Period of permutation

[Award] **10 pts**

[Category] **Math**

Let *i*1, *i*2, *i*3, …, *in* be a permutation of the set {1, 2, 3, ..., *n*} where *n* is a positive integer. A permutation can also be viewed as a function *f*. We denote this permutation by the 2-by-*n* array



It maps number 1 to *i*1, number 2 to *i*2 and so on. When this function operates on a permutation of set {1, 2, 3, ..., *n*}, that is *x*1, *x*2, *x*3, …, *xn*, a new permutation *y*1, *y*2, *y*3, …, *yn* can be obtained. Here *y*1 = *f*(*x*1), *y*2 = *f*(*x*2), …, *yn* = *f*(*xn*).

For example, when *n* = 4 and there is a permutation 2, 4, 1, 3. We make this permutation operate on a permutation 1, 2, 3, 4 continuously, and it will be

**1, 2, 3, 4** → 2, 4, 1, 3 → 4, 3, 2, 1 → 3, 1, 4, 2 → **1, 2, 3, 4** → …

Obviously after 4 operations the result permutation returns to the initial one.

Let *F*(*l*, *p*) be the number of permutations of the set {1, 2, 3, ..., *l*} which makes the permutation 1, 2, 3, …, *l* returns to itself after *p* operations. For instance, *F*(4, 3) = 9, as there are 9 permutations meet the condition: (1, 2, 3, 4), (1, 3, 4, 2), (1, 4, 2, 3), (2, 3, 1, 4), (2, 4, 3, 1), (3, 1, 2, 4), (3, 2, 4, 1), (4, 1, 3, 2), (4, 2, 1, 3). You are also given *F*(5, 5) = 25, *F*(10, 6) = 625176, *F*(20, 11) = 609493248001.

Let. Find *S*(10000, 1000) mod 1000000007.

Thanks to **baihacker** for the idea.

[Answer] **33981364**