# 1333 – Grid Coloring

You have to color an **M x N** two dimensional grid. You will be provided **K** different colors for this. You will also be provided a list of **B** blocked cells of this grid. You cannot color these blocked cells.

A cell can be described as **(x, y)**, which points to the $\mathbf{y}^{th}$ cell from the left of the $\mathbf{x}^{th}$ row from the top.

While coloring the grid, you have to follow these rules -

1. You have to color each cell which is not blocked.
2. You cannot color a blocked cell.
3. You can choose exactly one color from **K** given colors to color a cell.
4. No two vertically adjacent cells can have the same color, i.e. cell **(x, y)** and cell **(x + 1, y)** shouldn't contain the same color.

You have to calculate the number of ways you can color this grid obeying all the rules provided.

## Input

Input starts with an integer **T (≤ 600)**, denoting the number of test cases.

Each test case starts with a line containing four integers **M N K B ($1 \le M, N, K \le 10^6$, $0 \le B \le 500$)**. Each of the next **B** lines will contain two integers **x** and **y ($1 \le x \le M$, $1 \le y \le N$)**, the row and column number of a blocked cell. Each of these **B** lines will contain distinct cells.

## Output

For each case, print the case number and the number of ways to color the grid modulo $\mathbf{10^9}$.

| Sample Input | Output for Sample Input |
|---|---|
| 3<br>3 3 3 0<br>3 4 4 2<br>3 1<br>3 3<br>2 2 5 2<br>1 2<br>2 2 | Case 1: 1728<br>Case 2: 186624<br>Case 3: 20 |