(Adv.) Competitive Programming

Submit until 24.05.2019 13:30, via the judge interface

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Problem: automaton (1 second timelimit)

Note: This is a bonus 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. Instead, you decide to calculate the number of black pixels modulo $998\,244\,353$, your second favorite prime number.

Input The input begins with a line containing i ($1 \le i \le 10^{18}$), the number of iterations. The next two line 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.
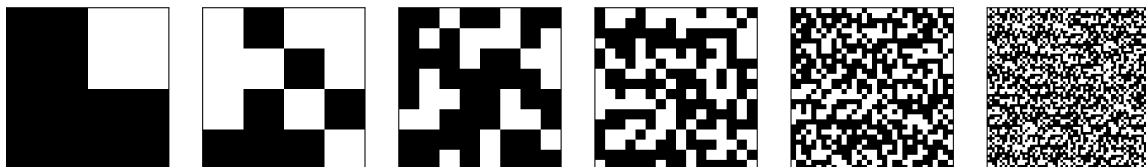
Initial state and after each of the first five iterations (Samples 1–5)