Appleby Contest '20 P5 - Ridiculous Tree

Time limit: 2.0s **Memory limit:** 1G

Ridiculous Ray has a ridiculous tree! Oh what crazy things can he do with thee!

In his ridiculous tree, each index i $(2 \leq i \leq N)$ has a parent index p_i such that $1 \leq p_i < i$.

Since he's so ridiculous, he wants to count the number of permutations $q_1, q_2, \ldots, q_N$ of the numbers $1, 2, \ldots, N$ such that for every index i $(2 \leq i \leq N)$, there exists no j $(1 \leq j < i)$ such that $p_{q_j} = q_i$.

As the answer can be very large, he wants you to output the prime factorization of it instead.

Constraints

For all subtasks:

$2 \leq N \leq 4 \cdot 10^5$

For all i where $2 \leq i \leq N$, $1 \leq p_i < i$.

Subtask 1 [10%]

$2 \leq N \leq 7$

Subtask 2 [40%]

$2 \leq N \leq 3\,000$

Subtask 3 [50%]

No additional constraints.

Input Specification

The first line contains the integer N.

The next line contains the integers $p_2, p_3, \ldots, p_N$.

Output Specification

Let A be the number of permutations that satisfy Ray's requirements, and $a_1^{b_1} \times a_2^{b_2} \times \cdots \times a_k^{b_k}$ be the prime factorization of A as defined under the fundamental theorem of arithmetic. The primes in the prime factorization will be ordered such that $a_1 < a_2 < \cdots < a_k$.

Note: If $A = 1$, print `0` on a single line instead.

It can also be shown that $A = 0$ is never possible under the constraints of the problem.

On the first line, output k.

Next, output k lines of space separated integers, where the i^{th} line contains the integers a_i, b_i.

Sample Input 1

```
5
1 1 2 3
```

Sample Output 1

```
2
2 1
3 1
```

Sample Explanation 1

There are 6 permutations that satisfy Ray's requirements:

- $1, 2, 3, 4, 5$
- $1, 2, 3, 5, 4$
- $1, 2, 4, 3, 5$
- $1, 3, 2, 4, 5$
- $1, 3, 2, 5, 4$
- $1, 3, 5, 2, 4$

The prime factorization of 6 is $2^1 \times 3^1$.

Sample Input 2

```
2
1
```

Sample Output 2

```
0
```

Sample Explanation 2

There is 1 permutation that satisfies Ray's requirements:

- $1, 2$

As the answer is 1, `0` is outputted instead.