ECE 468
Problem Set 6: Dependence analysis and Dataflow analysis

1. Draw the iteration space graph for the following piece of code (be careful about the index expressions!):

```
for (i = 0; i < 5; i++)
  for (j = 0; j < 5; j++)
    A[j+1][i] = A[j][i+1] + A[j+1][i+2];
```

2. What are the distance vectors? The direction vectors?

3. Can the loops be interchanged? Why or why not?

4. Use the GCD test to argue that the following loop does not have any loop-carried dependences:

```
for (i = 0; i < N; i++) {
  A[3i + 2] = A[6i + 3];
}
```

5. Give an example of a piece of code where the GCD test shows that the loop has a dependence, but where the loop itself does not have a dependence (hint: remember that the GCD test does not take into account loop bounds; try to come up with a loop where the dependence can only exist outside the bounds of the loop)

6. Show the results of running a *reaching definitions* analysis on the following piece of code: for each line of code, show which definitions reach that line of code by indicating the line number the definition occurred in.

```
    1: x = 4;
    2: y = 7;
L1  3: if (x > c) goto L4
    4:   if (y > 3) goto L2
    5:     a = x + 1;
    6:     b = a + x;
    7:     goto L3
L2  8:     a = a + x;
    9:     b = x + 1;
L3 10:   y = a + b;
```

```
   11:   goto L1;
L4 12: halt
```