

Circles Math



You are given a set A containing n integers from 1 to n ; $A = \{1, 2, 3, \dots, n\}$.

Let's call $P(A)$ as a set that contains all [permutations](#) of A ;

For eg: if $A = \{1, 2\}$. $P(A) = \{\{1, 2\}, \{2, 1\}\}$

Can you find the number of elements $a \in P(A)$ which satisfies following conditions:

- For every $1 \leq i \leq n$, $a[i] \neq i$ where $a[i]$ is the i^{th} integer in permutation a
- There exists a set of k integers $\{i_1, i_2, i_3, \dots, i_k\}$ such that $a[i_j] = i_{j+1} \forall j < k$ and $a[i_k] = i_1$ (cyclic)

Input Format

The first line contains an integer T indicating the number of test-cases. T lines follow. Each line has two integers n and k separated by a single space.

Constraints

$1 \leq T \leq 100$

$1 \leq k \leq n \leq 10^6$

Output Format

Output the remainder of the answer after divided by 1000000007 ie., (10^9+7)

Sample Input

```
4
3 2
4 2
5 3
6 2
```

Sample Output

```
0
3
20
105
```

Hint

10^9+7 is a **prime number**.

Explanation

note : Array's are 1 indexed.

Lets take a look at $N = 3$ and $K = 2$

We will get 2 sets of A that satisfy the first property $a[i] \neq i$, they are

- $[3, 1, 2]$
- $[2, 3, 1]$

Now, as $K = 2$, we can have 6 such elements.

- $[1, 2], [1, 3], [2, 3], [2, 1], [3, 1], [3, 2]$

Lets consider the first element of $P(A) \rightarrow [3, 1, 2]$

- $[1, 2], a[1] \neq 2$
- $[1, 3], a[1] = 3$ but $a[3] \neq 1$

- $[2,3], a[2] \neq 3$
- $[2,1], a[2] = 1$ but $a[1] \neq 2$
- $[3,1], a[3] = 1$ but $a[1] \neq 3$
- $[3,2], a[3] \neq 2$

Lets consider the second element of $P(A) \rightarrow [2,3,1]$

- $[1,2], a[1] = 2$ but $a[2] \neq 1$
- $[1,3], a[1] \neq 3$
- $[2,3], a[2] = 3$ but $a[3] \neq 3$
- $[2,1], a[2] \neq 1$
- $[3,1], a[3] =$ but $a[1] \neq 3$
- $[3,2], a[3] \neq 2$

As none of the elements of a satisfy the properties above, hence 0.

In the second case, $n=4, k=2$. Here follows all the permutations of

$A=\{1,2,3,4\}$ we could find that satisfy the two condition above.

2 1 4 3 # $(a[2] = 1, a[1] = 2)$ or $(a[4] = 3, a[3] = 4)$ is ok.

4 3 2 1 # $(a[4] = 1, a[1] = 4)$ or $(a[3] = 2, a[2] = 3)$ is ok.

3 4 1 2 # $(a[3] = 1, a[1] = 3)$ or $(a[4] = 2, a[2] = 4)$ is ok.

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