

# 15-745 Advanced Optimizing Compilers: Worksheet

## Optional

April 25, 2006

1. Suppose we were to add `setjmp()` and `longjmp()` to L3. Briefly explain the changes you would have to make to your compiler, starting with the construction of the flowgraph and the impact on the dataflow analyses and optimizations we have implemented this semester.
2. Is there a difference in running time between computing iterative dataflow analysis in terms of both `in()` and `out()` sets, vs using only one of them?
3. Give an example of a lattice that is not strongly distributive.
4. Give an example of a specific dataflow analysis problem and an instance for which the MOP and MFP solutions are different.
5. Draw the lattice of monotone functions from  $BV^2$  to itself.
6. What are the flow, anti, and output dependences in the following basic block?

```
r1 = [r7+4]
r2 = [r7+8]
r3 = r2 + 2
r4 = r1 + r2
[r5] = r4
r4 = r5 - r3
[r5] = r4
[r7+r2] = r3
r4 = r3 + r4
r3 = r7 + r4
r7 = r7 + 2
```

7. Formulate the dataflow analysis that is the inverse of available expressions, ie, the backward-flow problem in which an expression is in `EVAL(i)` if it is evaluated in block `i` and none of the variables in it are changed between the entrance to the block and the given evaluation, with the path-combining operator being intersection. Is there an optimization problem for which this analysis is useful?

8. Consider the following loop:

```
for (i=0; i<N; i++)  
    A[i] = A[i] + B * C[i];
```

Rewrite this code (in either source code form or in any suitable pseudo-assembler) in software-pipelined form.