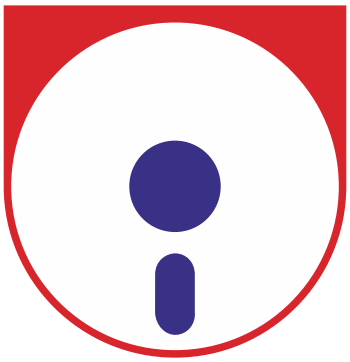


Croatian Open Competition in Informatics

Round 3, January 13th 2024

Tasks

Task	Time limit	Memory limit	Score
Eurokod	1 second	512 MiB	50
Vrsar	1 second	512 MiB	70
Milano C.le	1 second	512 MiB	110
Restorani	2 seconds	512 MiB	110
Slučajna Cesta	3 seconds	512 MiB	110
Total			450

Task Eurokod

This year, for the first time, the *Eurokod* is being held, an international competition in writing beautiful and readable code!

There are n contestants participating in the competition, labeled with numbers from 1 to n, and each of them has written a code.

Their codes are evaluated by an association of computer scientists. The association consists of a president and members of the association. The president awards points to codes in one way, and the members of the association award points in another way.

President's points:

The president will rank the codes from the most beautiful to the least beautiful (in his opinion). The first code will be awarded n points, and each subsequent code will be awarded one point less than the previous one.

Members of the association's points:

Each member of the association will vote for the code he considers the most beautiful. After each member of the association has voted, the codes will be ranked in descending order according to the number of votes they received from the members of the association. The first code (the one with the most votes) will be awarded n points, and each subsequent code will be awarded one point less than the previous one.

Total points:

The total number of points for each code is equal to the sum of the points awarded by the president and the number of points awarded by the members of the association.

Your task is to print the order of codes in descending order according to the number of points.

If more codes have the same number of points, then the better ranked one is the one that has won more points from the members of the association.

Input

The first line contains an integer n ($1 \leq n \leq 50$), the number of contestants.

The second line contains n integers a_i ($1 \leq a_i \leq n$), where the i-th integer represents the label of the code that the president ranked i-th. The ranking of the president is given in the order from the most beautiful to the least beautiful, it contains all the labels from 1 to n exactly once.

The third line contains n integers b_i ($0 \leq b_i \leq 200$), where the i-th integer represents the number of **votes** that the i-th code received from the members of the association. There won't be two codes that received the same number of votes.

Output

In n lines, print the ranking of codes in descending order according to the number of points.

Each line should be in the form `"[rank]. Kod[label] ([number of points])"`, where `[rank]` is the rank of the code in the ranking, `[label]` is the label of the code written in two-digit form with leading zeros, and `[number of points]` is the number of points that the code won.

For example, if the first place was won by the code with the label 3 with 12 points, then the first line is `"1. Kod03 (12)"`.

Scoring

Subtask	Points	Constraints
1	17	For each code, the number of obtained votes from the members of the association is equal to the number of points awarded by the members of the association, and there won't be two codes that scored the same number of total points.
2	19	There won't be two codes that scored the same number of total points.
3	14	No additional constraints.

Examples

input

```
3
1 2 3
50 10 20
```

output

```
1. Kod01 (6)
2. Kod03 (3)
3. Kod02 (3)
```

input

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

output

```
1. Kod02 (9)
2. Kod05 (8)
3. Kod01 (6)
4. Kod04 (4)
5. Kod03 (3)
```

input

```
7
6 3 2 1 5 4 7
200 56 11 0 13 105 12
```

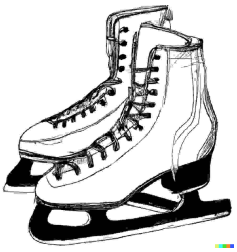
output

```
1. Kod06 (13)
2. Kod01 (11)
3. Kod02 (10)
4. Kod03 (8)
5. Kod05 (7)
6. Kod07 (4)
7. Kod04 (3)
```

Clarification of the first example:
`Kod03` and `Kod02` have the same number of points, but `Kod03` has more votes from the members of the association, so it is better ranked.

Clarification of the second example:
The president ranked the `Kod05` as the most beautiful, so it won $n = 5$ points.

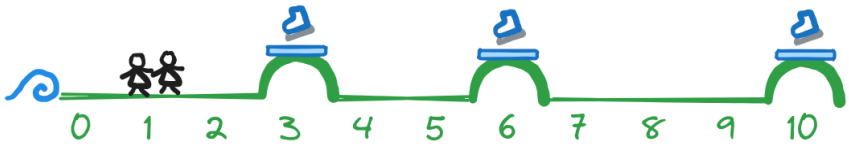
Task Vrsar



Vrsar is a small coastal town consisting of n hills. Surprisingly, all the hills, when viewed from the sea, are arranged one behind the other so that the i-th hill is x_i meters away from the sea. At the top of each hill, there is an ice rink. All ice rinks open simultaneously every day, but they do not close at the same time: the i-th ice rink is open for t_i minutes.

Iva and Mia have come to Vrsar and will be here for m days. Iva and Mia love ice skating and want to skate every day they spend in this town. At the beginning of the i-th day, they are a_i meters away from the sea, and their ice-skating adventure starts at the same time as the ice rinks open. To reach an ice rink, they must walk to it, moving at a speed of one meter per minute. They can walk both to the left and to the right. If they are at a position where there is a hill, they can climb the hill and reach the ice rink on top of it, or they can bypass it without climbing.

They are in very good shape, so they can climb the hill without spending extra time. Once they reach the top, they can skate as much as they want or until the ice rink closes. Going downhill is not as easy as going up. Recently, it rained, and the ground is slippery, so it takes s_i minutes for them to descend the i-th hill. After descending from a hill, they can continue walking towards the next ice rink.



The illustration shows the first example.
Iva and Mia are at the starting point at position 1. *They walk for* 2 *minutes to the ice rink on the hill at position* 3 *and ice skate there for* 5 *minutes. Then they descend from the hill (in* 0 *minutes), continue walking for* 3 *minutes to the ice rink on the hill at position* 6, *and ice skate there for* 1 *minute. In total, they have ice skated for* $5 + 1 = 6$ *minutes.*

Iva and Mia are interested in determining the maximum number of minutes they can ice skate each day. In one day, they can visit any number of ice rinks. Since they want to spend more time skating and less time calculating, they have turned to you for help. Help them solve this problem!

Note: If Iva and Mia at the beginning of the day are at the same position as a hill, they are at the bottom of the hill, and so they have to climb it if they want to ice skate on the ice rink on top of it.

Input

The first line contains integers n and m ($1 \leq n, m \leq 10^5$), the number of hills and the number of days.

The i-th of the following n lines contains integers x_i, t_i and s_i ($0 \leq x_i, t_i, s_i \leq 10^9$), the distance of the i-th hill from the shore, closing time of the ice rink and the time required for the descent from the hill.

The third line contains m integers a_i ($0 \leq a_i \leq 10^9$), Iva's and Mia's starting distance from the shore at the beginning of the i-th day.

Output

In one line, print m integers, the i-th of which is the maximum time Iva and Mia can ice skate on i-th day.

Scoring

Subtask	Points	Constraints
1	8	$n, m \leq 10$
2	17	$m = 1, a_1 = 0$
3	19	$n, m \leq 1\,000$
4	26	No additional constraints.

Examples

input

```
3 1
3 7 0
6 11 3
10 13 5
1
```

output

```
6
```

input

```
3 2
5 10 3
3 6 1
1 5 0
0 3
```

output

```
5 8
```

input

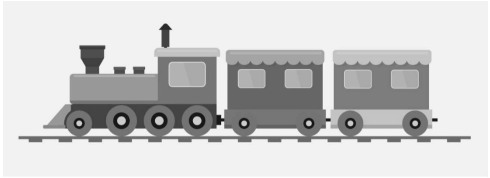
```
1 3
3 3 3
0 1 2
```

output

```
0 1 2
```

Clarification of the first example:
Take a look at the illustration in the statement.

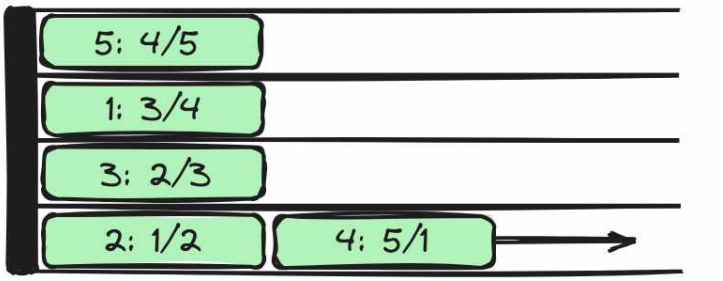
Task Milano C.le



Silvia is at the Milano Centrale railway station and she noticed that the station has a lot of platforms. She thought that there are too many of them, so she decided to check how many of them are actually needed.

Silvia also noticed an interesting fact that holds at this station: the schedule of arrivals and departures repeats every two days, and additionally, the schedule is such that all n trains arrive at the station on one day, and leave the station on the other day. Note that in this way no train will leave before all trains have arrived.

The platforms at the station are long enough so that all n trains can be lined up one after another on the same platform. However, if train x enters the platform first, and then train y, then train x cannot leave the platform before train y.



The illustration shows a possible train schedule on the platforms in the second sample test.
The labels on the train 'i : a_i/b_i' denote that the i-th train will arrive a_i-th at the station on the first day, and leave the station b_i-th on the second day.
The train $(2 : 1/2)$ *cannot leave the platform before the train* $(4 : 5/1)$.

Silvia is interested in what is the minimum number of platforms needed so that all trains can be lined up on the platforms, without the possibility that a train cannot leave the platform because there is a train in front of it that has not yet left.

Input

The first line contains an integer n ($1 \leq n \leq 2 \cdot 10^5$), the number of trains.

The second line contains n integers a_i, ($1 \leq a_i \leq n$, $a_i \neq a_j$ for all $i \neq j$), which denote that the i-th train arrives at the station as the a_i-th train on the first day. The sequence (a_i) is a permutation.

The third line contains n integers b_i, ($1 \leq b_i \leq n$, $b_i \neq b_j$ for all $i \neq j$), which denote that the i-th train leaves the station as the b_i-th train on the second day. The sequence (b_i) is a permutation.

Output

In the first and only line you should output the minimum number of platforms needed.

Scoring

Subtask	Points	Constraints
1	21	$n \leq 10$
2	18	The minimum number of platforms needed will be either 1 or 2.
3	31	$n \leq 1\,000$
4	40	No additional constraints.

Examples

input

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

output

```
2
```

input

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

output

```
4
```

input

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

output

```
1
```

Clarification of the second example:
Take a look at the illustration in the statement.

Clarification of the third example:
All the trains can be lined up on the same platform without any problems.

Task Restorani

Coming to Szeged, Mr. Malnar is, as usual, obliged to get acquainted with the local culture, and thus try all traditional meals, culinary specialties, and local drinks.

We can imagine Szeged as n interesting locations numbered from 1 to n connected by $n-1$ bidirectional roads in such a way that there is a path using roads between every pair of interesting locations. Amazingly, Mr. Malnar needs exactly one minute to walk across each road. Time spent walking in an interesting location is negligible.

Mr. Malnar has a list of m restaurants he would like to visit. It consists of m positive integers where the i-th number represents an interesting location near which there is the i-th restaurant.

One problem is that Mr. Malnar must eat an ice cream in a pastry shop right after dining in a restaurant. Another problem is that he refuses to visit the same pastry shop twice.

Luckily, he came prepared as he is familiar with m pastry shops whose locations he remembers as a list of m positive integers where the i-th number represents an interesting location near which is the i-th pastry shop.

Mr. Malnar is tired from his travel and doesn't want to walk more than he has to, so he asks you to calculate how much will he have to walk and offer the order of visiting restaurants and pastry shops, as he is capable of navigating between them without help.

Mr. Malnar is currently at an interesting location number 1 and must return to it at the end of his walk.

Input

The first line contains integers n and m ($1 \leq m \leq n \leq 3 \cdot 10^5$), the number of interesting locations and the number of restaurants/pastry shops, respectively.

The second line contains m integers a_i ($1 \leq a_i \leq n$, $a_i \neq a_j$ for all $i \neq j$), the list of restaurants.

The third line contains m integers b_i ($1 \leq b_i \leq n$, $b_i \neq b_j$ for all $i \neq j$), the list of pastry shops.

In each of the next $n-1$ lines there are two integers x_i and y_i ($1 \leq x_i, y_i \leq n$) - this means that there is a road between interesting locations x_i and y_i.

Output

In the first line output t, the time in minutes that Mr. Malnar will have to walk to visit all restaurants and pastry shops, returning to location 1 at the end.

In the second line output $2m$ integers v_i, the order of visiting restaurants and pastry shops.

The numbers in odd positions represent restaurants and should form a permutation of the first m positive integers. The numbers in even positions represent pastry shops and should also form a permutation of the first m positive integers.

Visiting locations in given order and returning to the starting position by taking the shortest route between each should take exactly t minutes.

If there are multiple optimal orders, output any.

Scoring

Subtask	Points	Constraints
1	20	$n \leq 5\,000, m \leq 10$
2	20	$x_i = i, y_i = i + 1$ for all $i = 1, \ldots, n - 1$
3	30	$n \leq 5\,000$
4	40	No additional constraints.

If your program, on some test, outputs the first line correct, but doesn't give the correct order in the second line, **it will receive 30% of points for that test.**

The number of points in a subtask corresponds to the least number of points achieved by some test in that subtask.

Examples

input

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

output

```
4
1 1
```

input

```
9 4
2 3 4 6
4 5 8 9
1 2
1 3
3 4
3 5
5 6
1 7
7 8
7 9
```

output

```
18
3 1 4 2 2 4 1 3
```

input

```
10 5
3 5 6 7 8
1 2 4 9 10
1 2
2 3
3 4
4 5
5 6
6 7
7 8
8 9
9 10
```

output

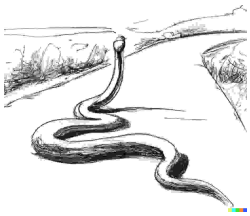
```
24
4 4 5 5 3 3 2 2 1 1
```

Clarification of the first example:
Mr. Malnar first has to walk 1 minute to the only restaurant on location 2, then 2 minutes to the only pastry shop on location 3 and finally 1 minute back to location 1. Mr. Malnar will walk in total $1 + 2 + 1 = 4$ minutes.

