A. Anomalous Arrays

time limit per test: 1 second
memory limit per test: 256 megabytes

Given \( m \) and \( n \), count the number of possible arrays \( a = (a_1, a_2, \ldots, a_n) \) such that

- \( a_i \in \{1, 2, 3, \ldots, m\} \) for each \( i \in \{1, 2, 3, \ldots, n\} \);
- There exists some \( 1 \leq i < n \) such that \( a_i = a_{i+1} \).

**Input**
A single line which contains \( m \) (\( 1 \leq m \leq 10^8 \)) and \( n \) (\( 1 \leq n \leq 10^{12} \)).

**Output**
Display the number of possible arrays. Since the answer may be large, display it modulo 1000003.

**Example**

<table>
<thead>
<tr>
<th>input</th>
<th>output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 3</td>
<td>6</td>
</tr>
</tbody>
</table>

B. Party Preparation

time limit per test: 1 second
memory limit per test: 256 megabytes

The professors were very happy about their party two weeks ago. Now they are already planning next year’s party. The professors plan to buy exactly \( n \) units of beer for the party. They have \( k \) different brands of beer to choose from, but they are not sure how many of each they should buy. Help the professors determine the number of options they have.

**Input**
The input contains a single line consisting of two integers, \( n \) (\( 1 \leq n \leq 100\,000 \)) and \( k \) (\( 1 \leq k \leq 100\,000 \)).

**Output**
Display the number of ways in which the professors could buy beer for the party. Since the answer may be large, display it modulo 1,000,000,007.

**Examples**

<table>
<thead>
<tr>
<th>input</th>
<th>output</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 3</td>
<td>66</td>
</tr>
<tr>
<td>15 8</td>
<td>178544</td>
</tr>
</tbody>
</table>

**Note**
There may be some brands that the professors don’t like, so they might purchase zero units of some brands.
C. Tenuous Triangles

You are given a directed graph $G = (V, E)$ with no self-loops. For each pair of vertices $u, v$ such that $u \neq v$, exactly one of the edges $(u, v)$ or $(v, u)$ exists in the graph.

We say three vertices $(u, v, w)$ form a triangle if there is an edge from $u$ to $v$, an edge from $v$ to $w$, and an edge from $w$ to $u$.

Count the number of triangles in $G$. Notice that $(u, v, w)$, $(v, w, u)$ and $(w, u, v)$ are regarded as the same triangle and should be counted only once.

Input
The first line contains a single integer $n$ $(1 \leq n \leq 2000)$. Each of the following $n$ lines contains $n$ characters. The character in the $i$-th line and $j$-th column will be Y if there is an edge from $i$ to $j$, will be N if there is an edge from $j$ to $i$, and will be - if $i = j$.

Output
Display a single integer, the number of triangles.

Example

<table>
<thead>
<tr>
<th>input</th>
<th>output</th>
</tr>
</thead>
</table>
| 4  
  YNN  
  N-YY  
  YN-Y  
  YNN- | 2      |

D. Easy Equations

Given an equation $x_1 + x_2 + \ldots + x_n = m$, count the number of solutions to the equation such that

- $x_i$ are all positive integers;
- $x_1 \leq a_1, x_2 \leq a_2, \ldots, x_p \leq a_p$;
- $x_{p+1} \geq a_{p+1}, x_{p+2} \geq a_{p+2}, \ldots, x_{p+q} \geq a_{p+q}$.

Input
The first line contains a single integer $T$ $(1 \leq T \leq 100)$ which denotes the number of test cases. For each test case, the first line contains four integers $n$ $(1 \leq n \leq 10^3)$, $p$ $(0 \leq p \leq 8)$, $q$ $(0 \leq q \leq 8)$ and $m$ $(1 \leq m \leq 10^9)$. The second line contains $p + q$ integers, which denote $a_1, a_2, \ldots, a_{p+q}$. If $p + q = 0$, the second line is empty.

It is guaranteed that $a_i \leq m$ for all $i$, and that $p + q \leq n$. Note that $p + q$ might not be equal to $n$.

Output
For each test case, display the number of solutions modulo 10,007.

Example

<table>
<thead>
<tr>
<th>input</th>
<th>output</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 1 1 6</td>
<td>3 6 0</td>
</tr>
<tr>
<td>3 3 0 0 5</td>
<td>3 3</td>
</tr>
</tbody>
</table>
E. Creating a Connected Component

time limit per test: 2 seconds
memory limit per test: 256 megabytes

You are given a graph on $n$ vertices. For each pair of vertices $u$ and $v$ such that $u \neq v$, you have $c_{u,v}$ different choices of undirected edges that you could add between $u$ and $v$. For each pair of vertices $u$ and $v$, you can choose no edge between $u$ and $v$, or you can choose exactly one edge from the $c_{u,v}$ different options.

Count the number of ways to choose edges so that the resulting graph is connected.

Input
The first line contains a single integer $n$ ($1 \leq n \leq 16$). Each of the following $n$ lines contains $n$ integers, where the integer in the $i$-th row and $j$-th column denotes $c_{i,j}$ ($0 \leq c_{i,j} \leq 1000000007$).

It is guaranteed that $c_{i,i} = 0$ for all $i$, and that $c_{i,j} = c_{j,i}$ for all $i$ and $j$.

Output
Display the number of ways to choose edges. Since the answer may be large, display it modulo $1,000,000,007$.

Example

<table>
<thead>
<tr>
<th>input</th>
<th>output</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 0 2 3</td>
<td>50</td>
</tr>
<tr>
<td>2 0 4</td>
<td></td>
</tr>
<tr>
<td>3 4 0</td>
<td></td>
</tr>
</tbody>
</table>
