Exercises

Program Analysis (CO70020)

Sheet 1

Exercise 1 *Give a labelling of the following program and the (intuitive) flow 'flow' and the reverse flow 'flow^R'.*

```
x := 1;
while y>0  do  (
               if y<=0
               then        x := x+3
               else        skip
               x := x-1;
               z := z+x;
               )
x := 2;
```

What "simplifications" could you think of with regard to the guard $y > 0$? What happens if you generalise your approach to any guard/test predicate $p(y)$ (and not $p(y)$, respectively)?

Exercise 2 *Consider the following* **While** *program:*

```
x:=1;
if (x>0)
then x:=x-1
else y:=y-1
```

Construct the flow formally.

Exercise 3 *Guess the* RD *solutions for the following three* **While** *programs:*

```
x := 4;
z := 2;
if y > x then
   x := 3;
else
   x := 4;
z := x;
```

```
x := 4;
z := 2;
if y > x then
   x := 3;
else
   x := 3;
z := x;
```

```
x := 4;
y := 2;
if y > x then
   x := 3;
else
   x := 5;
z := x;
```

What kind of optimisation could you suggest.

Exercise 4 *Construct the* RD *equations for the following program:*

```
x := 4;
z := 2;
if y > x then
   x := 3;
else
   x := 4;
z := x;
```

Exercise 5 *Is there a program such that:*

1. $\{(\mathtt{x}, 1), (\mathtt{x}, 4), (\mathtt{x}, 8)\} \subseteq \mathsf{RD}_{entry}(9)$*, or a program such that:*
2. $\{(\mathtt{x}, 1), (\mathtt{x}, 4), (\mathtt{y}, 4)\} \subseteq \mathsf{RD}_{entry}(9)$

Give example(s) or argument(s).