Homework - Version B.

Exercise 1

We define the syntactic category of bits $B = \{0, 1\}$. By $b$ we denote a meta-variable ranging over $B$. We define inductively a set of bitstrings $BS$ by the following BNF:

$$bs ::= b \mid 0 bs 0 \mid 01 bs 10$$

where $bs$ is a meta-variable ranging over the set of bitstrings $BS$. Of the following two statements, one is wrong and one is right. You get to tell which is which and justify your answers by either a proof (by induction) or a counter-example.

1. In the set of bitstrings $BS$, all elements contain at least one 0.
2. Every bitstring in the set $BS$ is a palindrome.

A palindrome is a sequence of symbols that reads the same from right to left or left to right (e.g. ‘Rise to vote sir’ is one, 1001 is one too).

Exercise 2

We consider the following program.

```
begin var
  z1 := 43;
  var
  z2 := 5 * (z1 - 1);
  proc toto is
    z1 := 3 * (z2 + z1);
  begin var
    z2 := 1;
  proc toto is
    z1 := z2 + 45;
  proc q is call toto;
  call q;
end

call toto;
end
```

You have been presented three different semantics for the While language with blocks and procedures: one with dynamic links for variables and procedures, another with dynamic links for variables but static links for procedures, and finally one with static links for variables and procedures.

What values are associated to $z_1$ and $z_2$ at the end of this program according to each of the three semantics you know? Justify your answer (you can either draw the tree or precise the state or the variable environment and the storage function after each ‘;’).