

- The algorithm does not correctly solve the mutual exclusion problem for two processes. For example, the following interleaving of statements executed by the two processes leads to an error:

Step	Process 0	Process 1
	Initialisation: want[0] := false;	Initialisation: want[1] := false; turn := 0;
1.		i := mypid(); // i = 1
2.		j := 1-mypid(); // j = 0
3.		// [noncritical section]
4.		want[1] := true;
5.		(turn != 1)? // true
6.		(!want[0])? // true
7.	i := mypid(); // i = 0	
8.	j := 1-mypid(); // j = 1	
9.	// [noncritical section]	
10.	want[0] := true;	
11.	(turn != 0)? // false	
12.	// [critical section]	
13.		turn := 1;
14.		(turn != 1)? // false
15.		// [critical section]

- Promela model of Hyman's algorithm (with an assertion mechanism for checking its correctness):

```

/* Hyman's algorithm, two parallel processes 0 and 1 */

bool want[2] = false; /* want[0..1] initially false */
bool turn = 0; /* turn initialised to 0 */
byte count = 0;

active [2] proctype hyman()
{
    pid i = _pid, j = 1 - _pid;
    /* i is my index, j is the other process */

again:

```

```

    /* [noncritical section] */

    want[i] = true;
    /* [trying section] */
    do
    :: (turn != i) ->
        do
        :: (!want[j]) ->
            turn = i;
            break;
        :: else ->
            skip
        od
    :: else ->

        count++;
        assert(count == 1);
        /* [critical section] */
        count--;

        want[i] = false;
        break;
    od;
    goto again
}

```

Spin easily finds the model (hyman.pml) to be faulty:

```

$ spin -a hyman.pml
$ cc -o pan pan.c
$ ./pan
hint: this search is more efficient if pan.c is compiled -DSAFETY
pan: assertion violated (count==1) (at depth 25)
pan: wrote hyman.pml.trail
(Spin Version 4.2.6 -- 27 October 2005)
Warning: Search not completed
        + Partial Order Reduction

```

Full statespace search for:

```

    never claim          - (none specified)
    assertion violations +

```

acceptance cycles - (not selected)  
invalid end states +

State-vector 20 byte, depth reached 37, errors: 1  
64 states, stored  
53 states, matched  
117 transitions (= stored+matched)  
0 atomic steps  
hash conflicts: 0 (resolved)

2.622 memory usage (Mbyte)

3. The following execution leads to an error:

Step	Process 0	Process 1
	Initialisation: x := 0; y := 0; z := 0;	
1.	me := mypid()+1; // me = 1	
2.	// [noncritical section]	
3.	x := 1;	
4.	(y != 0 and y != me)? // false	
5.	z := 1;	
6.	(x != 1)? // false	
7.		me := mypid()+1; // me = 2
8.		// [noncritical section]
9.		x := 2;
10.		(y != 0 and y != me)? // false
11.	y := 1;	
12.	(z != 1)? // false	
13.	// [critical section]	
14.		z := 2;
15.		(x != 2)? // false
16.		y := 2;
17.		(z != 2)? // false
18.		// [critical section]