Exercise 1

We are interested in the semantics with static links for variables and procedures. We extend the
While language with blocks and procedures with a write command: write \(x\) prints out the value
of \(\text{sto} \circ \text{env}_V(x)\), but variable environment and storage function are left unchanged.
We consider the following program:

\[
\begin{align*}
\text{begin} & \quad \text{var} \ x := 2; \\
& \quad \text{begin} \quad \text{var} \ y := 7; \\
& \quad \quad \text{begin} \quad \text{var} \ x := 5; \\
& \quad \quad \quad \text{var} \ y := 0; \\
& \quad \quad \quad \text{call} \ p; \\
& \quad \end{\text{begin}} \\
\end{align*}
\]

Place instructions proc \(p\) is \(x := x \ast y\); and write \(x\) so that the value 14 appears on screen.
Justify your answer by computing the output using the rules.

Exercise 2

1. Compute the effect of the sequence of instructions
PUSH 1; FETCH(\(x\)); ADD; STORE(\(x\));
starting from a state of the abstract machine where the memory associates value 41 to \(x\).
2. What happens when performing the code LOOP(TRUE,NOOP) ?

Exercise 3

Write the sequence of instructions to be performed by the abstract machine in order to compute
the euclidian quotient of two non-negative integers \(a\) and \(b\).

Exercise 4

Show that the transition relation defined by the operational semantics of the abstract machine
is deterministic.