Northwestern European Regional Contest 2018

NWERC 2018 Practice

Eindhoven, November 24

Problems

A Achievements
B Banana Republic
C Contemporary Art

Do not open before the contest has started.

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Problem A
Achievements

Did you know that Greg practices his Swedish skills every day? Well, almost every day.

The app that Greg uses to learn languages gives out achievement badges to keep you engaged with the app. One of the achievements is for the longest streak, i.e., the highest number of consecutive days that Greg practices Swedish. Remember that Greg does not practice every day, so there are gaps. Fortunately, the app allows him to pay for the days where he did not practice and still obtain the achievement.

The streak badge that Greg shoots for (designed by VectorsMarket from Flaticon).

Given the days when Greg actually practiced his Swedish and the number of days he is willing to pay for, what is the longest streak he can reach?

Input

The input consists of:

- One line with two integers n and p ($1 \leq n, p \leq 2 \cdot 10^5$), where n is the number of days Greg practiced with the app and p is the number of days that he is willing to pay for.
- One line with n distinct integers $d_1, \ldots, d_n$ ($0 \leq d_1 < d_2 < \ldots < d_n \leq 10^6$), the days when Greg actually practiced.

Output

Output the length of the longest streak that Greg can reach when using the paid days in an optimal way.

Sample Input 1	Sample Output 1
5 2 3 5 6 10 11	5

Sample Input 2	Sample Output 2
2 2018 42 424242	2019

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Problem B
Banana Republic

Prime Minister Louie, the democratically appointed top banana of the sovereign nation of orangutans, has a monkey on his back. His hairy subjects traditionally travel between locations by swinging from vine to vine along the forest superhighway. However, due to increasing traffic, there has been a dramatic increase of mid-air collisions and other forms of swinging accidents.

To improve travel safety, Louie has decided to replace the old vine-based transportation system by a new network of rope bridges. Two trees A and B along the highway will be connected by a rope bridge if all of the trees between A and B are strictly shorter than both A and B. If A and B are not connected by a bridge, a citizen travelling from A to B has to use multiple bridges, changing between bridges at some intermediate tree or trees between A and B (see Figure B.1). Note that a citizen travelling from A to B only does so by taking bridges leading towards B, never in the opposite direction.

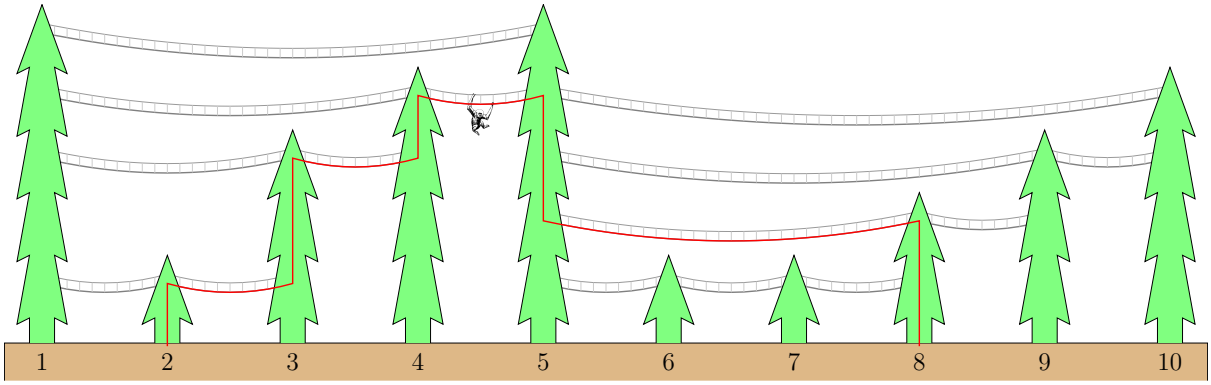

Figure B.1: A solution to Sample Input 2 showing the bridges built. Travelling from tree 1 to 4 can be done using a single bridge. Travelling from tree 2 to 8 requires 4 bridges—the trip could be made using 3 bridges by going via tree 1, but citizens never travel away from their destination.

The trees tend to be very crowded, especially during rush hour, so changing between bridges can be frustrating enough to make you go ape. Therefore, Louie aims to minimise the number of bridges that the average traveller needs to use to get to their destination. All routes travelled along the highway are well understood and have been collected in the most recent jungle census. What remains is to design the tree layout along the forest superhighway, or more specifically, the heights of the trees.

Find out how to set the heights of the trees so that the total number of bridges used, summed over all journeys in the jungle census, is minimised.

Input

The input consists of:

- One line with two integers n and m ($2 \leq n \leq 500$, $1 \leq m \leq 50\,000$), the number of trees and the number of journeys. The trees along the highway are numbered from 1 to n.
- m lines, each with two integers s and t ($1 \leq s, t \leq n$, $s \neq t$), the starting and ending trees of a journey.

Output

On the first line, output the minimum possible total number of bridges used.

On the next line, output a sequence of heights, in metres, of the trees that achieves this minimum. Your answer may only use integer tree heights between 1 and 10^9 (inclusive).

If there are multiple valid solutions, output any one of them.

Sample Input 1

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

Sample Output 1

```
4
4 2 1 3
```

Sample Input 2

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

Sample Output 2

```
12
5 1 3 4 5 1 1 2 3 4
```

Problem C
Contemporary Art

At the Van Abbemuseum of modern and contemporary art in Eindhoven, we always look to present our muses in the most interesting way possible. Sometimes we have our work cut out for us.

Today we are exploring whether we can modify one of our perfectly-square picture frames (such as the one shown in Figure C.1) to include an electrical filament. The purpose of this filament is so that the image can set itself alight at some opportune and hilarious moment—for example, in the middle of a sale by auction.

You will be responsible for buying the filament to run around the entire perimeter of the artwork. How many centimetres will you need to obtain?

Figure C.1: A test subject for the frame.

Input

The input consists of:

- One line with an integer a ($1 \leq a \leq 10^{18}$), the area of the image in square centimetres.

Output

Output the total length of filament needed for the frame, in centimetres. Your answer should have an absolute or relative error of at most 10^{-6}.

Sample Input 1	Sample Output 1
64	32.0

Sample Input 2	Sample Output 2
1234	140.51334456

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