Project Euler #213: Flea Circus

This problem is a programming version of Problem 213 from projecteuler.net

A $n \times n$ grid of squares contains n^2 fleas, initially one flea per square.

When a bell is rung, each flea jumps to an adjacent square at random (usually 4 possibilities, except for fleas on the edge of the grid or at the corners).

What is the expected number of unoccupied squares after m rings of the bell? As this number is rational, it could be represented as $\frac{P}{Q}$. Give your answer as $P \times Q^{-1} \bmod 10^9 + 7$. It's guaranteed that Q is coprime to $10^9 + 7$.

Input Format

The first line of each test file contains a single integer q, which is the number of queries per test file. q lines follow with integers n and m on each, separated by a single space.

Constraints

- $1 \leq q \leq 100$
- $1 \leq n \leq 40$
- n is even
- $1 \leq m \leq 200$
- Sum of all m in each test file ≤ 200

Output Format

Print exactly q lines with an answer for the corresponding query on each.

Sample Input 0

```
1
2 1
```

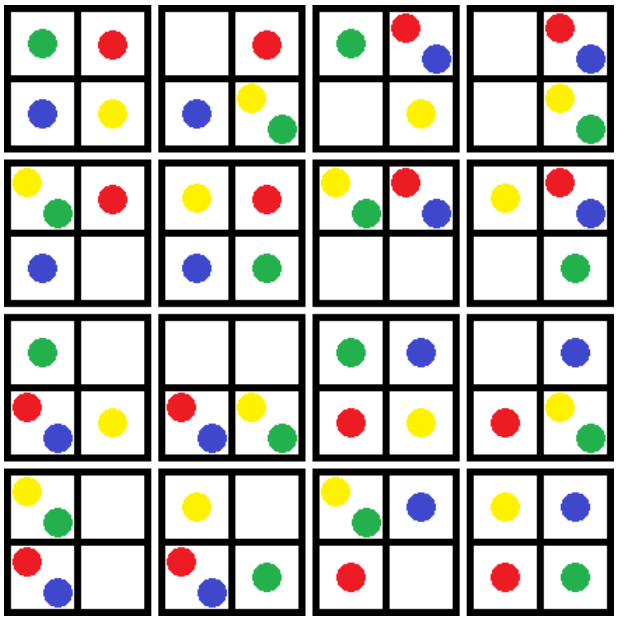
Sample Output 0

```
1
```

Explanation 0

At the beginning, the field looks as follows:

After the only bell ring there could be 16 variants:



So we have 4 variants with 0 free cells, 8 variants with 1 free cell and 4 variants with 2 free cells. That means, the expected number of empty cells is equal to $\frac{4}{16} \times 0 + \frac{8}{16} \times 1 + \frac{4}{16} \times 2 = 1$.