IOITC 2016 TST Day 1

Alice and Permutations

One lazy afternoon, Alice was enjoying her favourite pastime - thinking about permutations. Her best friend Dori gave her a magic machine which takes a permutation of the first n positive integers and attempts to sort it. In each run of the machine, it goes through the sequence from left to right and swaps two adjacent elements if the first one is bigger than the next. Unfortunately for Alice, the machine's battery lasts only for k runs. Call a permutation *Good*, if it can be sorted by the machine in k runs, that is, using a single battery. Alice, being inquisitive, is now wondering how many *Good* permutations there are, so that she can show off her skills to Dori. In fact, she is thinking about this for t different pairs of n, k.

Formally, Alice wants to count the number of permutations $(p_1, \ldots, p_n)$ of $(1, 2, \ldots, n)$ such that it is sorted (ie. becomes equal to $(1, 2, ..., n)$) in atmost k runs. A run is formally defined as the following loop:

One Run

```
1: for i = 1 to n − 1 do
2:     if p_i > p_{i+1} then
3:         swap(p_i, p_{i+1})
4:     end if
5: end for
```

Please help Alice find the number of permutations for t instances of n and k. Since the answer might be large, print it modulo $10^9 + 7$.

Input

The first line contains number of test cases t.
Each of the next t lines contain two space separated integers n and k.

Output

Print t lines, the i^{th} line being the answer to the i^{th} test case.

Test Data

In all inputs, $1 \leq t \leq 100$.

Subtask 1 (10 Points):

- $1 \leq n \leq 9$
- $1 \leq k \leq 9$

Subtask 2 (90 Points):

- $1 \leq n \leq 10^5$
- $1 \leq k \leq 10^5$

Sample Input1

```
4
4 1
4 2
4 3
5 6
```

Sample Output1

```
8
18
24
120
```

Limits

Time: 1 second

Memory: 512 MB