

Software Verification

Exercise: Data Flow Analysis

1 Reaching definitions analysis

Consider the following program fragment:

```
x := 10
while x > 0 do
  y := 2 * y
  if y > 10 do
    x := x - 1
  else
    y := x + 2
  end
  x := x - 1
end
x := x - 1
```

- Draw the control flow graph of the program fragment.
- Annotate the control flow graph with the analysis result of a reaching definitions analysis.
- Provide the use-definition information for the program variables x and y .

2 Live variables analysis

Consider the following program fragment:

```
x := y
x := x - 1
x := 4
while y < x do
  y := y + x
end
y := 0
```

- Identify the elementary blocks of the program and label them.
- Write down the data flow equations for a live variables analysis of the program.
- Solve the data flow equations using chaotic iteration.
- Using the result obtained in (c), perform dead code elimination of the program fragment.
- After step (d), is the resulting program free of dead variables? If not, explain why and modify the live variables analysis so that it can be used to produce a program free of dead variables.