PyRTLSweeper: Automated Transformation of Digital Circuits to Minesweeper Boards

Edwin Chang   University of California, Santa Barbara   November 8, 2025
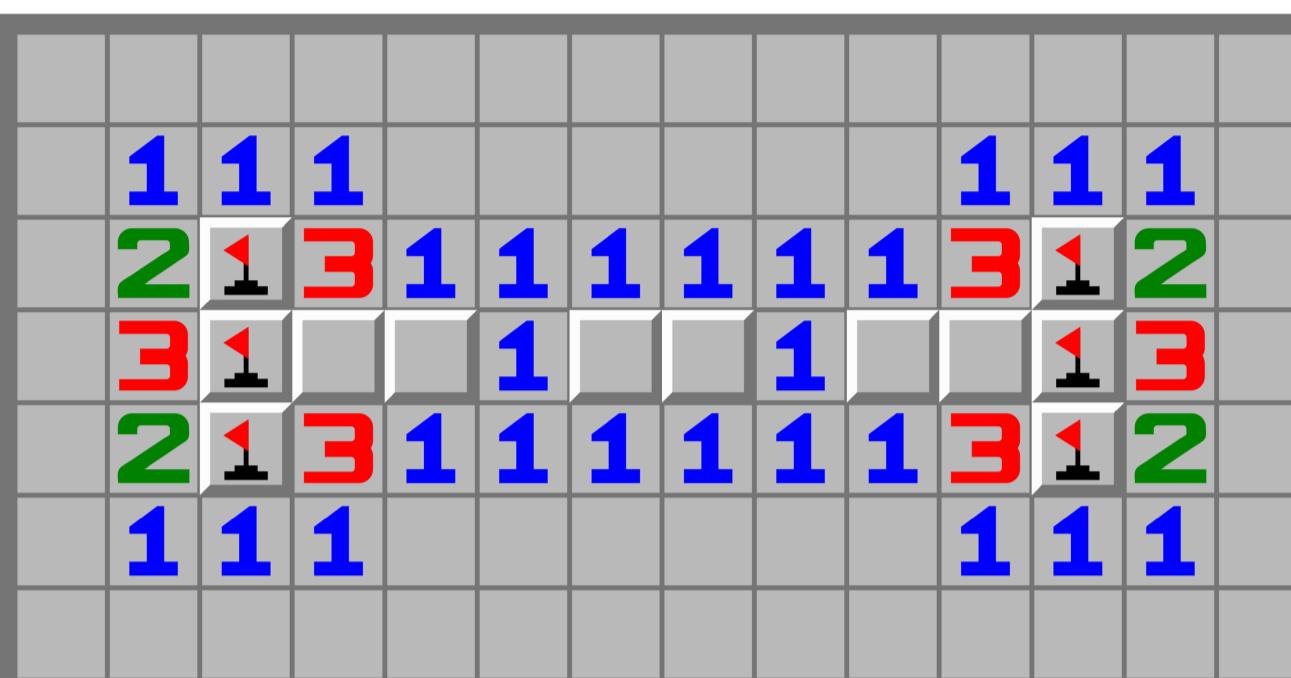
1 Wires

Can you solve this board?

There's **2 ways** to lay out the mines:
on the left side of each hidden cell pair (0)
or on the right side (1).

0   1

If you know a mine on one side,
you can carry the 0 or 1 to the other side!

2 Phases

Wires need to line up with each other.
Phases keep things organized.

