

# Written Assignment 9

## Due April 20, 2006

This assignment asks you to prepare written answers to questions on global optimization and register allocation. Each of the questions has a short answer. You may discuss this assignment with other students and work on the problems together. However, your write-up should be your own individual work. *Please write the name of the account you are using for CS164 and your section time on your homework.* Remember that written assignments are to be turned in either in class or in the CS164 homework box in 283 Soda by 12:30 PM on the due date.

1. Optimize the following code, using global constant propagation:

```
b := 1
d := 4

top:
  a := b+2
  c := a+b
  if p goto L

  d := 2*d
  if q goto L2
  goto end

L:
  d := d+1
  c := c-1

L2:
  c := d+1
  if q goto top
  goto end

end:
  print a
```

2. Consider the following program:

```
L0: e := 0
    b := 1;
    d := 2;
L1: a := b+2
    c := d+5
    e := e + c
    f := a * a
    if f < c goto L3
L2: e := e + f
    goto L4
L3: e := e + 2
L4: d := d + 4
    b := b - 4
    if b != d goto L1
L5:
```

This program uses six temporaries a-f. Assume that our machine has only 4 available registers \$r0, \$r1, \$r2, and \$r3 and that only e is live on exit from this program.

- (a) Draw the register interference graph. (Computing the sets of live variables at every program point may be helpful for this step.)
- (b) Use the graph coloring heuristics discussed in lecture to assign each temporary to a register on a machine that has 4 registers. Rewrite the program replacing temporaries by registers and including whatever spill code is necessary. Use the pseudo-instructions `load x` and `store x` to load and spill the value of x from memory.