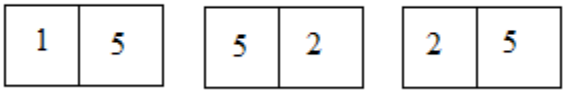
UCF Local Contest — September 3, 2016

Lineup the Dominoes

filename: `dominoes`
(*Difficulty Level:* `Hard`)

Consider a game of solitary dominoes, where you are given several dominoes with a number of dots on both sides, with the number of dots ranging from 1 to 6, inclusive, and the goal is to line up the dominoes from left to right such that all touching sides between dominoes share the same number of dots. Here is a valid solution with a set of three dominoes:



D_1 D_2 D_3

Given dominoes D_1 through D_n, we consider a solution to be different than another solution if at least one domino is in a different location in the two solutions. Also, we allow dominoes to be flipped so, for example, a domino that reads 5, 2 from left to right can also be placed to read 2, 5 from left to right by flipping it. Note that for two solutions to be different, only the positions of dominoes matter, i.e., the values on the dominoes and the orientation of each domino does not matter. For example, let's assume D_1=[4,4] and D_2=[4,4]; the solution $\{D_1, D_2\}$ is different from the solution $\{D_2, D_1\}$ even though both solutions represent the same pattern: $\{D_1, D_2\}$=[4,4][4,4] and $\{D_2, D_1\}$=[4,4][4,4]. But the solution $\{D_1, D_2\}$ is not different from any other $\{D_1, D_2\}$ even if we flip one or both dominoes.

Using the three dominoes above, multiple solutions exist. One solution is shown above; another solution is D_1, D_3 and D_2, in sequence. We can get the latter to work by flipping both D_2 and D_3 compared to how they are shown above. Note again that these two solutions are different since one solution is $\{D_1, D_2, D_3\}$ and one is $\{D_1, D_3, D_2\}$, i.e., the position of D_2 has changed (and position of D_3 as well).

The Problem:

Given a set of dominoes, count the number of different solutions to the domino puzzle. As previously described, a correct solution will arrange all the dominoes in a line such that all touching sides between dominoes share the same number of dots. Since the number of solutions may be very large, calculate it mod $10^9 + 7$.

The Input:

The first input line contains a single positive integer, m ($1 \leq m \leq 100$), indicating the number of sets of dominoes to evaluate. This is followed by the data for these sets of dominoes.

The first line of input for each set of dominoes will contain an integer, n ($1 \leq n \leq 16$), the number of dominoes for that set. Each of the following n lines will contain two space separated integers, s_i ($1 \leq s_i \leq 6$) and t_i ($1 \leq t_i \leq 6$), representing the number of dots on each side of the i^{th} domino.

The Output:

For each set of dominoes, on a line by itself, output the number of different solutions to the domino puzzle mod $10^9 + 7$.

Sample Input:

```
5
3
1 5
5 2
2 5
2
1 3
4 5
3
1 2
3 4
1 4
4
1 1
1 1
1 1
1 1
4
3 5
3 5
3 5
3 5
```

Sample Output:

```
4
0
2
24
24
```