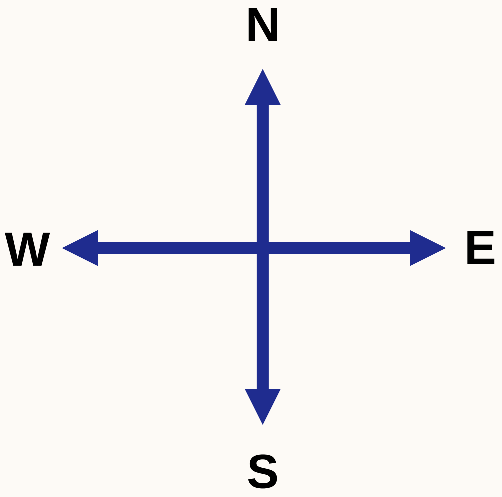
MODIFIED GAME OF LIFE

In this modified Game of Life, there are only 2 rules:

1. **Birth/Survival:** an uninhabited cell becomes inhabited, and an inhabited cell stays inhabited, if exactly 3 of its adjacent neighbours are inhabited.
2. **Death:** an inhabited cell becomes uninhabited, and an uninhabited cell stays uninhabited, if the number of inhabited adjacent neighbours is *not* exactly 3.

We define “adjacent neighbours” to be cells directly above, below, left, and right of the cell.

Create a circuit that outputs whether an individual cell will be uninhabited or inhabited next.



0 = uninhabited

1 = inhabited

N	E	S	W	Cell
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

NE\SW	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	0	1	0	1
10	0	0	1	0

$(\neg N \land E \land S \land W) \lor (N \land \neg E \land S \land W) \lor (N \land E \land \neg S \land W) \lor (N \land E \land S \land \neg W)$

$$(\neg N \wedge E \wedge S \wedge W) \vee (N \wedge \neg E \wedge S \wedge W) \vee (N \wedge E \wedge \neg S \wedge W) \vee (N \wedge E \wedge S \wedge \neg W)$$

$$(((\neg N \wedge E) \vee (N \wedge \neg E)) \wedge (S \wedge W)) \vee (N \wedge E \wedge \neg S \wedge W) \vee (N \wedge E \wedge S \wedge \neg W)$$

$$(((\neg N \wedge E) \vee (N \wedge \neg E)) \wedge (S \wedge W)) \vee ((N \wedge E) \wedge ((\neg S \wedge W) \vee (S \wedge \neg W)))$$

$$((N \oplus E) \wedge (S \wedge W)) \vee ((N \wedge E) \wedge ((\neg S \wedge W) \vee (S \wedge \neg W)))$$

$$((N \oplus E) \wedge (S \wedge W)) \vee ((N \wedge E) \wedge (S \oplus W))$$

Let’s compare creating circuits based on our original expression and our last expression…