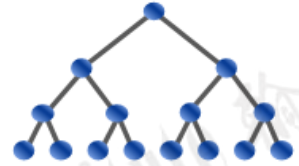


USA Computing Olympiad



OVERVIEW

DETAILS / FAQ

TRAINING

HISTORY

RESOURCES

USACO 2024 DECEMBER CONTEST, PLATINUM PROBLEM 3. MAXIMIZE MINIMUM DIFFERENCE

[Return to Problem List](#)

Contest has ended.

Log in to allow submissions in analysis mode

English (en) ▾

****Note: The time limit for this problem is 4s, twice the default.****

Moo! You are given an integer N ($2 \leq N \leq 2000$). Consider all permutations $p = [p_0, p_1, \dots, p_{N-1}]$ of $[0, 1, 2, \dots, N-1]$. Let $f(p) = \min_{i=0}^{N-2} |p_i - p_{i+1}|$ denote the minimum absolute difference between any two consecutive elements of p . and let S denote the set of all p that achieve the maximum possible value of $f(p)$.

You are additionally given K ($0 \leq K \leq N$) constraints of the form $p_i = j$ ($0 \leq i, j < N$). Count the number of permutations in S satisfying all constraints, modulo $10^9 + 7$.

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains T ($1 \leq TN \leq 2 \cdot 10^4$) and N , meaning that you will need to solve T independent test cases, each specified by a different set of constraints.

Each test case starts with K , followed by K lines each containing i and j . It is guaranteed that

- The same i does not appear more than once within the same test case.
- The same j does not appear more than once within the same test case.

OUTPUT FORMAT (print output to the terminal / stdout):

For each test case, the answer modulo $10^9 + 7$ on a separate line.

SAMPLE INPUT:

```

3 4
0
1
1 1
2
0 2
2 3

```

SAMPLE OUTPUT:

```

2
0
1

```

The maximum possible value of $f(p)$ is 2, and $S = \{[2, 0, 3, 1], [1, 3, 0, 2]\}$.

SAMPLE INPUT:

```

9 11
2
0 5
6 9
3
0 5
6 9
1 0
4
0 5
6 9
1 0
4 7
5
0 5
6 9
1 0
4 7

```

2 6
 6
 0 5
 6 9
 1 0
 4 7
 2 6
 9 3
 7
 0 5
 6 9
 1 0
 4 7
 2 6
 9 3
 5 2
 8
 0 5
 6 9
 1 0
 4 7
 2 6
 9 3
 5 2
 7 4
 9
 0 5
 6 9
 1 0
 4 7
 2 6
 9 3
 5 2
 7 4
 3 1
 10
 0 5
 6 9
 1 0
 4 7
 2 6
 9 3
 5 2
 7 4
 3 1
 8 10

SAMPLE OUTPUT:

6
 6
 1
 1
 1
 1
 1
 1
 1

$p = [5, 0, 6, 1, 7, 2, 9, 4, 10, 3, 8]$ should be counted for all test cases.

SAMPLE INPUT:

10 11
 0
 1
 3 8
 2
 3 8
 5 7
 3
 3 8
 5 7
 4 2
 4
 3 8
 5 7
 4 2
 10 6
 5
 3 8
 5 7

4 2
 10 6
 8 10
 6
 3 8
 5 7
 4 2
 10 6
 8 10
 1 9
 7
 3 8
 5 7
 4 2
 10 6
 8 10
 1 9
 7 5
 8
 3 8
 5 7
 4 2
 10 6
 8 10
 1 9
 7 5
 2 3
 9
 3 8
 5 7
 4 2
 10 6
 8 10
 1 9
 7 5
 2 3
 6 0

SAMPLE OUTPUT:

160
 20
 8
 7
 2
 1
 1
 1
 1
 1

$p = [4, 9, 3, 8, 2, 7, 0, 5, 10, 1, 6]$ should be counted for all test cases.

SAMPLE INPUT:

5 987
 3
 654 321
 543 210
 432 106
 2
 654 321
 543 210
 1
 654 321
 1
 0 493
 0

SAMPLE OUTPUT:

0
 538184948
 693625420

 932738155
 251798971

Make sure to output the answer modulo $10^9 + 7$.

SCORING:

- Input 5: $N = 15$
- Input 6: $N = 2000$
- Inputs 7-9: For all test cases, the constraint $p_0 = \lfloor N/2 \rfloor$ appears.
- Inputs 10-13: For all test cases, there exists some constraint $p_i = j$ with j equal to $\lfloor N/2 \rfloor$.
- Inputs 14-20: No additional constraints.

Problem credits: Benjamin Qi

Contest has ended. No further submissions allowed.