

4. Exercise sheet *Static Program Analysis 2011*

Due Mon, 23. May 2011, *before* the exercise course begins.

Exercise 4.1:

(4 points)

Perform an interval analysis on the following program.

```

 $x := 0;$ 
 $y := 100;$ 
while  $x \geq 0$  do
     $x := x + 1;$ 
     $y := x + y;$ 

```

- (a) Apply widening by means of the worklist-adaption.
- (b) Narrow your results from a) using the method presented in the lecture.

Exercise 4.2:

(4 points)

Perform a constant propagation analysis using assertions on the following program:

```

 $x := 1;$ 
while  $x \leq y$  do
    if  $x = y$  then
         $x := x \cdot y;$ 
    else
         $y := y + 1;$ 

```

Exercise 4.3:

(2+2 points)

Consider the interval analysis equipped with assertions. Restrict the boolean expressions to the following:
 $b := t \mid x_1 = x_2 \mid x_1 < x_2$ with $x_1, x_2 \in Var_c$

- (a) Give an evaluation function for statements $assert(b)$, $b \in BExpr$ computing accurate intervals for each $x \in Var_c$.
- (b) Extend the boolean expressions by the disjunction. Give a “precise”, but “safe” approximation of the resulting intervals. Are your resulting intervals optimal? If not, can you think of further improvements (informally)?