Problem C. Graph Coloring 2

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

You are given an undirected graph with n vertices numbered 0 through $n-1$. Obviously, the set of vertices have $2^n - 1$ non-empty subsets. For a non-empty subset S, a proper coloring of S is a way to assign each vertex in S a color, so that no two vertices in S with the same color are directly connected by an edge. Assume we used k different kinds of colors in a proper coloring. The *chromatic number* of subset S is the minimum possible k among all the proper colorings of S.

Now your task is to compute the chromatic number of every non-empty subset of n vertices.

Input

The first line contains an integer T. Then T test cases follow.

The first line of each test case contains an integer n. Each of then next n lines contains a string consisting of '0' and '1'. For $0 \le i \le n-1$ and $0 \le j \le n-1$, if the j-th character of the i-th line is '1', then vertices i and j are directly connected by an edge, otherwise they are not directly connected.

The i-th character of the i-th line is always '0'. The i-th character of the j-th line is always the same as the j-th character of the i-th line.

For all test cases, $1 \le n \le 18$. There are no more than 100 test cases with $1 \le n \le 10$, no more than 3 test cases with $11 \le n \le 15$, and no more than 2 test cases with $16 \le n \le 18$.

Output

For each test case, print an integer on a separate line. This integer is determined as follows: We define the identity number of subset S as $id(S) = \sum_{v \in S} 2^v$. Let the chromatic number of S be $f_{id(S)}$. You need to output

$$\left(\sum_{id(S)=1}^{2^n-1} f_{id(S)} \cdot 233^{id(S)} \right) \bmod 2^{32}.$$

Example

standard input	standard output
2 4 0110 1010 1101 0010 4 0111 1010 1101 1010	1022423354 2538351020

Note

For the first test case, $ans[1..15] = \{1, 1, 2, 1, 2, 2, 3, 1, 1, 1, 2, 2, 2, 2, 3\}$.