TRAINING COMPETITION OF THE BULGARIAN EXTENDED NATIONAL TEAM
Bankya, 18 June 2025
group A

Problem AT3. MATRIX

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Here *natural* numbers will be understood as their set-theoretic definition. That is the set of all natural numbers begin with 0.

Let's call an $n \times n$ matrix A *cute* if for all permutations p of the numbers $1, 2, \ldots n$ such that it is true that the sum $\sum_{i=1}^{n} A[i][p_i]$ remains the same.

You will be given an $n \times n$ matrix, consisting of natural numbers and -1. Count how many ways are there to modify this matrix in such a way that you get a *cute* matrix if you must substitute all the -1s with natural numbers modulo $10^9 + 7$. If there are infinite such ways, let the answer be -1.

Input

The first line of the input consists of n – the size of the matrix. Each of the next n lines consist of n integers such that the value of $A_{i,j}$ is the j-th number on the i-th line.

Output

Output a single digit – the number of ways to fill the matrix and make it *cute* (modulo $10^9 + 7$) or -1 if there are infinite such ways.

Constraints

- $1 \leq n \leq 10^3$
- $-1 \leq A_{i,j} \leq 10^9$

Subtasks

Subtask	Points	Necessary subtasks	Additional constraints
0	0	–	Examples.
1	4	–	$n = 2$
2	7	–	$-1 \leq A_{i,j} \leq 0$
3	7	–	$n \leq 8, A_{i,j} \neq -1$
4	7	3	$n \leq 80, A_{i,j} \neq -1$
5	13	4	$A_{i,j} \neq -1$
6	12	–	$A_{1,1} = 0$ $A_{i,j} = -1$ if and only if $i \neq j$
7	14	6	$A_{i,j} = -1$ if and only if $i \neq j$
8	8	–	$n \leq 5, A_{i,j} \leq 7$ There is at least one element $A_{i,j} = 0$
9	10	8	$n \leq 100, A_{i,j} \leq 100$ There is at least one element $A_{i,j} = 0$
10	12	9	There is at least one element $A_{i,j} = 0$.
11	6	$0 - 10$	–

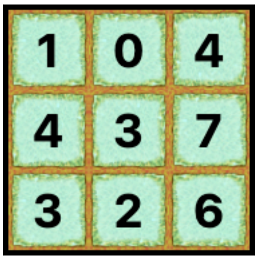
Points for a given subtask are only awarded if all tests provided for it are successfully passed.

Examples

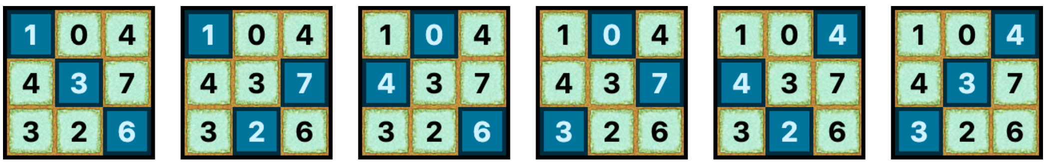
Input	Output
3 -1 0 -1 4 -1 7 3 -1 -1	4
2 -1 1 2 -1	4
2 -1 -1 -1 -1	-1
2 2 6 5 265	0

Explanations

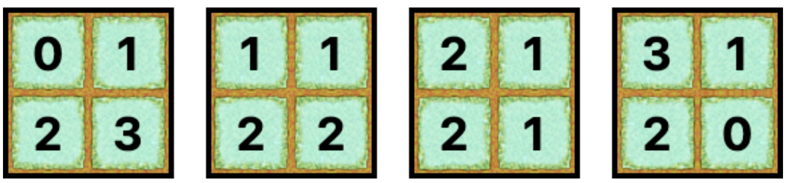
The following is one of the four answers to the first example:



There are 6 possible permutations of 3 elements:



The four ways to fill the matrix in the second example are:



In the third example there are infinite ways to fill the matrix. In the fourth example there are no ways to fill the matrix.