3 Turns

Wires can **turn** up or down, left or right.
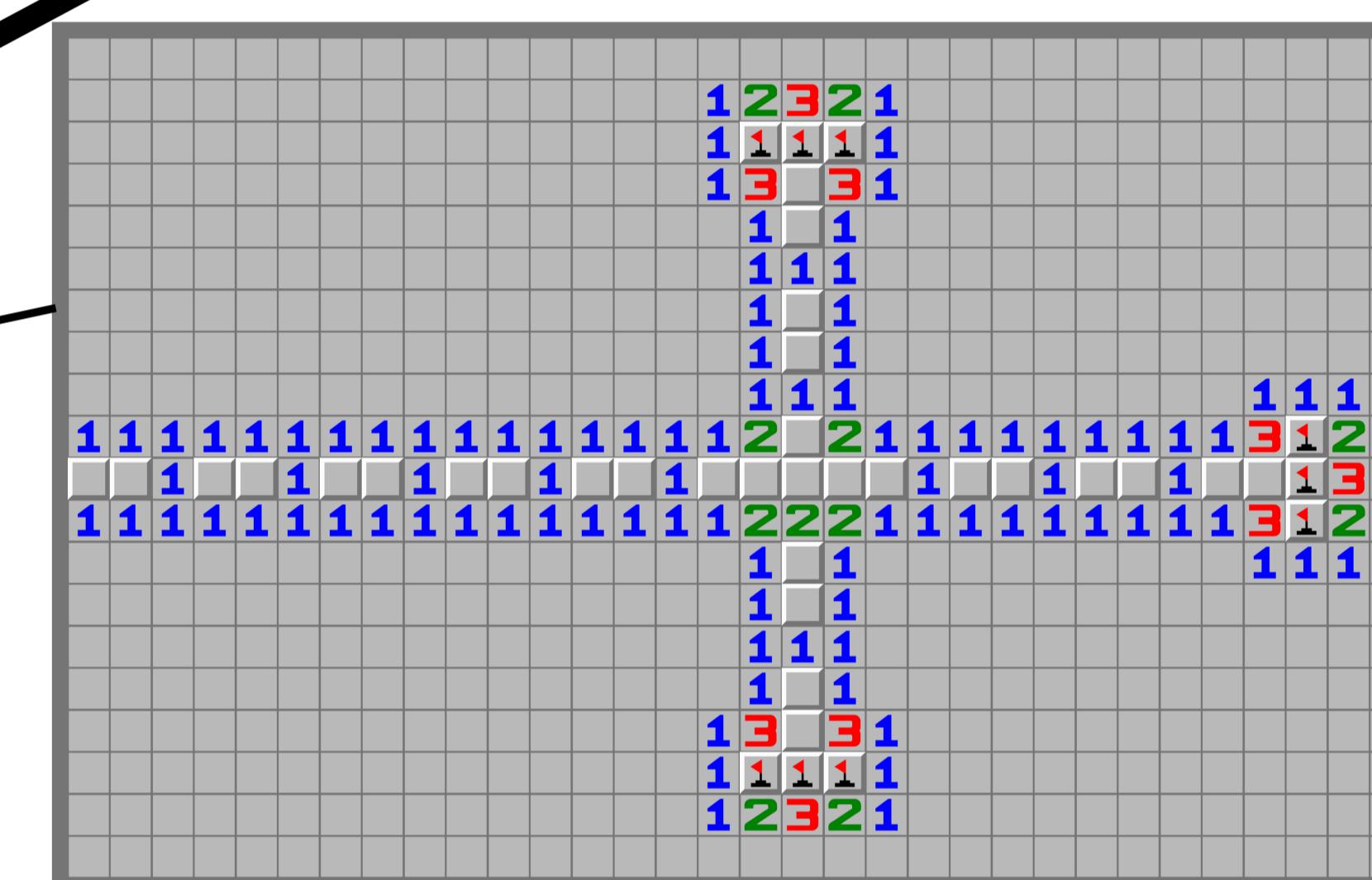
4 Splitters

Wires can **split** off
into two directions.

