CMPSC 260, Spring 2004 – Homework Assignment 2
Due April 30th

1. Consider the following program:

$$[\mathtt{x} := 1]^1; (\mathtt{while}[\mathtt{y} > 0]^2 \mathtt{do}[\mathtt{x} := \mathtt{x} - \mathtt{1}]^3); [\mathtt{x} := 2]^4$$

Write the *kill* and *gen* sets and the system of equations for the Live Variables Analysis (given in Section 2.1.4) for this program. Find a solution for these equations using the worklist algorithm given in Table 2.8, show the iterations of the algorithm (contents of worklist W and *Analysis* array).

2. Consider the following program:

$$[\mathtt{x} := 1]^1; [\mathtt{x} := \mathtt{x} - \mathtt{1}]^2; [\mathtt{x} := 2]^3$$

Clearly `x` is dead at the exits from 2 and 3. But `x` is live at the exit of 1 even though its only use is to calculate a new value for a variable that turns out to be dead. We shall say that a variable is a *faint variable* if it is dead or if it is only used to calculate new values for faint variables; otherwise it is *strongly live.* In the example `x` is faint at the exits from 1, 2, and 3. Define a Data Flow Analysis that detects strongly live variables (define the *kill* and *gen* functions and show a characterization of your analysis as in Figure 2.6).

3. Programming Assignment: Download the WHILE language parser from the class webpage: `http://www.cs.ucsb.edu/~bultan/courses/260/`

(a) Construct the control flow graphs for the WHILE programs. You should print the *init* and *final* labels and the *flow* edges.

(b) Implement the *Reaching Definitions* analysis using the worklist algorithm (Table 2.8) and print the *Definition-Use (du)* matrix (as in page 51).