Alien Languages

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Problem Submissions Leaderboard Discussions Editorial

Sophia has discovered several alien languages. Suprisingly, all of these languages have an alphabet, and each of them may contain thousands of characters! Also, all the words in a language have the same number of characters in it.

However, the aliens like their words to be aesthetically pleasing, which for them means that for the i^{th} letter of an n-letter alphabet (letters are indexed $1 \dots n$):

- if $2i > n$, then the i^{th} letter may be the last letter of a word, or it may be immediately followed by any letter, including itself.
- if $2i \leq n$, then the i^{th} letter can not be the last letter of a word and also can only be immediately followed by j^{th} letter if and only if $j \geq 2i$.

Sophia wants to know how many different words exist in this language. Since the result may be large, she wants to know this number, modulo 100000007.

Input Format

The first line contains t, the number of test cases. The first line is followed by t lines, each line denoting a test case. Each test case will have two space-separated integers n, m which denote the number of letters in the language and the length of words in this language respectively.

Constraints

- $1 \leq t \leq 5$
- $1 \leq n \leq 10^5$
- $1 \leq m \leq 5 \cdot 10^5$

Output Format

For each test case, output the number of possible words modulo 100000007.

Sample Input

```
3
1 3
2 3
3 2
```

Sample Output

```
1
3
6
```

Explanation

For the first test case, there's one letter ('a') and all the words consist of 3 letters. There's only one possibility which is "aaa".

For the second test case, there are two letters ('a' and 'b') and all the words are of 3 letters. The possible strings are "abb", "bab", & "bbb". The words can end only with 'b' because $2 \cdot \text{index}(b) = 2 \cdot 2 > 2$ and for 'a', it's $2 \cdot \text{index}(a) = 2 \cdot 1 \leq 2$. "aab" is not allowed because 'a' can not be followed

immediately by 'a'. For a word of length 4 and alphabet of size 2, "abab" would be allowed.

For the third test case, there are three letters ('a', 'b' and 'c') and all of the words are 2 letters. The words can only end with 'b' or 'c'. The possible words are "ab", "ac", "bb", "cc", "bc", "cb".

Submissions:558

Max Score:60

Difficulty: Hard

Rate This Challenge:

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Current Buffer (saved locally, editable) Java 7

```
1  import java.io.*;
2  import java.util.*;
3  import java.text.*;
4  import java.math.*;
5  import java.util.regex.*;
6
7  public class Solution {
8      public static void main(String args[] ) throws Exception {
9          /* Enter your code here. Read input from STDIN. Print output to STDOUT */
10     }
11 }
12
```

Line: 1 Col: 1

Upload Code as File Test against custom input Run Code Submit Code