
MODULE *GameOfLife*

EXTENDS *Integers*

CONSTANT N
VARIABLE $grid$

ASSUME $N \in Nat$

$vars \triangleq grid$

RECURSIVE $Sum(-, -)$
 $Sum(f, S) \triangleq$ IF $S = \{\}$ THEN 0
ELSE LET $x \triangleq$ CHOOSE $x \in S$: TRUE
IN $f[x] + Sum(f, S \setminus \{x\})$

$Pos \triangleq \{\langle x, y \rangle : x, y \in 1 \dots N\}$
 $TypeOK \triangleq grid \in [Pos \rightarrow \text{BOOLEAN}]$

$sc[\langle x, y \rangle \in (0 \dots N+1) \times (0 \dots N+1)] \triangleq$ CASE $\vee x = 0 \vee y = 0$
 $\vee x > N \vee y > N$
 $\vee \neg grid[\langle x, y \rangle] \rightarrow 0$
 \square OTHER $\rightarrow 1$

$score(p) \triangleq$ LET $nbrs \triangleq \{x \in \{-1, 0, 1\} \times \{-1, 0, 1\} : x \neq \langle 0, 0 \rangle\}$
 $points \triangleq \{\langle p[1] + x, p[2] + y \rangle : \langle x, y \rangle \in nbrs\}$
IN $Sum(sc, points)$

$Init \triangleq grid \in [Pos \rightarrow \text{BOOLEAN}]$
 $Next \triangleq grid^0 = [p \in Pos \mapsto \text{IF } \vee (grid[p] \wedge score(p) \in \{2, 3\})$
 $\vee (\neg grid[p] \wedge score(p) = 3)$
THEN TRUE
ELSE FALSE]

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