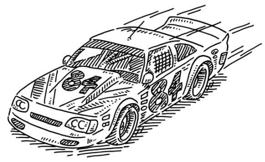
Croatian Open Competition in Informatics

Round 4, January 29th 2022

Tasks

Task	Time limit	Memory limit	Points
Autići	1 second	512 MiB	50
Autobus	1 second	512 MiB	70
Izbori	3 seconds	512 MiB	110
Parkovi	3 seconds	512 MiB	110
Šarenlist	1 second	512 MiB	110
Total			450

Task Autići



There are n friends. Each friend has a remote control toy car and a garage in which the car is stored. Every friend also has a pack of road parts used to build the track for the cars. All the road parts in the i-th friend's pack have the same length d_i.

Two different friends a and b may connect their garages with a road. To build this road, they will both take a road part from their pack and join them, obtaining a road of length $d_a + d_b$. Some pairs of friends are going to connect their garages in the described way, so that everyone's garages are connected. In other words, starting from any garage it should be possible to reach any other garage using the roads.

What is the minimum total road length needed to make a road network in which all the garages are connected?

Input

The first line contains a positive integer n ($1 \le n \le 100\,000$), the number of friends.

The next line contains n positive integers d_i ($1 \le d_i \le 10^9$), the length of the road parts in the i-th friend's pack.

Output

In the only line print the minimum total road length needed to make all the garages connected.

Scoring

Subtask	Points	Constraints
1	10	$d_1 = d_2 = \cdots = d_n$
2	20	$1 \le n \le 1000$
3	20	No additional constraints.

Examples

input

```
1
10
```

output

```
0
```

input

```
3
5 5 5
```

output

```
20
```

input

```
4
7 3 3 5
```

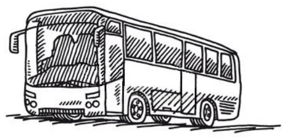
output

```
24
```

Clarification of the first example:
Since there is only one friend, his garage is already connected to itself, so there is no need for building any roads.

Clarification of the third example:
If roads are built between friends 1 and 2, 2 and 3, and between 3 and 4, everyone will be connected, and the total cost will be $(7+3)+(3+3)+(3+5) = 24$.

Task Autobus



In a country there are n cities. The cities are connected by m bus routes, where the i-th route starts in city a_i, ends in city b_i and takes t_i minutes.

Ema loves to travel, but doesn't like transferring between buses. On her trip she wants to use **at most** k different bus routes.

Help her answer q questions of the form 'What is the shortest travel time to get from city c_j to city d_j (using at most k different bus routes)?'.

Input

The first line contains two positive integers n and m ($2 \le n \le 70$, $1 \le m \le 10^6$), the number of cities and the number of bus routes.

The i-th of the next m lines contains positive integers a_i, b_i and t_i ($1 \le a_i, b_i \le n$, $1 \le t_i \le 10^6$), the terminal cities and the travel time of the i-th bus route.

The next line contains two positive integers k and q ($1 \le k \le 10^9$, $1 \le q \le n^2$), the maximum number of used routes and the number of queries.

The j-th of the next q lines contains positive integers c_j and d_j ($1 \le c_j, d_j \le n$), the cities from the j-th query.

Output

Print q lines. In the j-th line print the shortest travel time from the j-th query, or `-1` if there is no trip that satisfies the requirements.

Scoring

Subtask	Points	Constraints
1	15	$k \le n \le 7$
2	15	$k \le 3$
3	25	$k \le n$
4	15	No additional constraints.