5 Crossovers
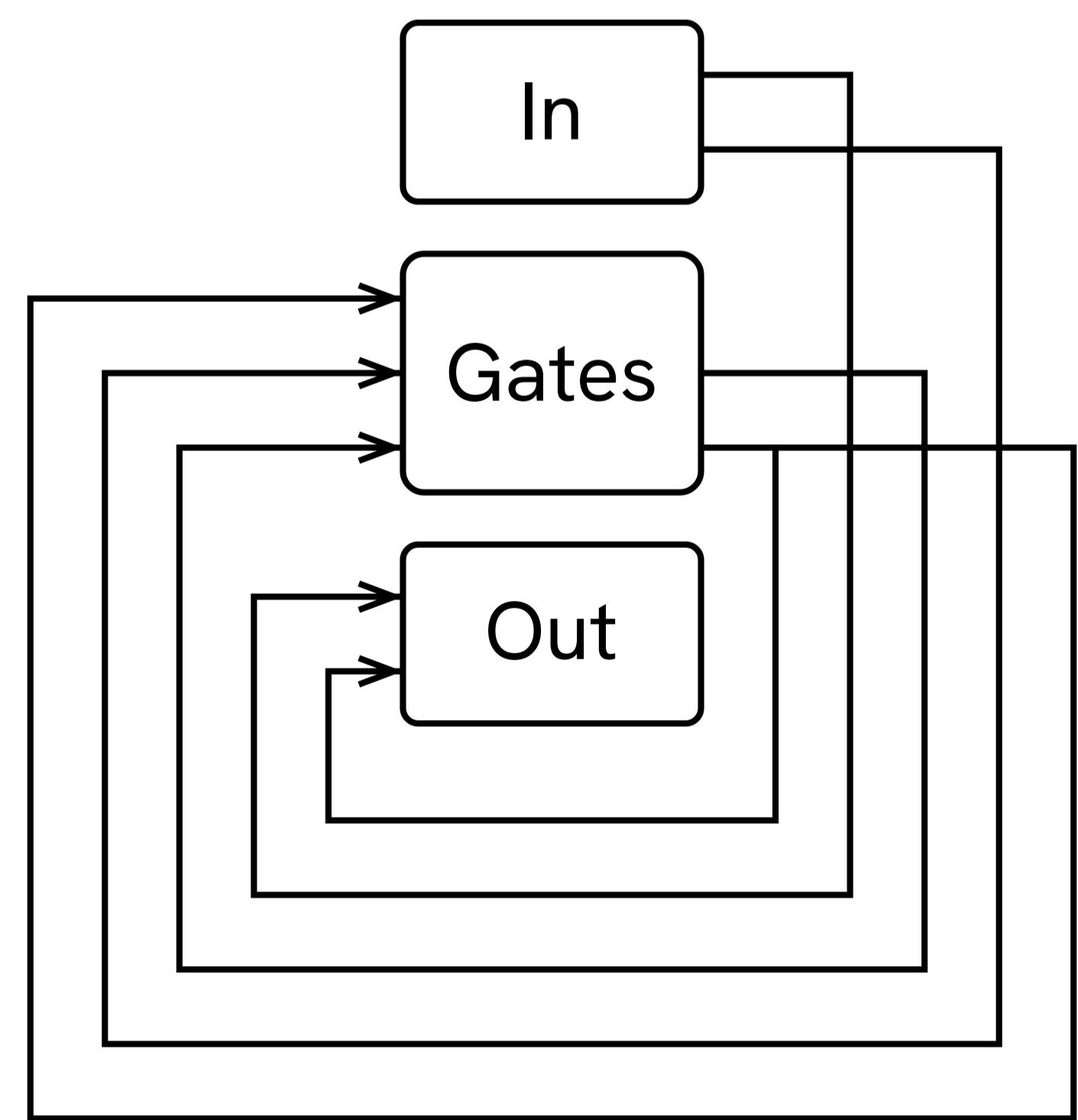
Wires can **cross**,
without interference!

These two wires are
completely **independent**.

6 NOT Gate

Here's a NOT gate!
It takes a signal from the left,
and produces the **opposite** signal to the right.

They don't stack nicely,
but we can **stagger** them.

7 AND Gate

AND gives a 1 when **both** of its inputs are 1.
We can make **any** logic with just NOT and AND gates.

