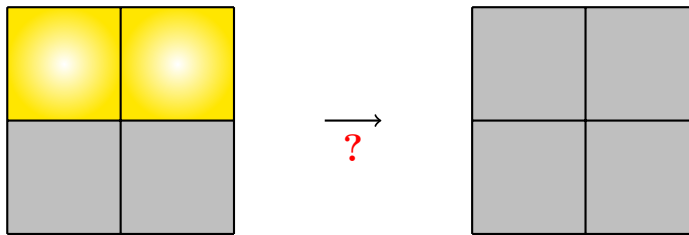# Lights Out

Lights Out is an electronic game released by Tiger Electronics in 1995. The game consists of a 5×5 grid of lights. The game starts, a random number of lights are switched on. Pressing any of the lights will toggle it and its 4 adjacent lights. The goal of the game is to find the smallest combination of lights in order to switch all the lights off.

Gameplay

$$\begin{pmatrix} 1 \\ 1 \\ 0 \\ 0 \end{pmatrix} \longrightarrow \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

$$\begin{cases} 1 + x + y + z + 0 = 0 \\ 1 + x + y + 0 + t = 0 \\ 0 + x + 0 + z + t = 0 \\ 0 + 0 + y + z + t = 0 \end{cases}$$

Combinatorics

- Best case: 0 light pressed (all the lights are already switched off).

- Worst case: for a $n \times n$ board, one must press on all the n^2 lights.

- Average case: $\dfrac{n^2}{2} \times \dfrac{(2^{n^2})}{(2^{n^2} - 1)}$ (around half of the lights).