

CSC 416/565: Compilers
Fall 2023
Final Exam Review
Questions to Supplement HW3 and HW4

Final:
Tuesday, December 12
8:15pm - 10:15pm

Two double-sided, hand-written, 8.5" × 11" cheat sheets (thus, 4 sides).
Closed Collaboration

1 Liveness Analysis

1. Which variables are live at the specified locations in the following intermediate code? Assume that only variable `e` is live following line 12.

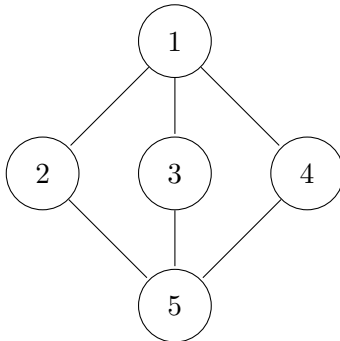
(a) before line 7

(b) after line 10

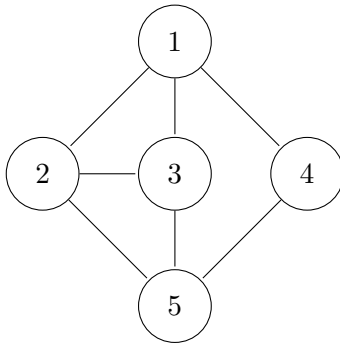
```
1  b := 6
2  if c > 1 goto LabelC
3 Label A:
4  a := a - 1
5  if c > 3 goto LabelC
6 Label B:
7  e := 2
8  if d < 2 goto LabelA
9 Label C:
10 a := 5
11 if d > 10 goto LabelB
12 e := a + c
```

2 Register Allocation

1. Is the following graph two-colorable? If so, assign a coloring. If not, why not?



2. Is the following graph two-colorable? If so, assign a coloring. If not, why not?



3. Perform these steps for the following program:

- (a) Identify the basic blocks.
- (b) Draw the control flow graph.
- (c) Perform liveness analysis.
- (d) Draw the interference graph.
- (e) Perform register allocation via graph coloring for 3 registers. Show your steps and the stack along the way.

```

1  Label Start:
2    if a < b
3      goto Next
4    else
5      goto Swap
6  Label Swap:
7    t = a
8    a = b
9    b = t
10 Label Next:
11   z = 0
12   b = b - a
13   if b = z
14     goto End
15   else
16     goto Start
17 Label End:

```

4. Repeat register allocation for the above program, but this time for 2 registers. Select spilled variables. Transform the program and repeat the process until register allocation is successful.