

CSc 553 Assignment 4

Handed Out: April 10, 2007

Turn in solutions to problems 1 and 2: April 23, 2007

1. A trace in a control flow graph is shown in Figure 1(a). Assuming that the trace is scheduled as shown in Figure 1(b), construct the modified control flow graph. Does the modified graph contain any redundant code? If so, indicate which code statements are redundant.

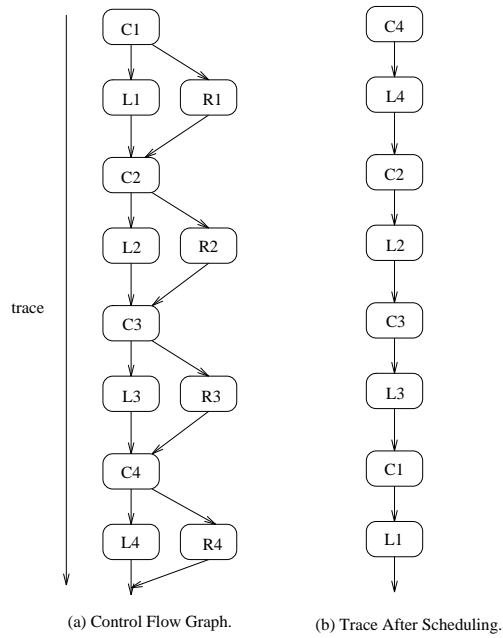


Figure 1: Trace Scheduling.

2. Eliminate the delays indicated below by propagating instructions across the loop boundary. Use the approach of circular scheduling, extending the technique as needed to minimize delays. Assume that 4 floating point registers and 3 integer registers are available for the execution of the loop.

Source Code:

```
sum = 0
for (i=1; i<10; i=i+1) {
x[i] = x[i] + c;
sum = sum + x[i]
}
```

Machine Code:

```
r1 = 0 /* array index */
fp3 = c
fp4 = 0 /* sum = 0 */
L: fp1 = mem(r1+1) /* load x[i] */
<delay>
fp1 = fp1 + fp3 /* x[i] = x[i] + c */
<delay>
mem(r1+1) = fp1 /* store x[i] */
fp4 = fp4 + fp1 /* sum = sum + x[i] */
r1 = r1 + 1
if r1<10 goto L
```

Assume the following machine description for the above problem:

instruction	latency	exception causing
integer add	1	no
integer mult	2	no
integer divide	3	yes
floating point operation	4	yes
load	2	yes
store	2	yes
branch	1	no
reg-to-reg move	1	no