Problem B
Bracketology

Time limit: 1.0 seconds

March Madness has arrived, and ICPC coaching icon **Coach K** is putting his renowned basketball instincts to the test!

The tournament is organized as a single-elimination tournament featuring 2^k teams ($1 \le k \le 20$), numbered 1 through 2^k. The tournament consists of k sequential rounds:

- **Round 1** features 2^{k-1} matches: match 1 is between team 1 and team 2, match 2 is between team 3 and team 4, and in general match i ($1 \le i \le 2^{k-1}$) is between team $2i-1$ and team $2i$.
- For each subsequent round r ($2 \le r \le k$), match i ($1 \le i \le 2^{k-r}$) is contested between the winners of the two preceding matches $2i-1$ and $2i$ from round $r-1$.
- The final round (**Round** k) consists of a single match to decide the national champion.

In total, there are exactly $\sum_{r=1}^{k} 2^{k-r} = 2^k - 1$ matches in the tournament.

Before the tournament begins, Coach K fills out a prediction bracket by choosing the winner of every match. A valid bracket must satisfy the standard progression rule: the predicted winner of a match in round r ($r > 1$) must be chosen from the two teams Coach K predicted to win the preceding two matches $2i-1$ and $2i$ in round $r-1$.

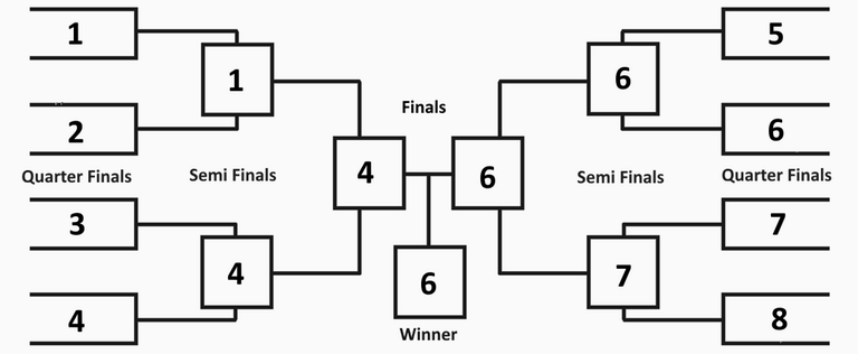


Figure 1: An example valid prediction bracket that Coach K could fill out for $2^3 = 8$ teams.

The tournament has fully concluded, and to the surprise of many, the actual outcomes are *chalk*: **in every single match, the lower-numbered seed (the smaller team ID) always wins** (e.g., team 1 beats team 2, team 3 beats team 4, and in any subsequent matchup between advancing winners, the team with the smaller ID prevails).

After the conclusion of this tournament, the official **Clevenger Scoring Machine** evaluates Coach K's bracket against the actual tournament results. For each match, the machine assigns:

- `1` if Coach K correctly predicted the winner of that match.
- `0` if Coach K's predicted winner was incorrect.

The machine concatenates these results into a binary string of length $2^k - 1$, ordered round by round from Round 1 to Round k, and within each round ordered from top to bottom (in increasing order of match index).

For example, consider the 8-team tournament ($k = 3$) shown in Figure 1. Suppose Coach K predicted teams $1, 4, 6$, and 7 to win their Round 1 matches; then predicted teams 4 and 6 to win the semi-finals;

and finally predicted team 6 to win the championship. The Clevenger Scoring Machine evaluates his predictions against the actual outcomes and prints:

```
1001000
```

where the first 4 digits (`1001`) score Round 1 (as $1, 2, 3, 4$ are the real winners), the next 2 digits (`00`) score Round 2 (as $1, 3$ are the real winners), and the final digit (`0`) scores Round 3 (as 1 is the real winner).

Disaster strikes! The Clevenger Scoring Machine suffered a hardware glitch, and several characters in the scoring string were corrupted and replaced with `?`.

Given the corrupted scoring string, determine the number of distinct valid prediction brackets Coach K could have submitted that are consistent with the string. As this count may be very large, output the answer modulo $1\,000\,000\,000$ (10^9).

Input

The input consists of two lines:

- The first line contains a single integer k ($1 \leq k \leq 20$), representing the number of rounds in the tournament (2^k teams).
- The second line contains a string of length $2^k - 1$ consisting only of the characters `'0'`, `'1'`, and `'?'`, representing the output of the Clevenger Scoring Machine.

Output

Output a single integer: the number of distinct valid brackets Coach K could have submitted that match the given scoring string, modulo $1\,000\,000\,000$.

Examples

Standard Input	Standard Output
3 1010010	2
2 ???	8
2 111	1