

Written Homework 1

CS 322 Compiler Construction
Winter Quarter 2006

Due: Wednesday, February 15 at **6:00pm**

THERE ARE TWO PAGES TO THIS HANDOUT.

Problem 1

You are given the following piece of code:

```
{
  m = 0;
  for (i = 0; i < n; i++)
  {
    s = 0;
    for (j = i; j < n; j++)
    {
      x = j;
      s = s + x;
      if (s > m)
        m = s;
    }
  }
  return m;
}
```

1. Convert it into a linear medium-level IR (MIR) similar to the one on slide 7, in the IR powerpoints.
2. Identify the basic blocks and draw the control flow graph.
3. Draw the dominator tree.
4. Calculate the dominance frontiers.
5. Convert the program to SSA form. Use the renaming algorithm in figure 9.13 of the textbook to rename the variables.
6. Convert it from SSA form back to MIR by inserting copy instructions in the appropriate places.

Problem 2

You are given the grammar :

$$\begin{aligned} \langle S \rangle &\rightarrow \textit{while } \langle E \rangle \textit{ do } \{ \langle S \rangle \} \\ &| \textit{if } \langle E \rangle \textit{ then } \{ \langle S \rangle \} \\ &| \langle S \rangle ; \langle S \rangle \\ &| \langle V \rangle := \langle E \rangle \\ \langle E \rangle &\rightarrow \langle E \rangle == \langle E \rangle \\ &| \langle E \rangle + \langle E \rangle \\ &| \textit{id} \end{aligned}$$

where non-terminals are enclosed in angle brackets. Assume that precedence and associativity rules resolve all ambiguities in the usual way.

1. Write a syntax-directed definition to emit MIR code. You may assume that there exists a routine `genLabel()` that generates unique labels when needed. Do not worry about ambiguities; assume they will always be resolved correctly.
2. Add the following production to the grammar:

$$\langle S \rangle \rightarrow \textit{break}$$

Update your SDD to handle *break* statements. A *break* inside a nested loop should jump to the instruction following the nearest enclosing loop.

Submitting your homework

You may submit the homework by email to `c22@cs.northwestern.edu`, or on paper, to Vana or Stefan. **NOTE THE DEADLINE!** It's 6:00pm, not midnight.

The usual rules apply for late homework. If you submit it after hours, make sure it's via some medium that timestamps it (e.g. email or fax).