Exercise 1

We are interested in the semantics with static links for variables and procedures. We extend the \textbf{While} language with blocks and procedures with a write command: \textit{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{verbatim}
begin var x := 2;
  begin var y := 7;
    begin var x := 5;
      var y := 0;
      call p;
    end
  end
end
\end{verbatim}

Place instructions \textbf{proc} $p$ is $x := x \ast y$; and \textit{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
   \texttt{PUSH 1; FETCH(x); SUB; 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 \texttt{LOOP(TRUE,NOOP)}?

Exercise 3

Write the sequence of instructions to be performed by the abstract machine in order to compute the exponentiation $a^b$, for non-negative integers $a$ and $b$. 