Clarification of the second example:
Mr. Malnar visits restaurants and pastry shops in this order: restaurant at location 4 (2 min), pastry shop at location 4 (0 min), restaurant at location 6 (3 min), pastry shop at location 5 (1 min), restaurant at location 3 (1 min), pastry shop at location 9 (3 min), restaurant at location 2 (3 min), pastry shop at location 8 (3 min). After eating an ice cream at a pastry shop on location 8 he returns to location 1 (2 min). Mr. Malnar walks in total $2 + 0 + 3 + 1 + 1 + 3 + 3 + 3 + 2 = 18$ minutes

Clarification of the third example:
Mr. Malnar visits restaurants and pastry shops in this order: restaurant at location 7 (6 min), pastry shop at location 9 (2 min), restaurant at location 8 (1 min), pastry shop at location 10 (2 min), restaurant at location 6 (4 min), pastry shop at location 4 (2 min), restaurant at location 5 (1 min), pastry shop at location 2 (3 min), restaurant at location 3 (1 min), pastry shop at location 1 (2 min). After eating his last ice cream, he is already at location 1 so he doesn't move. Mr. Malnar walks in total 24 minutes.

Task Slučajna Cesta



Vito lives in a city with n parks labeled from 1 to n. The parks are connected with $n-1$ roads such that there is a path between any two pairs of parks. Every park has some beauty value, beauty value of i-th park is v_i.

Last night Vito decided to wander around the city in such a way that after he visits a park he chooses a random road with equal probability and visits a park to which that road leads. But before he started his journey he looked through the window of his skyscraper and saw that on every road there is either a blue or a red snake. Blue snakes attack all people traveling from the park with a lower label to a park with a higher one, a red snakes attack everyone traveling from a park with higher label to lower. As Vito doesn't want to get attacked by a snake he decided to change his plans by considering only roads on which he will not get attacked by a snake when choosing a random road. Since he likes long walks he will not stop on his journey until there is at least one road he can safely pass.

And while Vito walks down the stairs of his skyscraper he completely forgot on which road is red or blue snake so he wonders: *If on every road there is an equal probability of a blue or a red snake, what is the expected beauty of my journey which starts in the i-th park?*

Beauty of path is the sum of beauties of parks visited on that journey. Expected beauty of journey is defined as the sum of product of beauty of a path and probability Vito takes that path, for every possible path.

Input

In the first line there is an integer n ($2 \leq n \leq 10^6$), which denotes the number of parks.

In the second line there are $n-1$ integers p_i ($1 \leq p_i < i$), which denote a road between the $(i+1)$-th park and p_i-th park.

In the third line there are n integers v_i ($0 \leq v_i \leq 10^6$), where v_i denotes the beauty of i-th park.

Output

If expected beauty of Vito's journey which starts at i-th park is $\frac{a}{b}$ for integers a and b, then in i-th line of output print $ab^{-1} \pmod{10^9+7}$ where b^{-1} is modular inverse of $b \pmod{10^9+7}$.

Scoring

Subtask	Points	Constraints
1	10	$n \leq 10$
2	30	$n \leq 1000$
3	30	In sequence p_i no value is present more than 2 times.
4	40	No additional constraints.

If your program, on some test, outputs the first line correct, but outputs a wrong answer in the following lines, **it will receive 50% of points for that test.**

The number of points in a subtask corresponds to the least number of points achieved by some test in that subtask.

Probni primjeri

input

```
2
1
2 1
```

output

```
500000006
2
```

input

```
3
1 1
8 8 8
```

output

```
14
14
14
```

input

```
11
1 1 1 2 3 4 1 2 6 2
1 1000 5 3 18 200 8 9 0 2 2
```

output

```
968750272
610352580
450521029
536458466
199219275
662760680
190972315
90277951
824219264
941840425
532552597
```

Clarification of the first example:
The expected beauty of a journey starting at the first park is $2.5 \pmod{10^9+7} = \frac{5}{2} \pmod{10^9+7} = 5 \cdot 2^{-1} \pmod{10^9+7} = 5 \cdot 500000004 \pmod{10^9+7} = 500000006 \pmod{10^9+7}$ and starting from the second park it is 2.

Clarification of the second example:
Probability that both snakes are red is $\frac{1}{4}$ and in that case if Vito starts at the first park he randomly chooses which road he will take.