# Software Verification
# Exercise: Slicing and Abstract Interpretation

## 1 Program slicing

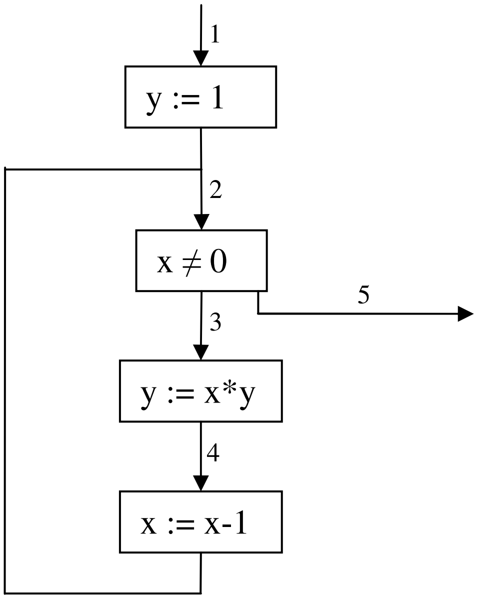
Consider the following program fragment:

```
x := 0
y := 0
i := n
j := n
while i > 0 do
        x := x + 1
        i := i – 1
        j := i
        while j > 0 do
                y := y + 1
                j := j – 1
        end
end
print(x)
print(y)
```

(a) Draw the program dependency graph of the program fragment.
(b) Compute the backward slice of the program fragment for the slicing criteria print(x) and print(y).

## 2 Abstract interpretation

Consider again the factorial algorithm from the lecture with sign analysis equations:



$$A_1 = [x \mapsto +,\ y \mapsto \top]$$
$$A_2 = A_1[y \mapsto +] \sqcup A_4[x \mapsto A_4(x) \ominus +]$$
$$A_3 = A_2$$
$$A_4 = A_3[y \mapsto A_3(x) \otimes A_3(y)]$$
$$A_5 = A_2 \sqcap [x \mapsto 0,\ y \mapsto \top]$$

(a) Compute the analysis result by chaotic iteration.

(b) The analysis is rather imprecise. Improve the result of the analysis by:

1. Changing the program but not the analysis.
2. Changing the analysis but not the program.