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Winter Semester 10/11
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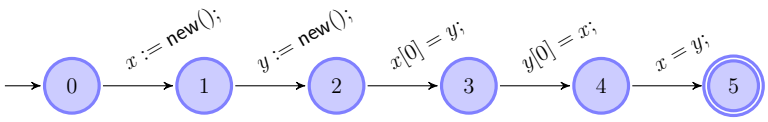
Program Optimization

Exercise Sheet 7

Deadline: January 17, at the lecture!

Exercise 1: *Pointer Analyses* *9 Points*

Consider the following simple program:



Give the result of applying the following analyses which correspond to the three "ideas" presented during the Lectures 10–11 (Nov. 22–25).

a) For the flow-sensitive points-to analysis, give the destination of pointers at each program point, as on page 377, except with one more column for the value of $(1, 2)$.
b) For the flow-insensitive analysis, give the corresponding constraint system, and then the final results, as on page 381.
c) For the flow-insensitive alias analysis, show the equivalence classes as you apply each statement from top to bottom, as on page 388.

Exercise 2: *Worklist Iteration* *8 Points*

Consider the following constraint system:

$$x_1 \supseteq \{a\} \cap x_2$$
$$x_2 \supseteq (a \in x_3)\ ?\ \{a, b\} : \{a\}$$
$$x_3 \supseteq x_2$$

The conditional operator in the second constraint is defined as follows:

$$(c)\ ?\ e_1 : e_2 = \begin{cases} e_1 & \text{if } c \text{ is true} \\ e_2 & \text{if } c \text{ is false} \end{cases}$$

(It is the same operator as you have in C or Java.)

a) Trace the execution of the worklist iteration. It suffices to make a similar table to the one on page 409 of the lecture notes (Lecture 12, Nov 29).
b) Assume we replace the second constraint with $x_2 \supseteq (a \in x_3)\ ?\ \{b\} : \{a\}$, which is not monotonic. Will the worklist iteration terminate? Explain why.