MODULE *token*

EXTENDS *Integers*

CONSTANTS N, M

Dijkstra's stabilizing token ring algorithm

```
--fair algorithm StabTokenRing{
    variable token = [j ∈ 0 .. N ↦ (j%M)] ;
    { while ( TRUE )
        { either with ( j ∈ 1 .. N )
            { await (token[j] ≠ token[(j − 1)]) ;
                token[j] := token[(j − 1)] ;
            }
          or
            { await (token[0] = token[N]) ;
                token[0] := (token[N] + 1)%M ;
            }
        }
    }
}
```

BEGIN TRANSLATION

VARIABLE *token*

$vars \triangleq \langle token \rangle$

$Init \triangleq$ Global variables

$\quad \land\ token = [j \in 0 \,..\, N \mapsto (j\%M)]$

$Next \triangleq \lor \land \exists j \in 1 \,..\, N :$

$\qquad \land (token[j] \neq token[(j-1)])$

$\qquad \land token' = [token \text{ EXCEPT } ![j] = token[(j-1)]]$

$\quad \lor \land (token[0] = token[N])$

$\qquad \land token' = [token \text{ EXCEPT } ![0] = (token[N]+1)\%M]$

$Spec \triangleq \land Init \land \Box[Next]_{vars}$

$\quad \land \mathrm{WF}_{vars}(Next)$

END TRANSLATION

$InvProp \triangleq \land (\forall k \in 1 \,..\, N : token[k] \leq token[(k-1)])$

$\quad \land (\forall k,\ l \in 0 \,..\, N : (token[k] - token[l]) \leq 1)$

$Stabilization \triangleq \Diamond InvProp$

* Modification History

* Last modified Sun *Dec* 14 22:56:54 *EST* 2014 by *Siddharth*

* Created *Fri Dec* 12 03:29:12 *EST* 2014 by *Siddharth*

CounterExample: *ProcessStates* = (0:> 1) (1:> 1) (2:> 0) (3:> 1) (4:> 0)

In the above example we see that there exist two tokens: Process 2 contains 1 token and Process 4 contains the other. This is in violation of the invariant.

Invariant: The invariant states that there exist a one and only token in the ring system.

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