A6: Spin MS

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The submitted program uses a slightly modified version of *Kadane*'s algorithm, which fails to report the correct sub-sequence in the case of the original sequence only composed by negative values: Wiki.

The program, as it is, successfully runs under Spin without reporting any errors, as you can see from Figure 1. Moreover, I tried several times to run the program by hand and it has always reported the correct results.

```
Paolo:~/Desktop/NMSU/3rd semester/SW engineering/spin code/mvcs$spin -a mvcs.prom
Paolo:~/Desktop/NMSU/3rd semester/SW engineering/spin code/mvcs$gcc pan.c
Paolo:~/Desktop/NMSU/3rd semester/SW engineering/spin code/mvcs$./a.out
Depth=     466 States=    1e+06 Transitions=    1e+06 Memory=   350.116 t=      1.3 R=   8e+05

(Spin Version 6.4.8 -- 2 March 2018)
        + Partial Order Reduction

Full statespace search for:
        never claim             - (none specified)
        assertion violations    +
        acceptance   cycles     - (not selected)
        invalid end states      +

State-vector 216 byte, depth reached 466, errors: 0
```

Figure 1: Spin output for original program

If anything changes inside the program, for example the value of a variable, Spin will discover the bug.

Let's take into consideration a slight modification, such as the one reported in Figure 2

```
inline findMaxSumsDyn()        inline findMaxSumsDyn()
{                              {
  int curr_max = vals[0];        int curr_max = vals[1];
```

Figure 2: On the left: original line, on the right: modified line to insert a bug

As expected, Spin correctly reports the presence of an error, shown in Figure 3:

```
Paolo:~/Desktop/NMSU/3rd semester/SW engineering/spin code/mvcs$spin -a mvcs.prom
Paolo:~/Desktop/NMSU/3rd semester/SW engineering/spin code/mvcs$gcc pan.c
Paolo:~/Desktop/NMSU/3rd semester/SW engineering/spin code/mvcs$./a.out
pan:1: assertion violated (max>=allSeqSums[i]) (at depth 362)
pan: wrote mvcs.prom.trail

(Spin Version 6.4.8 -- 2 March 2018)
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 216 byte, depth reached 466, errors: 1
```

Figure 3: Spin output for modified program

For the sake of completeness, in Figure 4 is presented the output of the program for 2 runs.

```
Paolo:~/Desktop/NMSU/3rd semester/SW engineering/spin code/mvcs$spin  mvcs.prom
     Array:
     vals[0] = 0
     vals[1] = -1
     vals[2] = 0
     vals[3] = 1
     vals[4] = 0
     Max sum is: 1
     Max sequence: [      0        1       ]
1 process created
Paolo:~/Desktop/NMSU/3rd semester/SW engineering/spin code/mvcs$spin  mvcs.prom
     Array:
     vals[0] = 1
     vals[1] = -1
     vals[2] = 2
     vals[3] = 0
     vals[4] = 0
     Max sum is: 2
     Max sequence: [      1       -1       2       ]
1 process created
```

Figure 4: Output