1 Data flow analysis: Reaching definitions

Consider the following program written in the WHILE language:

\[
\begin{align*}
    x &:= 1; \\
    y &:= 1; \\
    r &:= x; \\
    \text{while } (n > 2) \text{ do } ( \\
        & \quad r := x + y; \\
        & \quad x := y; \\
        & \quad y := r; \\
        & \quad n := n - 1 \\
    )
\end{align*}
\]

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 \(RD_0(i)\) and \(RD_\bullet(i)\) as on the slides (p. 27 ff.).

3. Calculate the achieving definitions analysis for the program. You can check your solution with the PAG online tool (http://pag.cs.uni-sb.de/).

2 Constraint based analysis: Control flow analysis

Consider the following program written in a functional language:

\[
[[\text{fn } z => [z]^1]^2 \quad \text{fn } y => [y]^3]^4]^5
\]

1. What is the result of evaluating this expression?

2. Specify a constraint system for the program, i.e. for each label \(l\) specify \(C(l)\), and for each variable \(x\), specify \(R(x)\) as on the slides (p. 45 ff.).

3. Can you give a solution for the constraint system? Is it a least solution?

Submission

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