CS335 (Lab Exam)

3 May 2021

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*In this task you are supposed to do **live variables analysis as per the techniques discussed in the class**. A variable is live at a point p if its value is used along at least one Path A use of x prior to any definition in basic block means x must be alive A definition of x in B prior to any subsequent use means previous uses must be dead. For all basic blocks B other than exit the In[] and OUT[] set is defined as:*

$$IN[B] = USE[B] \cup (OUT[B] - DEF[B]) \quad (1)$$

$$OUT[B] = \cup_{S\ a\ Successor\ of\ B}\ IN[S] \quad (2)$$

For a Basic block, two terminologies are defined:

- *Define two terms:*
  - *def_B as the set of variables defined (i.e., definitely assigned values) in B prior to any use of that variable in B, and*
  - *use_B as the set of variables whose values may be used in B prior to any definition of the variable.*

For a block i, the use{} set is defined as:

$$InUse(i) = Use(i) \cup \big(OutUse(i) - Def(i)\big) \quad (3)$$

On the other hand, the def{} set is defined as:

$$InDef(i) = Def(i) \cup OutDef(i) \quad (4)$$

Note that, you need to process each block in a bottom up manner. Calculate the In() and Out() set for invidual lines in a Basic block using Eq. 1 and 2 first. After that apply Eq. (3) and (4) to calculate the use{}, (i.e. Eq. 3) and def{} (i.e. Eq. 4) set for the block.

Task 1: Calculate the use{} and def{} sets for all the Basic Blocks in the given CFG (Fig 1).

Task 2: Calculate the IN{} and OUT{} set for each Basic Blocks.

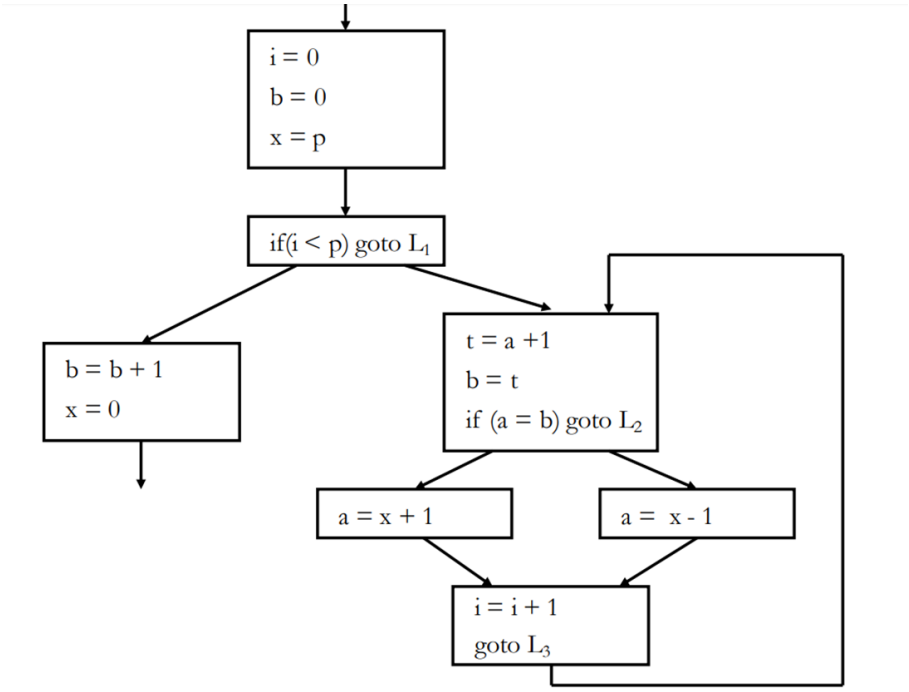

Figure 1: CFG for the assignment.

The Live Variable Iterative algorithm is as follows:

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input: control flow graph CFG = (N, E, Entry, Exit)
// Boundary condition
in[Exit]  = ϕ
// Initialization for iterative algorithm
For each basic block B other than Exit
      in[B]  = ϕ
// iterate
While (changes to any in[] occur) {
      For each basic block B other than Exit {
            out[B] = U(in[s]), for all successors s of B
            in[B] = fB(out[B]) // in[B]=Use[B] U(out[B]-Def[B])
}
```