ECE 468
Problem Set 5: Dependence analysis, Dataflow analysis and Points-to analysis

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

```
for (j = 0; j < 5; j++)
  for (i = 0; i < 5; i++)
    A[j+2][i+1] = 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. Can the following two loops be fused? Why or why not? Explain your answer in terms of dependences between the loops.

```
for (i = 0; i < 10; i++)
  A[i] = B[i + 1]

for (i = 0; i < 10; i++)
  A[i + 2] = A[i + 1]
```

5. Show the results of running a *very busy expressions* 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:     c = x + 1;
    6:     b = a + x;
    7:     goto L3
L2  8:     a = a + x;
    9:     b = x + 1;
L3 10:   y = a + x;
   11:   goto L1;
L4 12: c = a + x
```

```
13: halt
```

6. Show the points-to graph after line 6 after running a *flow-sensitive* analysis on the following code.

```
1: x = &a;
2: y = x;
3: x = &b;
4: a = &p;
5: b = &q;
6: z = *y;
```

7. Show the points-to graph generated by a *flow-insensitive* analysis on the same code.