

Competitive Programming SS24

Submit until end of contest



Problem: automaton (1.0 second timelimit)

Note: This is a problem that is harder to solve than usual. Solve the other problems first before spending too much time on this one.

While studying, you stumble across a weird cellular automaton. It starts with a 2×2 grid of black and white pixels. In each iteration the grid is split into non-overlapping 2×2 blocks and each block evolved into 4×4 block.

Implementing this schema is easy, and soon enough you have generated lots of fancy black and white pictures. However, due to the exponential growth, you can only simulate a limited number of iterations.

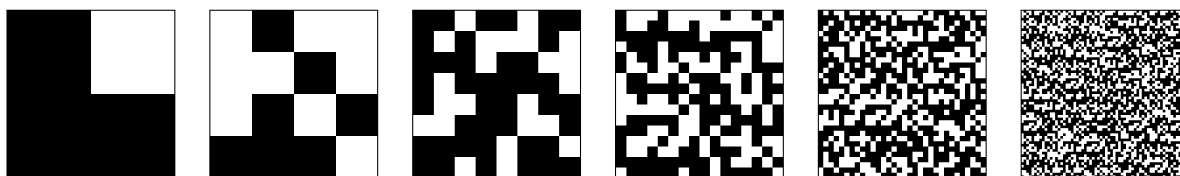
Input The input begins with a line containing i ($1 \leq i \leq 10^{18}$), the number of iterations. The next two lines contain the initial state as a 2×2 block, with '#' for black pixels and '.' for white ones. Then follow 16 evolution rules, each consisting of a 2×2 block followed by the 4×4 block to evolve it to. The 16 source blocks are unique and thus cover all possible 2×2 combinations.

```
#.
##
.#..
..#.
.#.#
####
```

Example rule

Output Output a line containing the number of black pixels after i iterations, modulo 998 244 353.

Samples The first five samples all use the same initial state and evolution rules with increasing values of i (1, 2, 3, 4, 100). You can use the images below as a reference for your solution. In the DomJudge interface you can download the sample input from the Problemset tab.



Initial state and after each of the first five iterations (Samples 1–5)