In	Out
0, 0	0
1, 0	0
0, 1	0
1, 1	1
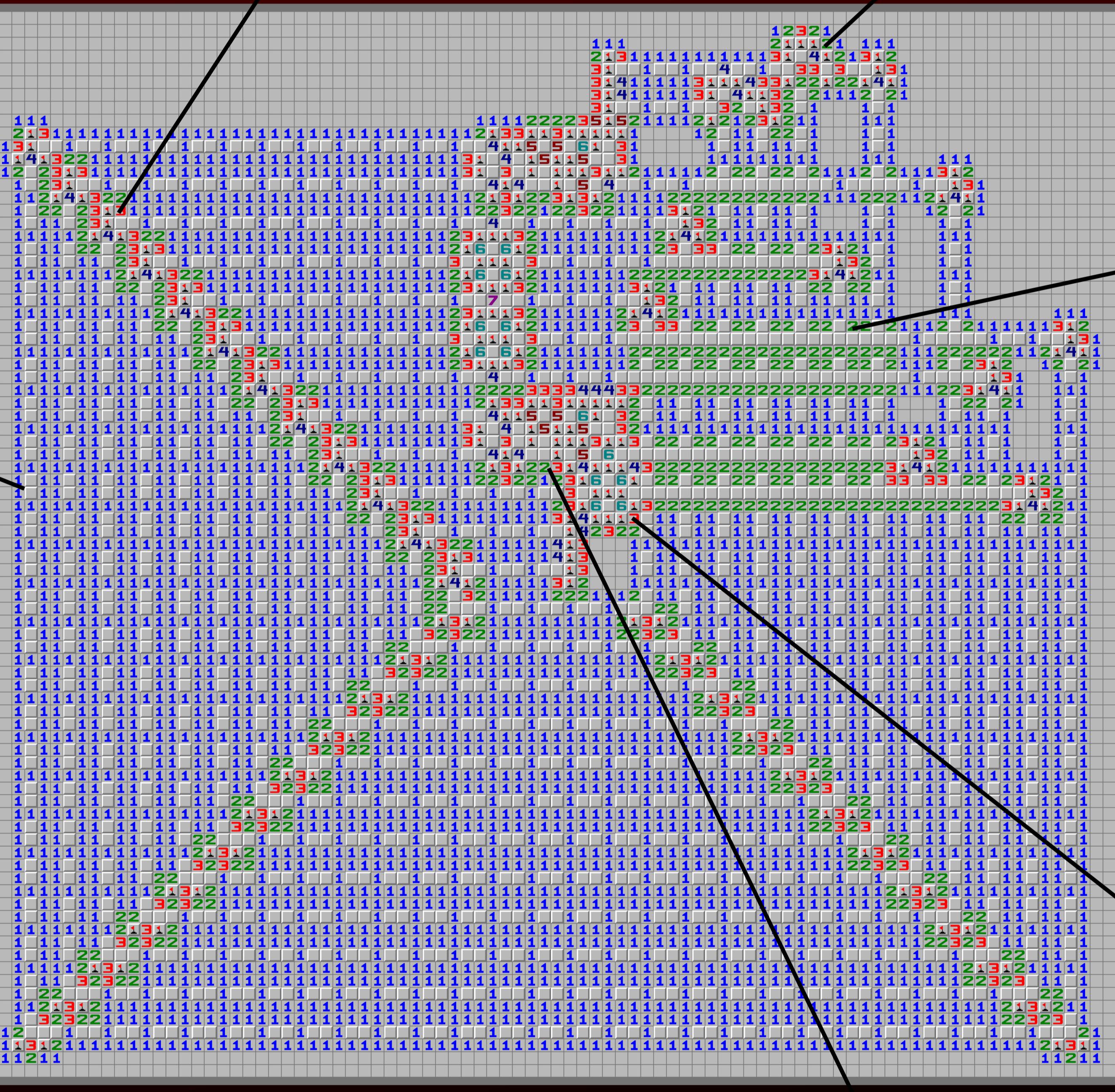
8 Board Layout

Stack everything vertically.
Inputs on top, then gates, then outputs in the middle.

In

Gates

Out

(not the same circuit)

Everything takes input from the left,
output to the right.
Wires loop all the way around.
And we're done!

A circuit? In Minesweeper?!

This board represents: c = a AND b; d = a OR b

Scan here to learn more: