# Gossip Spreading (`gossip`)

A class has N students (numbered from 0 to $N-1$), who are all very petty and always discuss the latest gossip. However, they only talk to their best friends. Student i's best friend is student P_i. Students i and P_i talk every day, telling each other what gossip they have heard the previous day. For jealousy reasons, all P_i values are distinct. Also, it is possible that $P_i = i$, which means student i has no best friend. Note that the best friend relationship is not necessarily mutual, but when two students talk, both of them will tell the gossips to the other.

Figure 1: Students sharing secrets known to few.

For example, there could be a class of 4 students where $P_0 = 1, P_1 = 2, P_2 = 0$, and $P_3 = 3$. The best friend relationships are displayed in the following figure.
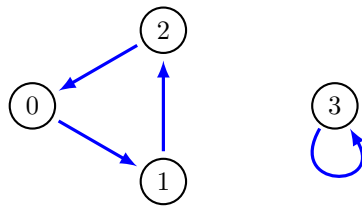
In this case, student 0 tells the gossips he heard the previous day to student 1 and student 2, since his best friend is student 1 and he is the best friend of student 2. Similarly, student 1 shares information with student 2 and student 0, while student 2 tells gossips to student 0 and student 1. Student 3 does not talk to anyone.

You are wondering how fast the gossips can spread in this intricate social network and ask Q questions about it, each of the form (A_i, B_i): How many days will it take for a new information to reach student B_i if you tell it to student A_i at the end of the day?

> ☞ Among the attachments of this task you may find a template file `gossip.*` with a sample incomplete implementation.

Input

The input file consists of:

- a line containing integer N.

- a line containing the N integers $P_0, \ldots, P_{N-1}$.

- a line containing integer Q.

- Q lines, the i-th of which consisting of integers A_i, B_i.

Output

The output file must contain a single line consisting of Q integers, the i-th of them must be the answer to the i-th question: The number of days it takes for a new information to reach B_i from A_i, or -1 if it never gets to B_i.

Constraints

- $1 \leq N \leq 100\,000$.

- $1 \leq Q \leq 200\,000$.

- $0 \leq P_i < N$ for each $0 \leq i < N$.

- $P_i \neq P_j$ for each $0 \leq i < j < N$.

- $0 \leq A_i, B_i < N$ for each $0 \leq i < Q$.

Scoring

Your program will be tested against several test cases grouped in subtasks. In order to obtain the score of a subtask, your program needs to correctly solve all of its test cases.

– **Subtask 1** (0 points)   Examples.

– **Subtask 2** (30 points) $N \leq 5000$, $Q \leq 5000$.

– **Subtask 3** (50 points) $N \leq 5000$.

– **Subtask 4** (20 points)   No additional limitations.

Examples

input	output
7 3 6 1 0 2 5 4 5 5 3 1 4 2 3 4 4 0 3	-1 2 -1 0 1
10 9 5 1 8 7 6 0 2 3 4 6 2 6 8 3 1 7 1 6 2 0 3 8	3 1 2 2 4 1

Explanation

In the **first sample case**:

- $P_5 = 5$, student 5 has no best friends nor is someone's best friend. Thus, there is no way that student 3 will get the information given to 5. The answer to the first question is -1.

- In the second question, the information is given to student 1, who will talk to 6 and 2 on the following day. On the day after, student 6 will talk to 1 and 4. Hence, it takes 2 days for the information to get to student 4.

- The answer to the third question is -1, since it is not possible for student 3 to get an information given to student 2.

- The answer to the fourth question is 0.

- In the fifth question, students 0 and 3 will talk on the day after the information is given. Thus, the answer is 1.
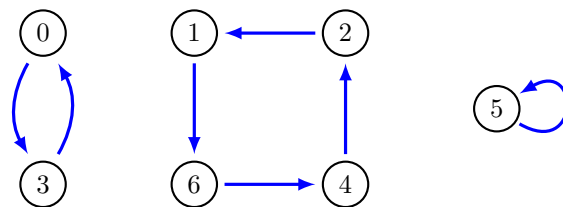

Figure 2: First sample case: arrows are pointing to best friend.