Listing 3: question41

```
1  |------------------------ MODULE qring ------------------------
2  EXTENDS Integers , Naturals , Sequences , TLC
3  \* CONSTANT N, NIL, TOKEN
4  N == 3
5  NIL == -1
6  TOKEN == 0
7  Remove(i , seq) == [j \in 1..(Len(seq)-1) |-> IF j < i THEN seq[j] ELSE seq[j+1]]
8
9  v0 == [i \in 0..N |->NIL]
10
11 (*
12 --algorithm  algo {
13
14 variable
15     v = v0;
16     port = [i \in 0..N |-> IF i # 0 THEN <<>> ELSE <<TOKEN>>];
17
18 \* Macro for sending primitive: sending a message m on the fifo channel chan
19 macro Send(m, chan) {
20     chan := Append(chan , m);
21   };
22
23 \* Macro for receivinbg  primitive: receiving  a message m on the fifo channel chan
24 macro Recv(v, chan) {
25     await chan # <<>>;
26     v := Head(chan);
27     chan := Tail(chan);
28   };
29
30  process (p \in 0..N )
31     variable  mes;
32     {
33  s:   while (TRUE) {
34  cc1:  Recv(mes, port[self]);
35        test: if (self = 0) {  pp: print <<"P[0]:",v>>;};
36        cc4: v[self] := mes;
37        rr:  v[self]:= NIL;
38        cc5:  Send(TOKEN, port[(self+1) % N]);
39        };
40        };
41        };
42
43
44
45 } \* end algorithm
46
47 *)
48
49
50 |==================================================================
```

Figure 3: Programme pour l'anneau de l'exercice 4