Question 1 *No skip [4 marks]*

```
byte x = 0;

active proctype P() {
  x = 1;
  x = 2;
  x = 3;
}

ltl skip_2 { <>(x == 1 until x == 3) }
```

Here we would be surprised if the value of x becomes 3 immediately after being 1. Yet Spin verifies that the property *skip_2* holds.

Explain why this model nonetheless satisfies *skip_2*. Also, give an LTL formula that better captures the intent stated above.

Answer:

When several processes are executed at the same time, it is possible.

First, When a process has completed the assignment of $x = 2$, it has not started the assignment of $x = 3$.
Second, some other processes which are just getting started assign $x = 1$ and do not start the assignment of $x = 2$.
Third, The processes which are in the same places with first step assign $x = 3$.

The change in x is as follows:

$$x = ... \ 2 \ 1 \ ... \ 1 \ 3 \ ...$$

LTL formula:

$$\diamond \ (x = 2 \ \mathcal{U} \ (x = 1 \ \mathcal{U} \ x = 3))$$
$$\{<> \ (x == 2) \ \textit{until} \ (x == 1 \ \textit{until} \ x == 3)\}$$