A - Circle Pond

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 100 points

Problem Statement

Print the circumference of a circle of radius R.

Constraints

- $1 \leq R \leq 100$
- All values in input are integers.

Input

Input is given from Standard Input in the following format:

```
R
```

Output

Print the circumference of the circle. Your output is considered correct if and only if its absolute or relative error from our answer is at most 10^{-2}.

Sample Input 1

```
1
```

Sample Output 1

```
6.2831853071795862320 0
```

Since we accept an absolute or relative error of at most 10^{-2}, 6.28 is also an acceptable output, but 6 is not.

Sample Input 2

```
73
```

Sample Output 2

```
458.67252742410977361942
```

B - Homework

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 200 points

Problem Statement

Takahashi has N days of summer vacation.

His teacher gave him M summer assignments. It will take A_i days for him to do the i-th assignment.

He cannot do multiple assignments on the same day, or hang out on a day he does an assignment.

What is the maximum number of days Takahashi can hang out during the vacation if he finishes all the assignments during this vacation?

If Takahashi cannot finish all the assignments during the vacation, print `'-1'` instead.

Constraints

- $1 \leq N \leq 10^6$
- $1 \leq M \leq 10^4$
- $1 \leq A_i \leq 10^4$

Input

Input is given from Standard Input in the following format:

$$
\begin{array}{llll}
N & M & & \\
A_1 & \ldots & A_M &
\end{array}
$$

Output

Print the maximum number of days Takahashi can hang out during the vacation, or `'-1'`.

Sample Input 1

```
41 2
5 6
```

Sample Output 1

```
30
```

For example, he can do the first assignment on the first 5 days, hang out on the next 30 days, and do the second assignment on the last 6 days of the vacation. In this way, he can safely spend 30 days hanging out.

Sample Input 2

```
10 2
5 6
```

Sample Output 2

```
-1
```

He cannot finish his assignments.

Sample Input 3

```
11 2
5 6
```

Sample Output 3

```
0
```

He can finish his assignments, but he will have no time to hang out.

Sample Input 4

```
314 15
9 26 5 35 8 9 79 3 23 8 46 2 6 43 3
```

Sample Output 4

```
9
```

C - management

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 300 points

Problem Statement

A company has N members, who are assigned ID numbers $1, \ldots, N$.

Every member, except the member numbered 1, has exactly one immediate boss with a smaller ID number.

When a person X is the immediate boss of a person Y, the person Y is said to be an immediate subordinate of the person X.

You are given the information that the immediate boss of the member numbered i is the member numbered A_i. For each member, find how many immediate subordinates it has.

Constraints

- $2 \leq N \leq 2 \times 10^5$
- $1 \leq A_i < i$

Input

Input is given from Standard Input in the following format:

N
$A_2 \quad \ldots \quad A_N$

Output

For each of the members numbered $1, 2, \ldots, N$, print the number of immediate subordinates it has, in its own line.

Sample Input 1

```
5
1 1 2 2
```

Sample Output 1

```
2
2
0
0
0
```

The member numbered 1 has two immediate subordinates: the members numbered 2 and 3.

The member numbered 2 has two immediate subordinates: the members numbered 4 and 5.

The members numbered 3, 4, and 5 do not have immediate subordinates.

Sample Input 2

```
10
1 1 1 1 1 1 1 1 1
```

Sample Output 2

```
9
0
0
0
0
0
0
0
0
0
```

Sample Input 3

```
7
1 2 3 4 5 6
```

Sample Output 3

```
1
1
1
1
1
1
0
```

D - Sum of Large Numbers

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 400 points

Problem Statement

We have $N+1$ integers: $10^{100}, 10^{100}+1, ..., 10^{100}+N$.

We will choose K or more of these integers. Find the number of possible values of the sum of the chosen numbers, modulo (10^9+7).

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $1 \leq K \leq N+1$
- All values in input are integers.

Input

Input is given from Standard Input in the following format:

N K

Output

Print the number of possible values of the sum, modulo (10^9+7).

