Homework #2

CS 2210

Due: November 22, before class

1. For the CFG above, for the purposes of a forward data flow analysis, show the dominator tree, identify any (natural) loops, and for each loop, identify the loop header and the entry, exit, and back edges. Is this graph reducible?

2. Repeat problem 1 for the purposes of a backward data flow analysis.

3. If a dataflow analysis can be represented as a bit vector problem, and the KILL and GEN bit vectors for each flow function can be expressed independently of the input bit vector, then the composition of a series of flow functions can be represented by a single pair of summary KILL and GEN bit vectors. Give a pair of simple inductive equations for computing the SUMMARY-KILL\_i and SUMMARY-GEN\_i bit vectors for the 0 through ith instructions in a basic block from the SUMMARY-KILL\_i-1 and SUMMARY_GEN\_i-1 bit vectors (i>0) and the KILL\_i and GEN\_i bit vectors for the flow function of the ith instruction.

4. Define a data flow analysis that can be used to compute two sets of variables: those which are definitely not defined before use, and those which may not be defined before use; these sets are intended to provide extra error checking of
programs. Strive for the highest quality information while maintaining safety. Use a lattice-theoretic formalism to define your analysis. Argue for the termination of your analysis. Explain how to use the information computed by your analysis to construct the two sets specified above for output to the user.