MODULE *GameOfLife*

EXTENDS *Integers*, *Sequences*

CONSTANT N
VARIABLE *grid*

ASSUME $N \in Nat$

$vars \triangleq grid$

$Pos \triangleq \{\langle x, y\rangle : x, y \in 1 \,..\, N\}$

$TypeOK \triangleq grid \in [Pos \to \text{BOOLEAN}\ ]$

RECURSIVE $Sum(\_)$
$Sum(S) \triangleq \text{IF } S = \langle\rangle \text{ THEN } 0$
ELSE $Head(S) + Sum(Tail(S))$

$score(p) \triangleq \text{LET } sc(a) \triangleq \text{LET } x \triangleq a[1]$
$y \triangleq a[2]$
IN CASE $\lor\ x = 0\ \lor\ y = 0$
$\lor\ x > N \lor\ y > N$
$\lor\ \neg grid[a] \to 0$
$\square$ OTHER $\to 1$
$nbrs \triangleq \langle\langle -1, -1\rangle, \langle -1, 0\rangle, \langle -1, 1\rangle,$
$\langle 0, -1\rangle, \langle 0, 1\rangle,$
$\langle 1, -1\rangle, \langle 1, 0\rangle, \langle 1, 1\rangle\rangle$
$points \triangleq [n \in \text{DOMAIN } nbrs \mapsto sc(\langle p[1] + nbrs[n][1],$
$p[2] + nbrs[n][2]\rangle)]$
IN $Sum(points)$

$Init \triangleq grid \in [Pos \to \text{BOOLEAN}\ ]$
$Next \triangleq grid' = [p \in Pos \mapsto \text{IF } \lor\ (grid[p] \land score(p) \in \{2, 3\})$
$\lor\ (\neg grid[p] \land score(p) = 3)$
THEN TRUE
ELSE FALSE]

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