

# Counting Equations



Sevenkplus was interested in contributing a challenge to hackerrank and he came up with this problem.

You are given a linear congruence system with  $n$  variables and  $m$  equations:

$$a_{11} x_1 + a_{12} x_2 + \dots + a_{1n} x_n = b_1 \pmod{p}$$

$$a_{21} x_1 + a_{22} x_2 + \dots + a_{2n} x_n = b_2 \pmod{p}$$

...

$$a_{m1} x_1 + a_{m2} x_2 + \dots + a_{mn} x_n = b_m \pmod{p}$$

where,

$p$  is a prime number

$$0 \leq a_{ij} < p$$

$$0 \leq x_i < p$$

$$0 \leq b_i < p$$

Given integers  $n$ ,  $m$ ,  $p$ ,  $a$ ,  $b$ , count the number of solutions to this equation. Since the output can be large, please output your answer modulo  $10^9+7$ .

He writes the standard solution and a test data generator without difficulty, and generates some test data. However, when he attempts to remove hidden folders from the problem folder before uploading, he accidentally deletes the input file. Luckily, the output file remains and he still remembers some features of the input. He remembers  $n$ ,  $m$ ,  $p$  and that  $w$  entries of  $a$  are zero. However, he cannot recall more about the input.

He wants to count how many possible inputs are there that will result in the desired output  $S$  (number of solutions to the equation system) output modulo  $10^9+7$ . Can you help Sevenkplus?

## Input Format

The first line contains an integer  $T$ .  $T$  testcases follow. For each test case, the first line contains five numbers,  $m$ ,  $n$ ,  $p$ ,  $S$ ,  $w$ . separated by a single space.

$w$  lines follow. Each line contains two numbers  $x$ ,  $y$ , which indicates that  $a_{xy}=0$ .

## Output Format

For each test case, output one line in the format **Case #t: ans**, where  $t$  is the case number (starting from 1), and **ans** is the answer.

## Constraints

$$1 \leq T \leq 33$$

$$1 \leq m, n \leq 1000$$

$$p \leq 10^9, p \text{ is a prime number}$$

$$0 \leq S < 10^9+7$$

$$w \leq 17$$

$$1 \leq x \leq m$$

$$1 \leq y \leq n$$

In any test case, one pair  $(x, y)$  will not occur more than once.

## Sample Input

```
6
2 2 2 0 1
1 1
2 2 2 1 1
1 1
2 2 2 2 1
1 1
2 2 2 3 1
1 1
```

```
2 2 2 4 1
1 1
488 629 183156769 422223791 10
350 205
236 164
355 8
3 467
355 164
350 467
3 479
72 600
17 525
223 370
```

## Sample Output

```
Case #1: 13
Case #2: 8
Case #3: 10
Case #4: 0
Case #5: 1
Case #6: 225166925
```

## Explanation

For test case 1, the 13 possible equations are:

```
a11 a12 b1 a21 a22 b2
0 0 0 0 0 1
0 0 1 0 0 0
0 0 1 0 0 1
0 0 1 0 1 0
0 0 1 0 1 1
0 0 1 1 0 0
0 0 1 1 0 1
0 0 1 1 1 0
0 0 1 1 1 1
0 1 0 0 0 1
0 1 0 0 1 1
0 1 1 0 0 1
0 1 1 0 1 0
```

## Timelimits

Timelimits for this challenge is given [here](#)