

## PROBLEM:

An  $N \times N$  matrix is called  $K$ -strange if all its elements are distinct numbers from 1 to  $N$ , and  $(A_{i,j} - A_{j,i})$  is a multiple of  $K$  for all  $(i, j)$ .

Let  $M_N$  be the largest number such that there exists a  $M_N$ -strange  $N \times N$  matrix.

You're given a matrix  $A$  with some elements missing.

Find the number of ways to fill in the missing elements such that the resulting matrix is  $M_N$ -strange.

## EXPLANATION:

There's a lot of stuff going on in the statement, so a good first step is to take things one at a time.

Our solution process can be broken up into three steps:

- First, find  $M_N$  for a given  $N$ .
- Second, characterize all  $M_N$ -strange matrices.
- Finally, find out how many of them can be obtained from  $A$ .

### ▼ Finding $M$

We want to find the largest integer for which there exists a strange matrix.

Suppose we fix  $K$ . When can there be a  $K$ -strange matrix?

Notice that:

- $A_{1,2}$  and  $A_{2,1}$  should be the same, modulo  $K$ . This means  $A_{1,2} - A_{2,1}$  must be a multiple of  $K$ . Since they must be distinct integers, their values must differ by at least  $K$  - that is,  $\min(A_{1,2}, A_{2,1}) + K \leq \max(A_{1,2}, A_{2,1})$ .

# Cp Algorithms And Problem Solving

**Shasha Hu**



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