Static Program Analysis

http://proglang.informatik.uni-freiburg.de/teaching/programanalysis/2014ss/

Exercise Sheet 1

29.04.2014

Exercise 1 (Data flow analysis: Detection of Signs)
In a Detection of Signs Analysis one models all negative numbers by the symbol $-$, zero by the symbol 0, and all positive numbers by the symbol $+$. As an example the set $\{-2, -1, 1\}$ is modelled by the set $\{-, +\}$, that is an element of the powerset $\mathcal{P}(\{-, 0, +\})$.

Let $S_\star$ be a program and $\mathbf{Var}_\star$ be the finite set of variables in $S_\star$. Take the *property space* used to represent the data flow information to be $\mathcal{P}(\mathbf{Var}_\star \times \{-, 0, +\})$.

Outline the analysis similary to the Reaching Definitions Analysis as presented in the lecture (see `http://www.imm.dtu.dk/~hrni/PPA/slides1.pdf`). Hint: As in the Reaching Definitions Analysis you want to formulate a *may* analysis and thus use the *combination operator* $\cup$ where an elementary block has more than one predecessor. Before you start, answer yourself the following questions.

- Is the analysis a forward or backward analysis?
- What is the initial value at the start of the analysis?

Consider the following program written in the WHILE language:

```
x := 1;
y := 1;
r := x;
while (n > 2) do (
    r := x + y;
    x := y;
    y := r;
    n := n - 1;
 )
```

1. For an input `n`, what does the program calculate in `r`?
2. Specify the data flow equations for the program, i.e. for each program point i specify $\mathbf{DoS}_\circ(i)$ and $\mathbf{DoS}_\bullet(i)$ similar to $\mathbf{RD}_\circ(i)$ and $\mathbf{RD}_\bullet(i)$ as on the slides (p. 27 ff.).
3. Calculate the Detection of Signs Analysis for the program. Where does the analysis result differ from your intuition?

Submission

- No submission for this "warm-up" exercise sheet.
- You might want to read up in Chapter 1 of *Principles of Program Analysis*.