Sample Input 1

```
3 2
```

Sample Output 1

```
10
```

The sum can take 10 values, as follows:

- $(10^{100}) + (10^{100} + 1) = 2 \times 10^{100} + 1$
- $(10^{100}) + (10^{100} + 2) = 2 \times 10^{100} + 2$
- $(10^{100}) + (10^{100} + 3) = (10^{100} + 1) + (10^{100} + 2) = 2 \times 10^{100} + 3$
- $(10^{100} + 1) + (10^{100} + 3) = 2 \times 10^{100} + 4$
- $(10^{100} + 2) + (10^{100} + 3) = 2 \times 10^{100} + 5$
- $(10^{100}) + (10^{100} + 1) + (10^{100} + 2) = 3 \times 10^{100} + 3$
- $(10^{100}) + (10^{100} + 1) + (10^{100} + 3) = 3 \times 10^{100} + 4$
- $(10^{100}) + (10^{100} + 2) + (10^{100} + 3) = 3 \times 10^{100} + 5$
- $(10^{100} + 1) + (10^{100} + 2) + (10^{100} + 3) = 3 \times 10^{100} + 6$
- $(10^{100}) + (10^{100} + 1) + (10^{100} + 2) + (10^{100} + 3) = 4 \times 10^{100} + 6$

Sample Input 2

```
200000 200001
```

Sample Output 2

```
1
```

We must choose all of the integers, so the sum can take just 1 value.

Sample Input 3

```
141421 35623
```

Sample Output 3

```
220280457
```

E - Active Infants

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 500 points

Problem Statement

There are N children standing in a line from left to right. The activeness of the i-th child from the left is A_i.

You can rearrange these children just one time in any order you like.

When a child who originally occupies the x-th position from the left in the line moves to the y-th position from the left, that child earns $A_x \times |x-y|$ happiness points.

Find the maximum total happiness points the children can earn.

Constraints

- $2 \leq N \leq 2000$
- $1 \leq A_i \leq 10^9$
- All values in input are integers.

Input

Input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
A_1 \quad A_2 \quad \ldots \quad A_N
\end{array}
$$

Output

Print the maximum total happiness points the children can earn.

Sample Input 1

```
4
1 3 4 2
```

Sample Output 1

```
20
```

If we move the 1-st child from the left to the 3-rd position from the left, the 2-nd child to the 4-th position, the 3-rd child to the 1-st position, and the 4-th child to the 2-nd position, the children earns $1 \times |1-3| + 3 \times |2-4| + 4 \times |3-1| + 2 \times |4-2| = 20$ happiness points in total.

Sample Input 2

```
6
5 5 6 1 1 1
```

Sample Output 2

```
58
```

Sample Input 3

```
6
8 6 9 1 2 1
```

Sample Output 3

```
85
```

F - path pass i

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 600 points

Problem Statement

We have a tree with N vertices numbered 1 to N. The i-th edge in this tree connects Vertex a_i and b_i. Additionally, each vertex is painted in a color, and the color of Vertex i is c_i. Here, the color of each vertex is represented by an integer between 1 and N (inclusive). The same integer corresponds to the same color; different integers correspond to different colors.

For each $k = 1, 2, \ldots, N$, solve the following problem:

- Find the number of simple paths that visit a vertex painted in the color k one or more times.

Note: The simple paths from Vertex u to v and from v to u are not distinguished.

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $1 \leq c_i \leq N$
- $1 \leq a_i, b_i \leq N$
- The given graph is a tree.
- All values in input are integers.

Input

Input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
c_1 \quad c_2 \quad \ldots \quad c_N \\
a_1 \quad b_1 \\
\vdots \\
a_{N-1} \quad b_{N-1}
\end{array}
$$

Output

Print the answers for $k = 1, 2, \ldots, N$ in order, each in its own line.

Sample Input 1

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

Sample Output 1

```
5
4
0
```

Let $P_{i,j}$ denote the simple path connecting Vertex i and j.

There are 5 simple paths that visit a vertex painted in the color 1 one or more times:
$P_{1,1}$, $P_{1,2}$, $P_{1,3}$, $P_{2,3}$, $P_{3,3}$

There are 4 simple paths that visit a vertex painted in the color 2 one or more times:
$P_{1,2}$, $P_{1,3}$, $P_{2,2}$, $P_{2,3}$

There are no simple paths that visit a vertex painted in the color 3 one or more times.

Sample Input 2

```
1
1
```

Sample Output 2

```
1
```

Sample Input 3

```
2
1 2
1 2
```

Sample Output 3

```
2
2
```

Sample Input 4

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

Sample Output 4

```
5
8
10
5
5
```

Sample Input 5

```
8
2 7 2 5 4 1 7 5
3 1
1 2
2 7
4 5
5 6
6 8
7 8
```

Sample Output 5

```
18
15
0
14
23
0
23
0
```