Examples

input

```
4 7
1 2 1
1 4 10
2 3 1
2 4 5
3 2 2
3 4 1
4 3 2
1 3
1 4
4 2
3 3
```

output

```
10
-1
0
```

input

```
4 7
1 2 1
1 4 10
2 3 1
2 4 5
3 2 2
3 4 1
4 3 2
2 3
1 4
4 2
3 3
```

output

```
6
4
0
```

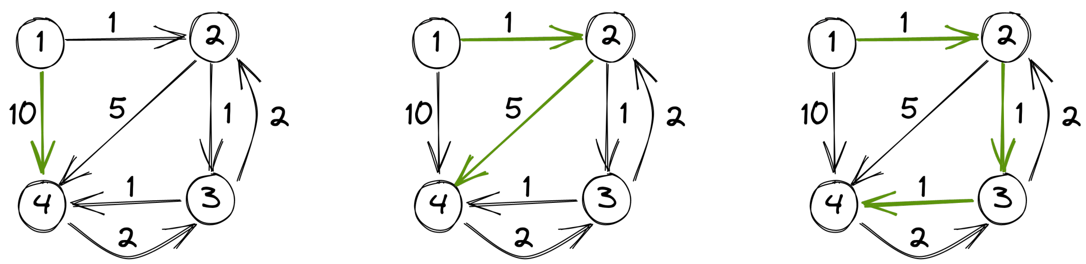
input

```
4 7
1 2 1
1 4 10
2 3 1
2 4 5
3 2 2
3 4 1
4 3 2
3 3
1 4
4 2
3 3
```

output

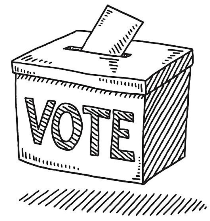
```
3
4
0
```

Clarification of the examples:



The answer to the first query from each example is marked on the graph.

Task Izbori



Mr. Malnar is running for mayor of the Tompojevci county. The Tompojevci county consists of a single village (called Tompojevci), made up of a row of n houses labeled with integers from 1 to n. In each house there is one resident, but more importantly for Mr. Malnar, a voter. Mr. Malnar knows that the election isn't won by the best candidate, but by the candidate who hosts the best banquet before the election. Therefore, a few days before the election he will organize a banquet. He'll invite all residents of the village who live at houses whose number is between l and r ($l \leq r$) inclusive and prepare a delicious meal for them.

Mr. Malnar knows all the residents of Tompojevci very well so he knows what the favourite dish of each resident is. That's why for the banquet he'll prepare the meal that is the favourite of the majority of the invited people. However, only the people that get their favourite meal will vote for Mr. Malnar, while the rest will vote for the only other candidate, Mr. Vlado. To win the election, Mr. Malnar needs to get strictly more than half of the votes from the people that voted. The residents that weren't invited to the banquet will forget about the election and are not going to vote.

Mr. Malnar now wants to know how many different ways there are for him to choose the numbers l and r so that he wins the election.

Input

The first line contains a positive integer n ($1 \leq n \leq 200\ 000$) from the problem statement.

The second line contains n positive integers a_i ($1 \leq a_i \leq 10^9$) each representing the favourite dish of the resident at house i.

Output

In the only line print the number of different ways for Mr. Malnar to choose the numbers l and r so that he wins the election.

Scoring

Subtask	Points	Constraints
1	10	$1 \leq n \leq 300$
2	15	$1 \leq n \leq 2000$
3	15	$1 \leq a_i \leq 2$ for all $1 \leq i \leq n$
4	70	No additional constraints.

Examples

input

```
2
1 1
```

output

```
3
```

input

```
3
2 1 2
```

output

```
4
```

input

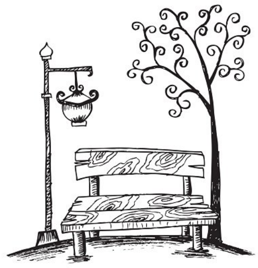
```
5
2 2 1 2 3
```

output

```
10
```

Clarification of the second example: The possible choices for (l, r) are: $(1, 1), (2, 2), (3, 3), (1, 3)$.

Task Parkovi



The town administration has decided to embellish the landscape by building new parks. To make the parks not only look good, but also be useful, they need to carefully choose which neighbourhoods to build the parks in so that the kids from the other neighbourhoods have at least one park near them.

The town consists of n neighbourhoods connected by $n-1$ roads of a certain length. There is a unique path connecting each neighbourhood to any other neighbourhood. In other words, the neighbourhoods and roads form a tree. Exactly k parks should be built in different neighbourhoods so that the other neighbourhoods have their nearest park as close to them as possible. To be more precise, the administration wants to minimize the maximum distance from a neighbourhood to its closest park.

Help the town administration and determine which neighbourhoods should have a park built in them and determine the maximum distance from a neighbourhood to its closest park.

Input

The first line contains two positive integers n and k ($1 \le k \le n \le 200\,000$), the number of neighbourhoods and the number of parks, respectively.

The i-th of the next $n-1$ lines contains positive integers a_i, b_i and w_i ($1 \le a_i, b_i \le n$, $1 \le w_i \le 10^9$), which denotes that the neighbourhoods labeled a_i and b_i are connected by a road of length w_i.

Output

In the first line print the least possible maximum distance from the problem statement.

In the second line print k positive integers, the labels of the neighbourhoods which will have a park built in them. If there is more than one solution, output any one.

Scoring

Subtask	Points	Constraints
1	10	$1 \le n \le 20$
2	10	$k = 1$
3	30	$a_i = i, b_i = i + 1$ for all $1 \le i \le n - 1$
4	60	No additional constraints.

Examples

input

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

output

```
8
4 5 8
```

input

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

output

```
3
2 4
```

input

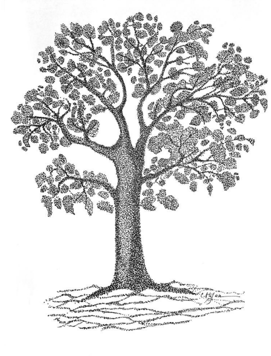
```
7 4
1 3 1
1 4 1
2 3 1
5 3 1
4 7 1
4 6 1
```

output

```
1
3 4 1 2
```

Clarification of the third example:
If the parks were built only in neighbourhoods 3 and 4, the maximum distance wouldn't change, but the city administration wants to build exactly k parks, so two more need to be built somewhere else.

Task Šarenlist



Warm summer night. Vito and his friend, Karlo, are lying in a forest clearing and watching the stars. Suddenly, Vito exclaims "Karlo, look! The trees around us are changing colors!" "Wooow so colorful" said Karlo, amazed. Indeed, the tree branches in the forest started to change colors.

Fascinated by the colorful trees, Vito and Karlo noticed a couple of facts about them. Each of the trees they are looking at can be represented as a tree graph, i.e. an undirected graph in which there exists a unique path between each pair of nodes. The trees they are looking at have the property that each edge of the tree is colored in one of k different colors. Some of the paths on the tree are *colorful*, meaning that such a path contains edges of at least two different colors.

Morning has arrived and the tree magic is now lost. In order to relive this experience, Vito and Karlo ask you to solve the following problem. Given a tree and m pairs of nodes on the tree, determine the number of different colorings of the tree edges so that each of the m paths determined by the m pairs of nodes is colorful. Since this number can be very large, output it modulo $10^9 + 7$.

Input

The first line contains three positive integers n, m and k ($3 \le n \le 60,\ 1 \le m \le 15,\ 2 \le k \le 10^9$), the number of nodes in the tree, the number of path required to be colorful and the number of possible colors for the tree branches, respectively.

The i-th of the next $n - 1$ lines contains a pair of positive integers a_i and b_i ($1 \le a_i, b_i \le n$), representing an edge of the tree.

The j-th of the next m lines contains a pair of positive integers c_j and d_j ($1 \le c_j, d_j \le n$), the labels of the endpoints of the paths which are required to be colorful. The nodes c_j and d_j **are not neighbouring**.

Output

In the only line print the number of ways to color the tree edges so that each of the m given paths is colorful, modulo $10^9 + 7$.

Scoring

Subtask	Points	Constraints
1	10	$m = 1$
2	15	$m = 2$
3	10	Each tree edge belongs to at most one of the m given paths.
4	10	$1 \le n \le 15, k = 2$
5	65	No additional constraints.

Examples

input

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

output

```
2
```

input

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

output

```
0
```

input

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

output

```
6
```

Clarification of the first example:
The tree consists of only two edges, both part of a colorful path between the nodes 1 and 3. So, the two edges must have a different color. One such coloring is obtained by coloring the edge 1-2 in color 1, and 2-3 in color 2, while the other is obtained by switching these color so that 1-2 has color 2, and 2-3 has color 1.