j * 4;
        for(k = 0; k < 100; k++)
            *t1 = *t1 + t2[k] * b[k][j];
    }
```

```
}
```

再进行强度削弱，注意到t2[k] = *(t2 + k * 4)、b[k][j] = *(b + k * 400 + j * 4)，有

```
int a[100][100], b[100][100], c[100][100];
int i, j, k; // int :  4 bytes
t4 = c;
t5 = a;
for(i = 0; i < 100; i++)
{
    t3 = t4;
    t2 = t5;
    t6 = t3;
    for(j = 0; j < 100; j++)
    {
        t1 = t6;
        t7 = t2;
        t8 = b + j * 4;
        for(k = 0; k < 100; k++)
        {
            *t1 = *t1 + *t7 * *t8;
            t7 += 4;
            t8 += 400;
        }
        t6 += 4;
    }
    t4 += 400;
    t5 += 400;
}
```

应用复写传播，可以删除t2和t3，得到优化后的最终代码

```
int a[100][100], b[100][100], c[100][100];
int i, j, k; // int :  4 bytes
t4 = c;
t5 = a;
for(i = 0; i < 100; i++)
```

```
{
    t6 = t4;
    for(j = 0; j < 100; j++)
    {
        t1 = t6;
        t7 = t5;
        t8 = b + j * 4;
        for(k = 0; k < 100; k++)
        {
            *t1 = *t1 + *t7 * *t8;
            t7 += 4;
            t8 += 400;
        }
        t6 += 4;
    }
    t4 += 400;
    t5 += 400;
}
```