CS 498mp: Spring 2006: Homework I

Due on Fri Feb 17

Hand over in class on Thursday or to Colin Robertson at 3229 SC

Problem 1.

The aim of this exercise is to *determine signs of variables*. Given any point in a program, we want to know which integer variables could evaluate to positive, negative, or 0. I.e. given any program point l and variable x, we want to know which of the facts $(x, +)$, $(x, -)$, and $(x, 0)$ hold. $(x, +)$ holds if there is *some* path to l where x takes on a positive value, etc.

- Take the domain of facts $D = \{(x, +), (x, -), (x, 0) \mid x \in \mathit{Var}\}$. For each program point l, we want to define the set Signs^l, which are the facts for each variable at point l.

  Write down a set of equations for Signs^l for programs written using the syntax defined in class.
  Assume the following simple syntax for arithmetic expressions:

  $$\mathit{expr} :: \quad x \mid c \mid x + y \mid x - y$$

  where $x, y \in \mathit{Var}$, c is a constant integer. Your analysis should take reasonable account of the effects of these arithmetic expressions; eg. what happens when assignments of the form $x := c$ occur, where c is a constant, etc. (Treat each assignment form differently.)

- Also, declare whether you want the lfp or gfp of this solution. Give a brief argument why your choice of lfp/gfp is correct.